FINAL
Preliminary Assessment Report
Camp Umatilla
Hermiston, Oregon

Perfluorooctane-Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

May 2020

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Table of Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGA	Critical Groundwater Area
CSM	conceptual site model
°F	degrees Fahrenheit
FTA	fire training area
NPDES	National Pollutant Discharge Elimination System
OMD	Oregon Military Department
ORARNG	Oregon Army National Guard
OWRD	Oregon Water Resources Department
OWS	Oil Water Separator
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RTI	Regional Training Institute
SI	Site Inspection
UMCD	Umatilla Chemical Depot
UMCDF	Umatilla Chemical Agent Disposal Facility
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VSI	visual site inspection
WWTP	Wastewater Treatment Plant

Executive Summary

The United States Army Corps of Engineers Baltimore District on behalf of the Army National Guard-Installations & Environment Division, Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at Army National Guard (ARNG) Facilities Nationwide*. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam released as part of firefighting activities, although other PFAS sources are possible.

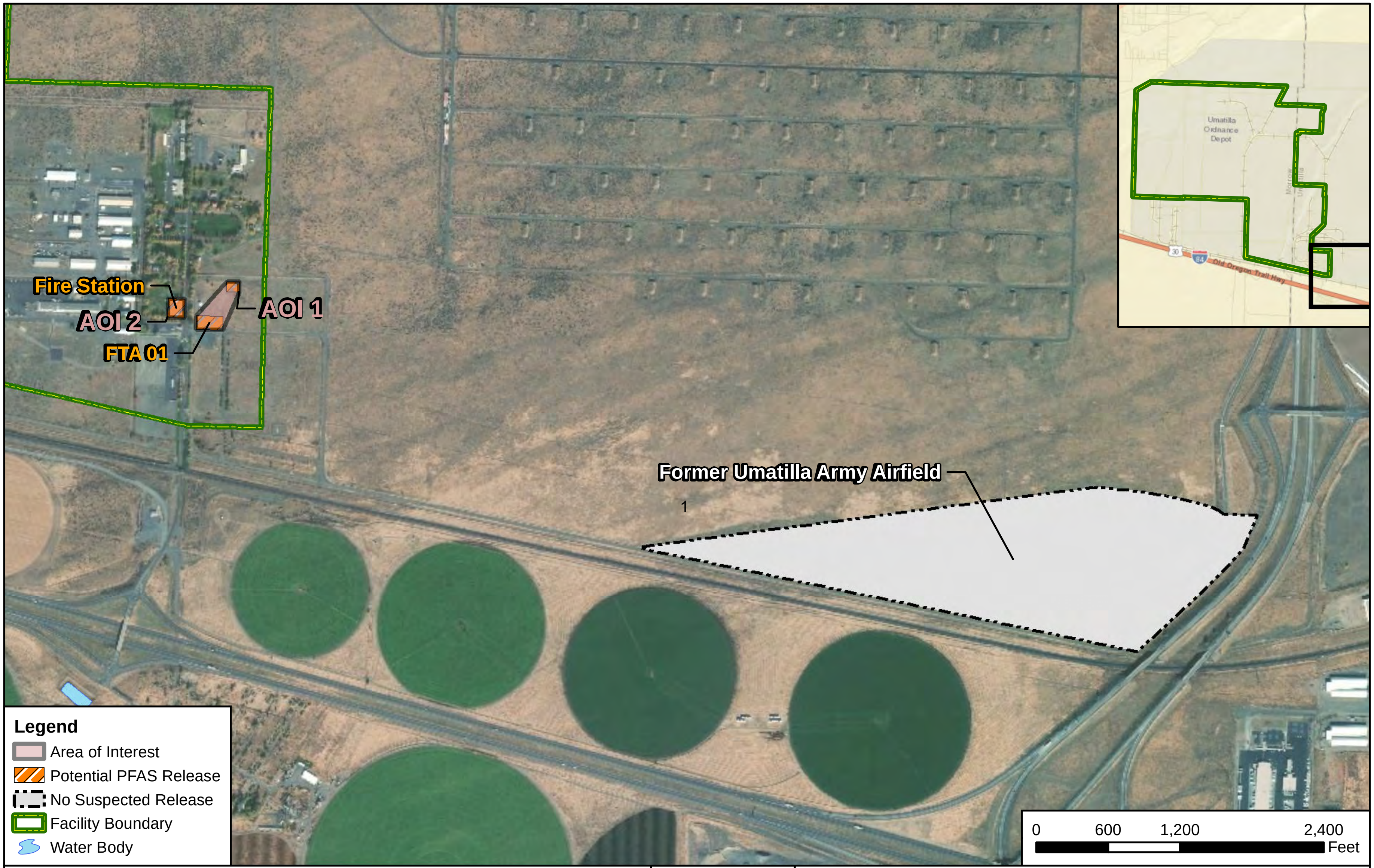
AECOM completed a PA for PFAS at Camp Umatilla in Hermiston, Oregon, to assess potential PFAS release areas and exposure pathways to receptors. The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 1 and 2 October 2018
- Interviewed current Oregon Army National Guard (ORARNG) and Oregon Military Department (OMD) personnel during the site visit, ORARNG environmental managers, operations staff, OMD Environmental Manager, OMD Cultural Resources Manager, OMD Wildland Fire Manager, OMD Camp Rilea Training Site Manager (former State Aviation Officer), and OMD Real Estate/Property Manager
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs
- Developed a conceptual site model to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility

Two AOIs related to a PFAS release were identified at Camp Umatilla during the PA. The AOIs are shown on **Figure ES-1** and described below:

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Former FTAs	ORARNG	~2003-2017
AOI 2	Fire Station	ORARNG	Unknown

Based on likely aqueous film forming foam releases at these AOIs, there is a potential for exposure to PFAS contamination in surface soil to site workers, construction workers, and trespassers via ingestion and inhalation of dust; subsurface soil to site and construction workers via ingestion; and groundwater to site workers, construction workers, trespassers, and nearby off-facility residents via ingestion. The conceptual site models for Camp Umatilla are shown on **Figures ES-2**.



CLIENT	ARNG				N	TITLE	Summary of Findings
PROJECT	Preliminary Assessment for PFAS at Camp Umatilla, OR						
REVISED	6/27/2019	GIS BY	MS	6/27/2019		AECOM 12420 Milestone Center Drive Germantown, MD 20876	Figure ES-1
SCALE	1:14,400	CHK BY	TK	6/27/2019			
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	6/27/2019			

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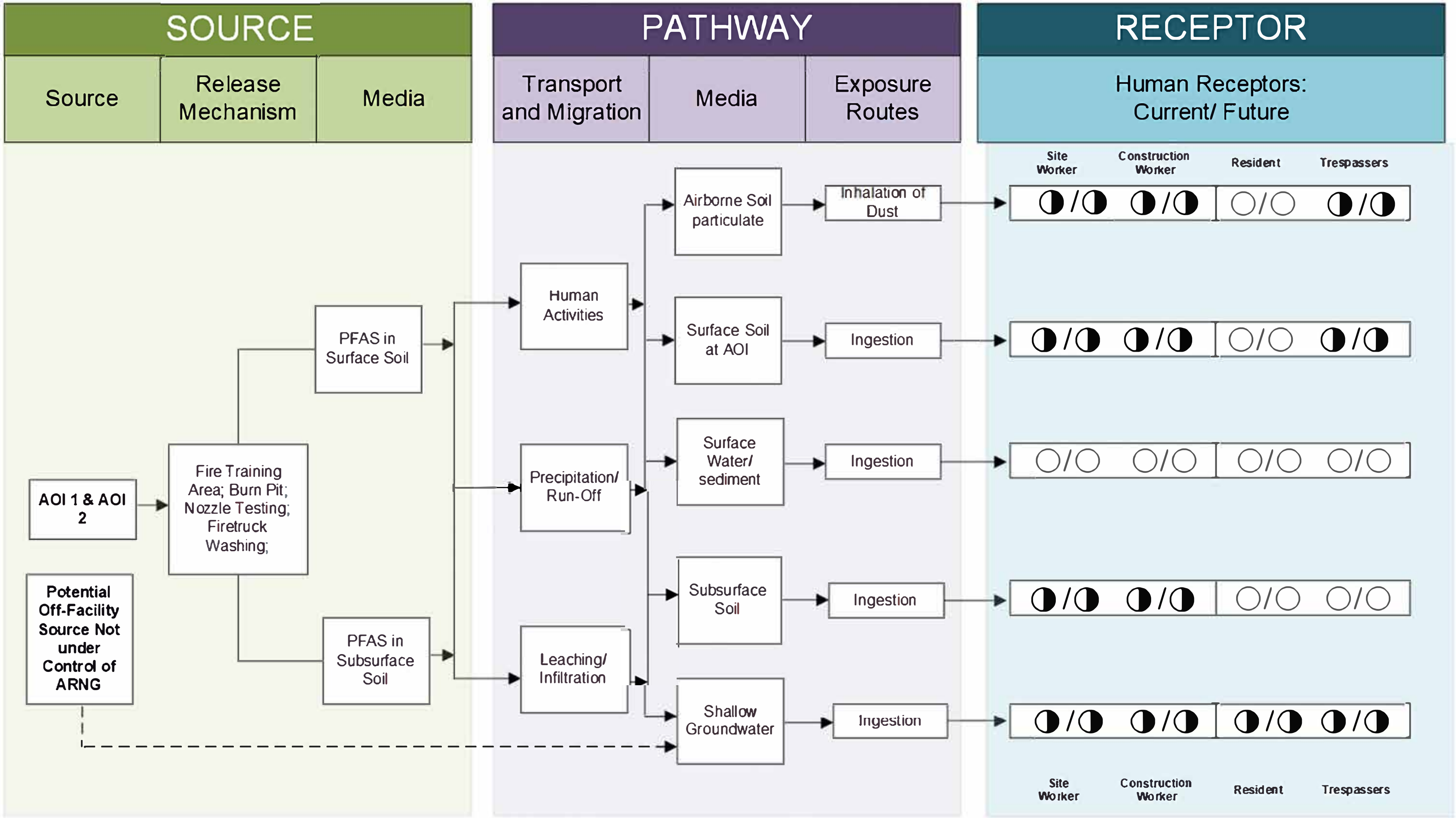


LEGEND

—□ Flow-Chart Stops

→ Flow-Chart Continues

- - -→ Partial / Possible Flow

○ Incomplete Pathway

◐ Potentially Complete Pathway

● Complete Pathway

Figure ES-2
Conceptual Site Model
AOI 1 Former FTAs and AOI 2 Fire Station
Camp Umatilla

1. Introduction

1.1 Authority and Purpose

The United States (US) Army Corps of Engineers (USACE) Baltimore District on behalf of the Army National Guard (ARNG)-Installations & Environment Division, Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide* under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017, and Modification 01 issued 30 September 2017. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The U.S. Environmental Protection Agency (USEPA) issued Drinking Water Health Advisories for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. In the absence of federal maximum contaminant levels, some states have adopted their own drinking water standards for PFAS. The Oregon Department of Environmental Quality has set Pollutant Initiation Levels (PILs) for PFAS/PFOA, which are not water quality standards (DEQ, 2017). According to OAR 340-045-0100, only facilities that operate under National Pollution Discharge Elimination System and Water Pollution Control Facility permits in Oregon are required to analyze effluent for PFAS/PFOA and report concentrations that exceed the PILs.

This report presents findings of a PA for PFAS at Camp Umatilla in Hermiston, Oregon, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300), and USACE requirements and guidance.

This PA documents the known fire training areas (FTAs) as well as other locations where PFAS may have been released into the environment at Camp Umatilla. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 1 and 2 October 2018
- Interviewed current Oregon Army National Guard (ORARNG) and Oregon Military Department (OMD) personnel during the site visit, ORARNG environmental managers, operations staff, OMD Environmental Manager, OMD Cultural Resources Manager, OMD Wildland Fire Manager, OMD Camp Rilea Training Site Manager (former State Aviation Officer), and OMD Real Estate/Property Manager

- Completed visual site inspections (VSIs) at known or suspected PFAS release locations and documented with photographs
- Developed a conceptual site model to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA, 1991). The report sections and descriptions of each are:

- **Section 1 – Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA
- **Section 2 – Fire Training Areas:** describes the FTAs at the facility identified during the site visit
- **Section 3 – Non-Fire Training Areas:** describes other locations of PFAS releases at the facility identified during the site visit
- **Section 4 – Emergency Response Areas:** describes areas of AFFF release at the facility, specifically in response to emergency situations
- **Section 5 – Adjacent Off-Site Sources:** describes sources of PFAS release adjacent to the facility that are not under the control of ARNG
- **Section 6 – Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the AOIs and the facility
- **Section 7 –Conclusions:** summarizes the data findings and presents the conclusions of the PA
- **Section 8 – References:** provides the references used to develop this document
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and History

Camp Umatilla is 3 miles south of the Columbia River (**Figure 1-1**) near the western city limits of Hermiston, Oregon positioned at the intersection of Interstate Highways 82 and 84. Formally the Umatilla Army Ordnance Depot, the facility opened in 1941 as a designated military munitions and supply depot. The facility named was changed to Umatilla Army Depot in 1962 and began receiving and storing chemical weapons until 1969. The ORARNG began utilizing the depot as a local training area in the early 1980s where it constructed and operated a number of small arms ranges and stored and maintained military vehicles. The Base Realignment and Closure (BRAC) Commission listed the facility for realignment in 1988. From 1990 to 1994, the facility reorganized in preparation for eventual closure, shipping all conventional ammunition and supplies to other installations. Umatilla Chemical Depot (UMCD) at one time stored 12 percent of the nation’s stockpile of chemical weapons, no chemical weapons were ever used, manufactured, or tested at UMCD.

In 1996, the Umatilla Chemical Agent Disposal Facility (UMCDF) was constructed to demilitarize the chemical weapons stored at the facility. Chemical weapon incineration was completed in 2011, the incineration plant was demolished, and the depot closed in 2012. This marked the end of the UMCDF's mission and the facility is now in Resource Conservation and Recovery Act closure.

In 2012, the UMCD was closed and transferred to inactive operational status in accordance with the Defense Base Closure and Realignment Act of 1990, Public Law 101–510, as amended, and the National Defense Authorization Act for Fiscal Year 2012, Public Law 112-81 (Doyle, 2018). UMCD was reassigned to the US Army Installation Management Command for management. The US Army Garrison Commander, Joint Base Lewis-McChord assumed command authority for UMCD and property accountability pending disposal of excess property. The BRAC division manages the installation and oversees a caretaker contractor to operate the facility pending disposal of the property.

In October 2017, The Adjutant General, Oregon, and the USACE signed over 7,500 acres of the former UMCD's 19,729 acres to ORARNG in order to develop a new training center they called Camp Umatilla (**Appendix A**). This new training center will accommodate the weekend and annual training requirements of the Oregon National Guard as well as military units from other services. It is also home to the 249th Regional Training Institute (RTI). Other parts of UMCD are in the process of being transferred to local governments for various uses, including a wildlife preserve.

There are 1,411 structures that were constructed on the site, including administration, maintenance, and housing facilities; ammunition storage igloos; and warehouses (UMADRA, 2010). UMCD is entirely enclosed by fencing. Activities at the site have included the disassembly, analysis, modification, reassembly, repacking, and storage of conventional munitions, and the storage and disposal of chemical agent-filled munitions and containerized chemical agents.

1.5 Facility Environmental Setting

Camp Umatilla is in north central Oregon on the southern edge of the Columbia Plateau that extends north across the Columbia River into Washington State. The Oregon portion of the plateau is made up entirely of lowlands, extending from the western Cascade Mountains to the southeastern Blue Mountains. With a generally flat to gently rolling topography, little runoff occurs on the camp because of the minimal amount of precipitation and permeable soil.

The only prominent surface feature on the Camp Umatilla is the Coyote Coulee, a valley that cuts across the facility. Land use in the vicinity of Camp Umatilla is almost exclusively zoned for agricultural use in both Morrow and Umatilla Counties with some rural-residential areas to the northwest and east of Camp Umatilla (Earth Technology Corporation 1994, 1995). The agricultural lands are easily identified by their circular shape as they are supported by center pivot irrigation. The surface elevation at the geographic center of Camp Umatilla is at 570 feet above mean sea level (amsl). However, the elevation ranges from 400 to 677 feet amsl.

1.5.1 Geology

During late Miocene and early Pliocene times, between 14 and 16 million years ago, a fissure volcanic eruption lead to a series of flood basalts that engulfed the Pacific Northwest, forming a large igneous province called the Columbia River Basalt Group. The rock group consists of five major basalt flows including the Steens Basalt, Imnaha Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt. As the molten rock came to the surface, the Earth's crust gradually sank into the space left by the rising lava, forming the down-warped bedrock surface of the Dalles-Umatilla Syncline. Camp Umatilla is near the base of the south flanks of this broad syncline. The underlying basalt is composed of layers and layers of separate basaltic lava flows, each of which is as much as 100 feet thick (Whitehead, 1994).

This subsidence of the crust produced a large plateau, slightly depressed lava plain known as the Columbia Plateau, covering more than 60,000 square miles. The northwesterly advancing lava forced the Columbia River into its present course. The Oregon portion of the plateau is made up entirely of lowlands, extending from the eastern slopes of the Cascade Mountains to the southern Blue Mountains.

Soils at Camp Umatilla consist of very deep, excessively drained sandy loam and coarse sand. Soil series identified at Camp Umatilla are Burbank loamy fine sand, Quincy fine sand, and Quincy loamy fine sand.

The surficial soil is underlain by as much as 200 feet of Pleistocene alluvial gravel deposits. These surface deposits are known as the Ordnance Gravels and are comprised of permeable silts, sands, and gravels, with some cobbles to the west of Coyote Coulee. Much coarser permeable deposits containing considerable quantities of boulders occur along the east wall of the Coulee and toward the east side of Camp Umatilla (Dames & Moore, 1992)

1.5.2 Hydrogeology

The Columbia Plateau Basaltic Aquifer system is an enormous regional groundwater resource that occupies about 50,600 square miles and extends across a small part of northern Idaho, northeastern Oregon, and a large part of southeastern Washington. The aquifer system is a layered series of fractured basalt formations of the Columbia River Basalt Group, separated by confining units and unconsolidated deposits of loose material, all underlain by pre-Miocene rocks (Whitehead, 1994).

The groundwater occurs beneath Camp Umatilla in a number of distinct hydrogeologic settings, in a series of confined basalt aquifers starting on the near surface level with an unconsolidated-deposit aquifer, Saddle Mountain Basalt, confining unit, Wanapum Basalt, confining unit, Grand Ronde Basalt, and pre-Miocene rocks (USACE, 2013). Additionally, there is a highly productive permeable unconfined aquifer to the south of Camp Umatilla, consisting of alluvial deposits and the weathered surface of the Elephant Mountain Member, basaltic flow of the Saddle Mountain Basalt group. This unit is overlain by approximately 20 to 125 feet of unsaturated alluvial sand and gravel. Depth to groundwater at the Camp Umatilla ranges from 60 to 100 feet below ground surface (bgs). Groundwater flow in the unconfined aquifer generally is to the northwest, seen in **Figure 1-2** (Dames and Moore, 1992).

Three municipal water supply systems, the Cities of Hermiston, Umatilla, and Irrigon, withdraw groundwater and approximately 1,500 domestic and irrigation wells have been identified within a 4-mile radius of Camp Umatilla. The Columbia River is a major source of potable and irrigation water in the region, and is used for recreation, fishing, and the generation of hydroelectric power. The Umatilla River is a tributary to the Columbia River, and its principal use is for irrigation (USACE, 2013).

Camp Umatilla is located within the Oregon Water Resources Department (OWRD) Ordnance Gravel Critical Groundwater Area (CGA) and the Ordnance Basalt CGA, both of which have restrictions on water allocation. The Ordnance Gravel CGA, which protects an overlying alluvial aquifer, comprises approximately 82 square miles, while the Ordnance Basalt CGA, which protects the underlying Columbia River Basalt aquifer, comprises approximately 175 square miles (OWRD, 2018). The OWRD, working in conjunction with other state agencies and local planning groups, has proposed a project to increase water availability in the Ordnance Gravel and Basalt CGAs. The plan evaluates pumping water from the Columbia River during available months for storage in the CGA aquifer for later use during seasonal higher water demand (IRZ, 2009).

Camp Umatilla drinking water is supplied by two groundwater wells that draw water from a confined basalt aquifer, with minimum depths at approximately 200 feet bgs; none of the drinking water supplies at Camp Umatilla draw water from the overlying unconfined alluvial aquifer. The pumping capacity of these drinking water wells ranges from 30 to 1,000 gallons per minute, with approximately 20 percent of the total capacity of these wells being used for domestic water, while the remainder is used for fire protection (USFWS, 2007). According to OMD, plans have been established to utilize three on-site wells and re-drill two additional wells in the immediate future for additional drinking water.

There has been a total of 120 groundwater monitoring wells installed at the facility (USACE, 2013). Data obtained from these wells suggest that the natural direction of groundwater flow at UMCD is northward, toward the Columbia River. However, irrigation pumping of the shallow alluvial aquifer causes groundwater in the south and central part of UMCD to flow to the south during the summer and fall (Earth Technology Corporation, 1994).

The snowmelt water from the Blue Mountains of Eastern Oregon contributes some to the recharge of deep basalt aquifers underlying the Columbia River Plateau. However, overall, recharge is slow because of the low rainfall in the region, and the recharge areas are not large compared to the expanse of the plateau. Historically, surface water withdrawals from the Columbia River have been greater than recharge in many areas and restrictions have been placed on groundwater in some parts of this aquifer system.

1.5.3 Hydrology

Surface waters infiltrate into the permeable soils before running off onto lower surrounding lands; therefore, no standing surface water is found at Camp Umatilla. The closest regional surface water sources are the Umatilla River located 2 miles east and the Columbia River located 3 miles north of Camp Umatilla.

The Umatilla River is an 89-mile tributary of the Columbia River with headwaters in the Blue Mountains. Draining a basin of 2,450 square miles, it enters the Columbia River near the city of Umatilla, northeast of the camp. The Columbia River is the largest river in the Pacific Northwest region of North America. With a drainage area of 258,000 square miles and length of 1,243 miles, the river extends into seven US states and a Canadian province. Starting in the Rocky Mountains of British Columbia, Canada, it flows northwest and then south into the US state of Washington, then turns west to form most of the border between Washington and the state of Oregon before emptying into the Pacific Ocean.

There are several canal systems surrounding Camp Umatilla including the West Extension Irrigation Canal to the north, High Line Canal to the south, and Westland Canals F, A, and I to the east (see **Figure 1-2** and **Figure 1-3**). These canals remove water from the Umatilla River for irrigation of the local agriculture.

The central part of Camp Umatilla lacks any well-defined drainage pattern. The minimal runoff generated in this area generally flows into the numerous shallow depressions found in the flat and gently rolling topography in the area. The most significant of these depressions are located at the base of the west-facing bluff of Coyote Coulee. Several of the buildings located at the top of the bluff have drainage going into these depressions. Surface runoff in the area east of Coyote Coulee is toward the southern boundary into a shallow, elongated depression running parallel to the Union Pacific Railroad and Interstate Highway 84 (Earth Technology Corporation 1994, 1995).

Camp Umatilla is responsible for handing and treating all wastewater produced within the facility. A sewage treatment plant, septic tanks, and drain field systems are located throughout the facility. Camp Umatilla operates these systems in accordance with one National Pollutant Discharge

Elimination (NPDES) permit as well as two water pollution control permits issued by the Oregon Department of Environmental Quality (USACE, 2013). Domestic wastewater is run through an oil water separator (OWS) and then routed to the sewage treatment plant at the south-center part of the facility (**Figure 1.3**).

1.5.4 Climate

Camp Umatilla is characterized as a semi-arid low humidity climate ideal for the storage of ammunition. Air temperatures are moderated year round by the Pacific Ocean with seasonal temperatures at Camp Umatilla averaging between 75 degrees Fahrenheit (°F) in summer and 35°F in winter. Highs in can reach 100°F when air from the Pacific is hindered by predominating, stagnant, high-pressure systems in the north or east in the summer or early fall. The resulting dry and hot southerly air allows for increased risk of wildfires in the region surrounding Camp Umatilla. Wind in the area tends to be channeled along the Columbia River valley, in conjunction with a prevailing westerly wind direction in the area, results in a prevailing west-southwest wind at UMCD.

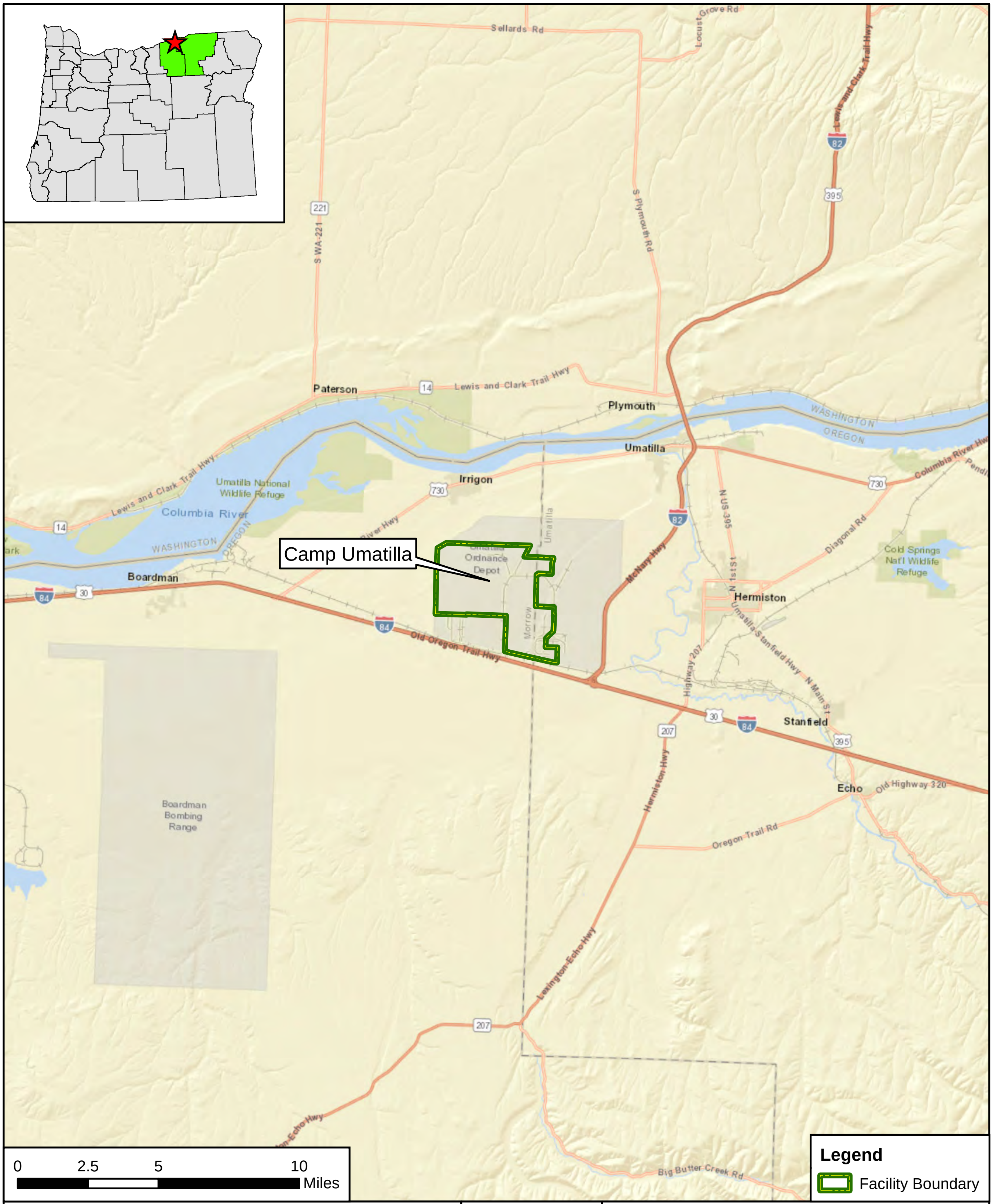
Average annual precipitation is 8.85 inches, 60 percent of which occurs between November and March. Annual snowfall is approximately 10 inches, with the majority of this falling between December and March. Although summer precipitation is unusual, when it does occur, it is usually in the form of thunderstorms, which can sometimes cause flash flooding.

1.5.5 Current and Future Land Use

In a recent BRAC meeting to reassess the land space and training needs of the former UMCD, a plan was developed to divide the installation into four parcels. One parcel will be turned into a wildlife conservation refuge. The second parcel will become an industrial zone to aid in the economic growth of the area. The third parcel will be taken over by the Oregon Department of Transportation with the fourth parcel going to the ORARNG for the use as a premier training facility, now known as Camp Umatilla. The OMD invested $2 million in infrastructure improvements to the 1940s era installation (Ingersoll, 2018).

Camp Umatilla is currently used for weekend and annual training requirements for the Guard and other military branches. Camp Umatilla is home to the ORARNG's 1st Infantry Training Battalion of the 249th RTI and the only certified Army infantry training academy west of the Mississippi River in the continental United States (Koester, 2016).

Over the next few years, OMD plans to invest in facility improvements that include sewer line repairs, new water distribution system, road realignments, security fencing, administration and office space enhancements, new classrooms, as well as barracks for more than 320 soldiers and dining facility improvements (Ingersoll, 2018). After these improvements, OMD plan to build an infantry training schoolhouse (McDowell, 2018).



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Base Map: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI,		PM	RG	1/8/2019

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Facility Location

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-1

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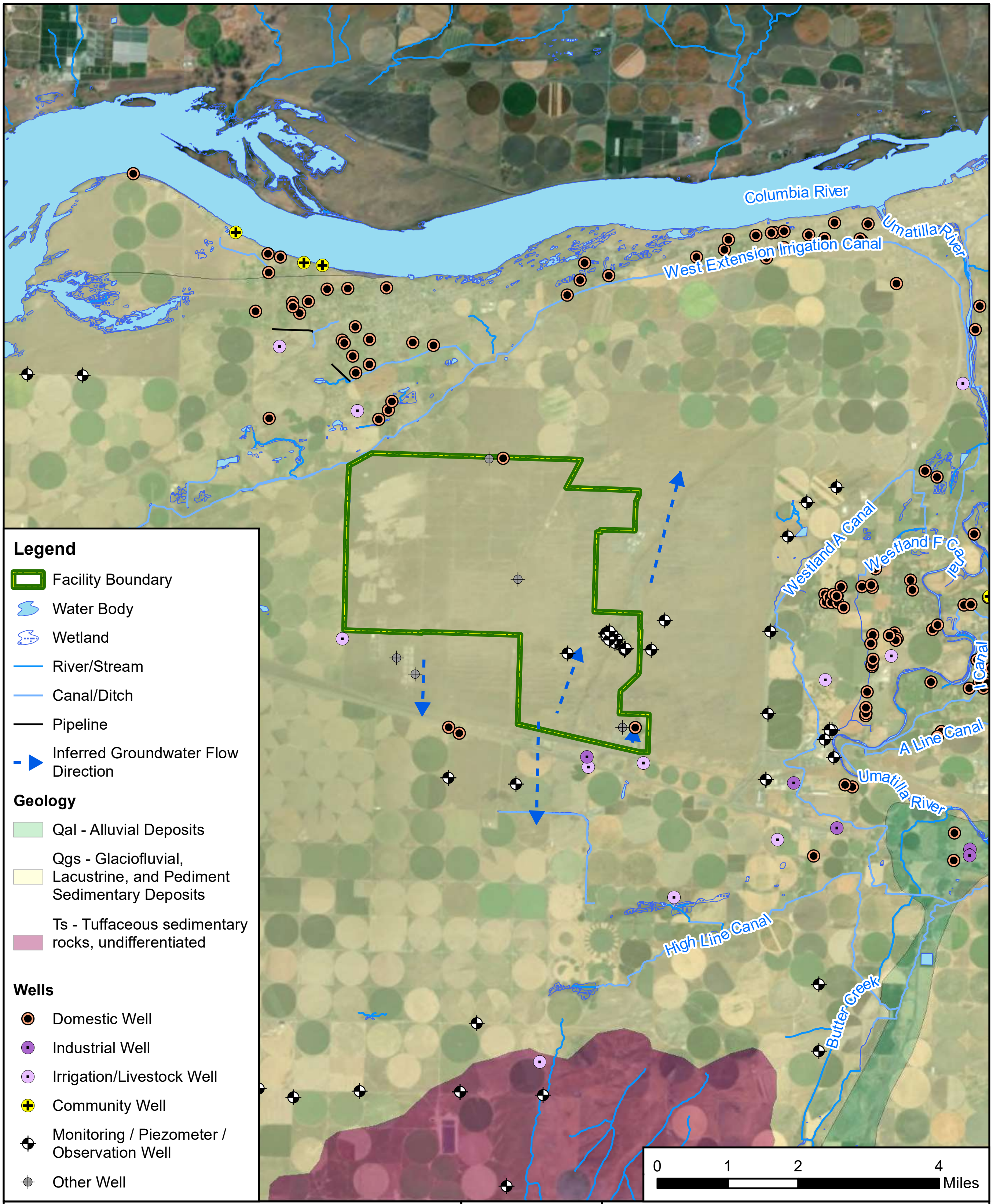

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Groundwater Features

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-2

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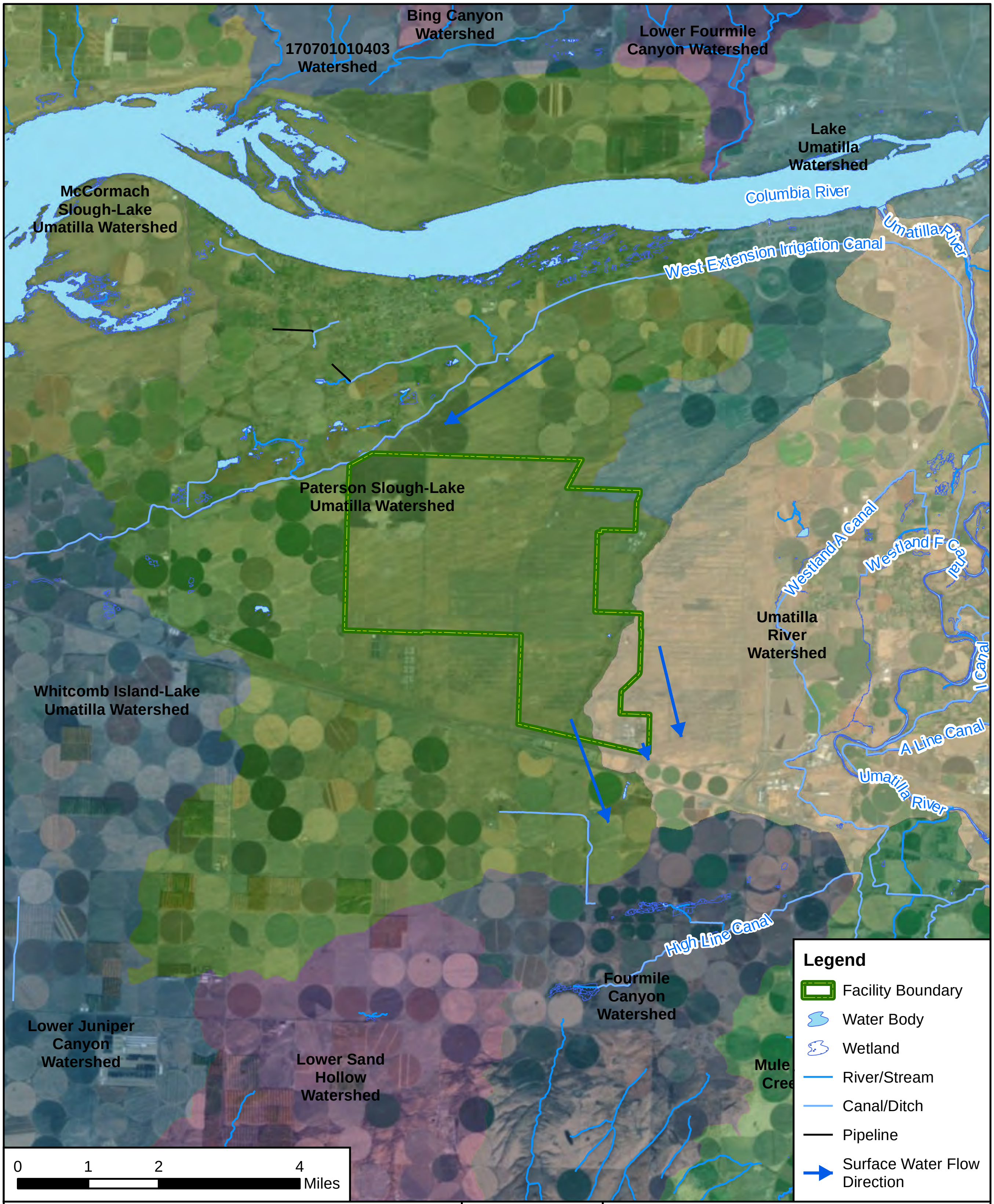

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-3

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2. Fire Training Areas

Two designated FTAs were identified within the Camp Umatilla facility during the PA through interviews. These FTAs are addressed below.

2.1 FTA 01

During interviews, facility personnel indicated that a former FTA was located directly across from the Fire Station in an open grassy area. Mixtures of water and foam were sprayed from the fire truck during fire training activities for nozzle testing. Interviewees were unsure if the foam used during these events was AFFF or Class A foam; however, it was confirmed that an unknown foam material was used during the training events. The time period of these trainings is unknown; however, interviewees recalled that training occurred at least ten to fifteen years ago. Current fire training activities do not include the use of AFFF; only water is used for the training events.

2.2 Burn Pit

Approximately 100 yards north of FTA 01 is a designated burn pit. Wood, brush, tumbleweed, and organic debris have been burned at this location for fire training activities for an unknown period of time. Controlled burns would occur at this pit and personnel would practice suppressing the fire with foam.

According to interviews, burning at this pit would occur frequently, with burns occurring daily or multiple times a week during cooler months from January to March and October to December. In warmer months, burning of debris at this location would occur on a weekly basis. Interviewees recall using foam during these burns to help suppress fires; however, the type of foam used is unknown and could not be confirmed during interviews. Based on interviewee knowledge and review of aerial photography, it is estimated that this burn pit has been used for at least the last ten years.

CLIENT	ARNG			
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Fire Training Areas

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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3. Non-Fire Training Areas

Two non-FTAs where AFFF was potentially stored and/or released were identified during the PA. A description of each non-FTA is presented below. The Fire Station is shown on **Figure 3-1**.

3.1 Fire Station

Located approximately 100 yards north of the Camp Umatilla facility entrance is an active fire station. Personnel from Camp Umatilla stated that any AFFF on site currently or in the past was stored at the Fire Station. Currently, there is one half-filled 5-gallon bucket of concentrated Angus Tridol AFFF stored within the Fire Station; it is unknown how long this bucket has been stored or where it originated from. Due to partial deterioration of the label, the concentration of AFFF in this bucket is unknown.

Previously, AFFF-capable firetrucks were located at Camp Umatilla and would be refilled using 5-gallon buckets at the Fire Station. It is unknown how many fire trucks were located at Camp Umatilla or the timeframe of their operation at Camp Umatilla. The AFFF tanks on the firetrucks were refilled manually with 5-gallon buckets and there was no designated staging area for the refilling. Additionally, any washing of the firetrucks would occur outside of the Fire Station. Drains within the Fire Station are routed to an on-site wastewater treatment plant, which then discharges wastewater via subsurface leachfield. Any solid residual is pumped out by a licenses septic hauler, which has the potential to be discharged to the City of Umatilla Wastewater Treatment Plant (WWTP). Wastewater treatment and management within Camp Umatilla is described in **Section 1.5.2**.

No AFFF fire suppression systems are located in the Fire Station or any other building at Camp Umatilla, including the fueling points. All fire suppression systems and portable extinguishers are non-PFAS containing.

3.2 Nozzle Testing

During an interview with a retired wildland firefighter, it was confirmed that nozzles on the fire trucks were tested annually at Camp Umatilla. There was no designated nozzle test area, so this annual testing would be performed at random locations throughout Camp Umatilla. Firetrucks used during these nozzle testing events were AFFF-capable firetrucks; however, one interviewee stated AFFF was potentially released during the testing events, while another interviewee recalls only water being released during the annual events. The location of the nozzle testing areas and whether AFFF was released during the annual events is unknown. The type, quantity, and concentration of AFFF potentially released during the testing events are also unknown.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Umatilla, OR			
REVISED	1/8/2019	GIS BY	MS	1/8/2019
SCALE	1:2,400	CHK BY	TK	1/8/2019
Base Map: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI,		PM	RG	1/8/2019

N

Non-Fire Training Areas

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Emergency Response Areas

No emergency response areas or incidents involving the use of AFFF were identified within the Camp Umatilla facility during the PA. A large brush fire occurred in May 2016 which burned approximately 12,000 acres, both within and outside the Camp Umatilla facility boundary. Several local area fire departments, including personnel from Camp Umatilla, responded to the brush fire. All interviewees confirmed that only Class A foam was used to suppress this brush fire. No AFFF was used during this emergency response incident.

5. Adjacent Off-Facility Sources

One potential off-facility source of PFAS adjacent to Camp Umatilla, not under the control of the ORARNG, was identified during the PA through interviews or historical document review. A description of the adjacent source is presented below and is shown on **Figure 5-1**.

5.1 Former Umatilla Army Airfield

Approximately one mile southeast of the facility fire station a former airfield. This airfield was part of the Umatilla Army Depot before the facility was realigned under BRAC in 1988. Based on historic aerial photography and documents, the airstrip was constructed sometime between 1956 and 1964 and was listed as closed in 1998. It is unknown what entities may have potentially used the airfield other than the Army and potential AFFF use, storage, or release at this airfield is also unknown. However, at least one building, potentially a hangar, is located on the northeast side of the airstrip. Hangars typically have fire suppression systems or other types of mobile fire extinguishers to aid in emergency response activities on or near the flightline, which often include the use or storage of AFFF. While detailed information regarding historic use of this airstrip is unavailable, the potential for AFFF to be historically used, stored, or released at this airfield leaves the potential for exposure to PFAS.

CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Camp Umatilla, OR			
REVISED	6/26/2019	GIS BY	MS	6/26/2019
SCALE	1:14,400	CHK BY	TK	6/26/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	6/26/2019

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TITLE

Adjacent Source

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Preliminary Conceptual Site Model

Based on the PA findings, two AOIs were identified at Camp Umatilla: AOI 1 Former FTAs and AOI 2 Fire Station. These AOI locations are shown on **Figure 6-1**. The following sections describe the conceptual site model (CSM) components and the specific CSMs developed for these AOIs. The CSM identifies the three components necessary for a potentially complete exposure pathway: (1) source, (2) pathway, (3) receptor. If any of these elements are missing, the pathway is considered incomplete.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Dermal contact is not considered to be a potential exposure pathway as studies have shown very limited absorption of PFAS through the skin (NGWA, 2018). Receptors at the AASF include site workers and construction workers. The CSM indicates which specific receptors could potentially be exposed to PFAS.

6.1 AOI 1 Former FTAs

AOI 1 is the Former FTAs area. This AOI consists of FTA 01 and the Burn Pit. Interviews confirmed that these two locations, approximately 100 yards apart, were used as former fire training areas with the potential for PFAS use. Based on close proximity and similar historical use, these two areas were grouped into one AOI.

FTA 01 was an area designated for fire training and nozzle practice; however, interviewee’s could not confirm whether the foam used during these trainings was PFAS-containing. It is estimated that this training occurred approximately 10 to 15 years ago; however, the duration and time period of these events is estimated. The Burn Pit area was formally used to conduct controlled burns of wood and other organic debris regularly throughout the year. Interviewee’s recall foam being used during these burns to suppress flames; however, it could not be confirmed if the foam used during these burns was PFAS-containing.

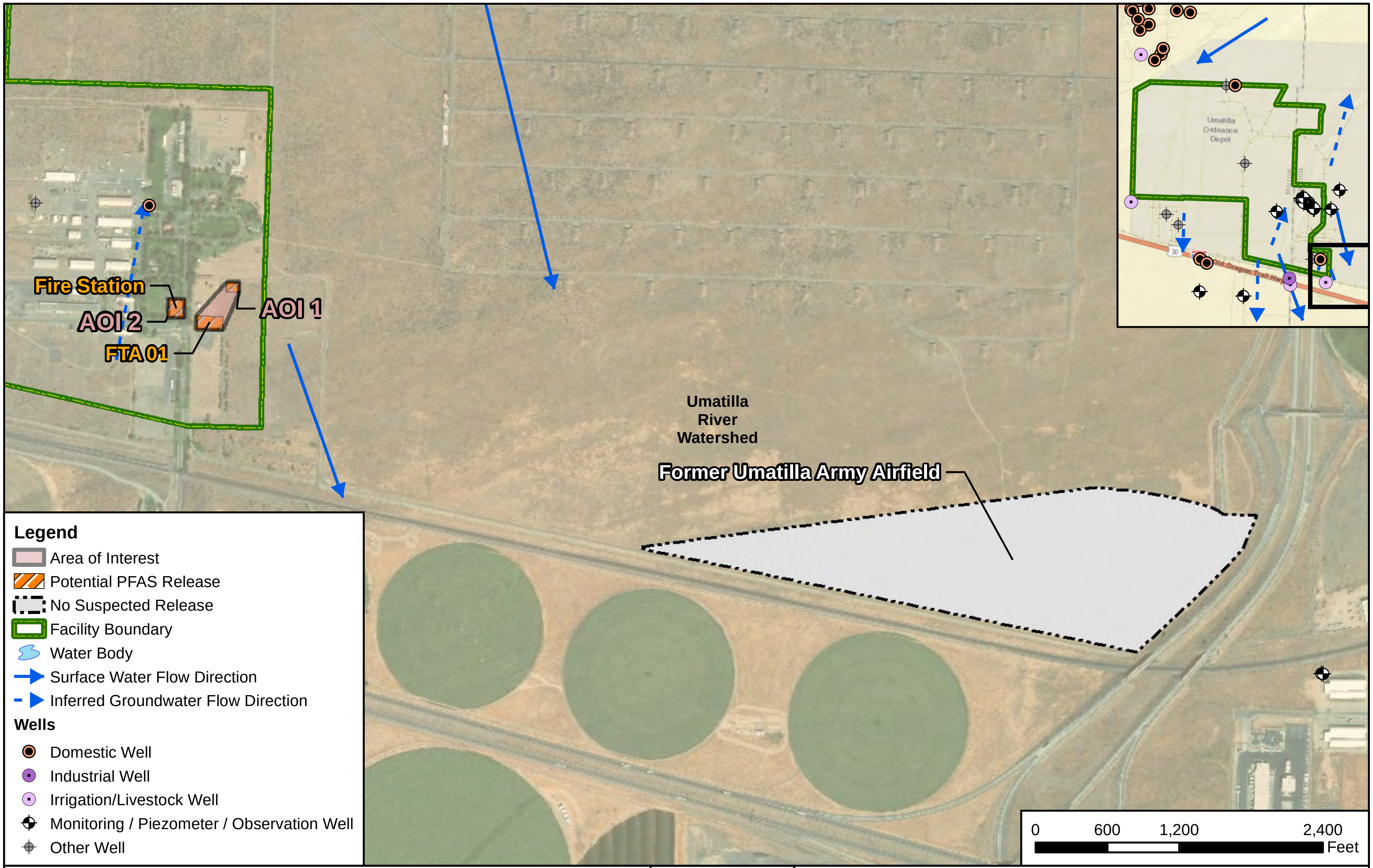
Ground-disturbing activities to soil at AOI 1 could result in site worker, construction worker, and trespasser exposure to potential PFAS contamination via ingestion of surface soil or inhalation of soil particles (dust). Ground-disturbing activities to subsurface soil could result in site and construction worker exposure. Therefore, the inhalation and ingestion pathways for these receptors are considered potentially complete for AOI 1.

PFAS are water soluble and can migrate readily from soil to the groundwater, which is estimated to be 60 to 100 feet bgs. Because potential PFAS releases to surface soil at AOI 1 have occurred, PFAS may migrate from the surface soil to the groundwater via leaching. Because drinking water wells are located within the facility boundary, the ingestion exposure pathway for groundwater to site workers, construction workers, nearby off-facility residents, and trespassers is considered potentially complete. No surface water features flow through this AOI; therefore, surface water and sediment exposure pathways are incomplete. The CSM for AOI 1 is shown on **Figure 6-2**.

6.2 AOI 2 Fire Station

AOI 2 is the Fire Station. This fire station has known and potential historic use or storage of PFAs-containing materials. There is currently one 5-gallon bucket of concentrated AFFF stored within the fire station. Previously, AFFF-capable firetrucks were located at Camp Umatilla and would be refilled using 5-gallon buckets at the fire station. The AFFF tanks on the firetrucks were refilled manually with 5-gallon buckets and there was no designated staging area for this refilling. Additionally, any washing of the firetrucks would occur outside of the fire station.

Because potential PFAS releases to surface soil at AOI 2 have occurred, PFAS may migrate from the surface soil to the groundwater via leaching. The pathways and receptors for AOI 2 are the same as described in **Section 6.1**. The CSM for AOI 2 is shown on **Figure 6-2**.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Camp Umatilla, OR			
REVISED	8/30/2019	GIS BY	MS	8/30/2019
SCALE	1:14,400	CHK BY	TK	8/30/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	8/30/2019

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TITLE

Areas of Interest

AECOM

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Germantown, MD 20876

Figure 6-1

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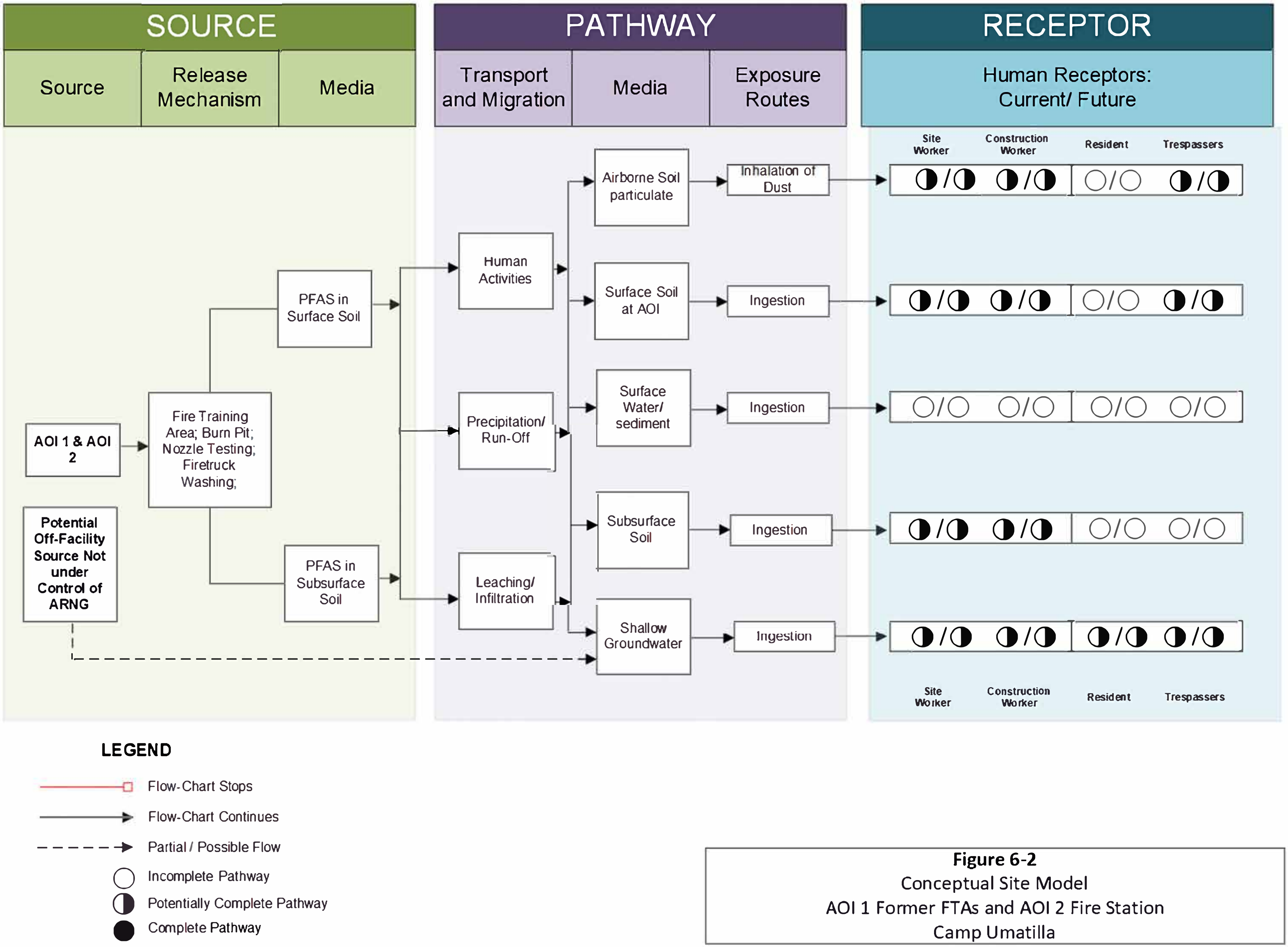


Figure 6-2
Conceptual Site Model
AOI 1 Former FTAs and AOI 2 Fire Station
Camp Umatilla

7. Conclusions

This report presents a summary of available information gathered during PA efforts on the use and storage of AFFF at Camp Umatilla. The PA findings are based on personnel interviews, environmental investigations and reports, historical documents, and the VSI.

7.1 Findings

Two AOIs related to a PFAS release were identified at Camp Umatilla (**Table 7-1**) during the PA (**Figure 7-1**).

Table 7-1: AOIs at Camp Umatilla

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Former FTAs	ORARNG	~2003-2017
AOI 2	Fire Station	ORARNG	Unknown

Based on the likely AFFF releases at these AOIs, there is potential for exposure to PFAS contamination in surface soils to site workers, construction workers, and trespassers via inhalation and ingestion; in subsurface soils to site and site and construction workers via inhalation and ingestion; and in groundwater for site workers, construction workers, nearby off-facility residents, and trespassers via ingestion.

The following areas discussed in **Section 2** through **Section 5** were determined to have no suspected PFAS releases to the environment (**Table 7-2**).

Table 7-2: No Suspected Release Areas

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Brush Fire	ORARNG and other various local and state entities	The large 12,000-acre brush fire that occurred in May 2016 required assistance from ORARNG along with other various local and state emergency response entities; however, all interviewees claimed only Class A foam was used during this emergency response incident.

7.2 Uncertainty

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at Camp Umatilla. Historically, documentation of PFAS use was not required because PFAS were considered benign. Records were not typically kept by the facility or available during the PA on the use of PFAS in emergency response or by non-ORARNG units during training events at the AASF.

The conclusions of this PA are predominantly based on the information provided during interviews with personnel who had direct knowledge of PFAS use at the facility. Sometimes the provided information was vague. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge due to staffing changes, the time passed since PFAS was first used (1969 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS release locations. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding the use and storage of PFAS were reviewed, multiple persons were interviewed for the same potential source area, and potential source areas were visually inspected. **Table 7-3** summarizes the uncertainties associated with the PA:

Table 7-3: Uncertainties

Area of Interest	Source of Uncertainty
All AOIs	Exact timeframe of use at the AOIs is unknown or estimated. Based on interviewee knowledge and review of historical documents, information regarding any associated AFFF-activity was only available from approximately 2003 until present. No information relating to AFFF was available prior to 2003.
FTA 01	The type, quantity, and concentration of AFFF potentially used at this FTA are unknown.
Burn Pit	The type, quantity, and concentration of AFFF potentially used at this FTA are unknown.
Fire Station	While only one bucket of concentrated AFFF is currently present at the fire station, storage of AFFF historically occurred at this fire station; however, quantities or concentrations of AFFF historically stored at the fire station are unknown. Whether any potential spills or releases occurred from storage of buckets, transfer of AFFF from buckets to firetrucks, or from the AFFF tanks on the firetrucks is unknown.
Nozzle Test Area	The various locations of the annual testing could not be confirmed during interviews. In addition, one interviewee indicated that AFFF was used during nozzle testing, while another interviewee stated only water was used for testing. Whether AFFF was used and released during nozzle testing is unknown. The type, quantity, and concentration of AFFF potentially released during annual nozzle testing are also unknown.
Former Umatilla Army Airfield	Exact timeframe of use and entities who used this airfield other than the Army are unknown. Whether there was a fire suppression system, mobile fire extinguishers, or other AFFF-materials used, stored, or released at this airfield is unknown.

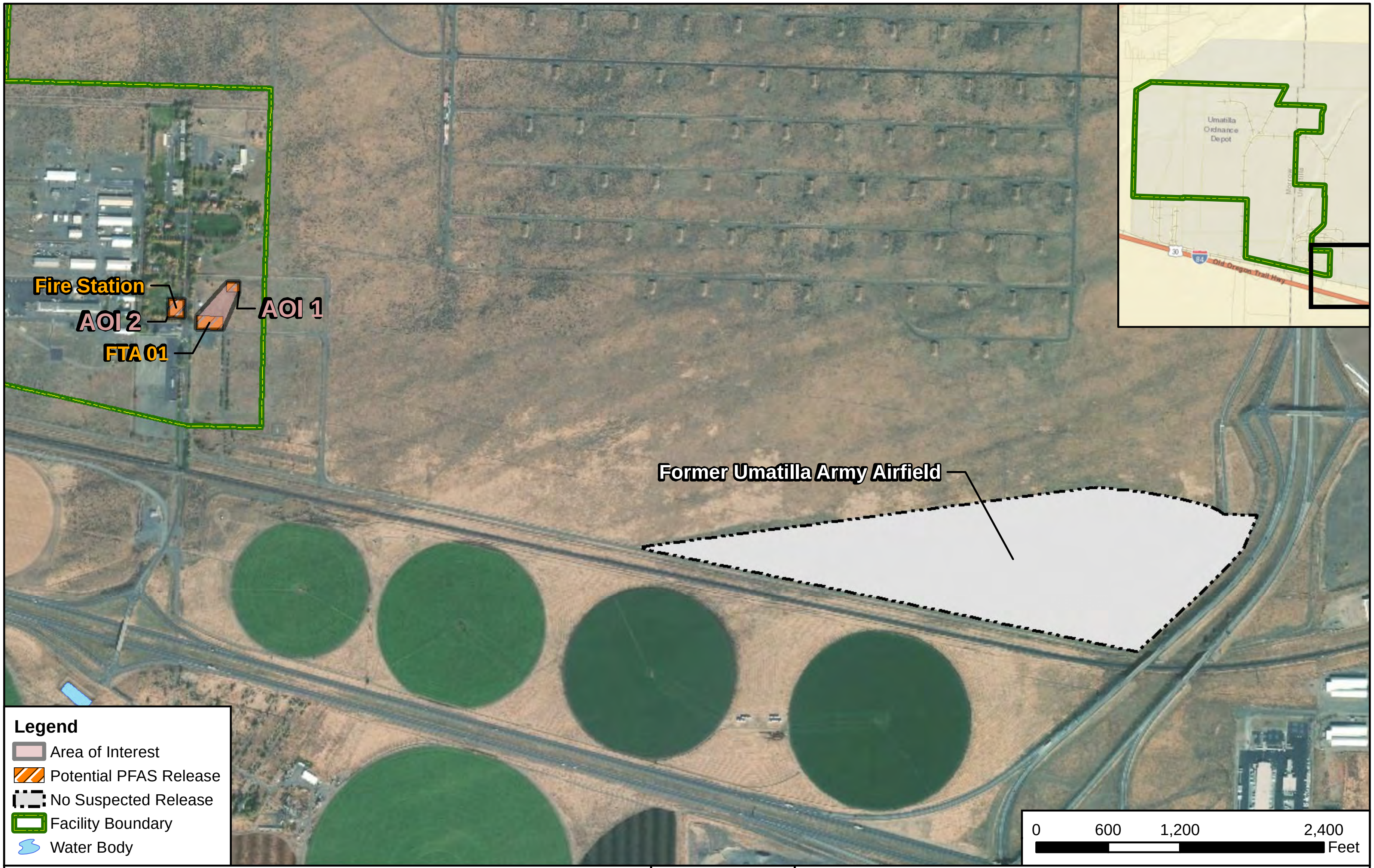
7.3 Potential Future Action

Interviews and records (covering 2003 to present) indicate that current or former ARNG activities may have resulted in potential PFAS releases at the two AOIs identified during the PA. Based on the CSMs developed for the AOIs, there is potential for receptors to be exposed to PFAS contamination in soil, subsurface soil, and groundwater at these AOIs. **Table 7-4** summarizes the rationale used to determine if the AOI should be considered for further investigation under the CERCLA process and undergo a Site Inspection (SI).

ARNG will evaluate the need for an SI at Camp Umatilla based on the potential receptors, the potential migration of PFAS contamination off the facility, and the availability of resources.

Table 7-4: PA Findings Summary

Area of Interest	Rational	Potential Future Action
AOI 1 Former FTAs	Former FTA released unknown foam during regular training events. Burning at the pit would occur frequently, with burns occurring daily or multiple times a week during cooler months, unknown foam used to surpass the fires.	Proceed to an SI, focus on soil and groundwater
AOI 2 Fire Station	Historic storage of AFFF-capable firetrucks, historic washing of firetrucks outside fire station, and current storage of one 5-gallon bucket of AFFF.	Proceed to an SI, focus on soil and groundwater



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Camp Umatilla, OR			
REVISED	6/27/2019	GIS BY	MS	6/27/2019
SCALE	1:14,400	CHK BY	TK	6/27/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	6/27/2019

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Summary of Findings

AECOM

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Figure 7-1

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Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for the Camp Umatilla include:

Camp Umatilla Leases, Licenses, and Permits

- 2017 Department of the Army License for National Guard Purposes Camp Umatilla National Guard Training center Morrow and Umatilla Counties, Oregon. License No. DACA67-3-17-66.

Previous Investigations Completed at the Camp Umatilla

- 2007 Final Integrated Natural Resources Management Plan October 2007 through September 2012, U.S. Army Umatilla Chemical Depot Hermiston, Oregon.
- 2009 Umatilla Basin Regional Aquifer Recovery Assessment Report, for Oregon Water Resources Department by IRZ.
- 2010 U.S. Army Umatilla Chemical Depot Base Redevelopment Plan, Umatilla Army Depot Reuse Authority.
- 2012 Revised Environmental Condition of Property Environmental Baseline Survey Report, Umatilla Chemical Depot.
- 2013 U.S. Army BRAC 2013 Environmental Condition of Property Report Umatilla Chemical Depot – Oregon, USACE.
- 2017 U.S. Army BRAC Environmental Condition of Property Report Update, Umatilla Chemical Depot – Oregon, BRAC.
- 2018 Final Environmental Assessment for Expanded Operations at the Oregon Army National Guard's Camp Umatilla Oregon (CUO), Oregon National Guard.

Camp Umatilla Installation Maps

- 2018 Site #41A82 Camp Umatilla Oregon, by Oregon Military Department.

Camp Umatilla EDR Report

- 2018 Camp Umatilla Environmental Data Resource Report.

NO. DACA67-3-17-66

DEPARTMENT OF THE ARMY

LICENSE FOR

NATIONAL GUARD PURPOSES

CAMP UMATILLA
NATIONAL GUARD TRAINING CENTER

MORROW & UMATILLA COUNTIES, OREGON

THE SECRETARY OF THE ARMY, hereinafter referred to as the Secretary, under the authority of Title 32, United States Code, Section 503 and Title 10, United States Code, Section 18235, hereby grants to the **State of Oregon**, hereinafter referred to as the grantee, a license to use and occupy for training and support of the Oregon Army National Guard, certain land, improvements, and interests, hereinafter referred to as the PREMISES. These are identified as approximately 7,500 acres of land (former Umatilla Chemical Depot) designated as Tract 100, Improvements and Facilities, Water Rights Certificates, Safety Easements, and Rights-of-Way, as identified and shown in Exhibits A through E, attached hereto and made a part hereof.

THIS LICENSE is granted subject to the following conditions:

1. TERM

This license is granted for an indefinite term, beginning 3 October, 2017, but revocable at will by the Secretary.

2. NOTICES

All notices and correspondence to be given pursuant to this license shall be addressed, if to the grantee, to the Oregon Military Department, Director of Installations, Oregon Army National Guard, 1776 Militia Way, P.O. Box 14350, Salem, Oregon 97309-5047; and if to the United States, to the District Engineer, Attention: Chief, Real Estate Division, Seattle District, Army Corps of Engineers, P. O. Box 3755, Seattle Washington 98124-3755; or to other addresses and designees as may from time to time otherwise be directed in writing by the parties. Notice shall be deemed to have been duly given if and when enclosed in a properly sealed envelope addressed as aforesaid, and deposited, postage prepaid, in a post office regularly maintained by the United States Postal Service.

3. AUTHORIZED REPRESENTATIVES

Except as otherwise specifically provided, any reference herein to "Secretary", "District Engineer", "Installation Commander", or "said officer" shall include their duly authorized representatives. Any reference to "grantee" shall include any duly authorized representatives.

4. SUPERVISION BY THE UNITED STATES PROPERTY AND FISCAL OFFICER

The use and occupancy of the PREMISES shall be without cost to the regular establishment of the military departments of the Department of Defense and shall be under the general supervision of the United States Property and Fiscal Officer for Oregon (USP&FO), hereinafter referred to as said officer, and subject to such rules and regulations as may be prescribed from time to time by said officer. This license shall not be construed so as to create a financial obligation on the Department of the Army or the Department of Defense arising from, or related to, the grantee's occupation or use of the Premises or to require the Department of the Army or the Department of Defense to incur, or reimburse the grantee for, the cost of any environmental response or corrective action that may be necessary as a result thereof. Provided, however, that this provision shall not restrict the acceptance, obligation, or expenditure of funds provided to the grantee or the Oregon Army National Guard from the regular appropriations of the NGB and pursuant to the NGB's authorities and or at the NGB's discretion.

5. APPLICABLE LAWS AND REGULATIONS

The grantee shall comply with all applicable Federal, state, county, and municipal laws, ordinances, and regulations wherein the PREMISES are located.

6. FACILITY MAINTENANCE

The grantee shall maintain and keep the PREMISES in good repair and condition and all costs of operation, maintenance, and restoration shall be paid for from funds available to the grantee.

7. RIGHT TO USE

The United States, hereinafter referred to as the Government, reserves the right to use the PREMISES, or any part thereof, including all buildings and improvements situated thereon, for such purposes as said officer deems necessary in the interest of national defense.

8. COST OF UTILITIES

The grantee shall pay the cost of obtaining, producing and/or supplying any utilities or other services required by the grantee. The Government shall be under no obligation to furnish utilities or services.

9. USE RESTRICTIONS

The buildings and improvements included in this license shall not be used for the quartering of personnel engaged in national guard activities except when such personnel are in the Federal service or are participating in authorized training. This clause shall not be interpreted to prohibit quartering of personnel who are not in the Federal service or who are not participating in authorized training if the costs of quartering such personnel are assumed by the grantee or ORARNG.

10. IMPROVEMENTS AND ALTERATIONS

Additions to or alteration or improvement of the PREMISES shall not be made without prior written approval of theUSP&FO. All such additions, alterations or improvements shall be maintained by the grantee in good repair and condition. All such work designated as permanent by said officer shall, upon completion, become property of the Government. The grantee shall provide a copy of all Master Plans and Master Plan Updates to the Army Corps of Engineers, Seattle District, Real Estate Division, ATTN: CENWS-REO, PO Box 3755, Seattle, WA 98124-3755.

11. CONDITION OF PREMISES

The grantee acknowledges that it has inspected the PREMISES, knows its condition, and understands that the same is granted without any representations or warranties whatsoever and without any obligation on the part of the Government. The responsibilities of the NGB and the U.S. Army Base Realignment and Closure Division with respect to the environmental restoration of the premises are described in the MOA at Exhibit G. The said MOA creates no rights enforceable by the grantee.

12. TERMINATION

This license may be terminated by the grantee at any time by giving the District Engineer at least thirty (30) days notice in writing.

13. RESTORATION

On or before the termination of this license by the grantee, the grantee shall vacate the PREMISES, remove its property (except those permanent additions, alterations, and improvements which have become property of the Government under provision of the condition on **IMPROVEMENTS AND ALTERATIONS**) and restore the PREMISES to a condition satisfactory to said officer, ordinary wear and tear and damage beyond the control of the grantee excepted. If, however, this license is revoked, the grantee shall vacate the PREMISES, remove said property and restore the PREMISES within such time as the District Engineer may designate. In either event, if the grantee fails to remove said property and restore the PREMISES, then, at the option of said officer, the property shall either become the property of the Government without compensation therefor, or said officer may cause the property to be removed at the expense of the grantee, and no claim for damages against the Government shall be created on account of such action.

14. USE BY OTHERS

The grantee shall not transfer or assign this license, or any interest in the PREMISES however, upon concurrence of the Director, Army National Guard, National Guard Bureau, the grantee may (1) permit the temporary or intermittent use of the PREMISES by elements of the Department of Defense for joint use or individual training purposes, provided such use will not interfere with the National Guard use; or (2) issue licenses for law enforcement, nonprofit, community service-type activities under the same conditions as those allowed by active installation commanders by existing Army regulations.

15. PROTECTION OF PROPERTY

a. The grantee shall keep the PREMISES in good order and in a clean, safe condition by and at the expense of the grantee. The grantee shall be responsible for any damage that may be caused to property of the United States by the activities of the grantee under this license, and shall exercise due diligence in the protection of all property located on the PREMISES against fire or damage from any and all other causes. Any property of the United States damaged or destroyed by the grantee incident to the exercise of the privileges herein granted shall be promptly repaired or replaced by the grantee to a condition satisfactory to said officer, or at the election of said officer, reimbursement made therefor by the grantee in an amount necessary to restore or replace the property to a condition satisfactory to said officer, in both instances taking into account the prior condition of the property.

b. Upon termination of the grantee's requirement for the PREMISES, the grantee shall remain responsible to protect and maintain the PREMISES until transfer to and acceptance by another accountability officer is accomplished or in accordance with applicable laws, rules and regulations.

16. ENVIRONMENTAL PROTECTION

a. Within the limits of their respective legal powers, the parties to this license shall protect the PREMISES against pollution of its air, ground and water. The grantee shall comply with any laws, regulations, conditions or instructions affecting the activity hereby authorized if and when issued by the Environmental Protection Agency, or any Federal, state, interstate or local governmental agency having jurisdiction to abate or prevent pollution. The disposal of any toxic or hazardous materials within the PREMISES is specifically prohibited. Such regulations, conditions or instructions in effect or prescribed by said Environmental Protection Agency, or any Federal, state, interstate or local governmental agency are hereby made a condition of this license. The grantee shall not discharge waste or effluent from the PREMISES in such a manner that the discharge will contaminate streams or other bodies of water or otherwise become a public nuisance.

b. The grantee will use all reasonable means available to protect the environment and natural resources, and where damage nonetheless occurs from the grantee's activities, the grantee shall be liable to restore the damaged resources.

17. ENVIRONMENTAL CONDITION OF PROPERTY

An Environmental Condition of Property Report (ECP) was initially prepared as of June 2010 establishing a baseline of the environmental condition of the entire Umatilla Chemical Depot (UCD). A second ECP report was prepared as of September 2013 summarizing the past and present environmental contamination and condition of the entire UCD property. An Environmental Condition of Property Report Update was also prepared as of May 26, 2017, for only the 7,500 acres to be reassigned to the National Guard Bureau and licensed to the Oregon Army National Guard documenting changes that have occurred since the update in 2013. The latter Update is attached hereto and made a part hereof as Exhibit H. The initial and second ECP documents are available upon request to the Seattle District Army Corps of Engineers Real Estate Office. Upon revocation or relinquishment of this license, another ECP shall be prepared which will document the environmental condition of the property at that time. A comparison of the two assessments will assist the said officer in determining any environmental restoration requirements. Any such requirements will be completed by the grantee to the satisfaction of the said officer.

18. HISTORICAL PRESERVATION

The grantee shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archeological, architectural, or other cultural artifacts, relics, or objects of antiquity. In the event such items are discovered on the PREMISES, the grantee shall immediately notify said officer and protect the site and material from further disturbance until the said officer gives clearance to proceed.

19. NON-DISCRIMINATION

The grantee shall not discriminate against any person or persons or exclude them from participation in the grantee's operations, programs or activities conducted on the licensed PREMISES because of race, color, religion, sex, age, handicap or national origin. The grantee by acceptance of this license, hereby gives assurance that it will comply with the provisions of Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000d); the Age Discrimination Act of 1975 (42 U.S.C 6102); the Rehabilitation Act of 1973 as amended (29 U.S.C. 794); and all requirements imposed by or pursuant to the Department of Defense Directive 5500.11 (32 CFR Part 195) issued on May 27, 1971.

20. PROPERTY NOTES AND LAND USE CONTROLS

A. The property improvements and facilities of all types are shown at Exhibit B.

B. All Water Rights include Certificate 33779 for Irrigation and one-half the General Industrial right at Well 1, Certificate 33778 for Domestic at Well 2, Certificate 33989 for Fire Protection at Well 3, and Certificate 91003 for Domestic at Wells 6/7 within the 7,500 acres as identified in Exhibit C; and the use of Certificates 33765 and 33988 for General Industrial at Wells 4 and 5 outside the 7,500 acres as identified at Exhibit E until the land is sold and thereafter use will be reserved as an easement for a term of of 7 years and noted by later Amendment to this License.

C. All safety interests include Easements in Tracts 108E, 109E, and 110E as shown in Exhibit D, containing 1,092.61 acres, and Rights-of-Way in Tracts 111E and 112E, as shown in Exhibit E, containing 704.35 acres; total 1,796.96 acres. The safety Rights-of-Way use will continue until the land is sold and thereafter use will be reserved as an easement in perpetuity and noted by later Amendment to this License.

D. The Rights-of-Way shown in Exhibit E are outside the 7,500 acres. Some of these are required in perpetuity for roads, railroads, electrical lines, telephone lines, safety, noise, and priority use of Water Certificate 91003. The use under these Rights-of-Way will continue until the lands are sold and thereafter use will be reserved as easements in perpetuity and noted by later Amendment to this License. Exhibit E also contains Rights-of-Way use for roads, electrical lines, water lines, sewer and storm lines, and telephone lines until the land is sold and thereafter use will be reserved as easements for a term of 7 years and noted by later Amendment to this License.

E. Use of the Premises is subject to the Land Use Controls set forth in Exhibit F and Exhibit G, attached hereto and made a part hereof. Land Use Controls specified for the areas described and mapped in Exhibit F are significant. These restrict use of certain buildings in the Administration Area and the Building 419 Area, igloos in I, J, and K-Blocks from residential and agricultural use or commercial use involving children. In addition, groundwater extraction is restricted in the Groundwater Pump and Treat Area, all current and future equipment including wells necessary for environmental remediation must be protected, and access to the Ammunition Disposal Area is restricted until remediation work is complete. The Restrictions may be modified according to Exhibit F.

F. Land Use Controls are further described in Exhibit G together with discussions of the contamination at various sites and the planned future remediation work which will continue for some years.

THIS LICENSE is not subject to Title 10, United States Code, Section 2662, as amended.

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the Secretary of the Army, this 1st day of December, 2017.

Patricia M. Fatherree
Chief, Realty Operations Branch
Real Estate Contracting Officer
Seattle District, Corps of Engineers

This license is executed by the grantee this 27 day of November, 2017.

STATE OF OREGON,

By: Michael E. Stencel

MICHAEL E. STENCEL
Major General
The Adjutant General

Exhibit A-Legal Description and Map 7,500 Acres
Exhibit B-List of Improvements
Exhibit C-Water Rights Certificates
Exhibit D-Safety Easements
Exhibit E-Rights of Way
Exhibit F-Land Use Controls and Areas
Exhibit G-BRAC/NGB MOA 2 Aug 2016
Exhibit H-ECP Update May 26 2017

INTEGRATED
NATURAL
RESOURCES
MANAGEMENT
PLAN

October 2007 through September 2012

U.S. ARMY UMATILLA CHEMICAL DEPOT
HERMISTON, OREGON

RISK DIRECTORATE — ENVIRONMENTAL OFFICE

FINAL

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

UMATILLA CHEMICAL DEPOT
HERMISTON, OREGON

APPROVAL

This Integrated Natural Resources Management Plan meets the requirements of the Sikes Act (16 U.S.C. 670a *et seq*.), Department of Defense Instruction 4715.3, *Environmental Conservation Program*, and Army Regulation 200-3, *Natural Resources—Land, Forest, and Wildlife Management.*

Donna E. Rutten
Lieutenant Colonel, U.S. Army
Commander, Umatilla Chemical Depot

Date

Ren Lohoefener
Regional Director, Region 1
U.S. Fish and Wildlife Service

Date

Roy Elicker
Director
Oregon Department of Fish and Wildlife

Date

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

UMATILLA CHEMICAL DEPOT, HERMISTON, OREGON

UMATILLA CHEMICAL DEPOT REVIEW

Don Gillis, Environmental Protection Specialist
Umatilla Chemical Depot
ATTN: AMSCM-OPUM-RME
Hermiston, Oregon 97838-9544

U.S. ARMY MATERIEL COMMAND REVIEW

Drew Lyle, Chief
Environmental Office
Chemical Materials Agency
Aberdeen Proving Ground, Maryland 21010-5424

U.S. ARMY INSTALLATION MANAGEMENT COMMAND REVIEW

Richard Clewell, Wildlife Biologist
U.S. Army Installation Management Command - West
Rock Island, Illinois 61299-7190

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION REVIEW

Eric Quaempts, Director
Department of Natural Resources
Confederated Tribes of the Umatilla Indian Reservation
Pendleton, Oregon 97801

Prepared by:

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Colorado Fish and Wildlife Assistance Office
U.S. Fish and Wildlife Service

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Environmental Management Office
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The Umatilla Chemical Depot, including the Umatilla Chemical Agent Disposal Facility and Washington Group International, is dedicated to excellence in environmental stewardship through continued compliance with all applicable Environmental and Natural Resource Laws and Regulations. Additionally, the Installation is committed to reviewing its environmental impacts and identifying targets and objectives for environmental process improvement and waste minimization opportunities.

Umatilla Chemical Depot
Environmental Mission Statement

PREFACE

This draft of the Umatilla Chemical Depot (the Depot) Integrated Natural Resources Management Plan (INRMP) supercedes the 1998-2002 plan prepared by Gene Stout and Associates in 1997. The Depot has continued operations without a current INRMP for approximately six years. Due to the relatively benign nature of the Depot's mission, there have been no significant impacts to Depot resources as a result of this gap in management plans. However, with some changes in the direction of the Depot's operational programs, as well as potential new initiatives in resource management, a revised INRMP is called for. This INRMP will cover the period fiscal years 2008 through 2012.

An Environmental Assessment (EA) was prepared by Horne Engineering Services, Inc. for the 1998-2002 INRMP. This revised draft of the INRMP does not prescribe management practices that will result in significant geophysical changes to the environment not addressed in the previous INRMP and EA; therefore developing a new EA to address this INRMP is not warranted. The 1997 EA can be found at Appendix C.

For ease of use, common names of plants and animals will be given in the text; scientific names of those species cited will be presented in Appendix A. Scientific names are not listed for arthropods as most of them are not identified to species in the text.

Many of the Figures found in this INRMP were prepared by Tetra Tech EM, Inc.

TABLE OF CONTENTS

12.5 WILDLIFE DISEASES SURVEILLANCE The RD – EO staff will remain vigilant for signs of diseases in wildlife populations, especially those diseases that may be transmissible to humans. The most likely evidence for the occurrence of such diseases is the finding of wildlife mortalities when the causes of death are not apparent (for example road kill), and many carcasses of the same species (such as magpies), or classes of animals (rodents) are being discovered. The observation of sick animals may also indicate a disease outbreak in wildlife populations. Potential diseases may be identified by the species affected. If several dead corvids (jays, magpies, or crows) are reported, West Nile Virus may be spreading through the bird populations. Raptors appear to be equally sensitive to West Nile Virus. (However, note that if found at the base of a power pole without raptor protection, a bird mortality may be due to electrocution). Multiple reports of dead rodents may indicate a plague outbreak in those populations. Sick canids (coyotes, foxes), sometimes evidenced by a lack of fear of humans, may indicate rabies in the populations. Skunks and bats also commonly contract rabies. Suspected outbreaks of wildlife diseases should be reported immediately to the Umatilla and Morrow County Health Departments. Either of these county agencies may want to perform tests to confirm the presence of viral or bacterial infections, and may need access to the Depot to collect animal carcasses. Or they may request that Depot staff collect the carcasses; the staff should do so only in accordance with accepted guidelines, provided by the health departments, for the safe handling and transportation of carcasses potentially infected with transmissible diseases. If a wildlife disease outbreak is suspected on or near Depot property, RD – EO should also make an announcement to the Depot residents, employees, and visitors that such a disease may be present. As a precautionary measure, the announcement should be made immediately, without waiting for confirmation on the identification of any diseases, and include precautions the personnel should take to prevent exposure to potential diseases. This should include monitoring the activities of their pets while outdoors.

Animals often become habituated to people when they are frequently in close proximity to human habitation. Habituation is often facilitated by well-meaning people unwittingly feeding wildlife. This can lead to serious problems when animals lose their natural tendency to fear or avoid humans. Coyotes, foxes, skunks, and raccoons are examples of animals easily habituated to people. Wild animals do not need supplemental feeding to survive; they will live quite well off of their natural food items. Feeding wildlife, except for feeding birds at birdfeeders, will not be tolerated on the Depot. Furthermore, all residents will ensure that pet food is not left in outside food dishes overnight to serve as attractants to coyotes or other forms of wildlife.

14.6.1.8 Free-roaming Pets

Free-roaming pets, such as cats and dogs, pose a serious threat to natural resources. Cats, in particular, significantly impact biotic communities, especially birds. Coleman and Temple (1996) estimate that rural cats kill 7.8 to 219 million birds in Wisconsin alone on an annual basis (three estimates were presented for bird mortalities, the numbers cited here reflect the high and low estimates). Studies have shown that even cats fed at home will kill wildlife if allowed to range freely in the out-of-doors. Security Guards are responsible for capturing stray pets and returning them to their owners or taking them to shelters. Feral cats, those that have reverted to the wild, or their progeny, should be captured and taken to shelters. Stray pets generally wear collars, whereas feral animals typically do not have collars.

TABLES

FIGURES

APPENDICIES

ABBREVIATIONS AND ACRONYMS

ADA	Ammunition Detonation Area
ADC	Animal Damage Control
AEC	Army Environmental Center
AIRFA	American Indian Religious Freedom Act
AMC	Army Materiel Command
AR	Army Regulation
ARPA	Archeological Resources Protection Act
BCA	Bird Conservation Area
BCR	Bird Conservation Region
BCC	Birds of Conservation Concern
BLM	Bureau of Land Management
BRAC	Base Realignment and Closure
CBDCOM	Chemical and Biological Defense Command
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERL	Construction Engineering Research Laboratories
CFR	Code of Federal Regulations
CMA	Chemical Management Agency
CSDP	Chemical Stockpile and Disposal Program
CX	Categorical Exclusion
DoA	Department of Army
DoD	Department of Defense
DOI	Department of the Interior
DPW	Directorate of Public Works
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMIS	Emergency Management Information System
EPA	Environmental Protection Agency
EPR	Environmental Program Requirements
EO	Executive Order
FWCA	Fish and Wildlife Conservation Act
FFCA	Federal Facilities Compliance Agreement
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GIS	Geographic Information System
gpm	gallons per minute
HAZWOPER	Hazardous Waste Operations and Emergency Response
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IAFWA	International Association of Fish and Wildlife Agencies
INRMP	Integrated Natural Resources Management Plan
IPA	Intergovernmental Personnel Act
IRMD	Industrial Risk Management Directorate
ISC	Installation Spill Contingency
ITAM	Integrated Training Area Management

IUCN	International Union for Conservation of Nature and Natural Resources
LCTA	Land Condition Trend Analysis
LRAM	Land Rehabilitation and Maintenance
MAPS	Monitoring Avian Productivity and Survivorship
MOU	Memorandum of Understanding
MOA	Memorandum of Agreement
mg/L	milligrams/liter
msl	mean sea level
NABCI	North American Bird Conservation Initiative
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFWA	National Military Fish and Wildlife Association
NOI	Notice of Intent
NPL	National Priorities List
NPS	National Parks Service
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
OB/OD	Ordnance Burn/Ordnance Disposal
ODEP	Office of the Directorate of Environmental Programs
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ONG	Oregon National Guard
ORAP	Operational Range Assessment Program
ORISE	Oak Ridge Institute of Science and Education
ORVs	off-road vehicles
OU	Operable Unit
PIF	Partners in Flight
PMO	Provost Marshal’s Office
PMP	Pest Management Plan
QA	quality assurance
RD – EO	Risk Directorate – Environmental Office
REC	Record of Environmental Consideration
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAR	Species at Risk
SBCCOM	Soldier and Biological Chemical Command
SCS	Soil Conservation Service
SHPO	State of Oregon Historic Preservation Office
SOC	Species of Concern
SOP	Standard Operating Procedures
SPCC	Spill Prevention, Control, and Counter Measures
SWCD	Morrow County Soil and Water Conservation District
SWMU	Solid Waste Management Unit
TBD	to be determined

TCP	Traditional Cultural Property
TRI	Training Requirements Integration
UBC	Uniform Building Codes
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance

EXECUTIVE SUMMARY

PURPOSE

This Integrated Natural Resources Management Plan (INRMP) guides the implementation of the Natural Resources Program on the Umatilla Chemical Depot (the Depot), located in north-central Oregon, from October 1, 2007 through September 30, 2012 (fiscal years 2008-2012). As the Depot follows through with Base Realignment and Closure (BRAC), the plan will help conserve the Depot's natural resources through identifying and defining those resources and prescribing best management practices.

SCOPE OF THE INRMP

This plan applies to internal and external organizations that are involved with or interested in the management or use of the Depot's natural resources.

RELATIONSHIP TO THE MILITARY MISSION

In 1988, the Commission on Base Closures recommended the Depot for realignment, a phase preliminary to a Chemical Stockpile Disposal Program (CSDP) and closure. This INRMP addresses impacts of the military mission on natural resources and the means to mitigate these impacts. However, it is not intended to replace the need for environmental documentation of the military mission at the Depot. As the Depot proceeds with BRAC, the relevant sections of the INRMP will be updated to reflect mission changes.

ENVIRONMENTAL COMPLIANCE

The Sikes Act, as amended (16 U.S.C. 670a-670f), Department of Defense (DoD) Instruction 4715.3 (*Environmental Conservation Program*), and Army Regulation (AR) 200-3 (*Natural Resources—Land, Forest, and Wildlife Management*), require the preparation and implementation of this INRMP. In addition, this INRMP helps to ensure that the Depot complies with other federal and state laws related to natural resources. This plan describes how the Depot will implement the provisions of AR 200-3 and local regulations.

The Sikes Act requires that this INRMP include the following:

- fish and wildlife habitat improvements or modifications;
- range rehabilitation for support of wildlife;
- control of off-road vehicular traffic;
- specific habitat improvement projects and related activities and adequate protection for species of fish, wildlife, and plants considered threatened or endangered.

This INRMP has the signatory approval of the U.S. Fish and Wildlife Service (USFWS) and the Oregon Department of Fish and Wildlife (ODFW). The USFWS approval includes concurrence that the INRMP complies with the Endangered Species Act.

ECOSYSTEM STATUS

The Depot has a special value to the region due to its relatively undisturbed status since construction more than 50 years ago. It is one of the few remaining areas of bitterbrush shrub-steppe habitat in the Columbia Basin. Discussions of trends in ecosystem status are very general due to a lack of data before and during Army occupation. Depot soils within the administrative and ammunition storage areas were significantly disturbed during the installation’s initial construction phase, but a natural restoration process is taking place and, with that, biological diversity is improving. The Depot lands are capable of supporting the military mission, and the protection of the shrub-steppe habitat presents no threat to that capability.

PARTNERSHIPS

This INRMP cannot be implemented solely by the Depot. In accordance with the ecosystem management philosophy, the Depot has developed partnerships with various agencies to manage its natural resources. The USFWS and the ODFW are major partners in implementing this plan. Another partner in this effort is the Confederated Tribes of the Umatilla Indian Reservation. Universities and other federal and state agencies can also provide support through the establishment of partnerships. As the 5-year period of the plan progresses, the Depot may become involved in some regional management initiatives as a supporting agency.

PLAN COMPONENTS

This INRMP outlines goals and policies in five general areas: stewardship, military readiness, quality of life, compliance, and program integration. It describes the Depot’s military mission in general terms, including the mission’s impacts on natural resources. It also describes the Depot’s climate, land base, facilities, and natural resources, including a brief history of natural resources management. The plan identifies internal and external responsible or interested parties for managing natural resources. An Environmental Assessment (EA) was prepared to support the development of the original Depot INRMP (Appendix C). However, since there will be no significant geophysical changes resulting from the implementation of this revised plan, a new EA is not warranted.

This INRMP is organized differently from the traditional, component-based natural resource plans (e.g., wildlife management, land management). It emphasizes an ecosystem management approach to natural resources management. Ecosystem management supports the use of natural resources for both military and other human-related values and purposes. Within this plan, ecosystem management chapters 11 through 17 address aspects of overall natural resources management, including inventory and monitoring, conservation and damage prevention, natural resources management, research and special projects, enforcement, and awareness.

Within these ecosystem management chapters are programs involving erosion control, general wildlife management, sensitive species, pest control, natural resources law enforcement, research programs, and overall conservation education. Additional chapters involve outdoor recreation associated with natural resources, cultural resources conservation during natural resources management activities, National Environmental Policy Act (NEPA) documentation, biopolitical issues, and the integration of natural resources within the Depot environmental program. A final chapter discusses specific measures to implement this plan.

This INRMP is concerned with land administratively controlled by the Army. It does not address management of adjacent co-use buffer areas (2,674 acres) because these properties are either administered by the Bureau of Land Management (BLM), or are privately owned. Army control of these properties is limited to prohibiting human settlement.

PLANNED MAJOR INITIATIVES

This INRMP includes a description of ongoing natural resource programs and projects. Most of these will either be continued or completed in FY08 through FY12. Major management initiatives within this INRMP include the following:

- maintain an ecosystem management philosophy.
- manage the Depot shrub-steppe habitat for native biodiversity.
- manage the captive pronghorn herd in cooperation with the ODFW.
- conduct Planning Level Surveys for terrestrial vertebrates.
- implement a raptor protection program on the Depot.
- consider conducting a second phase pronghorn genetics research project in cooperation with the ODFW.
- consider establishing a threatened and endangered plant restoration program.

BENEFITS

Environmental Benefits: The INRMP outlines strategies needed to protect and manage natural resources, thereby conserving ecosystems and biodiversity. It reduces the potential for environmental pollution through erosion control and groundwater monitoring. The plan's implementation will promote understanding of the functioning of the shrub-steppe ecosystem. The plan also supports and enhances cultural resources conservation on the Depot.

Military Mission Benefits: Implementation of this plan will maintain the natural resources needed to support the military mission as the Depot moves forward with BRAC. It will also enhance opportunities for the properties to be acquired by a land management entity when the closure process is implemented.

Other Benefits: Both community relations and the Depot's environmental image, internal and external to Defense, will be enhanced. Plan implementation will decrease long-term environmental costs and reduce personal and Depot liabilities from environmental noncompliance.

COSTS

Implementation of this INRMP will cost approximately $272,500 for fiscal years 2008 through 2012. Support will come primarily from agricultural and environmental funding sources. The Planning Level Surveys, baseline inventories, monitoring and assessments needed to facilitate the ecosystem management approach are considered in the cost estimate for budgeting purposes.

SUMMARY

This INRMP presents a package that will comply with environmental laws, conserve and protect the Depot's natural resources, and support the military mission. It will not resolve all existing or future environmental issues. The plan will, however, provide the philosophy and outline the strategies needed to work toward resolving such issues.

INTRODUCTION

The proud tradition of the Umatilla Chemical Depot's role in the defense of the United States began in 1941 when a complete facility, including 1,001 ammunition storage igloos, was constructed in less than 1 year—a magnificent accomplishment. For more than half a century this facility has safely stored ammunition for use in conflicts worldwide. And now, even though the Depot is in its waning years as it is decommissioned, the tradition continues as its final mission is accomplished in the professional manner in which the Depot has functioned over the decades.

The 2001 terrorist attacks in New York City and on the Pentagon have served as a wake-up call among the nation's population to the threat of aggressors within our midst, and the need for vigilance to protect American lives, livelihoods, and freedom. As a result, Department of Defense installations across the nation have stepped up security measures to restrict or prohibit public access onto military lands. Accordingly, security measures on the Depot have intensified, and public access to the installation for recreational pursuits has been restricted. However, the resources themselves have not suffered as a result of this restricted access.

The Depot's lands and natural resources are important to the military mission and to the region as a whole. A stewardship responsibility came with the acquisition of these properties. The Depot is committed to excelling in this stewardship role, and this Integrated Natural Resources Management Plan is the Depot's plan of action for the care and wise use of its lands.

The plan is for a 5-year period, but the philosophy behind this plan is for a much longer period of time. The Depot is committed to an ecosystem management approach to its natural resources program. This approach will help protect biological diversity and allow informed decisions to be made regarding the use of natural resources to support both the military mission and the region's needs.

1.0 GOALS AND POLICIES

The Army strategy for the Environment is designed to strengthen the Army today and into the future. It establishes the long-range vision for a sustainable Army, and the goals upon which the vision is based.†

The Army's commitment to natural resources management is reflected in, "*Sustain the Mission, Secure the Future: The Army Strategy for the Environment*" (U.S. Army 2004). This document outlines six goals to which the Army has committed its environmental philosophy and strategy: Foster a Sustainability Ethic; Strengthen Army Operations; Meet Test, Training, and Mission Requirements; Minimize Impacts and Total Ownership Costs; Enhance Well-Being; and Drive Innovation. A primary theme, if not *the* primary theme, throughout these six goals, is sustainability. Ultimately, the Army recognizes that protecting and maintaining the environment now means sustaining the Army's capabilities to achieve its primary mission, "....to defend the United States - its people, its land, and its heritage", into the future (U.S. Army 2004).

The Army's commitment to natural resources management is also reflected in Department of Defense (DoD) Instruction 4715.3 (*Environmental Conservation Program)*, and Army Regulation (AR) 200-3 (*Natural Resources—Land, Forest, and Wildlife Management*), which require that Integrated Natural Resource Management Plans (INRMPs) be developed and maintained for all Army installations with significant natural resources. The INRMP is a living, dynamic document that will be maintained and added to or amended, as necessary, to reflect the natural resources information available. At a minimum, the status of the Depot's programs and projects, as outlined in this INRMP, will be reviewed annually by those cooperators signatory to the document.

1.1 GOALS

1.1.1 Military Readiness

Provide sustainable native natural resources on which to accomplish the Depot's military mission.

1.1.2 Stewardship

Manage natural resources on the Depot to ensure proper, science-based maintenance of public lands entrusted to Army care.

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†Excerpted from *U.S. Army Environmental Strategy into the 21st Century*.

1.1.3 Compliance

Comply with laws and regulations that pertain to the management of the Depot's natural resources.

1.1.4 Integration

Integrate elements of natural resources management into a single program that, in turn, is integrated into the Depot's environmental program.

1.2 POLICIES

The policies presented below represent general Depot policies to attain the goals presented in Section 1.1. These policies also serve as a broad checklist to monitor the plan's success.

1.2.1 Military Readiness

- Ensure that there is no net loss in the capability of Depot lands to support the ongoing mission of chemical munition storage and demilitarization, and continue to support the Depot's changing mission under Base Realignment and Closure (BRAC).
- Maintain quality training lands by minimizing and mitigating damage through restoration or other means.

1.2.2 Stewardship

- Manage ecosystems to protect, conserve, and enhance native flora and fauna with an emphasis on native biodiversity conservation.
- Monitor and manage soils, vegetation, and wildlife on the Depot considering all biological communities and those human values associated with these resources.
- Provide professional enforcement of natural resource-related laws.
- Involve the surrounding community and the Confederated Tribes of the Umatilla Indian Reservation in the Depot's natural resources program.
- Ensure that the Depot's natural resources program is coordinated with other conservation agencies and organizations with similar interests.

1.2.3 Compliance

- Manage natural resources within both the letter and spirit of environmental laws.
- Emphasize the conservation, restoration, and management of protected species.
- Use procedures within the National Environmental Policy Act (NEPA) to make informed decisions that include natural resource considerations and mitigation.

- Ensure that the Depot’s natural resources program is consistent with the installation’s cultural resources program.
- Implement this INRMP within the framework of Army policies and regulations.

1.2.4 Integration

- Ensure the integration of, and consistency among, the various activities identified within this INRMP.
- Ensure that this INRMP is both consistent with and supports the principles of the Pest Management Program at the Depot.
- Coordinate the implementation of this INRMP with the operation of the Depot’s overall environmental program.
- Use the natural resources program to support and enhance other elements within the Depot’s environmental program.
- Provide command elements with the information needed to make decisions that include natural resource-related values.

2.0 LOCATION AND BACKGROUND

2.1 LOCATION

The Depot is located in northeastern Oregon and lies within parts of Umatilla and Morrow Counties. It is at the intersection of Interstates 82 and 84 and is approximately 35 miles south of the Tri-Cities area of Washington State (Figure 1). The Depot encompasses 17,054 acres and has a buffer area, the Quality Assurance (QA) Function Range, on 2,674 acres of private property and Bureau of Land Management (BLM) lands north and east of the Depot perimeter (this parcel is inaccurately labeled the ADA Range in Figure 2). Private property owners in the buffer area reserve the right to farm and graze their land; however, the buffer allows the U.S. government to prohibit residential use of the area. The Columbia River is located 3 miles to the north of the installation.

2.2 ADJACENT PROPERTIES

The area surrounding the Depot is primarily privately-owned and converted to agricultural purposes. Population centers near the Depot in Oregon include Umatilla, approximately 4 miles northeast, Hermiston, approximately 4 miles east, Pendleton, approximately 34 miles southeast and the small community of Irrigon, 2 miles northwest. Population centers near the Depot in Washington include the Tri-Cities (Richland, Kennewick, and Pasco) located approximately 35 miles north. Public lands in the vicinity include the Umatilla National Wildlife Refuge, located approximately 3 miles northwest of the Depot, and the Cold Springs National Wildlife Refuge, about 10 miles east of the installation. The Boardman Naval Training Facility, a 47,000-acre DoD facility, is situated approximately 6 miles southwest of the Depot.

2.3 ACREAGE AND ACQUISITION

The 17,054 acres that form the Depot were farmed or grazed prior to acquisition by the DoD. Some of this land was acquired by the federal government in 1941 from Morrow and Umatilla Counties, Northern Pacific Railroad, West Extension Irrigation Company, and private owners. Additional parcels were transferred from the BLM and the Department of the Interior (DOI) to the Department of Army (DoA).

2.4 DEPOT HISTORY

The land currently occupied by the Depot was inhabited by the Sahaptin-speaking Umatilla Indians during its ethnohistoric period. Initial contact between the Umatilla Indians and Euro-Americans took place in the last quarter of the 18th century. However, settlement of the area by Euro-Americans did not begin in earnest until the middle of the 19th century when mining and grazing opportunities became apparent. The introduction of flood irrigation in 1862, however, soon made agriculture the principle economic force in the area.

On 14 October 1941, an approximately 16,000-acre parcel of land was designated as a Military Reservation by War Department General Order Number 11. On 20 March 1942, exclusive jurisdiction was taken by the U.S. government. It was established as an Army ordnance depot in 1941 to store chemical-filled munitions and containerized chemical agents, and to repackage and store conventional munitions.

Ammunition demolition began at the Depot in 1945, and in 1947 an ammunition renovation facility was constructed. Two additional ammunition maintenance buildings were constructed in 1955 and 1958. During the period 1957 through 1959, an additional 3,939 acres were acquired (Intermountain Range Consultants 1988).

In 1962, the old Umatilla Ordnance Depot was assigned to the U.S. Army Supply and Maintenance Command. As the Umatilla Army Depot, storage of chemical agent-filled munitions and 1-ton containers of chemical agents began in K Block igloos and in Building 659. Besides chemical weapons, the Depot also stored conventional munitions in 14 magazines and igloos. Chemical weapons have not been used, tested, or manufactured on the Depot. The Depot was redesignated by the Army Materiel Command (AMC) in August 1973 as an “activity” of the Tooele Army Depot and was renamed the Umatilla Depot Activity.

In 1988, the Commission on Base Closures recommended the Depot for realignment. Under BRAC, the storage of conventional ordnance was moved from the Depot to Hawthorne Army Depot, Nevada, and the remaining conventional ordnance that could not be transported was destroyed on site. The Depot’s current, realigned mission is the ongoing storage and demolition of chemical munitions; however, this will change with the full implementation of the Chemical Stockpile and Disposal Program (CSDP) and subsequent closure of the Depot.

In October 1995, the Depot was placed under the Major Subordinant Command, Chemical Biological Defense Command (CBDCOM) and was renamed the Umatilla Chemical Depot. In 1998 CBDCOM transitioned into the Soldier and Biological Chemical Command (SBCCOM), which in 2003 became the Chemical Management Agency (CMA). The Depot began destroying chemical munitions in September, 2004; a process that is not expected to be complete until approximately 2012. Umatilla Chemical Depot is expected to close no earlier than 2017, and because this INRMP is a 5-year plan, closure and reuse of the Depot are not addressed.

3.0 MILITARY MISSION

3.1 GENERAL

From the period of property acquisition and development to recent years, the Depot's primary mission has been the storage of munitions in support of U.S. military operations. That mission changed with the inception of the BRAC program, whereby the installation was realigned and the storage and eventual destruction of chemical munitions became the primary mission of the site. The Depot is currently in the chemical destruction phase of the BRAC process, which is projected to be completed by 2012. Ultimately the installation will be decommissioned and the Army will divest itself of these properties, although that is not projected to occur until at least 2017.

3.2 EFFECTS OF MILITARY MISSION ON NATURAL RESOURCES

The Depot's mission does not involve significant training activities, therefore there are few impacts on natural resources. In fact, the passive nature of the Depot's mission has resulted in the preservation of the native high plains desert habitat that has recovered since the initial damage experienced during construction of the facility. An in-depth discussion of the Depot's habitat can be found in Chapter 8.

The Oregon National Guard (ONG) has until recently used a small portion of the Depot for military training, including a rifle range and a tank maintenance testing track. These activities were highly controlled, resulting in a limited amount of localized maneuver damage that has been mitigated. The ONG is not intending to resume training on the Depot within the next 5 years. However, if training activities are resumed, all feasible measures will be employed to protect the resources while yet sustaining realistic training opportunities for the ONG units.

3.3 NATURAL RESOURCES NEEDED TO SUPPORT THE MILITARY MISSION

The primary mission of the Depot is the storage and destruction of chemical munitions. Maintaining open corridors called clear zones, with vegetation less than 8 inches in height, around sensitive areas is essential for this mission. Clear zones are planted with low growing native species and maintained by mechanical means and non-selective herbicides.

3.4 ENVIRONMENTAL CONSTRAINTS ON THE MILITARY MISSION

Due to the passive nature of the Depot's military mission, there are few environmental constraints that may impede activities on the installation. Furthermore, NEPA documentation is required to assess the impacts of any activities which could significantly affect natural or cultural resources, for example off-road travel or ground disturbance, prior to those actions being implemented.

4.0 FACILITIES

4.1 OVERVIEW

The Depot can be divided into 15 specific land use areas necessary to support the military mission (Earth Tech 1995). Acres not included in Table 4-1 are in open space.

Table 4-1: Significant Land Use Areas

Area	Acreage	Area	Acreage	Area	Acreage
Ammunition Storage	5,933	Standard Magazines	140	Landfill	15
Ammunition Demolition	1,716	Former Firing Range	621	Airfield (Closed)	293
Open Space Buffer	4,851	Spoil Areas	32	Administrative	136
Chemical Storage	646	Abandoned Landfills	20	Facilities Maintenance	40
Housing	15	Utilities Service	7	Union Pacific Railroad	140

4.2 TRANSPORTATION SYSTEM

There are 165 miles of paved, two-lane roads and 27 miles of gravel roads within the boundaries of the Depot (Del Grosso 1996). The Depot has a 3,000-foot long, 60-foot wide, 8,000-pound capacity airstrip. However, due to the construction of nearby power co-generation plants with tall emissions stacks, the airstrip has been decommissioned (U.S. Army 1995). The Depot does have a helipad located south of the clinic in the administrative area. The Union Pacific Railroad parallels the Depot’s southern border and at one time a spur from this line entered the Depot. Rails have been removed from the line at the Depot’s boundary however, preventing access to the installation by way of rail.

4.3 WATER SUPPLY

The Depot’s water needs are supplied by seven wells that draw from a basalt aquifer whose minimum depth is approximately 200 feet below the surface. Three of these wells are active, three are on reserve, and one is inactive. The wells range in depth from 327 feet to 600 feet, and their pumping capacity ranges from 30 to 1,000 gallons per minute (gpm). Approximately 20% of the total capacity of the system is used for domestic water and the remainder is used for fire protection (Weston 1989 *in* U.S. Army 1996). Some of the water supply is also used for animal watering devices.

4.4 PROJECTED CHANGES IN FACILITIES

Nolte et al. (2002) noted that in 2002 there were approximately 1,389 standing structures on the Depot. Structures may be demolished as their condition deteriorates and their purpose becomes obsolete. Forty-three structures had been demolished as of 2006.

5.0 RESPONSIBLE AND/OR INTERESTED PARTIES

5.1 UMATILLA CHEMICAL DEPOT, HERMISTON, OREGON

Unless otherwise indicated, parties listed in this section are based at the Depot.

5.1.1 Depot Commander

The Depot Commander coordinates the activities of installation directorates, and is responsible for the provision of installation-wide support to implement this INRMP.

5.1.2 Risk Directorate – Environmental Office

The Risk Directorate – Environmental Office (RD – EO) is responsible for managing land, air, water, cultural, and wildlife resources at the Depot. RD – EO manages land to conserve flora and fauna, maintains storage and training lands, and ensures that the Depot complies with federal and state environmental laws and regulations. RD – EO is the primary organization responsible for implementing this INRMP.

5.1.3 Directorate of Public Works, Services Division

The Services Division is responsible for applying herbicides and pesticides to various areas of the Depot. Maintaining the appearance of the administrative area is currently conducted by a contractor, and the Services Division is responsible for the remainder of the Depot. The Depot's Pest Management Program is implemented by the Services Division as well.

5.1.4 Public Affairs Office

The Public Affairs Office has three primary roles: internal communication, media relations, and community relations. Consequently, the Public Affairs Office is responsible for disseminating information contained within this INRMP to the media and public when necessary.

5.1.5 Security Directorate

The Depot has a Security Directorate whose primary responsibility is the security and safety of the installation, its weapons stockpile, and its personnel. A guard force is employed to patrol the grounds and facilities and to detect and apprehend intruders.

5.1.6 Other Depot Organizations

Implementation of this plan also requires the support and assistance from other offices on the depot including contracting, purchasing, equipment authorizations, and personnel.

5.2 OTHER DEFENSE ORGANIZATIONS

5.2.1 Chemical Management Agency

The Depot is under the command of the Chemical Management Agency (CMA), located in Aberdeen Proving Ground, Maryland, which oversees the overall management of the Depot.

5.2.2 Installation Management Command - Western Region

The Installation Mangagement Command (IMC), Western Region, provides oversight of the Depot's natural and cultural resource management programs, and ensures installation staff is kept informed on issues regarding regulatory compliance, as well as other pertinent information.

5.2.3 Army Materiel Command

This major command headquarters will, per AR 200-3, assist the Depot with developing and implementing conservation programs. AMC has review and approval authority for this INRMP, and has the responsibility for programming funds to implement the INRMP.

5.2.4 Army Environmental Center

The Army Environmental Center's (AEC) mission is to provide oversight, centralized management, coordination, and execution of Army environmental programs and projects. It also has support capabilities in INRMP preparation, NEPA, endangered species, cultural resources, environmental compliance, and other related areas.

5.2.5 Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE), Seattle District, administers permitting under Section 404 of the Clean Water Act for activities that may impact waters of the United States, including wetlands. USACE works in consultation with other federal and state agencies in making decisions on issuing permits.

5.3 U.S. FISH AND WILDLIFE SERVICE

A 2006 Memorandum of Understanding (MOU) between the DoD, the USFWS, and the International Association of Fish and Wildlife Agencies (IAFWA), stipulates that INRMPs will be developed for military installations with “significant natural resources” (Appendix D). It further states that, as promulgated in the Sikes Act, as amended, 16 U.S.C. 670a-670f, DoD installations will cooperate with the USFWS and the respective state natural resource management agencies in which the installations are situated, in managing their natural resource programs. Further, the MOU encourages the parties involved to enter into cooperative agreements to “coordinate and implement natural resource management” on military installations. Such an agreement between the Depot, the USFWS, and the ODFW, is found at Appendix E. In addition, in early 2006 the Depot entered into a Cooperative Agreement with the

USFWS to outline strategies for raptor protection on Depot properties (Appendix F). Finally, in July, 2006, an MOU between the U.S. Department of Defense and the USFWS was developed to promote the conservation of migratory birds (Appendix G).

5.4 CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

The Depot is responsible for protecting cultural resources found within its boundaries, including objects or properties of cultural significance for Native American tribes. The National Historic Preservation Act of 1966 (as amended), the Archaeological Resources Protection Act (ARPA) of 1979, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, and the American Indian Religious Freedom Act (AIRFA) of 1978 establish policies for consulting with Native American tribes on the management of, and access to, significant resources. In October of 1996, the Assistant Secretary of the Army and the Chairman of the Board of Trustees of the Confederated Tribes of the Umatilla Indian Reservation (Confederated Tribes) signed a Memorandum of Agreement (MOA) that defined the protocols for government-to-government relations between the Army and the Confederated Tribes in matters concerning the destruction of the chemical weapons stockpile at the Depot. In accordance with federal laws, the Depot will continue to provide the Confederated Tribes access to all areas of the Depot that are not restricted due to reasons of safety and/or security.

The Confederated Tribes retained certain rights to natural resources on the Depot through the Treaty of 1855, such as collecting plants needed for ceremonial purposes. The Confederated Tribes do not distinguish between cultural and natural resources and have identified the general ecosystem of the Depot as a significant cultural resource worthy of preservation. Particular natural resources such as some species of plants may be individually significant for traditional subsistence patterns, such as hunting and gathering, and medical or religious practices.

The Confederated Tribes were consulted during the preparation of an Integrated Cultural Resources Plan for the Depot (Earth Tech 2002) and provided information on the historical uses of the land by their people. The Confederated Tribes were provided a draft of this INRMP so that they may participate in the INRMP decision-making process.

5.5 OREGON DEPARTMENT OF FISH AND WILDLIFE

The ODFW is a signatory and cooperating agency in the implementation of this plan in accordance with the Sikes Act and the MOU signed by the DoD, the USFWS, and the IAFWA (Appendix D). ODFW staff offer technical expertise and planning assistance for wildlife management. Specific items of cooperation between the ODFW and the Depot are outlined in Appendix E.

5.6 MORROW COUNTY SOIL AND WATER CONSERVATION DISTRICT

From 1986 to 2001, the Morrow County Soil and Water Conservation District (SWCD) was involved with monitoring and eradicating noxious weeds, performing rangeland inventories, and monitoring the condition of wildlife watering devices on the Depot. These activities were conducted under an MOA between the Depot and the SWCD. However, the terrorist attacks of 2001 resulted in access restrictions to military installations, and the SWCD’s activities on the Depot have been suspended.

5.7 OTHER INTERESTED PARTIES

No special interest groups have shown significant interest in the Depot natural resources program.

6.0 HISTORY OF NATURAL RESOURCES MANAGEMENT

When the Depot was established in 1941, the pressure to produce and store ammunition for World War II was an overriding concern. The land on which the Depot was constructed was razed, and the soil was scraped up and mounded onto newly constructed concrete igloos. During construction of the Depot, its biodiversity was greatly diminished. Following construction, however, the land was allowed to rehabilitate and native flora and fauna returned. The first Wildlife Management Plan was implemented in 1973. That plan made reference to trial food-plot seedings and cover-tree plantings. These plantings were apparently limited and are currently non-existent, having been reclaimed by the native flora of the area.

In 1969, 17 pronghorn were released on the Depot by the ODFW as part of a transplant program. The intent was to produce surplus animals to be relocated to preserves off the Depot. In the first year of the pronghorn reintroduction, it was decided that coyotes were limiting herd growth, and a predator control program was instituted. Between 1970 and 1980, the pronghorn herd's size increased to over 175 animals, and in 1986, the population was estimated at more than 400. Meanwhile, pronghorn were being removed from the Depot herd and translocated to Nevada and other parts of Oregon. The population started to decline, and approximately 130 animals were counted at the Depot in 1995. From 1997 to 2001 pronghorns were counted in conjunction with road surveys for long-billed curlews. Total numbers have ranged from 0 to 31 animals being observed. Herd composition was recorded during these surveys, and fawn numbers appeared to be especially low. A study was conducted in 2000 to assess the genetic variability of the remaining pronghorn on the Depot. It was found that the Depot herd had much lower genetic diversity, as well as significant haplotypic and genotypic differentiation, than its source herd.

In 1986 and 1987, the SWCD, funded by the Oregon Department of Agriculture, assisted the Depot with monitoring and eradicating rush skeletonweed, a noxious weed native to Eurasia. In 1987, however, Oregon mandated that eradication of noxious weeds is the responsibility of the property owner on whose land they occur. As a result, the Depot funded the SWCD for control of rush skeletonweed and rangeland inventories until 2001, when SWCD activities on the Depot were suspended due to access restrictions.

In March of 1988, a Natural Resources Management Plan was prepared for the Depot by Intermountain Range Consultants. The plan was written under the authority of an interagency agreement between the DoA and the SWCD. This plan recommended the teaming of the DoA with the SWCD to control rush skeletonweed, plant perennial grasses in locations susceptible to wind erosion, monitor vegetation annually to determine pronghorn grazing pressures, and monitor the pronghorn herd annually.

In 1995, the SWCD and the United States Department of Agriculture (USDA), Soil Conservation Service (SCS) prepared a report entitled *Rangeland Inventory and Planning Considerations, U.S. Army, Umatilla Depot Activity* (SWCD and SCS 1995). The report contains information on the condition of the range, monitoring to be conducted to assess impacts on the range, and planning considerations for range management.

In 1993, a risk-based, retrospective EA was prepared to assess impacts from chemical and ordnance storage and documented disposal activities. The assessment was conducted to support the decision-making process involved in remediation assessment, site monitoring and cleanup (USACE 1993). As part of the study, site-specific data on wildlife populations and plant communities were collected.

Gene Stout and Associates prepared an INRMP for the Depot in 1997, to direct the installation’s natural resource management program from 1998 through 2002 (Gene Stout and Associates 1997). The plan recommended continuing many of the inventories, surveys, and monitoring programs that had been conducted in the past. Most of the recommendations put forth in the 1998-2002 INRMP have been implemented.

Planning Level Surveys for vegetative communities and threatened and endangered species were conducted on the Depot in 1999 and 2000 (Tetra Tech 2002a, 2002b). The results of those surveys are incorporated into this INRMP.

7.0 NATURAL RESOURCES AND CLIMATE

7.1 ECOREGIONAL CONTEXT

Several authors describe the geophysical areas of north-central Oregon using a number of different classification systems, with many of the names being interchangeable. For the purposes of this INRMP, Kagan et al. (2000), who generally adopts the system described in Omernik (1986) and McNab and Avers (1994) (*see also* Bailey 1995, 1998), is followed.

The Columbia Basin Ecoregional Province, generally characterized by mixed shrub-steppe and grassland habitats, with a semiarid and cool climate, extends from central Washington down into northeastern Oregon. Within that ecoregion, the Depot is located in the Umatilla Basin in north-central Oregon.

7.2 TOPOGRAPHY

The topography in the vicinity of the Depot is level to gently rolling and slopes northwest to the Columbia River. Elevations on the Depot range from 400 to 677 feet above mean sea level (msl) (Earth Tech 1995). Topography is depicted in Figure 2.

The surface of the Depot is characterized by two distinct features. The first is the parallel, lacustrine-deposited dune lines that are oriented along a north 69-degree east axis. These dune lines have a crest-to-crest interval of between 200 and 1000 feet. Relief between dunes varies from 5 to 30 feet. Strong southwest winds are responsible for streamlining and rounding the dunes. One to several feet of loess-like material have been deposited over the original gravel surface of the area by eolian processes. Water erosion has played little part in shaping the landscape due to scant rainfall and rapid infiltration in the area. The Depot's floral communities are significantly affected by the wind and by the solar protection offered by dunes. The northern and steeper faces of the dunes offer such protection and usually support more diverse and dense flora. Elevated dune crests are often devoid of vegetation and are subject to wind erosion (USACE 1993).

The second distinct feature is Coyote Coulee. This is a valley that traverses the Depot along a north 30-degree east axis. The eastern edge of this valley is an escarpment that rises 60 to 90 feet at a 30 to 45 percent slope. The western edge of Coyote Coulee slopes at 5 to 10 percent. The Coulee directs local winds northward and upward, resulting in a tendency for blowout area (localized areas of wind erosion) formation along the toe of the escarpment (USACE 1993).

7.3 GEOLOGY

Geologically, the Depot is situated in the Dalles-Umatilla Basin, which is a depression in the Columbia Plateau physiographic province (Jacobs Engineering Group 1987, *as cited in* U.S. Army 1995). The topography slopes gently toward the Columbia River from Horse Heaven Hills in Washington and the Blue Mountains in Oregon. The Depot is located on the southern side of this depression, in an area known as the Umatilla Plateau and lowlands (U.S. Army 1995).

Detailed information on and references for the geology of the area are provided in the EA found at Appendix C.

7.4 PETROLEUM AND MINERALS

The mineral resources in the Depot's vicinity consist of glaciofluvial sand and gravel deposits, which are used for road and other construction activities. There are two gravel quarries on the installation, although they have not been used for several years. Inert construction materials are being buried at one of the quarries. There are no other known mineral deposits, including oil and coal deposits, on or in the vicinity of the Depot (Brown 1991).

7.5 SOILS

There are two named and one un-named soil series mapped for the Depot (SCS 1983, SCS 1988; Figure 3). Isolated gravel pits and a blowout area are also indicated. The Quincy Series (mixed, mesic, Xeric Torripsamments) and the Burbank Series (sandy-skeletal, mixed, mesic, Xeric Torriorthents) are found throughout the Depot with Quincy dominating the area west of Coyote Coulee and Burbank dominating the area east of Coyote Coulee. The southeast corner of the Depot is also composed of the Quincy Series. These two soil series are both deep, excessively drained soils that formed in eolian sand and gravelly alluvium, and are located on terraces. The surface layer and substratum of the Quincy soils are fine sand and loamy fine sand with some areas having a gravelly substratum. The surface layer of the Burbank soils is loamy fine sand and the substratum is extremely gravelly sand (SCS 1988).

7.5.1 Cryptobiotic Soil Crusts

A thin and fragile biotic layer often covers soils in arid and semi-arid regions. This layer, called a cryptobiotic soil crust, is composed of mosses, lichens, algae, and bacteria, functioning in a symbiotic relationship, and is generally an indicator of a relatively undisturbed soil ecosystem. Also called cryptogamic soils, these crusts help stabilize soils, reduce wind and water erosion, and provide nitrogen and other nutrients for plant growth. Soils with cryptobiotic crusts are "blocky" in structure, forming irregular surfaces to retain and absorb moisture, and provide germination sites for seeds. Tetra Tech (2002b) noted cryptogamic soils in association with several vegetative communities during the Planning Level Surveys for vegetative communities on the Depot. For information on cryptobiotic crusts, see *http://eduscapes.com/nature/cryptsoil/index1.htm*, and *http://www.pnl.gov/pals/resource_cards/cryptogamic_crusts.stm*.

7.5.2 Soil Erosion

The Quincy and Burbank soils have rapid permeability and slow run-off, resulting in a low water erosion hazard. Both soils have high hazard for wind erosion due to the predominance of fine sands in the surface layers and the region's frequent, high winds. The Quincy fine sand phase has one of the highest hazard ratings for blowing soil and it is recommended that new land disturbance be limited to the period March 15 to September 15 (SCS 1983). Table 7-1 provides the wind erosion factor (T factor) erodibility groups and land capability classifications for the Quincy and Burbank phases located on the Depot.

Table 7-1 Wind Erosion Hazard Ratings For Depot Soils

Soil Name	Erosion Factor (T)	Wind Erodibility Group	Land Capability Classification (N)
Quincy Fine Sand	5	1	VII e
Quincy Loamy Fine Sand, gravelly substratum	3	2	VII e
Burbank Loamy Fine Sand	2	2	VII e

Key

Erosion Factor T: An estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. Rate is in tons per acre per year (SCS 1988).

Wind Erodibility Group: The susceptibility of a soil to wind erosion and the amount of soil left. They are represented by federal classes and range from 1 to 8 with Group 1 soils being extremely erodible and Group 2 soils being very highly erodible (SCS 1988).

Land Capability Classification: The suitability of a soil for field crops based on a soil's limitation for field crops, risk of damage if used for field crops, and their response to management. Classes range from I to VIII with increasing severity of limitations as one approaches VIII. Subclass e indicates the main limitation is risk of erosion (SCS 1988).

Cryptogamic soils are especially vulnerable to erosion. Light damage to the cryptobiotic crusts in arid and semi-arid regions may take 5-7 years to rehabilitate, whereas extensive damage may require up to 250 years to fully restore. Once fractured and displaced, it is unlikely the detached pieces of crust will be able to reattach themselves. Furthermore, when the protective crust is displaced, soils exposed by the damage may now be windblown onto adjacent healthy crust, preventing light from getting to the crust and in turn killing the microorganisms that form that crust as well.

The nature of the Depot's storage mission does not result in extensive soil disturbance or vegetative cover destruction; however, exposed areas on the Depot, such as the ONG tracked vehicle course, Coyote Coulee, and unprotected construction areas, are highly susceptible to wind erosion. Section 14.7 discusses the Depot soil erosion controls.

7.5.3 Agricultural Land

There are no agricultural or grazing outleases on the Depot. Private property owners in the buffer area adjacent to the northeast corner of the Depot reserve the right to farm and graze their land. Also, the BLM issues grazing leases for the use of two parcels, of 670 and 480 acres, respectively, in the buffer area.

7.6 WATER RESOURCES

7.6.1 Surface Water

A National Wetlands Inventory was conducted on the Depot in June, 2000, and no permanent, naturally occurring surface water features were found on the installation (Swords and Tiner 2001). The final report documents 11.6 acres of palustrine wetland habitat on the Depot, however the accompanying map indicates that those acres are located on adjacent properties immediately east of the installation (Figure 4). A couple of sprinkler systems create wetland microhabitats on the Depot (Figure 4), although that designation is determined more by the presence of wetland vegetation than surface waters.

The lack of wetlands is due to the region's arid climate; annual rainfall is approximately 10 inches and infiltration is rapid (U.S. Army 1995). The Depot's highest point is in the north-central portion of the installation with an elevation of 677 feet msl. From this high region, the land slopes gently southeast in the eastern portion of the Depot; south in the central and southern portions; and northwest in the western portion. Runoff on the western portion of the Depot flows toward the West Extension Irrigation Canal. An approximately 1,750-foot section of the canal is located in the extreme northwest corner of the Depot, entering on the north boundary and leaving on the west boundary. The irrigation canal runs west as a ditch for about 18 miles before ending just northwest of the Boardman Naval Training Facility.

Stormwater runoff from the administrative area is collected by a curb and gutter system and is piped to an open ditch discharge site several hundred feet west of the sewage treatment facility tile field. Sampling of the outfall has indicated no exceedance of contaminant levels. In addition, there is a lined stormwater retention pond, approximately 100 by 160 feet in size, in the vicinity of the chemical demilitarization site, that collects water from the site. There is little use of the pond by terrestrial wildlife, although shorebirds have been observed to use it to some extent. No significant runoff leaves the Depot.

The Columbia River is located 3.3 miles north of the Depot's northern boundary. The river is essential for agricultural irrigation in the region and has several dams along its course, the closest to the Depot being McNary Dam, located approximately 6.5 miles northeast of the installation. The Umatilla River, located approximately 6 miles east of the Depot, is regulated by dams and reservoirs and discharges into the Columbia River. Many diversions have been made in the Umatilla River basin for agricultural purposes. Irrigation canals, which link to the Umatilla River, surround the Depot's eastern, western, and northern sides. The Umatilla River is joined by Butter Creek near the southeastern corner of the Depot.

Bodies of water near the Depot include McKay Reservoir, located south of Pendleton and Cold Springs Reservoir, located northeast of Hermiston. Lost Lake is located approximately 4 miles south of the Depot, northwest of Ward Butte on the Morrow-Umatilla County line.

7.6.2 Groundwater Resources

The Depot's groundwater exists in unconfined alluvial aquifers within surface sediments, as well as in a confined basalt aquifer system (U.S. Army 1996). Localized hydraulic interconnection exists between the unconfined aquifer and the uppermost portion of the basalt aquifer system in the Saddle Mountain Basalt. Groundwater in the alluvial aquifer and the interflow zones between basalt flows or layers primarily flows in a horizontal direction. Groundwater flow in areas where vertical joining of the basalt is prevalent has higher vertical flow rates. All interflow zones in the Columbia River Basalt Group are hydrologically interconnected, creating a large aquifer system.

The overall flow direction of unconfined and confined aquifers near the Depot is northwest toward the Columbia River, from recharge areas in the Blue Mountains. This overall flow is diverted northward on the southeastern corner of the Depot. It is probably attributed to year-round pumping of groundwater at the Lamb-Weston well located near the Depot. Unconfined alluvial aquifers, and possibly the Saddle Mountain Basalt portion of the confined basalt aquifers, discharge into local streams and rivers via seeps and springs with an ultimate discharge point at the Columbia River. The deeper portions of the confined basalt aquifers in the Wanapum Basalt and particularly in the Grande Ronde Basalt, provide minimal input to these baseflows.

The Depot's groundwater is slightly alkaline and of the calcium, sodium calcium, or sodium bicarbonate type. Dissolved solid concentrations in the basalt aquifer system range from 200 to 400 milligrams/liter (mg/L) with an average of 230 mg/L. Higher concentrations of dissolved solids exist in the alluvial aquifer at the surface. While groundwater is suitable for most purposes, its hardness in the alluvial aquifer is greater than what is desired for domestic use. Groundwater in the deeper portions of the basalt aquifer system has decreased hardness and concentrations of sulfate and bicarbonate, with greater concentrations of sodium and fluoride.

7.7 CLIMATE

The Depot is found within Oregon's North Central Climatic Zone (Zone 6), as established by the National Climatic Data Center (*http://www.ncdc.noaa.gov/oa/ncdc.html*). Its climate is influenced to some extent by air from the Pacific Ocean, allowing for relatively moderate temperatures; however the Cascade Mountains to the west of the installation block much of the precipitation from that direction (DeBano and Wooster 2004).

7.7.1 Temperature

The Depot has a dry continental climate with significant variation in temperature between summer and winter. In January, the average daily temperature is 30 °F and typical winters include just a few days with minimum temperatures below 0 °F. In July, the average daily temperature is 70 °F and typical summers include just a few days with maximum temperatures above 100 °F (U.S. Army 1995).

Unusual temperatures tend to occur when air from the Pacific Ocean is hindered by slow-moving, high-pressure systems over the interior of the country. Predominating, stagnant high pressure systems in the north or east in the summer or early fall can result in dry and hot southerly air at the Depot. This southerly air increases the risk of fire. The lowest temperatures in winter tend to occur when high pressure systems in central Canada force cold air southwest across the Rockies and into the Columbia Basin (U.S. Army 1995).

7.7.2 Precipitation

The Depot and its surrounding lands are relatively dry due to the influence of the Cascade and Coast mountain ranges west of the installation. As air from the Pacific Ocean clips the western slopes of these two mountain ranges, it cools and moisture is removed as precipitation. This effect, known as a rain shadow, results in the Depot receiving only approximately 10 inches of annual precipitation (U.S. Army 1995). Peak precipitation occurs as snow in November, December, and January as a result of winter storms. Annual snowfall is approximately 10 inches, and the majority of this falls between December and March (U.S. Army 1995). Although summer precipitation is unusual, when it does occur, it is usually in the form of thunderstorms, sometimes causing flash floods.

This region has been experiencing reduced precipitation for a number of years. The U.S. Drought Monitor, a multi-agency service established to monitor drought conditions throughout the nation, currently classifies the drought in this area as severe (*http://www.drought.unl.edu/dm/monitor.html*). Consequently, in April 2005 the Governor of Oregon, Theodore Kulongoski, signed Executive Order 05-05 declaring a state of drought emergency in Crook, Gilliam, Hood River, Morrow, Sherman, and Umatilla Counties, directing state agencies to provide assistance in mitigating the effects of drought on the public and economies of the state of Oregon (Office of the Governor of the State of Oregon 2005).

7.7.3 Wind

Wind in the vicinity of the Depot is channeled by the Columbia River Valley. This channeling, in conjunction with a generally prevailing westerly wind, results in a prevailing west-southwest wind at the Depot itself. A minor secondary peak in wind direction occurs from the east-northeast due to the draining of cold air down the river valley at night and early morning hours (U.S. Army 1995).

8.0 FLORA AND FAUNA

8.1 GENERAL

The Depot is situated in what is classified as an *Artemisia-Agropyron* steppe biome located in the upper part of the Columbia Basin floristic province of northeastern Oregon (Gene Stout and Associates 1997). Kagan et al. (2000) indicates that the Umatilla Chemical Depot and the Boeing Lease Lands contain the largest remaining bitterbrush shrub-steppe habitats in the Columbia Basin. As such, the Depot provides valuable habitat for native plant and animal species. Due to the limited distribution of the shrub-steppe habitat, many of the associated wildlife species are listed by the state as sensitive. The passive nature of the Depot's mission as a munitions storage facility, established in the early 1940s, has resulted in preservation of this significant habitat.

The Columbia Basin Province, also known as the Umatilla Plateau, originally supported vast natural grasslands. These have been replaced by irrigated crops and, to a lesser extent, cattle raising. Of Oregon's ten recognized physiographic provinces, the Columbia Basin is the one most modified by human influences. The availability of hydroelectric power and irrigation water has resulted in an expansion of croplands into this arid region (Puchy and Marshall 1993). The Depot is currently surrounded on all sides by intensively farmed lands employing pivot-type sprinkler irrigation systems.

While conducting surveys on the Depot, Tetra Tech EM Inc. (Tetra Tech) noted cryptogamic soil crusts underlying many of the vegetative communities on the installation. This indicates that much of the property has been protected from human disturbance for many years (para. 7.5.1). Cryptogamic crusts reduce soil erosion, retard runoff, offer structural "niches" to collect native plant seeds, and provide nutrients for plant growth.

8.1.1 Species at Risk

The DoD, in conjunction with NatureServe, has developed a Species at Risk (SAR) program, whereby imperiled species on military installations are identified, and management priorities recommended for those species and installations. NatureServe defines SAR as "…native, regularly occurring species in the United States that are not federally listed under the U.S. Endangered Species Act, but are either:

- *Candidates* for listing under the U.S. Endangered Species Act, or
- *Critically imperiled*….or *Imperiled*…., according to the NatureServe conservation status rank criteria." (NatureServe 2004.)

In general, NatureServe adopts the ranking system used by their cooperative member Natural Heritage Programs in assessing the status of SAR species in each respective state. In their "Species at Risk on Department of Defense Installations," NatureServe (2004) classifies the Depot as "closed," and further indicates that there are no SAR on the Depot. However, it does concede that many areas have not been adequately inventoried. The list indicates that nearby

Boardman Naval Training Facility has one unidentified SAR, presumably the Washington ground squirrel, which has not been documented on the Depot. In reviewing the SAR list, that is the only species on the list whose range may include the Depot.

8.2 FLORA

Tetra Tech EM Inc. (Tetra Tech) conducted Planning Level Vegetation Surveys on the Depot in 1999-2000, identifying seven shrubland and seven grassland vegetative communities on the site. Most of the communities appear to be variations of *Artemisia tridentata/Stipa comata*, *Purshia tridentata/Stipa comata*, and *Stipa comata-Poa secunda* associations (Tetra Tech 2002b). Overall, the vegetative communities support a relatively high degree of native species diversity.

The classification and distribution of vegetative communities as described by Tetra Tech (2002b) do not match those of the 1993 Ecological Assessment Report (USACE 1993), as presented in Gene Stout and Associates (1997). This may be due to differences in interpretation; changes in plant associations and distributions from 1992 to 1999 due to weather conditions and other environmental and human-induced influences; and/or an apparent lack of sufficient time spent in the field during the 1992 inventories (Gene Stout and Associates 1997). Tetra Tech's data is used in this INRMP because theirs is the more recent work, and considerable time was spent in the field ground-truthing the data.

Furthermore, it should be noted that the current drought gripping the region may result in some variations in plant species distribution, composition, diversity and cover from that reported by Tetra Tech in 2002.

In general, the Depot supports large communities of shrublands, dominated by sagebrush and bitterbrush with an understory of annual grasses and forbs; and grasslands, dominated by a mixture of native and exotic species such as Sandberg's bluegrass, cheatgrass (downy bromegrass), and crested wheatgrass. The shrublands are found primarily in the eastern and southwestern portions of the Depot on soils with a higher silt content, and consequently a higher moisture capacity. Note that Kagan et al. (2000) indicates that the Depot contains the largest remnants of bitterbrush habitat in the Columbia Basin, as well as high quality needle-and-thread sandy grasslands. The central region of the Depot is dominated by the grasslands, which are intermixed with the shrublands in the eastern portions as well. Tetra Tech (2000b) also identifies what they call "mixed communities", defined as areas wherein several vegetative communities are present and intermingled. The mixed communities are primarily in the northwestern and northeastern portions of the Depot. Cheatgrass is a prevalent understory in many of the shrubland communities.

See Tetra Tech (2002b) for a more in-depth treatment of the vegetative communities described below. A complete listing of plant species documented on the Depot during the Tetra Tech inventories can be found at Appendix B1. For a general overview of the Depot's vegetative communities, see Figure 5. Shrubland, grassland, and mixed vegetative communities are presented in Figures 6, 7, and 8, respectively.

8.2.1 Shrublands

8.2.1.1 Sagebrush/Annual Grasslands

This community, occupying approximately 173 acres, is found primarily in the sand dunes in the eastern portion of the Depot. Its dominant species are big sagebrush and cheatgrass. The cheatgrass understory presents a fire hazard, as it forms a continuous, light and flashy fuel load. Sagebrush is fire intolerant, and may be declining in the western states due to the incidence of both controlled burning and wildfires.

8.2.1.2 Sagebrush - Bitterbrush/Sandburg's Bluegrass - Cheatgrass

As with the sagebrush/annual grasslands community described above, this community is found in the eastern portion of the Depot, although it is characterized by about equal shrub coverage of sagebrush and bitterbrush. The cheatgrass understory is still dense and continuous however. This community occupies about 397 acres of the Depot.

8.2.1.3 Bitterbrush/Sandberg's Bluegrass - Cheatgrass

This is the most extensive shrubland community on the Depot, covering about 3,072 acres in the southern and eastern portions of the installation. Some older stands are over 6 feet in height. This community has the lowest species diversity of the shrub communities, as well as the lowest percent of native grass species. As with the other shrub communities already described, this community presents a high fire risk due to the continuous understory of cheatgrass.

8.2.1.4 Bitterbrush/Indian Ricegrass Sand Dunes

This community occupies approximately 164 acres in the north-central portion of the Depot. It is found in dunal areas, and except for the effects of past wildfires, has been relatively undisturbed by human traffic or grazing, as evidenced by an extensive coverage of cryptogamic soil crusts. Also, this type is the most species rich of the shrub communities, and has a high percentage of native species.

8.2.1.5 Gray and Green Rabbitbrush/Sandberg's Bluegrass - Cheatgrass

This shrubland community occupies only about 110 acres along the northeastern boundary of the Depot. Both species of rabbitbrush are present in the overstory, and although cheatgrass is found in the understory, it is not as prevalent as in other communities.

8.2.2 Grasslands

8.2.2.1 Needle-and-Thread Grass - Sandberg's Bluegrass - Cheatgrass

This grassland community, occupying about 313 acres in the northeastern and southeastern portions of the Depot, appears to be one of the least disturbed native plant communities on the installation. Along with a well developed and extensive layer of soil cryptogams, it has the highest species diversity of the grassland communities, as well as a high percentage of native species.

8.2.2.2 Sandberg’s Bluegrass - Cheatgrass

This community covers about 607 acres in the northeastern and north-central portions of the Depot. With the cheatgrass component, native species comprise only about 62 percent of the community.

8.2.2.3 Sandberg’s Bluegrass - Balsamroot

This community is found in the east central portion of the Depot, and covers about 137 acres. The type can also be found as minor inclusions in other shrub- and grassland communities. As the name indicates, the type hosts large patches of Carey’s balsamroot, as well as the highest percent cover of cryptogamic crust (22 percent).

8.2.2.4 Cheatgrass - Bulbous Bluegrass

This is the largest plant community on the Depot, covering approximately 3,097 acres in the central and eastern portions of the installation. Both dominant species are invasive exotics, and have occupied the area previously disturbed during the construction of the ammunition storage bunkers.

8.2.2.5 Cheatgrass - Sandberg’s Bluegrass

The cheatgrass - Sandberg’s bluegrass type occupies extensive areas on the Depot, covering 2,418 acres across the site. It typically occurs in association with the cheatgrass - bulbous bluegrass community in disturbed areas. As such, it has the highest percent cover of exotic species, and the lowest percent cover of cryptogamic crust.

8.2.2.6 Crested Wheatgrass

Crested wheatgrass, a non-native, was commonly planted on the Depot as a cover crop to stabilize soils. However, as a bunchgrass it tends to grow in a dispersed fashion, leaving a relatively high percentage of bare ground between bunches. The community is found primarily among the ammunition bunkers in the central portion of the Depot.

8.2.3 Mixed Communities

Several large areas on the Depot can only be characterized as mixed communities: an integrated combination of several of the above plant communities. As indicated earlier, these are found primarily in the northeastern and northwestern portions of the installation. See Figure 8 for a presentation of the installation’s mixed communities.

8.2.4 Rare, Threatened, Endangered, and Sensitive Plants

As of September 2005, four species of concern were listed by the USFWS as potentially occurring within the Depot area: northern wormwood, Laurence's milk-vetch, hepatic monkeyflower, and Columbia yellow-cress. However, based on habitat, only one of these, Laurence's milk-vetch, is likely to occur on the installation. Laurence's milk-vetch is state-listed as a threatened species. In addition, Douglas' milk-vetch is not federally listed but is state-listed as a candidate and may occur within the Depot area.

Despite the extensive amount of time Tetra Tech spent in the field during their Planning Level Surveys, they found no federally listed vascular plant species on the Depot. They did, however, discover crouching milkweed, or Columbia milk-vetch, a state watch list species, in several of the vegetative communities on the site (Tetra Tech 2002b). The species was found primarily in the less disturbed dry shrub and grassland communities in the eastern portion of the Depot. However, it was also documented in a disturbed crested wheatgrass community and in a bitterbrush dominated community in the southwestern part of the installation.

A listing of federal and state-listed sensitive Oregon plant species can be found at Table 8-1, and at *http://www.oregon.gov/ODA/PLANT/CONSERVATION/statelist.shtml*.

8.2.5 Non-native Plant Species

Approximately 25 percent of the vascular plants documented by Tetra Tech (2002b) on the Depot are exotic species for the area. Two of those species are listed by the Oregon Department of Agriculture as noxious weeds: diffuse knapweed and rush skeletonweed. Land owners and managers are required to control or eradicate these species, when found on their properties, per state regulation (*Oregon Revised Statutes, Chapter 452, Vector and Weed Control*). Tetra Tech found rush skeletonweed in only a few locations along roadsides near the southern and northern boundaries of the installation. Diffuse knapweed was found extensively throughout the Depot along roadsides and in otherwise disturbed areas. However, this species can successfully invade native shrubland communities as well (Tetra Tech 2002b).

Cereal rye was found during the Planning Level Surveys conducted by Tetra Tech as well. This annual grass is commonly planted for domestic agricultural purposes. During the surveys the species was detected in two locations along the southeastern boundary of the Depot, but may become more widespread on the installation without aggressive control measures.

In previous years non-native crested wheatgrass and European beachgrass were both planted on the Depot in an attempt to prevent or reduce soil erosion. Both species have the potential for invading adjacent native plant communities, and to a limited extent have done so on the Depot. These species are no longer planted on the Depot.

Russian thistle and tumblemustard are non-native forbs found on the Depot by Tetra Tech. Russian thistle, once it has passed its life cycle, becomes the ubiquitous "tumbleweed" which accumulates in depressions and along fencerows, becoming a fire hazard in such situations.

The most common non-native species found on the Depot are cheatgrass and bulbous bluegrass. As noted in the plant communities described above, cheatgrass is a pervasive understory species found throughout the installation. Not only do these species degrade the integrity of native communities, often outcompeting other species to form monocultural stands, they create a severe fire hazard due to the heavy fuel-loading as a result of dense, light and flashy plant materials. DeBano and Wooster (2004) indicate that cheatgrass can return quickly after a fire, and may burn as frequently as every five years, making reestablishment of native species, such as sagebrush, very difficult.

8.2.6 Wetlands

A National Wetlands Inventory was conducted on the Depot in June, 2000, and no permanent, naturally occurring wetlands were found on the installation (Swords and Tiner 2001; Figure 4). There are, however, two small wet areas created by wildlife watering devices releasing water onto the land at these sites (Figure 4). Wetland vegetation can be found at these locations.

8.3 FAUNA

A general qualitative assessment of wildlife at the Depot was conducted as a component of an ecological assessment process, which was prepared as part of the Remedial Investigation/ Feasibility Study (RI/FS) (USACE 1993). The field survey for the assessment was limited to a three-day period in March 1992. Lists 4, 5, and 6 in Appendix B2 summarize the confirmed and possible mammal, bird, and reptile and amphibian species, respectively, occurring at the Depot. No comprehensive planning level surveys for nonsensitive vertebrate species have been conducted on the Depot.

As indicated earlier, the Depot contains the largest remnants of bitterbrush shrub-steppe habitat in the Columbia Basin (Kagan et al. 2000). Therefore, more extensive and comprehensive Planning Level Surveys for terrestrial wildlife species should be conducted on the installation, to document the faunal species in this diminishing habitat.

In general, faunal species on the Depot are consistent with what one would expect in Columbia Basin native shrub-steppe and grassland habitats: pronghorn, coyote, American badger, jack- and cottontail rabbits, Swainson’s and redtail hawks, burrowing owl, long-billed curlew, and many other species common to this habitat. Note that the pronghorn herd is not free-ranging, as the Depot’s perimeter fence keeps it captive. The lack of permanent surface water on the Depot precludes the occurrence of native fish species, however, mosquito fish are stocked in a stormwater retention pond to eat mosquito larvae (para. 14.6.1.1). See Appendix B2, from the *Ecological Assessment Report* (USACE 1993), for a more complete listing of Depot wildlife. The following species on the Depot are worthy of special note.

8.3.1 Pronghorn

The pronghorn is indigenous only to Canada, the United States, and Mexico, and past populations are estimated to have been between 30 and 40 million (O'Gara and Yoakum 2004). Prior to settlement of the area by Euro-Americans, the species was abundant and widely distributed in Oregon. However, primarily as a result of over harvesting following settlement, pronghorn numbers plummeted and by 1915 it was estimated there were only about 2,000 animals left in the state (Bailey 1936, *as cited in* Verts and Carraway 1998). Laws were passed first prohibiting and then restricting the taking of pronghorn, and eventually viable populations were again seen in the state.

Several studies have been conducted assessing pronghorn habitats in Oregon. However, given that the Depot herd is confined to the area by the perimeter fences, their movements relative to habitat variability or quality are severely restricted. Suffice it to say that pronghorn were found in the area during pre-settlement periods, and since the Depot hosts some of the best remaining examples of native shrub-steppe habitat in the area, it may also have the best pronghorn habitat in the region.

Pronghorn are herbivores that graze on grasses, various forbs, and cacti during the summer (Whitaker 1980). Verts and Carraway (1998) indicate that, in Oregon, they feed largely on shrubs. In the winter, pronghorn browse on many different plant species, favoring sagebrush (Whitaker 1980). Under normal conditions, sagebrush, rabbitbrush, and saltbrush make up most of their diet at 25 to 50%, 10 to 25%, and 5 to 10% respectively (Martin et al. 1951). When succulent vegetation is available, pronghorn may drink little water, obtaining most of their water from the plants they ingest. However, during periods of drought, they are benefitted by free-water, and may experience weight loss and depressed activity without it (O'Gara and Yoakum 2004). Under these conditions, free-water availability may affect pronghorn distribution as well. Several sprinkler systems and water catchments offer free-water for wildlife use on the Depot.

In 1969, 17 pronghorn were reintroduced to the Depot by the ODFW as part of a transplant program. The original herd composition was two adult males, two juvenile males, ten adult females, and three juvenile females. The intent was to manage the herd to produce surplus animals for relocation to offsite preserves. In the first year following the pronghorn reintroduction, it was decided that coyotes were limiting herd growth, and a predator control program was initiated. Between 1970 and 1980, 374 coyotes were removed from the Depot and the immediate surrounding area by USDA Animal Damage Control (ADC) personnel (this and the following survey data was taken from ODFW, unpublished data). During that period, the pronghorn herd's size increased to over 175 animals (Oregon State Game Commission 1972 *as cited in* O'Gara and Yoakum 2004).

In 1981, seven pronghorn were tested for internal parasites and disease. While a few animals had intestinal nematodes and tested positive for blue-tongue, the pronghorn were generally in good health. Based on the studies conducted in 1981, it was estimated that the pronghorn carrying capacity of the Depot was between 300 and 350 individuals (Intermountain

Range Consultants 1988). However, ODFW personnel estimated the carrying capacity to be much lower, at 100-150 individuals.

In 1985, 40 pronghorn were transported to Nevada in a joint operation between the ODFW and the Nevada Department of Wildlife. In 1986, the pronghorn population was estimated at more than 400 animals, and in 1987, 110 head were transplanted to other locations in Oregon. The following year an additional 65 head were removed to Baker and Union Counties, within Oregon. According to a SWCD/SCS report, a pronghorn population census conducted on 18 September 1995 indicated that the herd's population had dropped to 130 (SWCD and SCS 1995). The reason for the population decline is unknown; however, predation, inbreeding, age, and/or other factors may have been responsible. From 1997 to 2001 pronghorns were counted in conjunction with long-billed curlew road surveys. Total numbers have ranged from 0 to 31 animals being observed. Herd composition was recorded during these surveys, and fawn numbers appeared to be especially low, a factor also noted through direct observation by the preparers of the 1998-2002 INRMP (Gene Stout and Associates 1997). This could be due to low production, low survivorship (possibly due to high predation), and/or limited observability. Finally, in February 2000, 50 head of pronghorn were trapped in support of an effort to trade Oregon pronghorn for Nevada bighorn sheep. Thirty pronghorn were sent to Nevada, 2 were injured and had to be euthanized, and the remaining 18 were released on site (Blakely, pers. com.).

On the Depot, coyotes are the main predators of pronghorn. The Depot's numerous fenced areas hinder the pronghorn's ability to escape predators whereas the coyotes easily pass under or through fences. Due to a lack of similar obstacles in their historical habitat, fences are a significant obstacle for pronghorn and can cause mortality in certain situations (Yoakum 1978). Gene Stout and Associates (1997) indicates the "....apparent lack of reproductive success may be attributable to coyote predation of pronghorn fawn."

A study comparing the levels of genetic diversity and structure in the Depot herd with those of its source population and another free-ranging Oregon pronghorn herd was recently conducted. Tissue samples were collected from the three discreet herds in 2000 and 2001, and it was found that the Depot herd exhibits "1) sharply lower diversity compared to its source and 2) significant haplotypic and genotypic differentiation from its source" (Stephen et al., *in press*).

8.3.2 Coyote

The coyote is a highly mobile predator that inhabits nearly all habitat types in eastern Oregon but prefers brushy areas or open plains. Coyotes will eat pronghorns, ground squirrels, mice, rabbits, pocket gophers, reptiles, birds, insects, carrion, and fleshy fruits. Coyote denning has been observed on the Depot; they excavate their own dens or use dens abandoned by other animals. On the Depot, the coyote is a top predator and may be partly responsible for the depressed pronghorn fawn counts (USACE 1993). Verts and Carraway (1998) indicate that in studies of pronghorn neonate survivorship in Oregon, coyotes were the primary predator causing losses in fawn crops. O'Gara and Yoakum (2004) summarized the data from 18 studies of pronghorn fawn survivorship throughout the pronghorn range, and found that at least 67% of predator-related fawn mortalities were attributed to coyote predation.

8.3.3 Imperiled Avifauna

The Fish and Wildlife Conservation Act (FWCA) of 1980, as amended, mandates the USFWS to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.” In response, the USFWS produced the Birds of Conservation Concern (BCC) in 2002 that identifies native bird species, “…that represent our highest conservation priorities and draw attention to species in need of conservation action” (USFWS 2002). Federally listed threatened or endangered bird species are not included on the BCC list, nor are gamebirds managed by state and/or federal entities through harvest quotas; however, the list was expanded over the FWCA requirements to include non-migratory species. BCC 2002 lists bird species of conservation concern at three geographic scales: North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs), USFWS Regions, and National. Spatially, the smallest of these scales, as well as the most relevant for management implications, is the BCR. BCRs are delineated by ecological regions, similar to the ecoregions described in paragraph 7.1; however, BCRs are more relevant to bird populations and species (*http://www.nabci-us.org/bcrs.html*). Umatilla Chemical Depot lies within BCR 9, Great Basin.

In 2004 the USFWS Migratory Bird Program produced a 10-year strategic plan, “A Blueprint for the Future of Migratory Birds” (USFWS, n.d.), describing the mandates, mission, vision, and operating principles forming the foundation of the Service’s bird conservation activities, as well as providing a list of migratory birds of management concern. This was followed up with the development of a goal to increase the percent of migratory bird species that are at healthy and sustainable levels (USFWS, n.d.). As a means of tracking the USFWS’s performance in attaining these goals, a small subset of the birds of management concern was identified as “focal species”, to “…document and demonstrate the depth and breadth of management challenges faced by the Service and its conservation partners” (USFWS 2005).

Umatilla Chemical Depot hosts several bird species that are on the BCC 2002 list and/or the USFWS Focal Species List. The sage sparrow and the long-billed curlew merit special mention due to their specialized living requirements or their declining numbers throughout their range.

8.3.3.1 Sage Sparrow

As indicated earlier, the Depot contains the largest remnants of intact bitterbrush shrub-steppe habitat in the Columbia Basin (Kagan et al. 2000). In their subbasin assessment of the Umatilla Basin, DeBano and Wooster (2004) select focal vertebrate species to “represent” vegetative communities; species that, if not obligate in their relationship with a respective community, at least rely heavily upon it for their survivorship requirements. The focal species for the bitterbrush shrub-steppe vegetative community is the sage sparrow. The following information on sage sparrows is taken from DeBano and Wooster (2004).

Sage sparrows are shrub-steppe obligates, meaning they require that habitat for their survival as a species. They are most closely associated with big sagebrush communities with perennial bunch grass understories. Sage sparrows are migratory, typically arriving in northern Oregon in late February to early March. They nest in or under sagebrush shrubs, and may raise one to three broods per nesting season. Brood parasitism by brown-headed cowbirds is known to occur. Predation by Townsend ground squirrels, gopher snakes, loggerhead shrikes and domestic and feral cats has been documented.

Undoubtedly, however, the greatest threat to sage sparrows is the loss of habitat through fragmentation and conversion. Using data generated by surveyors in the 1850s compared to current information, Kagan et al. (2000) estimates that 55% of the bitterbrush shrub-steppe habitat in the Umatilla Basin has been lost, mostly through conversion to agricultural uses. However, the Depot retains significant acreages of this vegetative community. Consistent with this, sage sparrows, which historic records indicate were once abundant in northern Morrow and Umatilla Counties (DeBano and Wooster 2004), are now relegated to remnants of their preferred habitats, such as those found on the Depot. A declining trend in sage sparrows on the Depot may signal detrimental trends or conditions in their preferred shrub-steppe habitat. As an example, the use of big sagebrush communities by sage sparrows may decrease as perennial bunch grass understories are taken over by invasive annual grasses, as is often found on the Depot (Kirsch, pers. com.) However, other factors, such as predation or disease, may contribute to population declines as well.

Altman and Holmes (2000) also use the sage sparrow as a focal species; for large, unfragmented patches of big sagebrush. As described in this Partners in Flight (PIF) conservation strategy, the ideal habitat for sage sparrows would consist of big sagebrush patches approximately 2,500 acres in size, greater than 20 inches in height, with 10-25% overstory cover and greater than 10% understory (herb) cover, and greater than 10% bare ground (Altman and Holmes 2000). Sage sparrows are a Bird of Conservation Concern species in BCR 9 (USFWS 2002).

8.3.3.2 Long-billed Curlew

The long-billed curlew is the largest shorebird in North America (Johnsgard 1981). The species breeds in grassland habitats, and feeds primarily on insects, using its long bill for snatching food items from the surface, or for probing slightly beneath the surface and in holes. Long-billed curlews arrive on their breeding grounds in mid-March, and may stay through the summer (Pampush 1980, Denchant et al. 2003). The species has been known to breed on the Depot; ODFW has conducted road surveys for curlews, in conjunction with burrowing owls, from 1988 to 2001. Survey results fluctuated considerably but suggest a declining trend in curlew numbers on the Depot (ODFW, unpubl. data). However, it’s difficult to assess how many observations were of resident versus transient birds. In addition, some variation in survey results may be due to changes in survey methodologies in response to elevated security measures on the Depot in recent years (Kirsch, pers. com.). Tetra Tech staff members found several active curlew nests while conducting planning level surveys (Tetra Tech 2002a).

Long-billed curlews are one of the most threatened shorebird species on the continent, and have been extirpated in several states. The primary causes for their population declines are degradation and loss of breeding habitat. In the U.S. Shorebird Conservation Plan (2004), they are classified as “Highly Imperiled”. The International Union for Conservation of Nature and Natural Resources (IUCN) lists the long-billed curlew as “Near Threatened” on its Red List (*see www.iucnredlist.org*), and the state of Oregon lists the species as “Vulnerable”. Long-billed curlews are a Bird of Conservation Concern species at the BCR, Regional, and National levels (USFWS 2002), and they are designated as a focal species for conservation by the USFWS (USFWS 2005). However, some sources indicate that in some local areas, including the Columbia Plateau, the species may be increasing.

8.3.4 Other Rare, Threatened, Endangered, and Sensitive Wildlife Species

Tetra Tech conducted Planning Level Surveys for threatened and endangered wildlife species on the Depot in 1999 and 2000. They focused their survey efforts primarily on three species: the bald eagle, the peregrine falcon, and the Washington ground squirrel (Tetra Tech 2000a). However, other sensitive species were the subject of investigation as well. The following are the results of Tetra Tech’s survey efforts for threatened and endangered species on the Depot, and unless otherwise indicated, the data presented is from Tetra Tech (2000a). See Table 8-1 for a listing of species of special concern potentially found on the Depot.

Bald Eagle: The bald eagle was recently removed from federal listing as a threatened species, but is still state-listed as threatened. It has been observed on the Depot in the past (Gene Stout and Associates 1997), although it is considered a transient on the site and likely observed during the winter months. Due to a lack of water and large trees, there is limited suitable foraging or resting habitat for the species on the installation.

American Peregrine Falcon: The peregrine falcon was removed from federal listing as an endangered species in 1999, however the species is still listed as endangered by the state. As with the bald eagle, the Depot lacks favorable habitat for the peregrine falcon, therefore the species may be observed incidentally as a transient. There are no known records of peregrine falcons having been observed on the installation. Peregrine falcons are a Bird of Conservation Concern species at the BCR, Regional, and National levels (USFWS 2002), and they are designated as a focal species for conservation by the USFWS (USFWS 2005).

Western Burrowing Owl: This diminutive owl is federally listed as a Bird of Conservation Concern in several western BCRs, USFWS Regions, and Nationally (USFWS 2002), and is designated as a focal species for conservation by the USFWS (USFWS 2005). It is also state-listed as sensitive critical. The Depot hosts several colonies of burrowing owls; during their surveys in 2000, Tetra Tech recorded 12 active nest sites on the installation, primarily in abandoned American badger dens.

Ferruginous Hawk: The ferruginous hawk is federally listed as a Bird of Conservation Concern in several western BCRs, as well as Nationally (USFWS 2002), and is designated as a focal species for conservation by the USFWS (USFWS 2005). It is also state listed as sensitive critical. The species has been observed foraging on the Depot, but is not known to nest on the site.

Swainson's Hawk: The Swainson's hawk is federally listed as a Bird of Conservation Concern in several western BCRs, USFWS Regions, and Nationally (USFWS 2002). The state considers it a vulnerable species. During their surveys, Tetra Tech observed two active Swainson's hawk nests near the Depot's administrative area.

Grasshopper Sparrow and Loggerhead Shrike: Both of these species are listed as Birds of Conservation Concern at the BCR, USFWS Regional, and National levels (USFWS 2002), and both are designated as USFWS focal species for conservation purposes (USFWS 2005). They are considered vulnerable on Oregon's sensitive species list, and are commonly observed on the Depot.

Sage Grouse: Although sage grouse have not been documented in the Columbia Basin region for many years, Tetra Tech staff flushed a bird in the northwestern part of the Depot that appeared to be a sage grouse. At that time the grouse was federally listed as a candidate species. Its candidate status was removed in early 2005 however. The Columbia Basin population of the Greater sage grouse is listed as a Bird of Conservation Concern at the BCR, USFWS Regional, and National levels (USFWS 2002). In addition, the species is listed as vulnerable by the state.

Northern Sagebrush Lizard: This lizard is federally listed as a species of concern, and state-listed as a vulnerable species. Tetra Tech staff members record having seen the species in two locations during the surveys.

Washington Ground Squirrel: The Washington ground squirrel is a federal candidate species, is state listed as an endangered species, and is on the DoD/NatureServe list as a SAR (NatureServe 2004). Although this was one of the species targeted during Tetra Tech's planning level surveys, and considerable effort was focused on finding the species if present, no Washington ground squirrels were documented on the Depot. However, the ODFW indicates that this species has been found elsewhere in Umatilla County where none were thought to exist (Kirsch, pers. com.); therefore potential evidence of Washington ground squirrels (reported sightings, sign), should be thoroughly investigated.

Table 8-1: Faunal and Floral Species of Special Concern Potentially Found on U.S. Army Umatilla Chemical Depot					
Common Name	**Scientific Name**	**Federal Status**	**BCC[a]** **FS[b]**	**State Status**	**Occurrence**
Reptiles and Amphibians					
Northern Sagebrush Lizard	*Sceloporus graciosus graciosus*	SoC		SV	Present
Birds					
Long-billed Curlew	*Numenius americanus*	None	BCR 9, R1, N FS	SV	Present
Bald Eagle	*Haliaeetus leucocephalus*	None		LT	Transient
Swainson's Hawk	*Buteo swainsoni*	None	BCR 9, R1, N	SV	Present
Ferruginous Hawk	*Buteo regalis*	SoC	BCR 9, N FS	SC	Present
Peregrine Falcon	*Falco peregrinus*	None	BCR 9, R1, N FS	LE	Transient
Sage Grouse	*Centrocercus urophasianus*	None	BCR 9, R1, N	SV	Potential
Western Burrowing Owl	*Athene cunicularia hypugea*	SoC	BCR 9 FS	SC	Present
Lewis' Woodpecker	*Melanerpes lewis*	SoC	BCR 9	SC	Present
Bank Swallow	*Riparia riparia*	None		SU	Present
Loggerhead Shrike	*Lanius ludovincianus*	None	BCR 9 FS	SV	Present
Grasshopper Sparrow	*Ammodramus savannarum*	None		SV	Present
Black-throated Sparrow	*Amphispiza bilineata*	None		SP	Present
Sage Sparrow	*Amphispiza belli*	None	BCR 9	SC	Present
Bobolink	*Dolichonyx oryzivorus*	None	FS	SV	Present

Table 8-1: Faunal and Floral Species of Special Concern Potentially Found on U.S. Army Umatilla Chemical Depot

Common Name	Scientific Name	Federal Status	BCC[a] FS[b]	State Status	Occurrence
Tricolored Blackbird	*Agelaius tricolor*	SoC	BCR 9, N FS	SP	Potential
Mammals					
Western Small-footed Myotis	*Myotis ciliolabrum*	SoC		SU	Potential
Long-eared Myotis	*Myotis evotis*	SoC		SU	Potential
Long-legged myotis	*Myotis volans*	SoC		SU	Potential
Townsend's Big-eared Bat	*Corynorhinus townsendii*	SoC		SC	Potential
Pallid Bat	*Antrozous pallidus*	None		SV	Potential
White-tailed Jackrabbit	*Lepus townsendii*	None		SU	Potential
Washington ground squirrel	*Spermophilus washingtoni*	C		LE	Potential
Plants					
Laurence's Milk-vetch	*Astragalus collinus var. laurentii*	SoC		ST	Potential
Douglas' Milk-vetch	*Astragalus kentrophyta*	None		SC	Potential

Key: The full keys are provided for comparison purposes.

Federal:

LT:	Listed Threatened. This category includes taxa listed as threatened by the USFWS under the Endangered Species Act.
C:	Candidate species. This category includes taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened.
SoC:	Species of Concern. This category includes taxa for which existing information may warrant listing, but for which substantial biological information to support a proposal rule is lacking.

[a]**BCC: Birds of Conservation Concern (see para. 8.3.3)**

BCR 9	Bird Conservation Region 9
R1	USFWS Region 1
N	National

[b]**FS: Focal Species (see para. 8.3.3)**

State Protected: (State Protected List also includes the categories listed as State Sensitive.)

LE	Listed as an Endangered Species.
LT	Listed as a Threatened Species.
PE	Proposed as an Endangered Species.
PT	Proposed as a Threatened Species.
SC	Sensitive - Critical. Those species for which state listing as threatened or endangered is pending, or for which state listing as threatened or endangered may be appropriate if immediate conservation efforts are not taken.
SV	Sensitive - Vulnerable. Those species for which state listing as threatened or endangered is not believed to be imminent and could be avoided through continued or expanded conservation measures or monitoring.
SP	Sensitive - Peripheral or Naturally Rare. Those species that occur in the state at the edge of their distribution. Naturally rare species are species that have been present in low numbers in Oregon historically due to natural limiting factors.
SU	Sensitive - Undetermined Status. Those species whose status is unclear.

9.0 ECOSYSTEM STATUS SUMMARY

9.1 GENERAL

This chapter analyzes information provided in previous chapters with regard to components of the Depot ecosystems and their ability to support the needs of the military mission and community. Much analysis within this chapter is subjective due to a lack of background data. However, implementation of this INRMP will significantly improve future trend analysis capability.

9.2 WATER QUALITY

The Depot was listed as a National Priorities List (NPL) site in July 1987 based on the Hazard Ranking System site score for the explosive washout lagoon area. This designation brought the Depot under Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Depot subsequently entered into a Federal Facilities Compliance Agreement (FFCA) with the Environmental Protection Agency (EPA), signed October 1989. Operable unit (OU) 3 is a remediation area where contaminated shallow groundwater is being remediated according to the *BRAC Cleanup Plan* (AEC 1995). It involves a pump and treat system using three extraction wells to remediate the contaminated water by carbon absorption, with recharge via infiltration to the shallow aquifer.

All known underground storage tanks (USTs) on the Depot have been removed and the Depot has converted all of its boilers to propane. Soil that was contaminated from underground storage tank operations was also removed from the installation to approved disposal sites.

There are no active sanitary landfills on the Depot; the Depot's solid waste is currently collected by a contractor and is landfilled off-site. One inactive landfill, OU 7, is involved with a selenium study, and there is a restrictive easement that bars the drilling of wells in its vicinity. Water quality monitoring for selenium is done twice annually as required by the State of Oregon under RCRA Subpart D.

9.3 SOIL PRODUCTIVITY

In the absence of irrigation, the Depot's soils are not particularly productive and support a shrub-steppe vegetation. In the early years of Army occupation, the loss of topsoil associated with igloo construction undoubtedly had significant impacts on soil productivity. A recent range condition survey showed approximately half of the Depot to be in fair condition and half to be in poor condition. Poor condition is associated with soil disturbance from historic Depot activities (SWCD and SCS 1995). Thus, the rehabilitation of the lands from construction more than 50 years ago is not complete.

There are localized problems with wind erosion, especially on and around the igloos. These are typically not significant because they are treated successfully on a case-by-case basis, generally by applying a layer of gravel, when they occur. Due to the arid climate and sparse vegetation, there is a constant level of wind erosion that may be considered naturally occurring. Due to difficulties in estimating wind erosion, it is not known if the prior land disturbing activities (igloo construction) and/or the existing igloos affect wind erosion and consequently, soil productivity. Application of the Revised Wind Erosion Equation (Fryrear 1997) may provide some insight into the current status of wind erosion and its affect on soil productivity.

9.4 BIODIVERSITY

Biodiversity has declined significantly in the Columbia Basin Ecoregion during the past 150 years; Kagan et al. (2000) estimates that over 85 percent of the native sagebrush steppe, grassland, and riparian communities have been converted to agricultural uses or have been overtaken by exotic species. The Umatilla Basin has been subject to widespread agricultural conversion, and the Depot is completely surrounded by crop fields with center-pivot sprinkler systems and grazing lands. The Boardman Naval Training Facility and the Depot, collectively, now host 25 percent and 35 percent, respectively, of the remaining bitterbrush shrub-steppe and needle-and-thread grassland habitats remaining in the Umatilla Basin (Kagan et al. 2000).

Biodiversity on the Depot significantly declined immediately following Army acquisition of the land. A review of aerial photographs from 1939 and 1949 indicate extensive disturbance to the entire Depot resulting from construction of 1,001 ammunition storage igloos and of the cantonment facilities. The *Ecological Assessment Report* (USACE 1993) noted that only 6 percent of the Depot was undisturbed. Little of the primary biome species association at the Depot is considered climax due to the past disturbances. However, the passive nature of the Depot’s mission has resulted in little to no recent disturbances, with the exception of the construction of the CSDP chemical destruction plant. This has led to the restoration and preservation of native habitats that, despite not being pristine, are significant due to their rarity in the area.

Kagan et al. (2000) indicates that the Depot contains the largest remnants of bitterbrush habitat in the Columbia Basin Ecoregion, as well as high quality needle-and-thread sandy grassland habitats. However, it also expresses concerns about the future integrity of those habitats, citing potential development as a “significant threat” to their preservation. As long as the Army retains ownership of the properties in question, and maintains a passive mission, the impact to native vegetative communities will likely remain minimal. However, those protections will come into question following the completion of the CSDP, when the Depot property is declared excess and must be transferred or sold to another owner. That action, however, is beyond the scope and timeline of this INRMP.

9.5 SUPPORT OF THE MILITARY MISSION

The Depot’s current realigned mission is the ongoing storage and destruction of chemical munitions. That mission is not particularly natural resources dependent, and in turn does not significantly impact the Depot’s resources. However, one key factor of the mission is the maintenance of open space, a provision supported by the Depot’s natural resources management program. Implementation of this INRMP directly supports the Depot’s mission. Priorities will change with the completion of the CSDP and the impending closure of the Depot after 2017 under BRAC; it will be left to be seen how precedents established by the Depot's natural resources management program may influence the future disposition of those resources.

9.6 PRODUCTION OF RENEWABLE PRODUCTS/RECREATION

9.6.1 Game and Associated Hunting

The Depot has the capability to produce game, and with the installation's emphasis on native species biodiversity and the mission's limited impact on the resources, game animals may thrive. However, the military mission precludes hunting activities on the Depot, due to restricted access.

9.6.2 Agriculture

The Depot has no agricultural outleases. The Depot's mission, as well as security considerations, preclude this option.

10.0 LAND MANAGEMENT UNITS

10.1 AMMUNITION DEMOLITION AREA

A 1,750-acre ammunition demolition area is located on the northwestern portion of the Depot (Figure 2). It was used for demilitarizing conventional munitions and burning defective or expired propellants. Currently, only authorized personnel are permitted to enter the ammunition demolition area. This area, which is fenced off from the rest of the Depot, is designated as OU 4 and is being remediated under the *BRAC Cleanup Plan* (AEC 1995).

10.2 TRAINING AND TESTING AREAS

For many years, the ONG used two parcels of land, covering approximately 1,380 acres: a tank maintenance quality and assurance testing area, for field-testing tanks that had been repaired or refurbished on the Depot, and a small arms range. Firm, stable soils and open space were required for effective maneuvering on the tank testing course. As stated earlier, the Depot's fine, sandy soils are susceptible to wind erosion when disturbed. To prevent disturbance of these soils, the ONG covered the tank trail with a layer of gravel. The ONG also conducted tank operations training exercises, however they used a tank simulator in these exercises.

10.3 CANTONMENT AREA

The cantonment portion of the Depot covers approximately 191 acres and includes the administrative, facilities maintenance, and housing areas. Landscaping is limited due to the arid climate, and irrigation is required to maintain grass lawns. A total of 24 acres is irrigated at the Depot. This acreage is primarily located in the housing/administation area and consists of lawns and open space parade ground areas. Grounds work is contracted out; however, the Grounds and Pest Management Department removes and replaces damaged trees and maintains the clear zones around sensitive areas. Over the last several years, the acreage of mowed land has decreased.

10.4 STORAGE AREAS

The Depot contains 1,001 ammunition storage igloos (Figure 2). Conventional munitions have been removed from the Depot and 900 of these igloos are currently empty. The remainder of the igloos are used for storing chemical agents, related wastes, and security munitions. In addition, some of the available igloos are used by contractors to store equipment, and the American Red Cross uses some igloos to preposition disaster relief supplies.

The maintenance of clear open spaces is essential to performing the Depot's storage mission. The open spaces, called clear zones, are areas where the height of vegetation is kept at a minimum. A 15-foot clear zone with vegetation less than 8 inches in height is maintained around the Depot perimeter and an approximately 50-foot clear zone with vegetation less than 2 inches in height is maintained around other sensitive areas as necessary. Most clear zones are maintained by mowing; however, mechanical clearing and non-selective herbicides are also used. Clear zone maintenance is not beneficial to natural resources because it removes vegetative cover that would otherwise be used by wildlife for cover. The Pest Management Coordinator will strive to reduce non-selective herbicide use for clear zone maintenance and will use mechanical means when possible.

11.0 ECOSYSTEM MANAGEMENT—GENERAL

Biodiversity protection is a DoD commitment and ecosystem management is recognized as the means to achieve this commitment. The publication *Conserving Biodiversity on Military Lands* (Leslie et al. 1996) provides guidance for military natural resource managers on conservation and ecosystem management, and may be used in the implementation of this INRMP.

11.1 OBJECTIVES

This chapter describes the following:

- biodiversity conservation and ecosystem management with regard to implementation by the DoA.
- how various natural resources programs fit within this INRMP and integrate with each other.

11.2 BIODIVERSITY CONSERVATION

This INRMP addresses biodiversity conservation in a variety of ways. It includes monitoring and inventorying that are critical to adaptive management, establishing conservation measures for protected species and communities, using and conserving native species, and reducing landscaping. Biodiversity conservation should not however, be related solely to maintaining or increasing numbers of individual species. Biological integrity of a system is a more encompassing goal that, if achieved, will provide the appropriate level of biodiversity for a given region or system (Angermeier and Karr 1994). This INRMP represents only the beginning of the process to manage for biodiversity and may need to be adjusted as DoD and DoA policies evolve.

11.3 ECOSYSTEM MANAGEMENT

Ecosystem management is a concept many natural resource managers have adopted on military installations during these past several years. Ecosystems can be defined on many levels, from genetic to landscape. Ecosystems often cross political boundaries, such as installation boundaries, which adds to the complexity of managing them. Ecosystem management strongly emphasizes processes, particularly adaptive management. Adaptive management is essentially flexibility: it involves implementing an option, monitoring the option's results, and modifying either the option or it's implementation accordingly.

Ecosystem management is not articulated formally in law, but its basic concepts have strong legal compliance aspects, especially within the Endangered Species Act, Sikes Act, Clean Water Act, and NEPA. Ecosystem management is a strategy that will help achieve biodiversity protection and maintain fully functional natural resource units.

The memorandum "Implementation of Ecosystem Management in the DoD" (Department of Defense 1994), states that ecosystem management will become the basis for future management of DoD lands and waters. In this context, ecosystem management will include:

Ecological approach: Individual species management will shift to ecosystem management.

Partnerships: Cooperation, coordination, and partnerships essential for managing ecosystems will be emphasized to "cross" the political boundaries that ecosystems straddle.

Participation: Public needs and desires will be considered in management decisions.

Information: The best available scientific information will be used to select technologies to be employed in managing natural resources.

Adaptive management: Adaptive management techniques will be incrementally applied as they are identified.

The DoD (1994), has an overall goal with regard to ecosystem management: " … to preserve, improve, and enhance ecosystem integrity. Over the long-term, this approach will maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies and communities." The principles and guidelines needed to achieve this goal are listed below:

- maintain and improve sustainability and native diversity of ecosystems.
- administer with consideration of ecological units and time frames.
- support sustainable human activities.
- develop a vision of ecosystem health.
- develop priorities and reconcile conflicts.
- develop coordinated approaches to work toward ecosystem health.
- rely on the best science available.
- use benchmarks to monitor and evaluate outcomes.
- use adaptive management.
- implement through installation plans and programs.

Ecosystem management provides a means for the Depot to both conserve biodiversity and provide high-quality military readiness. The Depot uses land for its military mission. Ecosystem management recognizes this and other human-related needs, including sustainable human activities, in a management program.

Adaptive management uses a feedback monitoring system to allow for the adjustment of management programs based on results. This system recognizes that it is important to implement "best judgement" programs rather than waiting until research provides all needed answers. These programs are monitored and adjusted as needed.

The Depot intends to use these ecosystem management concepts to guide its program in the future. This management philosophy will enable the Depot to proactively manage its natural resources in a manner that supports the safe storage and destruction of military munitions while protecting natural resources. Concurrently, ecosystem management will help ensure compliance with environmental laws.

11.4 INTEGRATED NATURAL RESOURCES MANAGEMENT

This INRMP provides the framework for ecosystem management implementation at the Depot. Chapters 12 through 18 each deal with aspects of conservation, management, and natural resources. The former military natural resources planning methodology of separating wildlife management, rangeland management, woodland management, Integrated Training Area Management (ITAM), and other programs based on the products they produce has been abandoned.

For several years the Depot has been conducting natural resources baseline studies and preparing various environmental documents, generally as the result of BRAC-related actions. This INRMP supplements these baseline studies and ties natural resources data into a single, integrated program.

11.5 PARTNERSHIPS

Partnerships are critical to the success of ecosystem management, and the Depot has a good basis upon which to build and maintain partnerships. Relationships with its INRMP signatory partners, the USFWS and ODFW, are good, and will continue to be developed in the years to come. This plan continues the partnership with the Confederated Tribes as well. In addition, should the opportunity present itself, the Depot may cooperate with the SWCD on projects in future years. The potential to develop partnerships with adjoining landowners is limited because the surrounding land is mostly agricultural; however, there may be opportunities to work cooperatively on projects of mutual interest such as insect control.

Interagency partnerships are typically grounded in cooperative agreements, and memoranda of agreements and understandings. The Depot maintains a Cooperative Agreement with the USFWS and the ODFW concerning the cooperative management of natural resources on the installation (Appendix E); and an MOA with the USFWS regarding the protection of raptors on the site, especially as it relates to raptor electrocution on utility poles and systems (Appendix F). Furthermore, the Depot operates in accordance with an MOU between the DoD, the USFWS, and the IAFWA, addressing the protection, management, and use of resources on DoD installations (Appendix D); and an MOU between the DoD and the USFWS addressing the conservation of migratory birds on DoD properties (Appendix G).

11.6 WILDLIFE MANAGEMENT

In recent years, wildlife inventory efforts on the Depot have been limited to studies conducted under BRAC and have not been specifically for natural resources management purposes. An exception to this is the monitoring of the pronghorn herd following reintroduction in 1969. Since the discontinuation of the ODFW's transplant program, the pronghorn inventory has been conducted intermittently by the ODFW and SCWD.

This INRMP will provide positive benefits to wildlife primarily through recommending the preservation and maintenance of native shrub-steppe habitats, as well as providing free-water with the wildlife watering devices. Recognizing the unique habitat on the Depot and making the effort to preserve it will prolong the reproductive success of native wildlife that inhabit the Depot.

11.7 APPLICATION OF INTEGRATED TRAINING AREA MANAGEMENT METHODS

The Depot does not have an intensive land use military mission. Therefore it does not have an ITAM program and, based upon the current passive mission, is unlikely to receive funding for ITAM in the future. However, ITAM program components are applicable to passive land use military missions since ITAM is built on the premise of land stewardship. Goals and objectives normally associated with the ITAM program are incorporated into INRMP objectives. Programs involving Environmental Awareness are in Section 17.0, and erosion control, which is similar to Land Rehabilitation and Maintenance (LRAM), is detailed in Section 14.7.

11.8 OTHER PERTINENT PLANS AND PROGRAMS

Other plans and programs are associated with natural resources management on the Depot. An INRMP is normally an integral part of the Master Plan, which is the planning document for the development of facilities on the Depot. However, due to the Depot's BRAC status, it is not required to have a Master Plan.

The *Pest Management Plan for Umatilla Chemical Depot* (Hunt 2005; Appendix H) and this INRMP are fully integrated and consistent with one another. The recommended practices related to pest management provided in this INRMP are also outlined in the Pest Management Plan (PMP). These include reduced use of pesticides and herbicides, use of non-selective herbicides, and the use of mechanical means of control rather than chemical, when feasible.

Programs and activities conducted in accordance with this INRMP, that may result in cultural resource "undertakings," will be reviewed prior to implementation to identify any appropriate mitigations to lessen or eliminate potential impacts to those resources. Such activities include, but are not limited to, firebreak maintenance and erosion control. INRMP implementation and cultural resources conservation integration procedures are consolidated primarily in Chapter 19 to avoid repetition in other sections.

12.0 INVENTORYING AND MONITORING

12.1 OBJECTIVE

The Army has completed inventories for sensitive, threatened and endangered species as well as vegetative communities on the installation (Tetra Tech 2002a , 2002b). Due to the passive nature of the Depot's mission, natural resources on the site are not expected to be significantly impacted as a result of the Army's actions. Therefore, the monitoring of those resources through the next 5 years is not expected to be intensive. The objectives are to monitor those resources that are important indicators of the following:

- the integrity of the overall ecosystem.
- the capability of lands to support military mission.
- the status of imperiled species or communities.

12.2 INVENTORYING AND MONITORING DEFINITIONS

The first step in biodiversity protection is to prepare an inventory. Inventory, as used here, means developing an itemized list or catalog of the aspects of an ecosystem. As indicated above, the vegetative communities as well as the sensitive, threatened and endangered species were inventoried in 2001.

Monitoring tracks trends (or absolute numbers if needed) of individual species or higher associations of species such as vegetative cover types or plant communities, is generally performed on a regular basis, and often targets species with high economic or human-use values, endangered species, and indicator species of overall ecosystem health. On the Depot, monitoring has generally not been conducted with the exception of ODFW monitoring the pronghorn population, particularly during the 1970s. In recent years, ODFW has been monitoring long-billed curlew and burrowing owl populations in conjunction with pronghorn surveys, as well.

12.3 FLORAL INVENTORYING AND MONITORING

12.3.1 Floral Surveys

Tetra Tech conducted Planning Level Surveys for vegetative species and communities on the Depot in 2001 (Tetra Tech 2002b). Plant communities can be seen at Figures 5-8; a listing of plant species observed during the surveys is included at Appendix B1.

The bitterbrush shrub-steppe habitat occurring on the Depot is the largest and best example of that native vegetative community in the Columbia Basin Ecoregion (Kagan et al. 2000). As such, it provides valuable habitat for native plant and animal species. Due to the limited distribution of the remaining shrub-steppe habitat in the region, many of the associated wildlife species are listed by the state as sensitive. Future population viabilities rely upon maintenance of these remnant habitat tracts.

12.3.2 Sensitive Plant Species

As discussed in paragraph 8.2.4, one federally listed species of concern which is also state listed as threatened, Laurence’s milk-vetch, may occur on the Depot. Douglas’ milk-vetch is not federally listed but is state listed as a candidate and may occur within the area as well. No federal or state listed threatened or endangered plant species were found on the Depot during the 2001 vegetation surveys, but Columbia milk-vetch, a state watch list species, was encountered in many of the vegetative communities (Tetra Tech 2002b).

12.3.3 Land Condition Trend Analysis

There is little need for a Land Condition Trend Analysis (LCTA) program to monitor the Depot’s resources due to the passive nature of the military mission on the installation.

12.3.4 Aerial Photographs and Satellite Imagery

Aerial photographs by themselves are not inventory items. However, they are indispensable tools for surveying relatively large parcels of land and for analyzing long-term vegetation changes. The Depot has a considerable aerial photograph collection from its acquisition in 1941 to present, and includes photograph sets for 1951, 1958, 1970, 1972, 1975, 1980, 1988, and 1993. More recent aerial photographs, as well as satellite imagery, can now be found on-line through several internet search engine sites. These photographs are extremely useful for evaluating long-term effects of the military mission, as well as monitoring changes in the natural environment.

12.3.5 Vegetation Map

As part of a Planning Level Survey process, a vegetation map was produced that shows 14 major plant community cover types, including 7 shrub-dominated types and 7 types of grasses and herbaceous species (Tetra Tech 2002b) (Figure 5).

12.3.6 Non-native Species and Noxious Plant Surveys

In conjunction with the Planning Level Surveys for vegetative communities, Tetra Tech documented invasive and non-native plant species in the area (Tetra Tech 2002b). Tetra Tech estimated that approximately 25 percent of the vascular plants encountered were not native to the area. Some species, such as cheatgrass, were pervasive, occupying the herbaceous understory of several plant communities. Two species were listed by the Oregon Department of Agriculture as noxious weeds: diffuse knapweed and rush skeletonweed.

Noxious weed control is the responsibility of landowners per Chapter 452 of the Oregon Revised Statutes, Vector and Weed Control. Consequently, the Depot is required to control diffuse knapweed and rush skeletonweed. Although intensive annual surveys are not conducted for these invasives, they are treated immediately upon discovery during the normal course of duties. In accordance with DoD guidance regarding the use of pesticides, manual removal of the plants is implemented if feasible. If chemical applications are required, the least amount of herbicides to attain an effective treatment is used.

12.4 FAUNAL INVENTORYING AND MONITORING

Data regarding the status of wildlife on the Depot is sparse. Given the size of the Depot and limited resources available to natural resources managers, there has been no consistent inventory and monitoring of species. Confirmed and potentially occurring mammal, bird, reptile and amphibian species lists were developed as a component of the ecological assessment (USACE 1993). It should be mentioned that habitat quality may be monitored by way of monitoring habitat obligate species. For example, declines in sage sparrow and sage thrasher populations may indicate decreases in the quality of the Depot's big sagebrush vegetative community. Surveys for pronghorn, long-billed curlews, and western burrowing owls have been conducted in the past, and should be continued in future years.

12.4.1 Terrestrial Vertebrate Species

To date, no comprehensive surveys have been conducted on the Depot for terrestrial vertebrate species. As indicated earlier, a 3-day field survey was undertaken in March 1992, in support of an RI/FS assessment. However, a much more in-depth inventory of the installation's mammal, herptile, and bird populations is needed to determine, in part, the integrity of the Depot's biotic systems.

Due to the rare status of the Depot's shrub-steppe and sandy grassland habitats in the Columbia Basin Ecoregion, and in light of the uncertain future of the Depot's properties when base closure takes effect, it is recommended that terrestrial wildlife Planning Level Surveys be conducted to document the presence/absence of wildlife species in these unique habitats.

12.4.2 Sensitive Wildlife Species

Tetra Tech conducted threatened and endangered species surveys on the Depot in 1999 and 2000. Specifically, Tetra Tech targeted three species in their search efforts: bald eagle (federally and state listed as threatened), peregrine falcon (state listed as endangered), and Washington ground squirrel (federal candidate, state listed as endangered). None of the target species was observed during these surveys. The Depot does not have nesting habitat for bald eagles or peregrine falcons, and both species are considered transient to the area. Tetra Tech suggests that the Depot's soils may lack the stability needed to be suitable for Washington ground squirrel burrows. In addition, the dry shrubland and grassland vegetation types at the Depot may lack suitable forage to support Washington ground squirrel populations (Tetra Tech 2002a). However, this species has been found elsewhere in the area where none were thought to exist (Kirsch, pers. com.); therefore potential evidence of Washington ground squirrels (reported sightings, sign), should be thoroughly investigated. In addition, an assessment can be made of the soils in those areas where Washington ground squirrels are known to exist in comparison with Depot soils.

In conjunction with the above surveys, Tetra Tech noted other species of special concern on the Depot as well. Those observed during the surveys were as follow (see Table 8-1 for the sensitivity status of each species):

- Western Burrowing Owl
- Swainson’s Hawk
- Long-billed Curlew
- Grasshopper Sparrow
- Loggerhead Shrike
- Northern Sagebrush Lizard

With minimal mission-related impacts to Depot habitats, these sensitive species will hopefully be found on the Depot for many years to come.

12.4.3 Neotropical/Migratory Birds

Migratory bird species that winter in the tropics and nest in the United States and Canada are declining in both their numbers and distribution. Partners in Flight (PIF), a governmental-private conservation coalition, is dedicated to reversing this trend, and DoD is a partner in this organization.

From 1995 to 1997, and again in 2000 and 2001 after a fire in 1998, shrub-steppe birds were studied at the Boardman Naval Training Facility. The distribution, abundance, site fidelity, and productivity of shrub-steppe birds were studied before and after the burn, along with measures of vegetation change. The Naval Training Facility used ODFW and the Point Reyes Bird Observatory to conduct these studies. Funding to continue this work is lacking; however, if this study is started again, it may be possible for the Depot to form a partnership with Boardman to expand the scope of the project.

12.5 WILDLIFE DISEASES SURVEILLANCE

The RD – EO staff will remain vigilant for signs of diseases in wildlife populations, especially those diseases that may be transmissible to humans. The most likely evidence for the occurrence of such diseases is the finding of wildlife mortalities when the causes of death are not apparent (for example road kill), and many carcasses of the same species (such as magpies), or classes of animals (rodents) are being discovered. The observation of sick animals may also indicate a disease outbreak in wildlife populations. Potential diseases may be identified by the species affected. If several dead corvids (jays, magpies, or crows) are reported, West Nile Virus may be spreading through the bird populations. Raptors appear to be equally sensitive to West Nile Virus. (However, note that if found at the base of a power pole without raptor protection, a bird mortality may be due to electrocution). Multiple reports of dead rodents may indicate a plague outbreak in those populations. Sick canids (coyotes, foxes), sometimes evidenced by a lack of fear of humans, may indicate rabies in the populations. Skunks and bats also commonly contract rabies.

Suspected outbreaks of wildlife diseases should be reported immediately to the Umatilla and Morrow County Health Departments. Either of these county agencies may want to perform tests to confirm the presence of viral or bacterial infections, and may need access to the Depot to collect animal carcasses. Or they may request that Depot staff collect the carcasses; the staff should do so only in accordance with accepted guidelines, provided by the health departments, for the safe handling and transportation of carcasses potentially infected with transmissible diseases.

If a wildlife disease outbreak is suspected on or near Depot property, RD – EO should also make an announcement to the Depot residents, employees, and visitors that such a disease may be present. As a precautionary measure, the announcement should be made immediately, without waiting for confirmation on the identification of any diseases, and include precautions the personnel should take to prevent exposure to potential diseases. This should include monitoring the activities of their pets while outdoors.

12.6 WATER QUALITY MONITORING

The Depot has no naturally occurring surface water, so groundwater is the only water quality index to be measured. The Depot monitors groundwater at 110 monitoring wells. Most of this monitoring is due to the Depot’s status on the NPL. This level of monitoring should continue through 2011 and beyond.

12.7 CULTURAL RESOURCE SITES

Natural resources management requires knowledge of cultural resources to avoid damage to cultural sites. Consistent with cultural resource laws and regulations, the Depot will survey areas that have not been previously surveyed prior to conducting soil disturbing activities associated with implementing initiatives included in this INRMP.

12.8 DATA STORAGE, RETRIEVAL, AND ANALYSIS

Collecting natural resources data in the absence of storage, retrieval and analytical capabilities does not provide support for decision-making processes. In many cases, biological data are collected and stored without being used. This practice is often due to inefficient data storage, retrieval, and analysis systems.

12.8.1 Geographic Information System

A Geographic Information System (GIS) integrates spatial data (e.g., maps, aerial photos, satellite images) with statistical data (e.g., elevations, percentiles) and works in a similar fashion as database software in allowing analyses and presentation of data. A GIS ideally has the capacity to address data in both vector (lines and points) and raster (areas) spatial formats.

The Depot’s Environmental Office has ArcView 9.0 GIS capabilities, with dedicated natural resource data layers; however, the system is not yet fully functional.

12.9 FY08 THROUGH FY12 INVENTORY AND MONITORING PLANS

The following are floral and faunal inventory and monitoring activities that will be initiated and/or continued in future years:

- continue noxious weed surveillance.
- continue ongoing groundwater monitoring.
- continue support of pronghorn, burrowing owl, and long-billed curlew surveys.
- continue wildlife diseases surveillance.
- conduct terrestrial vertebrate Planning Level Surveys.
- conduct additional inventory and monitoring if the need arises or if opportunities to collect needed data occur with little additional expense.

13.0 CONSERVATION AND DAMAGE PREVENTION

Avoiding damage to ecosystems is a key factor in ecosystem management. The Depot's passive chemical storage and destruction mission depends upon the maintenance of the land in an undisturbed state. Unlike those installations which involve significant training activities, the success of the Depot's mission is to some degree dependent upon maintaining an absence of land disturbing activities.

One safeguard recently established to reduce or mitigate negative environmental impacts resulting from military projects is the Environmental Checklist for Work Orders or Contract Proposals (Appendix I). Project proponents prepare this checklist, describing the project and any potential impacts, and submits the document to RD – EO. RD – EO reviews the checklist and determines whether the Depot will remain in compliance with federal, state and local regulations if the project goes forward, and whether NEPA coordination is required to implement the project.

13.1 OBJECTIVES

The Depot has developed the following objectives for conservation and damage prevention:

- protect lands from wildfires.
- conserve areas of special ecological concern.
- protect wildlife from mission-related impacts.

13.2 WILDFIRE PROTECTION

Range wildfires account for approximately 95 percent of fires at the Depot. Most of the 30 to 50 annual range fires are started by lightning strikes, or railroad-related activities originating from the main rail lines passing along the south boundary of the installation. Flames ignited along this stretch are fanned by prevailing east-northeasterly winds, creating a significant fire hazard. The primary fire season is May through September.

Wildfire suppression is the responsibility of the Depot Fire Department which maintains a policy of actively suppressing all wildfires. Suppression normally does not involve ground disturbance beyond traversing cross-country with fire fighting equipment. Interagency agreements have been established to obtain assistance from Boardman, Umatilla, and Hermiston for range fire suppression, but the Depot responds to more off-post fires than it requests help for on-post fires.

There are no firebreaks on the Depot. However, security zones, which are kept clear of vegetation, act as firebreaks. These security zones are located around the Depot perimeter as well as around interior sensitive areas. These are maintained through mowing and the use of non-selective herbicides.

The Depot bales and burns tumbleweeds when they accumulate sufficiently enough to be a fire hazard. Beyond this practice, there is no prescribed burning on the Depot.

13.3 SHRUB-STEPPE HABITAT PROTECTION

The Depot is classified as an *Artemisia-Agropyron* steppe biome located in the upper part of the Columbia Basin floristic province of northeastern Oregon (Gene Stout and Associates 1997). The Depot is one of the few remaining areas of shrub-steppe in a region dominated by intensive, irrigated croplands and pasturelands. Vegetation on the depot consists primarily of a ground cover of grasses and forbs among shrubs and sagebrush, with some planted trees in the administrative area.

The Columbia Basin remains largely treeless, aside from riparian sites, farmsteads, and towns. Of the ten physiographic provinces, the Columbia Basin is one of two provinces that has been the most modified by human activities. Only remnants of the original grass steppe remain, and some of these remnants are dominated by exotic species (Puchy and Marshall 1993). In an ecoregional perspective, Kagan et al. (2000) maintains that the Depot contains the largest and best example of bitterbrush shrub-steppe in the Columbia Basin Ecoregional Province, which extends from central Washington to Central Oregon.

The Depot’s mission does not involve significant training activities, therefore the natural resources are relatively undisturbed by mission functions. In fact, the passive nature of the Depot’s mission has resulted in the preservation of the shrub-steppe habitat which has recovered since initial construction of the facility in 1941. Areas immediately surrounding the Depot are irrigated agricultural lands and are largely devoid of the native shrub-steppe habitat. As such, the Depot lands are a valuable natural resource as they represent one of very few remaining contiguous tracts of native shrub-steppe vegetation in the Columbia Basin.

All undeveloped land on the Depot will continue to be managed using very restrictive land-use designations. Off-road maneuvers will not be permitted and agriculture will continue to be precluded. Off-road vehicle use by Depot support personnel and contractors, except for emergency situations related to safety or security or that which is required to support the military mission, will be strictly prohibited. Actions involving vegetation removal will require NEPA documentation. In general, impacts to the land as a result of activities unrelated to the Depot’s core mission, the safe and secure storage and destruction of the chemical stockpile, will not be tolerated.

The protection and maintenance of the native steppe and shrub-steppe habitats on the Depot, as outlined in this INRMP, are consistent with other management plans and recommended strategies developed for this general area, such as the Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington (Altman and Holmes 2000), the Umatilla and Willow Creek Basin Assessment for Shrub Steppe, Grasslands, and Riparian Habitats (Kagan et al. 2000), the Draft Umatilla/Willow Subbasin Plan (DeBano and Wooster 2004), and the Oregon Conservation Strategy (Oregon Department of Fish and Wildlife 2006).

13.4 MIGRATORY SPECIES CONSERVATION

In July 2006 the DoD and the USFWS signed an MOU to promote the conservation of migratory birds on DoD installations. This was a comprehensive agreement, calling for the two agencies to work cooperatively toward the protection and enhancement of migratory bird species and their habitats (Appendix G). The Depot fulfills the obligations of this agreement to the fullest extent practical, within the parameters of staff and funding limitations. As noted elsewhere in this INRMP, the Depot has instituted a raptor protection program, is considering installing burrowing owl artificial nest burrows and structures, and rigorously protects the unique native shrub-steppe habitat upon which some sensitive bird species depend. Other programs have been considered, such as the establishment of a Bird Conservation Area (BCA) designation (Altman and Holmes 2000), an Important Bird Area (IBA) designation (DoD PIF 2005), and/or implementing a Monitoring Avian Productivity and Survivorship (MAPS) program (DoD PIF 2002); however the Depot habitats, significant as they are, are likely too small and isolated to support these types of programs. If cooperators, such as the USFWS, the ODFW, or PIF, expressed interest in such projects on the installation, however, the Depot would be eager to join in discussions on the matter.

13.5 SENSITIVE SPECIES RESTORATION

As indicated earlier, the Laurence’s milk-vetch is a federally listed species of concern and is state listed as threatened. Kagan et al. (2000) states the species is endemic to the lower Umatilla Basin, in which it is found in only 14 locations. This may present an opportunity for the Depot to proactively assist in the restoration of a sensitive species. The feasibility of establishing a viable Laurence’s milk-vetch population on the Depot, which may be determined primarily by soil types, should be investigated. If there is a good potential the project can be met with success, it should be undertaken through partnerships with the ODFW and other interested organizations.

13.6 RAPTOR PROTECTION

The loss of hawks, eagles and owls through electrocution on electrical transmission systems has long been recognized a significant problem in the United States (APLIC and USFWS 2005, APLIC 2006). Raptors use power poles as perches for resting, hunting and feeding. Electrocution typically occurs as the birds are approaching or flying off the power poles, when each of their wings simultaneously touch two wires, resulting in an electrical surge passing through their bodies. These birds are protected by the Migratory Bird Treaty Act (MBTA), and each electrocution is a violation of that federal statute. Furthermore, eagles are protected by the Bald and Golden Eagle Protection Act, and bald eagles, being a federally-listed threatened species, are protected by the Endangered Species Act. Several measures have been identified to reduce or prevent the incidence of raptor electrocution (APLIC and USFWS 2005, APLIC 2006), most involving devices attached to the poles to preclude or discourage raptor perching, and methods of insulating wires and insulators to prevent direct contact with hot electrical systems.

Military bases often have electrical systems dating to the early- to mid-forties, which can be especially conducive to raptor electrocutions. Although not a frequent occurrence, raptors have been electrocuted on the Depot. The Depot has recently entered into an agreement with the USFWS to cooperatively review raptor protection needs on the installation, and address those needs through preventative measures (Appendix F). These measures will consist primarily of retrofitting power poles with devices to reduce the chances of electrocutions. The program will be implemented in four phases:

1.) in a raptor electrocution incident, raptor protection will immediately be installed on the pole at which the electrocution took place.

2.) a program to retrofit existing power poles with raptor protection devices will be implemented. If full project funding is not available, the project may be apportioned through time, with “sections” of power lines being retrofitted each year as money is available.

3.) new power line systems will employ raptor protection devices upon installation. (It should be noted that the lines may be configured on the poles in a manner that precludes raptor electrocution, thus the necessity for raptor protection.) Alternatively, new lines may be buried rather than installed as overhead systems.

4.) as old transmission lines are decommissioned and removed, poles with cross pieces will be left standing to serve as alternate perch poles for raptors. Approximately every fourth pole may be left standing, or more if the area is especially attractive to raptors for foraging purposes. The USFWS may be consulted on the number, spacing, and locations of poles to be left standing.

This four phase process is a fulfillment of paragraph 2.f.(4) of the DoD/USFWS MOU for promoting the conservation of migratory birds (Appendix G), wherein the interaction of migratory species with communications towers, utilities, and energy development is addressed.

13.7 BUILDING DEMOLITIONS AND WILDLIFE PROTECTION

In conjunction with the BRAC program, buildings no longer being used by the Army may be slated for demolition. Abandoned structures often serve as nesting sites for birds and roost sites for bats. Harming or destroying most bird species, eggs, and/or bird nests are a violation of the MBTA, and care must be taken to avoid this action if at all possible. Some species, such as rock doves (pigeons) and starlings, are not protected by the MBTA. Bats are not protected under the MBTA, but are protected as nongame species under state regulations.

If buildings are scheduled for demolition during the breeding season, a thorough inspection of the structures should be made prior to destruction activities, to ensure no migratory birds be harmed. If nesting migratory species are present, demolition must be postponed until the protected species are done nesting. Although it is recognized that the timing of demolitions is often dictated by funding availability, it is better, if possible, to schedule demolish projects for the late fall and winter months (note that some species prone to nesting in abandoned buildings, such as great-horned owls, initiate nesting relatively early in the year).

Large structures, such as warehouses, or buildings with attics, sometimes house bat colonies. These may be either day-roost sites or maternity sites. Presumably, day-roosting bats can escape demolition activities and seek alternate roost sites. However, the demolition of a structure housing a maternity colony while the pups are still incapable of flight will result in the destruction of those bats.

13.8 WILDLIFE RESCUE/REHABILITATION

Despite the Army's best efforts to prevent impacts to native wildlife, harm will inevitably come to some animals as a result of human activities. The Depot has been commendable in its efforts to rescue and aid those animals in need of assistance. Typically the subjects of attention are birds: those that fly into windows, are struck by vehicles, or become sickened from unknown causes. Immediate attention is often required to save the animals, and the level of care needed is generally above that available on the Depot. In past years many animals have been rescued from the Depot and transferred to Blue Mountain Wildlife, a wildlife rehabilitation center in Pendleton, for assessment, medical attention and recovery. Blue Mountain Wildlife has an amazing recovery rate for its patients and, being the closest such facility available, should continue to be used when wildlife needs medical assessment and attention.

13.9 ENVIRONMENTAL CONTAMINANTS

Due to the generally benign nature of the Depot's military role through the years, the installation is relatively clean of contamination resulting from Army actions. The Depot once had 11 Solid Waste Management Units (SWMUs), or sites that were identified, per CERCLA remedial investigations, as being potentially contaminated with solid wastes or hazardous materials. An aggressive restoration and rehabilitation program has reduced that number to three. One of those is an explosives plume discussed in Section 9.2, Water Quality, where a pump-and-treat system was installed in 1996. This plume qualified the Depot as an NPL site under CERCLA. The other two SWMUs are unexploded ordnance (UXO) areas, one located in the Ordnance Burn/Ordnance Disposal (OB/OD) Range, in the Depot's northwest sector; and the other in the QA Function Range, an extension area adjacent to the Depot's northeast boundary. Both of these areas have restricted access.

All known historic USTs on the base have been removed and the Depot has converted all of its boilers to propane. Soil that was contaminated at UST locations was removed from the installation to approved disposal sites. One regulated UST currently in operation was installed to support the CSDP program. The Depot has 17 above ground storage tanks (ASTs), ranging in capacity from 275 to 15,000 gallons, used for the storage of petroleum products (Lopez 2004). Spill control measures are incorporated into all ASTs in accordance with 40 CFR 112.8(c) and AR 200-1, 3–3.a.(4), and 4–5.k.

Programs and operations that have been in place for several years, such as the Pest Management Program and operation of the shooting range, have discrete Standard Operating Procedures (SOPs) and plans that address potential contamination issues and response procedures. For example, Section G, Environmental Considerations, of the Pest Management

Plan (Appendix H), addresses such issues as protection of the public, pesticide use in sensitive areas, pesticide spills and remediation, and pollution prevention (Hunt 2005). On the shooting range, copper jacketed ammunition is used to reduce lead contamination of the soils, and the backstop berm, installed in 2004, is underlain by an impermeable barrier to further keep incidental lead contaminants from leaching into the groundwater. Remedial investigations conducted preliminary to the berm installation found no lead contamination at the site. The Depot is included in the Operational Range Assessment Program (ORAP), designed to identify potential migratory pathways for munitions constituents from military ranges to offsite communities and/or sensitive environments.

As noted earlier, there are no active sanitary landfills on the Depot; the Depot's solid waste is currently collected by a contractor and is landfilled off-site. One inactive landfill, OU 7, is involved with a selenium study, and there is a restrictive easement that bars the drilling of wells in its vicinity. Water quality monitoring for selenium is conducted twice annually as required by the State of Oregon under RCRA Subpart D.

A Spill Prevention, Control, and Countermeasures (SPCC) Plan and an Installation Spill Contingency (ISC) Plan have been developed for the Depot (Lopez 2004). The first plan identifies potential hazardous substance spill sites while the second establishes procedures for responding to and cleaning up hazardous substance spills. These plans pertain to the industrial operations at the Depot, and do not address potential spills in association with the chemical demilitarization program. While the CSDP maintains a separate SPCC Plan, that document is classified and not available for public review. Depot Risk Directorate – Emergency Services team personnel are trained in spill response procedures per 29 CFR 1910.120(q), and AR 200-1, 3–3.d.

The CSDP is a discrete program with operations and contingency plans separate from the normal operations of the Depot. The destruction of chemical munitions and supporting operations were addressed in the EIS, "*Disposal of Chemical Agents and Munitions Stored at Umatilla Depot Activity, Oregon*" (Program Manager for Chemical Demilitarization 1996). The subject EIS addresses the impacts of normal operations, including stack emissions, transport of agents and munitions from storage to the disposal plant, and the treatment of wastes resulting from the disposal process. The document also addresses the risks of, and responses to, potential accidents involving chemical munitions. In addition to the above, a Quantitative Risk Assessment was developed to assess the risks of continued storage of chemical munitions compared to disposal of the munitions, to the general public, as well as the disposal process workers (Science Applications International Corporation 2002).

An overview of the environmental contaminants program at the Depot is being prepared by the installation's Environmental Office and may be added to this document as an addendum upon completion.

14.0 NATURAL RESOURCES MANAGEMENT

14.1 OBJECTIVES

The Depot's objectives with regard to natural resources management are as follow:

- identify and develop appropriate management strategies for sensitive plant and animal species.
- protect and conserve all native biological communities.
- manage the shrub-steppe habitat at the Depot to enhance ecosystem integrity.
- restore damaged areas and provide conditions that can sustain the military mission without precluding future options for land use.
- engage in restoration projects, as much as feasible, for threatened and endangered plant and animal species.
- protect groundwater quality and its associated values on the Depot.
- manage the pronghorn herd as a component of the Depot ecosystem.
- protect and manage species to ensure sustainability and native species diversity.
- maintain cooperative working relationships with the USFWS, the ODFW, and the Confederated Tribes.

14.2 OTHER RELEVANT RESOURCE MANAGEMENT DOCUMENTS

Several natural resource assessments and management strategies and plans have been developed on ecoregional, state, and regional scales during recent years, including the Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington (Altman and Holmes 2000), the Umatilla and Willow Creek Basin Assessment for Shrub Steppe, Grasslands, and Riparian Habitats (Kagan et al. 2000), the Draft Umatilla/Willow Subbasin Plan (DeBano and Wooster 2004), and, most recently, the Oregon Conservation Strategy (Oregon Department of Fish and Wildlife 2006). The latter effort is part of a larger federally funded initiative for all states to develop management plans for their respective natural resources.

The Oregon Conservation Strategy assesses, and makes management recommendations for, the state's resources through a process decreasing in scale: from statewide, to ecoregion, to habitat, to species. Within the Habitats section, two Strategy Habitats found on the Depot are described: grasslands, and sagebrush steppe and shrublands. Furthermore, bitterbrush communities are identified as specialized and local habitats (Oregon Department of Fish and Wildlife 2006).

The Conservation Strategy also addresses strategy species, which it defines as "'low and declining' or otherwise at risk" for each ecoregion and habitat. Strategy species that have been observed on the Depot or in the immediate vicinity include the Brewer's sparrow, ferruginous hawk, grasshopper sparrow, loggerhead shrike, long-billed curlew, sage sparrow, Swainson's hawk, western burrowing owl, and northern sagebrush lizard (Oregon Department of Fish and

Wildlife 2006). The pallid bat and Townsend’s big-eared bat may be present, but no survey work has been conducted on the Depot’s bat species.

The Conservation Strategy strongly emphasizes partnerships and volunteerism for achieving management goals (Oregon Department of Fish and Wildlife 2006). Due to access restrictions on the Depot, volunteerism may be problematic at best. The Depot has already developed partnerships with the USFWS and the ODFW, as exemplified by this INRMP.

14.3 HABITAT MANAGEMENT

Habitat management includes those initiatives taken specifically to maintain or improve habitat for wildlife species. Generally speaking, management for wildlife habitat is minimal on the Depot. Considering the sensitive military mission, the Depot’s restricted access, and the limited opportunities to use wildlife, major program changes to enhance habitat are not planned for the foreseeable future.

With the exception of those areas necessary for the CSDP program, and other developed areas, all lands on the Depot are considered to be wildlife habitat.

14.3.1 Wildlife Water Devices

The Depot provides water for the pronghorn herd and other wildlife through a variety of devices. Many of the watering devices were installed by ODFW to support the pronghorn herd that was reintroduced to the Depot in 1969 as part of a breeding/relocation program. The watering devices include three sprinklers, eight gallinaceous, self-filling water guzzlers, and five water troughs (Figure 4). The sprinklers operate continuously and are supplied by the Depot drinking water supply which is maintained by seven water supply wells. A guzzler is a type of cistern that is self-sustaining and is intended to operate on stored water maintained by precipitation. The troughs can collect water; however, they occasionally require filling by the Depot Fire Department to provide a reliable water supply.

Maintaining these watering devices is an important component of the wildlife habitat management program on the Depot. The Fire Department will continue to fill water tanks as needed and guzzlers will be maintained as required.

14.3.2 Wildfire Suppression

The Depot’s Fire and Emergency Services Division is responsible for suppressing fires. The Depot has interagency agreements with Hermiston Rural and the cities of Boardman, Umatilla, and Hermiston for fire control assistance. Limited control burns are used by the fire department to reduce accumulated Russian thistle and to control wildfires. There are no specifically maintained firebreaks or significant controlled burns on the Depot. There are no prescribed burns planned for FY08 through FY12; however, the Depot is currently in the process of developing an Integrated Wildland Fire Management Plan in which the issue of prescribed and controlled burning will be addressed.

14.3.3 Burrowing Owl Nest Structures

Due to the sandy nature of the Depot's soils, burrows abandoned by rodents or other fossorial animals are often structurally unsound and may readily collapse. Burrowing owls are found on the Depot, and are seen during surveys conducted by the ODFW. However, these owls require underground burrows in which to nest and raise their broods. Therefore, their nesting success may be enhanced through augmentation of nest structures, namely tubes placed in the ground, that lead to subsurface nest boxes. Aside from ensuring structural stability in the nest tunnel and box, these tubes would also protect the owls from coyote predation. This project is supported by the PIF conservation strategy for the Columbia Plateau (Altman and Holmes 2000).

14.4 PRONGHORN MANAGEMENT, STOCKING AND TRANSLOCATION

As indicated earlier, the Depot's pronghorn herd provides some cause for concern. Seventeen pronghorn were introduced to the installation in 1969, to build a discreet and contained population from which animals may be taken to translocate to other areas. There has been no introduction of new genetic material into this herd since that time. In addition, due to the security fences enclosing the area, the captive pronghorn were not able to leave the site and pronghorn in adjacent areas were not able to join this herd. Although the population increased rapidly following introduction and was estimated to be at about 400 head in the mid- to late-1980s, that number is now much reduced and annual fawn productivity and/or survivorship appear to be extremely low (ODFW, unpublished data). Meanwhile, from 1969 to present, there have been at least four translocations of Depot pronghorn to other sites.

A study was conducted in 2000 to compare the genetic diversity of the Depot herd with that of its source herd, in central Oregon, and an independent herd in southeastern Oregon. It found that due to the small size of the original herd, and the lack of new genetic material being introduced since that time, the Depot herd had: "1) sharply lower diversity compared to its source, 2) significant haplotypic and genotypic differentiation from its source and, 3) an average relatedness that is 3.5 times that of the source population" (Stephens et al., *in press*). As a result, the authors of this study cautioned against further use of this herd as a reintroduction source. Furthermore, they suggested that translocations of pronghorn from other sites, in other words new genetic material, into the Depot herd may well be advised, to increase the genetic diversity of this population.

The Depot faces closure and uncertain land tenancy sometime after 2017. The surrounding properties have been converted to agricultural economies and landscapes, with little suitable habitat for free-ranging pronghorn. Therefore with closure the Depot herd will likely have to be destroyed or translocated elsewhere. However, with no introduction of new genetic material, the genetic diversity of this herd will continue to lessen between now and closure. If feasible, a program to introduce pronghorn from other herds in Oregon into the Depot population could be implemented that would not only "prepare" the Depot herd for eventual translocation into other sites/herds, but would offer an excellent opportunity to conduct a study of the reversal of the declining trend of genetic diversity in this herd.

The decision to destroy the Depot pronghorn herd, move it elsewhere, or reverse the declining trend in genetic diversity by introducing additional animals and reinvigorating the genetics study, hinges on projected Depot closure dates. For many reasons, including political, it is unlikely the animals will be destroyed. If closure were scheduled to occur in 2017 or soon thereafter, as currently projected, too little time would be available between the introduction of additional animals and closure for a research study to produce meaningful and applicable results. Therefore, with closure in approximately 10 years, the ODFW will remove the remaining pronghorn and introduce them to large herds with good genetic diversity (Kirsch, pers. com.). If the projected closure date for the Depot is extended an additional 10+ years, the opportunity for additional genetic studies, as described above, should be investigated.

Coyote predation has significantly reduced pronghorn survivorship on the Depot. Fawns are especially vulnerable to predation once coyotes perfect their "technique" in finding and capturing them. Coyote control programs have proven to be effective in increasing pronghorn survivorship, as demonstrated by control efforts on the Depot in the 1970s and the resultant increases in pronghorn numbers. However, predator control measures are often controversial, and employing control programs must be measured against public image and sentiment. The Depot will assess the merits of reinstituting a coyote control program in conjunction with other resource management agencies.

The potential to implement a pronghorn hunting program on the Depot has been discussed in the past. However, with the advent of heightened security due to the 9/11 terrorist attacks, and in light of the CSDP and its associated infrastructure, such a hunting program is not an option in the foreseeable future.

14.5 GROUNDS MANAGEMENT

The Depot has 191 acres of improved grounds. Del Grosso (1996) reports the following breakdown of these improved grounds:

• Lawns	29 acres
• Athletic Fields	4 acres
• Parade and Drill Fields	4 acres
• Playgrounds and Parks	9 acres
• Other	145 acres

In addition, the Depot has 1,975 acres of semi-improved grounds (lands that are not maintained regularly), most of which are associated with igloos and the infrastructure necessary to move, protect, and secure ammunition. Periodic maintenance, such as the application of non-selective herbicides, weed and brush control, drainage maintenance, and mowing for the maintenance of security standards, is required on some of these lands (Del Grosso 1996).

General grounds maintenance on the Depot is the responsibility of the Directorate of Public Works (DPW). This maintenance includes routine urban tree and shrub management within the cantonment area. Most of the 200 acres that are mowed are maintained by military personnel; the remainder are maintained by a private contractor. The acreage of mowed land has decreased over the past several years, although there is little potential to further decrease the amount of mowing. A total of 24 acres is irrigated at the Depot. This acreage is primarily located in the housing/administation area and consists of lawns and open space parade ground areas.

14.6 PEST CONTROL

The *Pest Management Plan for Umatilla Chemical Depot, Hermiston, Oregon* (Hunt 2005; Appendix H), addresses pest control on the Depot. The DPW's Pest Management Coordinator is responsible for preparing, updating, and implementing the Depot's PMP, as well as coordinating nuisance animal control. Only approved (EPA, State of Oregon and DoD) pesticides and herbicides are applied under the direction of certified personnel, as required in the AR 200-5, *Pest Management Program*. Unless stated otherwise, information below is taken from *Pest Management Plan for Umatilla Chemical Depot, Hermiston, Oregon* (Hunt 2005).

14.6.1 Animal Pests

14.6.1.1 Disease Vectors and Medically Important Arthropods

Mosquitoes are minor pests on the Depot. Larvicides and occasional fogging are used as needed to control this pest, as well as eliminating breeding areas. In addition, the storm water retention pond is stocked with mosquito fish to feed on mosquito larvae. Black widow spiders, hobo spiders, and scorpions (all poisonous species), are found on the Depot but they cause few problems. Bees and wasps can be problems due to their painful stings and the allergic reactions experienced by some people. Chemical control is sometimes required on a case-by-case basis.

14.6.1.2 Quarantine Pests

Retrograde cargo is infrequently encountered at the Depot, and when encountered it is inspected for pests on an individual basis.

14.6.1.3 Structural/Wood Destroying Pests

The Depot surveys wooden structures biennially for termites, and chemically treats them when found. Therefore, damage to structures is minimal. Carpenter ants occasionally enter wooden structures, especially when conditions are wet, and are treated as needed.

14.6.1.4 Stored-Products Pests

Stored-products pests are a very infrequent complaint at the Depot. However, both saw-toothed grain beetles and red flour beetles have been found on the site, generally in homes.

14.6.1.5 Ornamental Plant and Turf Pests

Various insect pests create problems for trees and shrubs on the Depot. Bark and locust beetles are the most common, but spiders, mites, aphids, and apple worms also occasionally do damage. All but aphids are generally managed by surveillance and chemical control, as needed. Aphids are generally controlled by natural predators and winter kills.

14.6.1.6 Household Pests

Crawling insects (ants, crickets, beetles, roaches) and spiders may require control in offices, warehouses, and billets. Spider control is the most prevalent requirement in this category at the Depot. Proper sanitation and housekeeping are the primary control measures used.

14.6.1.7 Habituated Animal Pests

Animals often become habituated to people when they are frequently in close proximity to human habitation. Habituation is often facilitated by well-meaning people unwittingly feeding wildlife. This can lead to serious problems when animals lose their natural tendency to fear or avoid humans. Coyotes, foxes, skunks, and raccoons are examples of animals easily habituated to people. Wild animals do not need supplemental feeding to survive; they will live quite well off of their natural food items. Feeding wildlife, except for feeding birds at birdfeeders, will not be tolerated on the Depot. Furthermore, all residents will ensure that pet food is not left in outside food dishes overnight to serve as attractants to coyotes or other forms of wildlife.

14.6.1.8 Free-roaming Pets

Free-roaming pets, such as cats and dogs, pose a serious threat to natural resources. Cats, in particular, significantly impact biotic communities, especially birds. As an example, Coleman and Temple (1996) estimate that rural cats kill 7.8 to 219 million birds in Wisconsin alone on an annual basis (three estimates were presented for bird mortalities, the numbers cited here reflect the high and low estimates). Studies have shown that even cats fed at home will kill wildlife if allowed to range freely in the out-of-doors. Security Guards are responsible for capturing stray pets and returning them to their owners or taking them to shelters. Feral cats, those that have reverted to the wild, or their progeny, should be captured and taken to shelters. Stray pets generally wear collars, whereas feral animals typically do not have collars.

14.6.1.9 Other Animal Pests

Mice frequently invade buildings, and their control (both chemical and trapping) makes up about 8 percent of the pest management workload. Gopher control is sometimes required on lawns. Snakes in occupied buildings present a common problem on the Depot. They are removed when located, and efforts are made to “snake-proof” buildings. Rattlesnakes have reportedly been observed on the Depot but they are uncommon and have not been found in the residential or administrative areas.

14.6.2 Noxious Plants

Rush skeletonweed, a noxious plant sometimes found in the southern portion of the Depot, is an “A” list noxious weed in Umatilla and Morrow Counties. Morrow County defines “A” list weeds as those being economically detrimental and limited enough in distribution to control. Landowners are required by Oregon statute ORS 570.545-570.550 and Morrow County ordinance MC-C-4-84 to eradicate “A” list weeds when found on their properties.

Rush skeletonweed was originally found in 1985 on the southern edge of the Depot near Interstate 84. When the species is found on the installation, Depot staff attempt to destroy all plants prior to seeding by spraying them with herbicide. In 1994, 199 plants were located, generally south of Block H, and all but 70 were sprayed prior to seeding. Since then, a few plants have been found and treated each year on the Depot, although in 2005 a patch of approximately 4 acres was located and treated with herbicide.

In 1994 the SWCD reported finding diffuse knapweed spreading along the roadsides of the Depot, and indicated it may be a problem in the future if the shrub-steppe habitat is to be preserved. During their Planning Level Surveys for vegetative communities on the Depot in 1999-2000, Tetra Tech found diffuse knapweed widely distributed across the Depot along roadsides and in disturbed areas, and strongly recommended instituting control measures for this species (Tetra Tech 2002). The Depot PMP does not address diffuse knapweed (Hunt 2005), however, control measures are implemented whenever the species is found on the installation.

Besides rush skeletonweed and diffuse knapweed, the Depot PMP (Hunt 2005) identifies musk thistle and puncture vine as noxious weeds. The PMP recommends nonchemical control (e.g., mowing, digging, grading, and thatching) of noxious weeds prior to chemical use. However, in areas where this is not practical, herbicides are used.

Noxious weed control is a difficult problem to resolve. Ongoing programs to control these species, such as non-selective herbicide applications, are often ineffective and expensive. If the opportunity for eradication exists, it is the preferred option, even if initial costs are higher.

Security for sensitive areas is paramount at the Depot. This includes maintaining an approximate 50-foot clear zone around the perimeter of those areas. These clear zones must have vegetation less than 2 inches in height, which is normally accomplished by mowing and the application of non-selective herbicides. The Depot maintains a 15-foot wide clear zone with 8-inch vegetation just inside the perimeter fence as well. This is accomplished by a combination of mowing and by application of non-selective herbicides. Herbicides are also used along railroad tracks.

14.6.3 Integrated Pest Management

In 1994, DoD established three guidelines for military installations that defined the course of pest management programs through the year 2000. The guidelines were to have a valid integrated PMP by the end of FY97, to reduce pesticide use by 50 percent over a 7-year period

(1994 to 2000), and to have pesticide handlers certified within 2 years of employment by the end of FY98. The Depot has successfully met all of these guidelines.

14.6.3.1 Pest Management Plan

DPW recently completed a revised *Pest Management Plan* (Hunt 2005; Appendix H) for the Depot. It follows guidance provided in AR 420-76, *Pest Management Program*, and emphasizes integrated pest management. The revised PMP contains detailed descriptions of management strategies by species and establishes policy for developing pest management procedures.

14.6.3.2 Pesticide Use

The Depot pest controllers understand that chemicals are not only expensive, but seldom provide lasting control of most pests. Pesticides on the Depot are controlled by the Pest Management Coordinator, who keeps records of all pesticide use and sends a monthly report to AMC on behalf of the installation. Only chemicals approved by the EPA and the Army are used. The PMP includes provisions for conserving sensitive areas and important wildlife species.

The use of chemicals on the Depot is being reduced primarily by using chemicals only when nonchemical means are either ineffective or infeasible. Also, the amount of pesticide and herbicide chemicals stored on site has been reduced. The PMP emphasizes keeping only a minimum amount of chemicals on site and purchasing chemicals only when needed for insecticide use. There is a strong reliance on site-specific and species-specific tactics in the pest management program.

14.6.3.3 Professional Certification

The Depot complies with the Army’s 1998 goal for certified pesticide application. Pesticides on the Depot are handled by personnel with a minimum of DoD Pest Management Certification in the EPA’s Categories 3, 5, 6, 7, and 8.

14.6.3.4 Public Awareness

RD – EO has recently developed a handout, *Indigenous Pests Found at UMCD*, which is distributed to guests, employees and residents at the Depot. The brochure describes several pests found in the area, means of avoiding them, and symptoms and treatments if bitten or stung by them. It also discusses some diseases carried by “wild” vectors which are transmissible to humans.

14.7 EROSION CONTROL

Erosion is not a major problem on the Depot. Considerable damage to soils occurred more than 50 years ago during igloo construction. Revegetation of those areas has virtually eliminated erosion since the initial site construction activities. Most of the Depot, including igloos, experiences little erosion beyond that normally associated with naturally functioning ecosystems.

In revegetation projects, the Depot is aware of its responsibilities toward using native plant species that require relatively little maintenance (Office of the President 1994). In this regard, Indian ricegrass shows promise for revegetation (Intermountain Range Consultants 1988). This species, or species with similar attributes, may be tested on the Depot in larger areas that require revegetation.

There are two primary sources of erosion on the Depot (Intermountain Range Consultants 1988). Each is treated differently.

- **Igloo blowout areas:** Small areas on igloos are sometimes exposed due to disturbance (for example, from animals burrowing or foraging). These areas are then vulnerable to wind erosion. Such small areas are successfully treated using gravel to stop exposure of sandy soils to winds but not to inhibit germination of seeds for revegetation. Feasible revegetation using native perennials will be used to stabilize the soil, rather than application of gravel alone. These practices will be continued in the future on an as-needed basis, but with an emphasis on revegetating areas.

- **Construction disturbance:** Areas that have been disturbed by construction and exposed to erosion, primarily wind-generated erosion. The ideal solution to these larger areas is revegetation using native plants. However, this is difficult to achieve in such a dry climate. For example, when 10 acres of the small arms range were contoured and seeded with wheatgrass, the effort was unsuccessful. Revegetation efforts will continue to be used in the foreseeable future, but attention will be paid to the use of proper seeding techniques and seeding during the appropriate seasons. Reseeding of disturbed areas will also emphasize the use of native species that have soil stabilizing qualities and that may have a higher potential for success. Initial disturbances may be controlled by following local recommendations such as the SCS recommendation to control soil blowing (Quincy Series) to certain times of the year (limit new land disturbance to March 15 to September 15) (SCS 1983). There are no plans for further construction on the Depot in the foreseeable future.

Techniques for erosion control have much in common with the Army's LRAM aspect of ITAM. As opposed to ITAM, erosion control on the Depot is not focused on maintaining training areas, but rather on protecting the Depot in general. If erosion becomes a significant problem on the Depot, environmental staff may investigate using components of LRAM technology to resolve the issue.

One LRAM technique is known as “hardened sites.” Some areas are required for use so often that it is impossible to provide a natural environment to support the mission. An example is a highly erodible area repeatedly traversed by vehicles. In such cases, hardened sites may be the best alternative. Hardening involves putting down base material, such as crushed rock, to provide a solid foundation. Hardened site techniques are also useful for areas not subject to repetitive training activity but are affected by frequent and damaging natural forces. The use of a heavy layer of gravel on the tracked vehicle course at the Depot is similar to hardening a site.

Of particular concern is the maintenance of cryptobiotic soil crusts on the Depot (para. 7.5.1, 7.5.2). These biotic crusts are easily damaged, and rehabilitation may take decades or centuries, depending on the degree of damage. Furthermore, when the crust is displaced, the underlying soils are vulnerable to wind erosion, which may result in adjacent healthy crusts being overlain by these soils, killing the microorganisms that make the cryptobiotic crusts viable, functioning systems.

Tetra Tech (2002b) noted cryptobiotic soil crusts in association with several vegetative communities during the Planning Level Surveys on the Depot. Due to restrictions on off-road vehicle use on the installation, as well as the lack of foot traffic away from developed sites, most of the cryptobiotic soil crusts on the Depot are protected by the benign nature of the Depot’s mission. However, proposed soil disturbing projects in areas wherein cryptobiotic soils are known to exist should be reviewed with respect to their potential impacts to these unique resources.

14.8 AGRICULTURAL LEASING

At this time, security measures are such that grazing is not a viable option, nor does the Depot have any intentions of initiating agricultural outleases for grazing or crop production in the foreseeable future.

The Depot has buffer zones just outside its boundaries (2,674 acres in nine parcels), generally to the north and east (Figure 2). Agriculture is permitted on these lands, and most of them are either tilled or grazed. Residences are not permitted in these areas, however. Since the Army does not own or control methods of agriculture on these properties, management of these lands is not addressed within this INRMP.

14.9 WETLANDS MANAGEMENT

The Depot has no naturally occurring wetlands (Swords and Tiner 2001). However, the sprinkler system for wildlife water sources has created wet areas at two sites. These sprinklers will be maintained in future years, which in turn will sustain the wetland microhabitats.

15.0 RESEARCH/SPECIAL PROJECTS

Special projects and research are often important to implementing natural resources management programs. Special projects are those that require outside assistance to complete and often include surveys and plans. Research is the evaluation of various management options or the study of ecological processes.

The 2006 MOU between the DoD, the USFWS, and the IAFWA (Appendix D) encourages the respective signatory agencies to cooperate on research and special projects on DoD installations. Implementing such projects as outlined in Table 15-1, below, would be in accordance with this directive.

15.1 OBJECTIVES

The Depot's objectives for research and special projects are as follow:

- implement research/special projects when possible to better understand how to manage Depot resources.
- partner with other organizations and agencies in conducting research/special projects.

15.2 SUPPORT MECHANISMS

15.2.1 In-house Capabilities

The Depot has extremely limited in-house research or special project capabilities. Natural resources management on the Depot is largely conservation oriented and low profile. The small size of the in-house natural resources staff precludes extensive field work or studies. Some studies and projects require specialized academic training, while others require more trained personnel than is available on the Depot.

15.2.2 Other Agency Support

The Depot depends on support from other agency partners such as the USFWS and the ODFW to implement this plan. This is particularly true with regard to special projects such as raptor protection and pronghorn management.

15.2.3 Contractor Support

The Depot's natural resources program may turn to contractors to conduct research studies and management projects. Contractors give the post access to a wide variety of specialties and fields. In recent years, contractors have provided NEPA documentation support, prepared the 1998-2002 draft Depot INRMP, and conducted the Planning Level Surveys for vegetative communities and threatened and endangered species.

15.3 PLANNED RESEARCH/SPECIAL PROJECTS

Table 15-1 indicates needed research/special projects and their respective priorities. In FY08 through FY12, these projects will be implemented according to funding availability.

Table 15-1: FY08 Through FY12 Natural Resources Research/Special Project Needs

Project	Priority	Completion Date	Comments
Pronghorn management	1	Base closure	Proposed—ODFW
Noxious plant survey and control	1	Ongoing	In-house
Raptor protection	1	To be determined (TBD)	USFWS
Pronghorn research	2	TBD	ODFW
Planning level surveys - fauna	2	TBD	Contract
Burrowing owl nest structures	2	TBD	TBD
Laurence milk-vetch restoration	2	Base closure	TBD

16.0 ENFORCEMENT

Some aspects of natural resources management require effective enforcement of regulations if they are to be successful.

16.1 OBJECTIVE

The Depot's enforcement objective is to enforce laws and regulations pertaining to the implementation of the natural resources program at the Depot.

16.2 JURISDICTION

The Depot has both proprietary and exclusive jurisdictions. These form a checkerboard pattern, based on land acquisition. Depot security personnel have the commissions needed to enforce laws on installation properties with either type of jurisdiction.

16.3 RESPONSIBILITIES

Natural and cultural resources law enforcement on the Depot is the responsibility of the Director of Security. Security workforce personnel have extensive military-type tactical training; however, they are not specifically trained in natural resources law enforcement.

The Fish and Wildlife Enforcement Division of the Oregon State Police have enforcement authority on the proprietary portions of the Depot, and are available for law enforcement support as needed. In addition, the ODFW may be called upon for the dispatch and disposal of injured or road-killed big game.

16.4 ENFORCEMENT ACTIVITIES

Law enforcement activities on the Depot consist primarily of around-the-clock patrols, and enforcement of natural resource laws is incorporated into routine Depot security activities. Violators of state wildlife laws are turned over to ODFW and Oregon State Police enforcement personnel.

17.0 CONSERVATION AWARENESS

Conservation education is an important part of natural and cultural resources management on the Depot. Awareness is instrumental in creating the conditions needed to conduct sound, professional practices that produce both user opportunities and resource conservation. The Depot relies on education as the primary awareness tool. A conservation awareness program must be geared toward both internal and external interests if it is to be effective.

17.1 OBJECTIVES

The Depot's objectives with regard to awareness include the following:

- minimize damage to lands and natural resources by creating a conservation ethic in those who use the Depot's properties.
- provide an understanding of the natural and cultural resources programs to the Depot employees and the surrounding communities.
- provide decision-makers with the information needed to make scientifically-based judgements affecting natural and cultural resources.
- provide general conservation education to the Depot community.

17.2 ENVIRONMENTAL AWARENESS

The Depot's educational efforts involve conducting briefings in classroom settings and distributing educational materials. Environmental awareness is a multifaceted ITAM initiative that uses education to create a conservation ethic in military personnel.

17.2.1 Environmental Awareness Briefings

Training units will develop environmental awareness briefings and present them to the unit personnel who are involved in training that may degrade the resources. The briefings will cover training restrictions and will attempt to instill a conservation ethic that stresses the importance of maintaining the Depot's lands for sustained training.

17.3 PRINTED MEDIA

The Depot makes available an online weekly publication *"The Depot Bulletin*", which occasionally includes items of natural resources interest, especially emphasizing water quality and recycling.

Opportunities to develop a more detailed natural resources awareness program on the Depot are few due to the limited scope of the natural resources program. As this INRMP is implemented, additional opportunities for awareness will arise.

18.0 OUTDOOR RECREATION

18.1 OBJECTIVES

The Depot's objectives with regard to outdoor recreation are as follow:

- manage outdoor recreation consistent with requirements of the Depot military mission, within allowances determined by security and safety.
- manage outdoor recreation while maintaining ecosystem integrity and function.

18.2 MILITARY MISSION AND PUBLIC ACCESS CONSIDERATIONS

AR 200-3 specifies that DoD installations will allow public access onto properties under their stewardship control for recreational purposes, within the limits of safety and security. This is further stipulated in paragraph D.2.h. of the 2006 MOU between the DoD, the USFWS, and the IAFWA: "DoD agrees to....Subject to mission, safety and security requirements, provide public access to military installations to facilitate the sustainable multipurpose use of its natural resources." (Appendix D.)

Despite the above, due to the sensitive nature of the Depot's military mission, as well as for safety reasons, little outdoor recreation is available. The Depot is a "closed" post, and the public does not have unrestricted access.

18.3 FISHING AND HUNTING PROGRAMS

The Depot does not have fishing or hunting programs.

18.4 OTHER NATURAL RESOURCES ORIENTED OUTDOOR RECREATION

Off-road vehicles (ORVs) have great potential for damaging natural resources, and Army policy on their use is very restrictive (AR 200-3). Dune habitat can be irreparably damaged by irresponsible ORV use. The vehicles can cause digging, flattening, and displacement of dune soils, and they may destroy flora and fauna. For these reasons, the Depot does not allow ORV use unless specifically authorized to support the military mission or natural resources management.

A 20-foot by 40-foot swimming pool is open to Depot employees from Memorial Day to Labor Day. Additionally, the Depot rents outdoor equipment to Depot employees and their families for offsite recreational activities. Rental equipment includes rafts, motor boats, ski equipment, camping trailers, and camping equipment. The Depot does not sponsor offsite recreational trips due to the small number of military personnel present.

19.0 CULTURAL RESOURCES PROTECTION

Cultural resources conservation programs at the Depot are implemented in accordance with Sections 106 and 110 of the National Historic Preservation Act (NHPA) (16 U.S.C. Section 470, as amended), the Archeological Resources Protection Act (ARPA) (16 U.S.C. Section 470a-47011), the American Indian Religious Freedom Act (AIRFA) (42 U.S.C.), the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. Section 3001 *et seq*.), DoD Directive 4710.1 (*Archeological and Historic Resources Management* 1984), Executive Order (EO) 13007 (*Indian Sacred Sites)*, and AR 200-4 (*Historic Preservation*). The Industrial Risk Management Directorate is responsible for cultural resources management. The Depot coordinates with DoA's Office of the Directorate of Environmental Programs (ODEP); the AMC Environmental Office; the Installation Management Command - West Region; the Advisory Council on Historic Preservation; the Oregon State Historic Preservation Office (SHPO); and the Confederated Tribes of the Umatilla Indian Reservation, comprised of the Cayuse, the Umatilla, and the Walla Walla Indian Tribes.

19.1 OBJECTIVES

Among the Depot's objectives for cultural resource protection is to ensure that implementation of this INRMP is consistent with the conservation and protection of its prehistoric and historic cultural resources.

19.2 PREHISTORIC AND HISTORIC CULTURAL RESOURCES

In 1987, the National Park Service (NPS) completed *An Archeological Overview and Management Plan for the Umatilla Depot Activity* (NPS 1987). More recently, Earth Tech developed the *Final Integrated Cultural Resources Management Plan, Umatilla Chemical Depot, Hermiston, Oregon* (Earth Tech 2002), to guide cultural resource management on the Depot.

Prehistoric, ethnohistoric, and historic evidence indicates that prior to construction of the installation in 1941, the Depot area was not a scene of intensive human use. No known significant archaeological or historical sites existed on the Depot. A general cultural resource inventory, except for archaeological clearance surveys for specific future projects, was not recommended for the Depot by the NPS. To date, Class III cultural resource inventories have been conducted on approximately 6 percent of the Depot.

In addition to archaeological sites, Traditional Cultural Properties (TCPs) and sacred sites may be found on the Depot. Parker and King (1998) define a TCP generally as: "…one that is eligible for inclusion in the National Register [of Historic Places] because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." A sacred site, as defined by EO 13007, is: "…any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." Traditional cultural properties and sacred sites are identified through consultation with the appropriate groups of peoples. It should be noted that while sacred sites are specific to Native American tribes, TCPs may be associated with any discrete cultural community, prehistoric or historic. No formal consultations have been held on TCPs or sacred sites on the Depot, although Earth Tech (2002) acknowledges that such areas may exist. If indeed TCPs and/or sacred sites are identified on the Depot, those areas would be afforded increased protection through the NHPA; and the AIRFA and EO 13007, respectively.

Earth Tech (2002) indicates that in 1984 a historic buildings and structures study concluded that Building Nos. 1 (Headquarters) and 2 (Firehouse) were eligible for listing in the National Register of Historic Places (NRHP). In 1998 the SHPO wrote a letter to the Depot stating its determination that the whole installation, in and of itself, is eligible for listing in the NRHP, due to its association with national defense efforts as well as for its architectural merit (SHPO 1998). The Depot is still in consultation with the SHPO regarding this matter.

19.3 NATURAL RESOURCES MANAGEMENT IMPLICATIONS

Due to the presumed small number of archaeological resources on the Depot, their preservation should not affect the installation's natural resource management program. The INRMP does not recommend activities that require significant land disturbance, therefore it is unlikely that implementing the plan would impact unknown archaeological sites. Currently, no ground disturbance is permitted at the Depot without the authorization of the Environmental Office. If natural resources program activities involving ground disturbance are proposed for implementation, they will be preceded by an archaeological survey of the site if the area has not already been surveyed and/or disturbed. Much of the Depot was significantly disturbed during its construction; consequently the integrity of impacted sites will likely have been compromised. Therefore extensive archaeological surveys are not anticipated.

If it is determined that a proposed action has the potential for affecting historic properties, Section 106 of the NHPA will be implemented, and coordination with the SHPO and, if appropriate, Native American tribes, will be initiated regarding the action. The procedures for coordinating with all appropriate parties, both internal and external, are outlined in Chapter 5 of the Depot's Integrated Cultural Resources Management Plan (Earth Tech 2002). It should be noted that relative to TCPs and sacred sites, ground disturbance alone may not result in impacts. For example, alterations or disruptions of viewscapes may constitute significant and detrimental impacts to such sites.

As stated in Section 5.4, the Confederated Tribes have identified the Depot's general ecosystem as a cultural resource worthy of preservation; however, they have not identified individual plant species, animal species, or areas that are important to them due to concern that once these resources are identified they will be exploited. Initial discussions have been held with the Tribes to implement a *First Foods* program, whereby the Native Americans identify plant species and communities on the Depot that hold cultural significance for the Tribes.

Identification of such species and communities would further strengthen protection of the habitats in which they are found, as well as facilitate access to the Depot by Native Americans for the purpose of collecting plant materials. In accordance with the Treaty of 1855, the NHPA of 1966 (as amended), EO 13007 (*Indian Sacred Sites*), and the AIRFA of 1978, the Depot will continue to grant the Confederated Tribes access to all areas of the Depot that are not restricted due to safety or security reasons. Also in accordance with these laws, the Confederated Tribes will be consulted when the Depot's activities may disturb the ground or natural resources, as it is unknown which areas, plants, or animals are culturally significant to them. It is not anticipated that this plan's implementation will negatively affect the Depot's cultural resources.

Since this INRMP does not propose changes in the use or structure of the cantonment area, the headquarters building and the fire house (which are listed as Category III historic properties) will not be affected. Therefore, this plan does not negatively affect the historic resources of the Depot.

20.0 NATIONAL ENVIRONMENTAL POLICY ACT IMPLEMENTATION

The federal law requiring the review of all federally supported activities with the potential to impact the environment is called NEPA. This review must be documented and the public has the right to be involved in the review process. AR 200-2, *Environmental Effects of Army Actions*, implements NEPA requirements and requires mitigation to limit damage to the environment. The purpose of NEPA is not to stop actions. Rather, it is designed to identify potential environmental problems early in the process and inform the decision-maker of alternative actions and their potential impacts. The proponent can then pursue actions, if he/she so chooses, to resolve these problems in the early stages of project development.

20.1 OBJECTIVES

The Depot's objectives for NEPA implementation with regard to natural resources are as follow:

- identify projects and activities on the Depot that might impact natural resources.
- work with project planners to resolve issues early in the planning process using NEPA.
- ensure the impacts of the INRMP are documented according to the spirit and intent of NEPA.

20.2 NEPA RESPONSIBILITIES AND IMPLEMENTATION

20.2.1 Responsibility

The proponent of an action has primary responsibility for preparing the appropriate NEPA documentation, as it relates to their project, at the Depot.

20.2.2 Environmental Checklist

One safeguard recently established to reduce or mitigate negative environmental impacts resulting from military projects is the Environmental Checklist for Work Orders or Contract Proposals (Appendix I). Project proponents prepare this checklist, describing the project and any potential impacts, and submits the document to RD – EO. RD – EO reviews the checklist and determines whether the Depot will remain in compliance with federal, state and local regulations if the project goes forward, and whether further NEPA coordination is required to implement the project.

20.2.3 NEPA Documentation

The most common NEPA document prepared for projects is a Categorical Exclusion (CX). The list of approved Army CXs can be found in Appendix A of AR 200-2. A Record of Environmental Consideration (REC) is required for some CXs if the action is covered in an existing NEPA document or if it qualifies for a CX.

An EA is prepared for actions that do not fit the requirement for a CX and for actions for which the effects on the environment are unknown. An EA results in a Finding of No Significant Impact (FONSI) or a Notice of Intent (NOI). A NOI is prepared if significant impacts are anticipated and an EIS will be prepared. An EIS results in a Record of Decision (ROD).

An EA was prepared for the Depot's original Master Plan (USACE 1993), which addresses natural resources management on the installation, and is included as an appendix to the 1998 INRMP. The requirement for updating the Master Plan was waived because the Depot is a BRAC facility. There is no requirement to amend or revise the EA for the preparation of this INRMP because there will be no significant impacts to biotic resources as a result of implementing this plan.

20.2.4 Mitigation

Mitigation is used to reduce the adverse environmental impacts of an action. Mitigative actions are identified in the FONSI or the ROD, which are by Army policy considered binding documents. Commitments made in these documents become legal requirements and must be monitored and documented. These become "must fund" items for Environmental Program Requirements (EPR). The RD – EO at the Depot will continue to track mitigation commitments made in NEPA documents for compliance purposes.

20.3 NEPA AND NATURAL RESOURCES MANAGEMENT

The RD – EO will use NEPA to ensure that its activities, as described in this INRMP, are properly planned, coordinated, and documented. The RD – EO will also review the Environmental Checklist and associated NEPA documents prepared by the proponents to identify potential natural resource impacts. RD – EO personnel can help decide where a proposed action should take place. Appropriate siting can eliminate unnecessary environmental impacts. Discussions regarding the location of a proposed project should be of help early in the planning process, even before the development of a draft NEPA document.

The checklist submitted by project proponents helps assess potential impacts to natural and cultural resources, directly addressing federal regulations such as the Endangered Species Act (Appendix I).

In FY08 through FY12, the RD – EO will continue the following steps to use NEPA to protect and conserve the Depot's natural and cultural resources:

- review proposed actions during the project concept phases whenever possible.
- ensure that mitigation is included in projects that may damage natural and cultural resources. If such mitigation is included, ensure that it is entered into the EPR report process.
- use RD – EO capabilities to provide mitigation. These resources include land rehabilitation and special area conservation.

- track projects to ensure that mitigation is accomplished and that restrictions included within the REC are followed.

20.4 NEPA AND THIS INRMP

The attached EA (Appendix C) provides an evaluation of the effects of implementing this INRMP, as well as alternatives, on the Depot’s natural resources. Future actions covered within the INRMP will be evaluated in the planning stages to determine the appropriate level of NEPA documentation in accordance with the NEPA regulations, the Council on Environmental Quality’s regulations, and AR 200-2.

21.0 BIOPOLITICAL ISSUES

The Depot has done a good job of protecting and conserving its natural resources, and there has been little controversy regarding the program. However, the installation lies within a region sensitive to environmental issues and potential threats to natural resources and quality of life.

Some issues involving the Depot are not easily resolved. This section deals with these issues. The first step to resolving issues is to admit that answers are not readily available and maintain a willingness to keep working toward resolution.

21.1 BASE REALIGNMENT AND CLOSURE CONSIDERATIONS

Umatilla Chemical Depot is moving forward with BRAC activities which include the CSDP and closure. The Depot was included in the 2005 BRAC closure list and, as of this writing, the Depot's estimated closure date is 2017. This INRMP, having a 5-year implementation period, does not directly address BRAC. However, decisions made during the ongoing BRAC process will ultimately affect natural resources on the Depot. Reuse decision-making must consider the impacts of multiple land-users (i.e. separately owned/managed tracts) on the resources.

Of primary concern is the future management and preservation of the bitterbrush shrub-steppe habitat. As has been indicated earlier, Kagan et al. (2000) states that the Depot contains the largest remnants of bitterbrush habitat in the Columbia Basin. Although some non-native species have invaded the vegetative communities on the Depot, the most pervasive being cheatgrass, relative to surrounding areas the Depot's habitats are ecologically in good condition. Kagan et al. (2000) expresses a concern that the Depot properties may be subject to industrial development.

In addition, thought must be given to the future of the Depot's pronghorn herd. Stephen et al. (*in press*), recommends that, due to the herd's lack of genetic variability, the animals no longer be used for translocation projects. However, decisions must be made regarding the fate of the herd in relation to Depot closure. With the current projected closure date of 2017, the ODFW will likely remove the animals prior to that date and introduce them into large herds with good genetic variability. If the closure date is extended for an additional 10 years or so, the Depot and the ODFW may consider increasing the genetic variability of the captive herd by introducing pronghorn from elsewhere in the state, and reinstitute research on the Depot to assess rate and effectiveness of genetic reinvigoration.

22.0 INRMP IMPLEMENTATION

22.1 ORGANIZATION

This INRMP can be implemented by the existing organization based at the Depot, with outsourcing to contractors and cooperating agencies when needed.

22.2 PERSONNEL

22.2.1 Staffing

The Depot's Natural Resources Management Program would clearly benefit from the addition of a full-time technician to the environmental staff. However, given the current budget constraints, it is obvious that such a position would be difficult to acquire and sustain. However, a technician position might be justified if it were not dedicated to a single program, but allowed to assume the responsibility for field tasks of any of the environmental program's projects where feasible.

22.2.2 Personnel Training

Due to the limited staff in the Depot's environmental office, the environmental program is benefitted by having each staff member be as multi-disciplinary as possible. This is achieved and sustained through training. Staff members should be expected to maintain state-of-the-art knowledge in those programs for which they are responsible. This involves not only training, but participation in conferences and workshops as well. Examples of training courses, workshops and conferences staff should attend to implement the Depot's Natural Resources Management Program might include:

- National Military Fish and Wildlife Association (NMFWA) annual workshops.
- State and National Wildlife Society meetings and conferences.
- range management workshops.
- Partners in Flight workshops.
- training courses on federal regulatory measures, for example MBTA.

Other conferences and workshops will be evaluated for their usefulness on a case-by-case basis. Decisions will be made based on their appropriateness to ongoing projects, funding availability, and time commitments. Involvement in state chapters of professional resource management organizations should be encouraged.

22.2.3 Outside Assistance

Implementation of this INRMP will require active assistance from the Depot partners, both signatory and otherwise. Much of this assistance will be facilitated through the MOUs, MOAs, and Cooperative Agreements the DoD and the Depot maintain with other agencies and organizations. Specific needs for interagency assistance are indicated throughout this document. In recent years, the Depot has received technical assistance from the USFWS, in both developing a raptor protection program as well as having independent review of their natural resources program in general. The installation hopes to maintain this working relationship with the USFWS in the future. Reimbursement for interagency assistance will be handled on a case-by-case basis, wherein sometimes the Depot may assume full responsibility for costs incurred, and at other times the Depot may engage in cost-sharing programs with cooperators.

In certain circumstances, the specific expertise needed to undertake tasks may not be found in any of the signatory cooperators, and the Depot may have to look to contractors to fulfill requirements, such as conducting Planning Level Surveys for biotic resources. Procedures are in place to locate and hire contractors when the need arises.

22.3 PROJECT/PROGRAM PRIORITIES

Preparation of this INRMP is required by the Sikes Act, as well as DoD Instruction 4715.3, and therefore is a high funding priority. However, it is unlikely that all programs within this INRMP will be funded immediately. Therefore, the following sections prioritize the relative importance of projects and programs specifically included within this INRMP. Each priority category’s programs are listed in the order they are first mentioned in this document. Estimated time schedules are provided.

Due to funding restrictions, lower priority projects may be implemented ahead of higher ones. Some “high priority” projects are critical, but they may not be compliance driven, making funding more difficult. The list below is based on need and effect on the Depot natural resources, not funding likelihood. Since these are programs planned for the next 5 years, ongoing BRAC actions should not significantly affect them.

22.3.1 High Priority Projects/Programs

- Mission support (INRMP, in general)
- Conserve biodiversity (11.2)
- Maintain an ecosystem management philosophy (11.3)
- Maintain ecosystem management partnerships (11.5)
- Faunal Planning Level Surveys (12.4)
- Monitor the pronghorn herd (12.4)
- Survey long-billed curlews and western burrowing owls (12.4)
- Wildlife diseases surveillance (12.5)
- Monitor groundwater quality (12.6)
- Wildfire suppression (13.2)
- Sensitive species restoration (13.5)
- Raptor protection (13.6)
- Building demolitions and wildlife protection (13.7)
- Wildlife rescue/rehabilitation (13.8)

- Maintain wildlife water devices (14.3)
- Establish burrowing owl nest structures (14.3)
- Determine future disposition of the pronghorn herd (14.4)
- Control pests including noxious plants (14.6)
- Implement PMP (14.6)
- Control erosion (14.7)
- Support the Natural Resources Law Enforcement Program (16.0)
- Use media resources to inform the public of natural resources programs (17.3)
- Protect cultural resources while implementing this INRMP (19.3)
- Ensure Environmental Office review of NEPA documents (20.3)
- Work to resolve unresolved biopolitical issues (21.0)
- Hire personnel to implement this INRMP (22.2)
- Provide personnel training (22.2)
- Obtain the outside assistance needed to implement this INRMP (22.2)
- Obtain funding to implement this INRMP (22.4)
- Provide command support to implement this INRMP (22.6)

22.4 FUNDING OPTIONS

22.4.1 Agricultural Funds

Agricultural funds are derived from agricultural leases on installations. They are centrally controlled at both DoA and Major Command levels, and can sometimes be spent at installations without agricultural programs. AR 200-3 (Chapter 2) outlines procedures for collecting and spending these funds. They are primarily intended to offset the costs of maintaining agricultural leases, but they may also be available for preparing and implementing INRMPs. These are the broadest use funds available exclusively to natural resources managers. They are also exempt from Base Commercial Equipment limits on the purchase of equipment more than $25,000. In recent years agriculture funds have been reserved for those installations maintaining agricultural (grazing and/or croplands) programs on an outlease basis.

22.4.2 Environmental Funding

Environmental dollars are a special category of Operations and Maintenance (O&M) funding. They are controlled by the EPR report process and are subject to the restrictions of O&M funds. The key to getting environmental funding is regulatory compliance. The program heavily favors high-priority funding projects needed to obtain or maintain compliance with federal or state laws, especially if findings of noncompliance result in notices of violation or other enforcement agency action. “Must fund” classifications include mitigation required and identified within FONSIs as well as items required within Federal Facilities Compliance Agreements. This INRMP is a Federal Facilities Requirement Agreement.

DoD Instruction 4715.3, *Environmental Conservation Program*, identifies the programming and budgeting priorities for conservation programs. Many of the inventories, assessments, and surveys needed to support ecosystem management implemented through the INRMP are classified as Class I: Current Compliance Action for funding purposes (these actions have a higher priority for funding than actions that are not compliance driven), (DoD 4715.3, Enclosure 4.B.). Class I also includes projects and activities needed that are not currently out of compliance (for example, requirements have been established by regulations and DoD policies but are not in force), but shall be if projects are not implemented in the current program year (DoD Instruction 4715.3, Enclosure 4.). Activities in these categories which are relevant to the implementation of this INRMP include:

> 1. environmental analyses for natural (and cultural) resources conservation projects, and monitoring studies required to assess and mitigate potential impacts of the military mission on conservation resources.
>
> ...
>
> 2. raptor protection, to reduce the potential for violation of the MBTA.
>
> ...
>
> 3. baseline inventories of natural (and cultural) resources.
>
> ...
>
> 4. biological assessments, surveys, or habitat protection for a specific listed species, critical for the protection of the species so that proposed or continuing actions can be modified in consultation with the USFWS to prevent "taking" of the species.

Environmental funding has been important to natural resource programs on the Depot. Implementation of much of this INRMP requires work from the Depot's small staff, none of whom is currently dedicated to natural resources management. Salaries to support this natural resources work are paid from environmental funding. As indicated earlier, the Depot will investigate opportunities to use external personnel to implement other portions of this INRMP.

22.4.3 Training Funds

Funds for natural resources training should be budgeted from environmental accounts or requested through the agricultural work plan. Training funds are needed to cover training workshops (e.g. 40-hour HAZWOPER), and related conferences and workshops.

22.5 INRMP IMPLEMENTATION FUNDING REQUIREMENTS

Environmental funding needed to implement this INRMP will vary from year to year, ranging from approximately $24,000 to $131,500, depending upon the programs and projects being undertaken during any given fiscal period (Table 22-1). Implementing this INRMP for the period FY08 through FY12 will cost somewhat more than an estimated $272,500.

Table 22-1: Estimated Funding Needs for Natural Resources for FY08 through FY12 (X $1,000)					
Support Area	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
USFWS Technical Assistance	92.5	12.0	14.0	15.0	15.0
Training	4.0	3.0	4.0	4.0	4.0
Surveys and Assessments	30.0	30.0	10.0	0	0
Monitoring	5.0	5.0	5.0	5.0	5.0
Special Projects	0	10.0	TBD	TBD	TBD
Fiscal Year Totals	131.5	60.0	33.0+	24.0+	24.0+
					5-Year Total: $272.5+

22.6 COMMAND SUPPORT

Command support is essential to implementation of this plan. The Commander is personally liable for noncompliance with environmental laws such as those affected by this INRMP, and therefore has a personal interest in assuring that this plan is properly implemented.

This INRMP has the support of the Depot Commander and other personnel in command positions who are needed to implement it. The Command is dedicated to maintaining and improving the military mission at the Depot, and implementing this plan is a means to that end.

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APPENDIX A

Scientific Names for Floral and Faunal Species Cited in the Text

APPENDIX B1

Floral Species Found at Umatilla Chemical Depot

From: Tetra Tech EM Inc. 2002. *Planning Level Survey Report for Vegetative Communities: Umatilla Chemical Depot, Hermiston, Oregon*. Umatilla Chemical Depot, Hermiston, OR. 50 pp + appendices.

APPENDIX B2

Faunal Species Found at Umatilla Chemical Depot

From: US Army Corps of Engineers. 1993. *Ecological Assessment Report for the Umatilla Depot Activity, Hermiston, Oregon*. Prepared by Dames & Moore, Inc. for the U.S. Army Corps of Engineers. Report number: CETHA-BC-CR-92056.

APPENDIX C

Environmental Assessment for the Development and Implementation of an Integrated Natural Resources Management Plan, Umatilla Chemical Depot, Hermiston, Oregon

APPENDIX D

Memorandum of Understanding Among the U.S. Department of Defense and the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies for a Cooperative Integrated Natural Resource Management Program on Military Installations

APPENDIX E

Specific Items of Cooperation Between the U.S. Fish and Wildlife Service, the Oregon Department of Fish and Wildlife, and Umatilla Chemical Depot

APPENDIX F

Memorandum of Agreement (MOA)
Between U.S. Army Umatilla Chemical Depot (UMCD)
and U.S. Fish and Wildlife Service (USFWS)
Mid-Columbia River National Wildlife Refuge Complex (NWRC)

APPENDIX G

Memorandum of Understanding Between the U.S. Department of Defense and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds

APPENDIX H

Pest Management Plan for Umatilla Chemical Depot, Hermiston, Oregon

APPENDIX I

Environmental Checklist for Work Orders or Contract Proposals

UMATILLA BASIN REGIONAL AQUIFER RECOVERY ASSESSMENT

REPORT

June 30, 2009

Prepared for:

Oregon Water Resources Department

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Optimizing Water Resources Through Technology

UMATILLA BASIN REGIONAL AQUIFER RECOVERY ASSESSMENT

PROJECT SUMMARY

The Oregon Water Resources Department (OWRD) has designated four aquifers within the Umatilla Basin of northeastern Oregon as Critical Groundwater Areas (CGAs) due to their documented overdraft. As a result, use of groundwater for irrigation in the CGAs has been curtailed. Additionally, surface water sources within the basin are fully appropriated between June 1 and October 31 (Oregon Administrative Rules OAR 690-507-0070) and the un-appropriated winter and spring flows are too unreliable for seasonal storage. The lack of reliable water supplies has caused adverse impacts to the economies of Umatilla and Morrow counties and severely reduced opportunities for improvement of environmental health of the aquifers and the Umatilla River. Figure 1 is a vicinity map showing the locations of the CGAs and key area features.

Significant local planning effort, much discussion with Oregon agencies, and the findings of several early projects in the basin resulted in development of a shared vision to increase water availability in the CGAs. The developed vision was given financial support by the State through Senate Bill 1069 which was signed into law in April 2008 by Governor Ted Kulongoski. The vision culminated in a plan to evaluate the merits of water storage in local aquifers for later use. As part of SB 1069, OWRD began an assessment to evaluate the feasibility of diverting water from the Columbia and Umatilla Rivers during high winter and spring flow periods and storing it in shallow sediment and deeper basalt aquifers. The stored water would later be used for irrigation and to achieve a range of environmental benefits in the CGAs.

OWRD contracted with a team of consultants led by IRZ Consulting LLC (IRZ) of Hermiston, Oregon, and aided by GSI Water Solutions, Inc. and HDR, Inc, Portland, Oregon, and others, to complete the feasibility study. The IRZ team also included Drs. Michael Campana and Todd Jarvis of Oregon State University to provide scientific peer review of the work products. The project began in April 2008 and completed in June 2009. A copy of the OWRD contract can be viewed at http://www.irz.com/ProjectInformation/ContractScopeofWork.pdf and http://www.irz.com/ProjectInformation/ProjectContractAmendment.pdf.

Monthly stakeholder meetings were held during the project to communicate project findings, receive input on important issues, and provide a forum for open discussion of many issues raised during the course of the project. Copies of the meeting slides and attendance rosters are available at http://www.irz.com/Meetings/. The meetings provided a significant opportunity for cooperation amongst the stakeholders which greatly assisted with the success of this project.

1.0 STATEMENT OF THE PROBLEM

Three of the four CGAs are the subject of this feasibility assessment including the Ordnance Gravel, Butter Creek, and Stage Gulch CGAs (Figure 1). In the Butter Creek and Stage Gulch CGAs, the basalt aquifers are the principle aquifers suffering from the overdraft condition. In the Ordnance Gravel CGA, the alluvial gravel aquifer is the principle water supplying aquifer. There are 63,489 acres of farmland within the CGAs with 190,466 acre feet (AF) of total certificated groundwater rights from these aquifers. During the last four decades, these water rights have been subject to curtailment of pumping due to overdraft in both the alluvial and basalt aquifers. Only 63,428 AF, or about 33 percent (%), of the total water rights are met annually, leaving a need of 127,038 AF every year. Curtailment of groundwater withdrawals from these aquifers currently is at levels of up to 91% of the permitted volumes, averaging 67%. Figure 2 is a satellite photograph showing the extent of irrigated agriculture as the dominant land use in the CGAs. Detailed assessment of the certificated and curtailed water rights is presented in http://www.irz.com/technicalmemoranda/Task1.DWaterNeedsTechMemoFinal.pdf.

Much discussion and effort have been organized by the local and State stakeholders during the last four decades to find solutions to reduce adverse impacts of irrigation water curtailment to local economy and stabilize groundwater levels in the aquifers. In addition to curtailment of irrigation water supplies, increase in summer flows in the Umatilla River to improve aquatic habitat quality has been a long-standing goal of the stakeholders. Finally, presence of high levels of nitrate nitrogen in groundwater in a large part of the CGAs has focused attention on potential solutions to address the problem.

2.0 BACKGROUND

Several previous projects appeared to point toward a possible solution to these problems. In mid-1970s a group of local growers formed the County Line Water Improvement District (CLWID) with the purpose of designing and implementing a relatively small-scale project to recharge a shallow alluvial aquifer with water diverted from the Umatilla River (Figure 1). Since then an average of approximately 6,000 AF of water have been stored and withdrawn for irrigation purposes every year. However, the availability of this water source has fluctuated from a low of nearly 600 to a high of more than 10,000 AF between 1976 and 2008 as a result of variable Umatilla River flow rates. The success of this project in increasing irrigation water supplies through aquifer recharge has provided a great impetus to consider the current study for a much larger project.

Beginning in 1998, IRZ conducted a series of studies in the Echo Meadows aquifer located west of the Umatilla River (Figure 1). These studies focused on the potential for using the river winter diversions to recharge the shallow alluvial aquifer with the purpose of increasing summer river flows. The findings of these projects have focused much attention on the viability of using aquifer recharge to achieve significant environmental benefits.

In another set of projects in the lower basin, two growers have been diverting winter flows from Butter Creek, a local tributary to Umatilla River, when flow is available, and storing it in deeper basalt aquifers to use later during the irrigation season (Figure 1). These two projects have shown the practicality and feasibility of storing water in the basalt aquifers in the area.

3.0 THE PROPOSED SOLUTION

A total annual water need of 159,000 AF is estimated for the CGAs. This volume provides for the following beneficial uses in the CGAs:

- 114,000 AF to meet curtailed groundwater rights including primary and supplemental rights.
- 27,000 AF to enhance Umatilla River instream flow. The benefits of stream flow augmentation with imported river water extend beyond the quantity added and also include potential reduction in river water temperature.
- 11,000 AF will be left in the basalt aquifers to help reverse their over-draft.
- 2,000 AF to provide for additional domestic and exempt well uses. This volume was considered in overall sizing of the supply system and not necessarily to decide on its final disposition.
- 5,000 AF to allow additional municipal supplies. It should be noted that not all communities have expressed a future need for additional water supplies. This volume was considered in sizing the supply system and not necessarily to decide on its final disposition.

A detailed discussion of the water needs in each of the CGAs is presented in http://www.irz.com/technicalmemoranda/Task1.DWaterNeedsTechMemoFinal.pdf.

The findings of this feasibility assessment indicate that the above beneficial uses can be served by three Supply, Storage, Recovery, and Distribution (SSRD) systems 1 through 3. The SSRD 1 system would serve the Butter Creek and Ordnance Gravel CGAs, the SSRD 2 system the area of Stage Gulch CGA west and south of the Umatilla River, and the SSRD 3 system the Stage Gulch CGA area east of the Umatilla River (Figure 1). As proposed, the SSRD 1 system will provide a total of 100,000 AF, SSRD 2 a total of 25,000, and SSRD 3 a total of 34,000 AF of water. This feasibility assessment did not identify environmental, regulatory, economic, or engineering fatal flaws with the proposed SSRD systems. Additional detail regarding the design concepts for these systems is provided in http://www.irz.com/technicalmemoranda/Task1.J&3.DEngineeringDesignTechMemoFinal.pdf. The three systems are discussed below.

3.1 THE SSRD 1 SYSTEM

At full build out, the SSRD 1 system is intended to supply a total of approximately 100,000 AF of water for use in the Ordnance Gravel and Butter Creek CGAs. This total includes 69,000 AF of unmet irrigation groundwater need, 24,000 AF for Umatilla River flow augmentation, 1,000 AF of additional domestic and municipal use, and 6,000 AF for basalt aquifer replenishment. The recommended system is to be built in three increments, initially importing 25,000 AF, then increasing to 55,000 AF, and finally to full capacity. The second and third increments will be built based on evaluations of success of the previous phase(s).

Figure 3 shows a schematic diagram of the concept of the SSRD 1 system. The Columbia River water is pumped to the alluvial “County Line” aquifer (Figure 1) via existing pump stations, pipelines and a canal. Additional pipelines will have to be constructed to reach the proposed recharge location. Storage in the alluvial aquifer will be conducted under the aquifer recharge (AR) regulations in OAR 690-350.

A range of existing water supply infrastructure available in, or immediately adjacent to, the CGAs was reviewed for this purpose and is described in http://www.irz.com/technicalmemoranda/Task1.EExistingInfrastructureTechMemoFinal.pdf. The Columbia Improvement District (CID) and Boardman Tree Farm (BTF) pump stations and conveyance structures are used to develop the conceptual layout of the proposed SSRD 1 system. Figure 4 shows the layout of the full-scale system.

River water can only be pumped during the “availability” months of October and December through March based on OWRD assessment and State regulations, as detailed in http://www.irz.com/technicalmemoranda/Task1.GRiverFlow&FisheriesTechMemoFinal.pdf. For the purpose of this study, the availability months are expected to allow an effective 90-day diversion period. Longer diversion periods will significantly reduce the project cost.

Use of the County Line aquifer provides four advantages for this system. First, it provides a large underground reservoir for direct storage. Due to its hydraulic characteristics, however, this aquifer is not expected to hold the entire volume of recharged water during the diversion and subsequent irrigation use periods. During the non-irrigation season, a portion of the recharged water is to be pumped out to be injected into the basalt aquifer for additional storage. As a result, this aquifer is secondly utilized to provide natural filtration of the recharged water prior to its injection into the basalt aquifers. This step is required so that the injected water meets the State’s water quality requirements. Thirdly, because this aquifer appears to be connected to the Umatilla River, a portion of the recharged water can be managed to discharge to the river to increase its flow. Finally, aquifer recharge with imported Columbia River water will reduce groundwater nitrate levels through dilution. These four advantages form the bases for the conceptual design of this system and are explained further below.

The County line aquifer is a 13,500-acre area straddling the border of Morrow and Umatilla Counties near Highways I-84 and I-82. It is composed of relatively large coarse sand and gravel sediments extending between 100 and 200 feet below ground. The aquifer is bounded laterally by sediments of significantly-lower permeability and is bounded on the bottom by basalt bedrock or fine sediments overlying basalt. The depth to groundwater ranges from approximately 40 to more than 100 feet and appears to have remained fairly stable in recent years. Based on the available data, the additional storage capacity of this aquifer appears to be adequate to accommodate the first and second increments of water recharge. Possibility of additional storage will be evaluated based on the findings of the initial increments.

Recharge will be conducted via surface spreading of river water. Available data shows that the infiltration rate of the soil is sufficiently high to allow recharge of the high volumes of water into the aquifer via this method within the assumed 90-day diversion period. The location and the approximate aerial extent of this aquifer are shown on Figure 1. A detailed description of the rationale for selection, storage capacity, and hydraulic properties of this aquifer are provided in http://www.irz.com/technicalmemoranda/Task1.CAlluvialHydrogeoReportText&TablesFinal.pdf, http://www.irz.com/technicalmemoranda/Task1.CAlluvialHydrogeoReportAppendicesFinal.pdf, and http://www.irz.com/technicalmemoranda/Task1.CAlluvialHydrogeoReportFiguresFinal.pdf.

As stated above, the recharged groundwater must be pumped out for further storage in the basalt aquifers during the non-irrigation season. River water could only be directly injected into the basalt aquifer if it meets State’s drinking water quality criteria. If treatment is required to achieve the criteria, the approximate capital cost of treatment facilities will range from $13 to $55 million ($1,600 to $1,650 per AF). The corresponding annual operation and maintenance cost would range from $210,000 to $610,000 ($26 to $18 per AF). The treatment cost estimates are presented in http://www.irz.com/technicalmemoranda/Task1.HTreatmentCostTechMemoFinal.pdf.

It was recognized early that the additional cost of such treatment would make the project infeasible. Therefore, the second rationale for initial storage in the alluvial aquifer is to provide natural filtration capacity of the imported river water to help achieve the required ASR water quality standards. Use of natural filtration for such applications is governed by the regulatory framework presented in http://www.irz.com/technicalmemoranda/Task1.HWatQualTreatNeedRegFrameTechMemoFinal.pdf. The County Line aquifer material was found to provide suitable natural filtration capacity, as described in http://www.irz.com/technicalmemoranda/Task1.HNaturalFiltrationEvaluationTechMemoFinal.pdf.

Injection of the alluvial groundwater into the basalt aquifer would be accomplished under the aquifer storage and recovery (ASR) regulations in OAR 690-350. The ASR potential is determined to be good for wells completed within the basalt aquifer for most of the CGAs, supporting ASR injection and recovery at rates averaging 1,000 gallons per minute. The results of the evaluation of the feasibility of basalt aquifer potential for ASR are described in http://www.irz.com/technicalmemoranda/Task1.CBasaltHydrogeologyReportFinalGSI.pdf. Finally, mixing injected river water with native basalt groundwater was determined to not pose aquifer clogging or other groundwater quality issues, as described in http://www.irz.com/technicalmemoranda/Task1.HGeochemicalCompatibilityEvaluationTechMemoFinal.pdf.

Two County Line aquifer water quality issues were identified which are not addressed by natural filtration treatment. First, alluvial aquifer wells have shown elevated concentrations of nitrate-nitrogen of up to 17.4 milligrams per liter. Secondly, the recharge water will reach and hydraulically affect a limited zone of groundwater underlying the Umatilla Army Depot containing inorganic contaminants. It is expected that the final design of the SSRD 1 system will include components and operational methods to dilute the nitrate concentrations and minimize impacts to the Depot groundwater plume. Additional data and discussion regarding quality of groundwater and river water, and Depot groundwater quality are presented in http://www.irz.com/technicalmemoranda/Task1.CAlluvialHydrogeoReportText&TablesFinal.pdf.

The total capital cost for the SSRD 1 system with river diversion capacities of 25,000 AF, 55,000 AF, and 100,000 AF were estimated to be $22, $42, and $100 million, respectively. The operation and maintenance cost are $2.5, $5.2, and $9 million, respectively. If groundwater disinfection is required, wellhead chlorination will require an additional capital expenditure of $240,000 to $700,000 ($30 to $21 per AF), and O&M cost of $60,000 to $160,000 ($8 to $5 per AF), respectively. Cost details are provided in http://www.irz.com/technicalmemoranda/Task1.J&3.DEngineeringDesignTechMemoFinal.pdf.

3.2 THE SSRD 2 SYSTEM

At full build out, the SSRD 2 system is intended to supply up to 25,000 AF of water for use in the Stage Gulch CGA west of the Umatilla River. Of this total, 20,000 AF will be is to address the unmet irrigation groundwater rights, 3,000 AF to augment Umatilla River flow, and 2,000 AF for basalt aquifer replenishment. However, at this time only 7,500 AF of water supply can be envisioned for this area due to a lack of reliable peak flow water supply from the Umatilla River. The amount of 7,500 AF is to be obtained through a transfer of water right from the CLWID. Therefore, the SSRD 2 system was only designed for this capacity. The total capital cost estimated for the SSRD 2 system is $7 million or $900 per AF, and the annual operation and maintenance cost is $500,000 or $70 per AF. The details of this system are summarized in http://www.irz.com/technicalmemoranda/Task1.J&3.DEngineeringDesignTechMemoFinal.pdf.

The CLWID diverts winter and spring flow from the Umatilla River. Upon transfer of this water for the SSRD2 system use, the river water is to be stored in the basalt aquifer. The river water will be recharged into the Echo Meadows aquifer primarily for treatment, and to a limited extent for storage. This aquifer is estimated to provide up to 6,000 AF of storage. The Echo Meadows aquifer underlies approximately 9,000 acres of farmland located west of the Umatilla River between the town of Echo and the Highway 207 River crossing (Figure 1). Groundwater is encountered at depths of between 2 to 12 feet across the aquifer. Groundwater and the Umatilla River form an interrelated hydraulic unit along the length of the river. Therefore, in addition to treatment and storage, this interaction can be exploited to design an aquifer recharge system to provide river flow augmentation. Aquifer characteristics recharge opportunities, and water quality evaluation results are presented in http://www.irz.com/technicalmemoranda/Task1.CAlluvialHydrogeoReportText&TablesFinal.pdf.

The findings of a recharge experiment with a limited volume of Umatilla River water in this aquifer in 2008 showed that recharge operations can fully be managed with existing conveyance systems requiring relatively minor system and field modifications.

3.3 THE SSRD 3 SYSTEM

The SSRD 3 system would need to supply a total of 34,000 AF of water for use in the Stage Gulch CGA east of the Umatilla River. This total amount includes 25,000 AF of unmet irrigation groundwater rights, 6,000 AF of additional domestic and municipal use, and 3,000 AF for basalt aquifer replenishment. A combination of systems will need to be developed based on existing private and public infrastructure to provide the total amount of need in this area. Concepts to provide this volume of water include one or a combination of small-scale aquifer recharge and basalt aquifer storage, small-scale surface storage reservoirs, creative use of BOR Phase II facilities, potential use of proposed “Phase III” exchange facilities, additional conservation efforts, water reuse, creative use of Hermiston aquifer groundwater, and creative use of infrequent Umatilla River excess flows.

4.0 ECONOMIC BENEFITS OF THE PROJECT

The economic benefits analysis included completion of two separate analyses. First, the current economy of the Umatilla and Morrow Counties (together referred to as the Region) was evaluated to illustrate the significance of agricultural, and related, activities to the Regional and State economies. The economic values from 2006 were used for evaluation, as it was deemed the most reasonable recent values for comparison purposes. The second analysis assesses the economic benefits of the proposed engineering alternatives and compares them with the 2006 values. It should be reiterated that these analyses were done at a level commensurate with the feasibility-level engineering concepts and designs. Further refinements can be done if desired when more detailed system designs are developed in the future. The details of the economic benefits study are presented in http://www.irz.com/technicalmemoranda/Task1.KEconomicBenefitsAnalysisReportFinal.pdf.

The first analysis includes a description of the economic structure of the sectors that constitute the Region's economic engine and estimates of the economic contribution of the agricultural industry to the Region and the State. The key findings of this analysis are summarized as follows:

- The majority of economic contribution of agriculture industry is attributed to irrigated agriculture.
- Farm production, frozen food manufacturing, vegetable canning and drying, cheese manufacturing, mining, utilities, transportation, and warehousing sectors provide the core employment and income sources in the Region, accounting for more than 50 percent of total jobs.
- The Region relies on employment as its main source of income. Earned income accounted for 65 percent of total personal income in 2006, which is consistent with the State's average of 65%. The 2006 per capita personal income (PCPI) of $25,254 represents 76 percent of Oregon's PCPI and 69 percent of the national PCPI.
- The farm production in the Region accounted for 12 percent of Oregon's 2006 total farm sales ($536 million), ranking first in production of grains ($102 million), hay and silage ($62 million), field crops ($75 million), vegetable ($58 million), and livestock production ($95 million) among the other 34 counties of Oregon.
- The agricultural industry accounted for 21 percent ($1.4 billion) of the total direct value of output and 22 percent (10,090 jobs) of the total direct employment in the Region in 2006. In the same period, the growers and food processors in the Region together exported more than $1 billion to domestic and foreign markets. The $1 billion accounted for 42 percent of total export value from the Region.
- The agriculture industry including its secondary effects, accounted for 27 percent of total value of output ($1.8 billion), 30 percent of total private employment (14,326 jobs), and 16 percent of total labor income ($697 million) in the Region in 2006.
- In 2006, the Region agricultural industry, directly and indirectly, generated about $2.6 billion in economic activities and $1.1 billion in personal income, supporting about 19,000 jobs in Oregon.

The second analysis includes an assessment of the economic benefits of the SSRD 1 system 55,000 and 100,000 AF scenarios as well as supplying the total need of 159,000 AF (Full-project) in the three CGAs. The analysis was conducted in accordance with the federal principles and guidelines for evaluation of federal water resource projects. The benefits analysis was performed from both National Economic Development (NED) and Regional Economic Development (RED) perspectives.

In developing the benefit estimates, the following unit water values were used for the different beneficial uses considered:

- Value of irrigation water at $95/AF.
- Value of stored water for flow augmentation in the Umatilla River between $85/AF and $124/AF with a mid-range of $104/AF.
- Value of water stored for aquifer replenishment at $95/AF.
- Wholesale value of water for municipalities in the Western States at $234/AF.

Economic Benefit Analysis from the National Perspective (NED): The direct net value is a measure of net contribution to NED (social welfare) and is calculated by subtracting total costs from total benefits (broadly stating it includes salaries and net profits). For the alternatives analyzed, this implies that the direct contribution to the national economy of the water diverted for irrigation, enhancing stream flows for fish migration and spawning in the Umatilla River, municipal, and groundwater replenishment should be weighed against the net value of the Columbia River water for instream uses such as hydropower production, fish enhancement program, recreational activities and other uses. If federal funding is used to finance the project, the construction and O&M costs should be included in the calculation. If the direct net value exceeds the total cost of the project, this implies the proposed project should be undertaken from the NED perspective.

The direct net value of water diverted from the Columbia River for the SSRD 1 system 55,000 AF and 100,000 AF scenarios and the Full-Project were estimated to be $99, $99, and $103 per AF, respectively.

Among alternative instream uses of the Columbia River water, only hydropower use was found to be adversely affected by the proposed diversion. The foregone hydropower generation for the SSRD 1 system 55,000 AF and 100,000 AF scenarios and the Full-Project were estimated to be $4.13, $4.22, and $4.44 per AF of diverted water, respectively. Comparing the instream uses of the Columbia River water to the diversions associated with each option shows a significant net gain of between $95 and $99 per AF.

Using a 50-year planning horizon and a discount rate of 2.44 percent, the annualized initial capital costs for the SSRD 1 system 55,000, 100,000 AF scenarios, and the Full-Project were estimated to be $26, $33, and $33 per AF, respectively. Based on O&M cost of $90, $87, and $85 per AF for the three options, respectively, the total annualized cost values are estimated at $116, $120, and $118 per AF, respectively. The O&M costs are described in http://www.irz.com/technicalmemoranda/Task1.J&3.DEngineeringDesignTechMemoFinal.pdf.

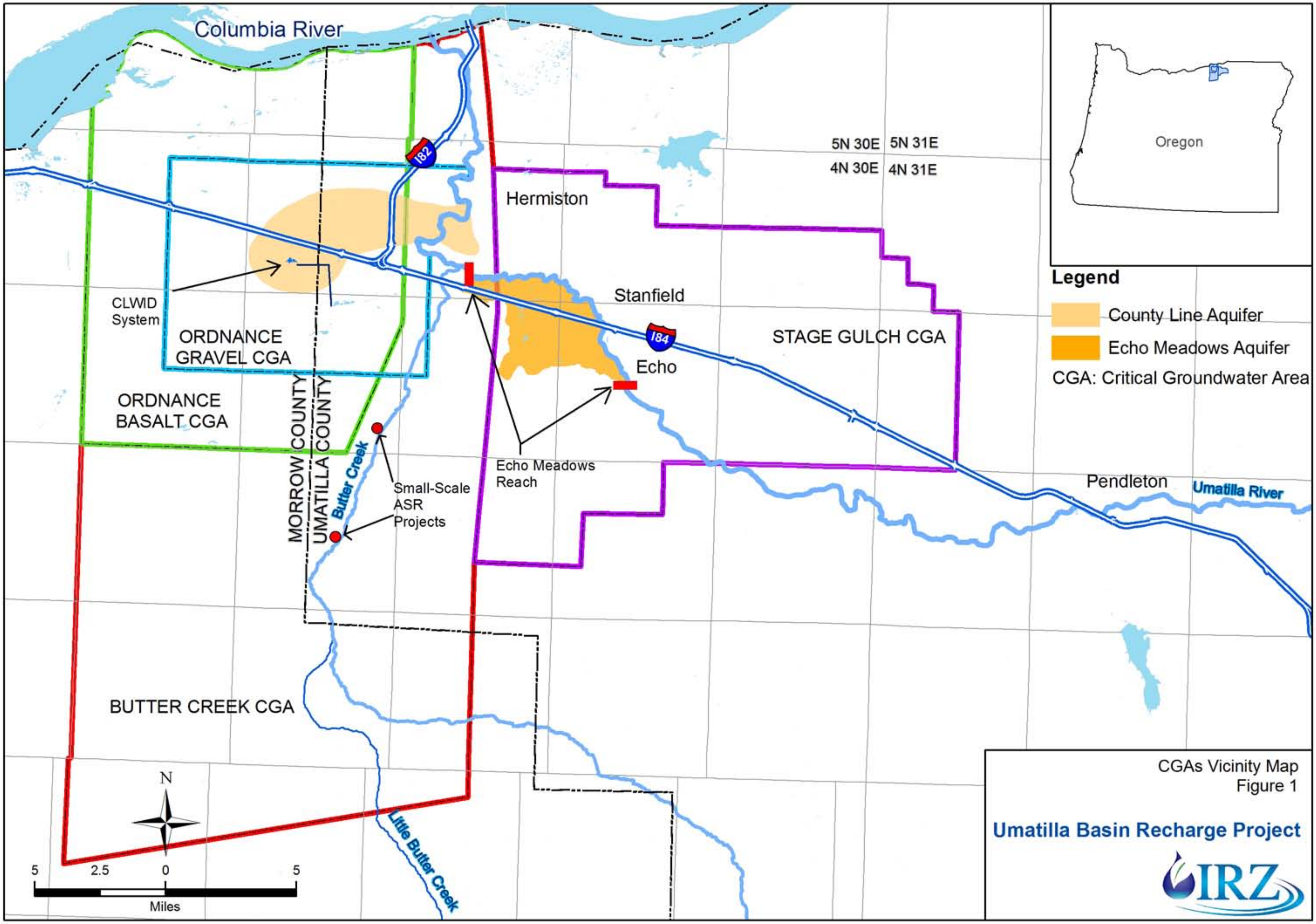
The total annualized cost is greater than the direct net values for the three scenarios considered, indicating that the engineering options considered are not economically feasible from a national NED perspective. However, this conclusion should be tempered since several other direct benefits were not considered due to lack of information, or are intangible. These include potential lower pumping costs associated with rising groundwater table, value of replenished aquifers, groundwater quality improvements, cultural values, and others.

Economic Benefits Analysis from the Regional Perspective (RED): The Regional economic benefits were evaluated based on increases in direct and indirect output (business activities), employment, and labor income (employee compensation plus proprietor's income) relative to the 2006 levels. The total economic impact is the sum of the direct and secondary impacts (or ripple effects). The direct impacts are the increases in farm production and direct value-added activities. The key benefits from the RED analysis are summarized below:

- The increase in total business activities are $116, $209, and $344 million for the SSRD 1 system 55,000 AF, 100,000 AF, and the Full-project scenarios, respectively. Of this, $80, $145, and $239 million are increases in direct output, respectively, and the remainder are increases in secondary impacts.
- The three scenarios create an additional 700, 1,200, and 2,100 total jobs, respectively, with 330, 600, 1,000 direct jobs and the remainder secondary impacts.
- The total annual labor income will increase by $24, $43, and $72 million, respectively, of which $13, $23, and $37 million are direct and the remainder are secondary impact incomes.
- The increase in annual State tax revenue associated with increased labor income will be $1.7, $3.1, and $5 million, respectively.

Since the change in labor income reflects the net contribution of a resource to the Regional social welfare, this report has used the change in labor income to calculate the Regional direct value of irrigation water. The increases in direct value to the Regional economy from use of river water for irrigation in the SSRD 1 system 55,000 AF, 100,000 AF, and the Full Project scenarios are $340, $330, and $328 per AF, respectively. The increases in total value (including the secondary impact) are $652, $633, and $629 per AF, respectively.

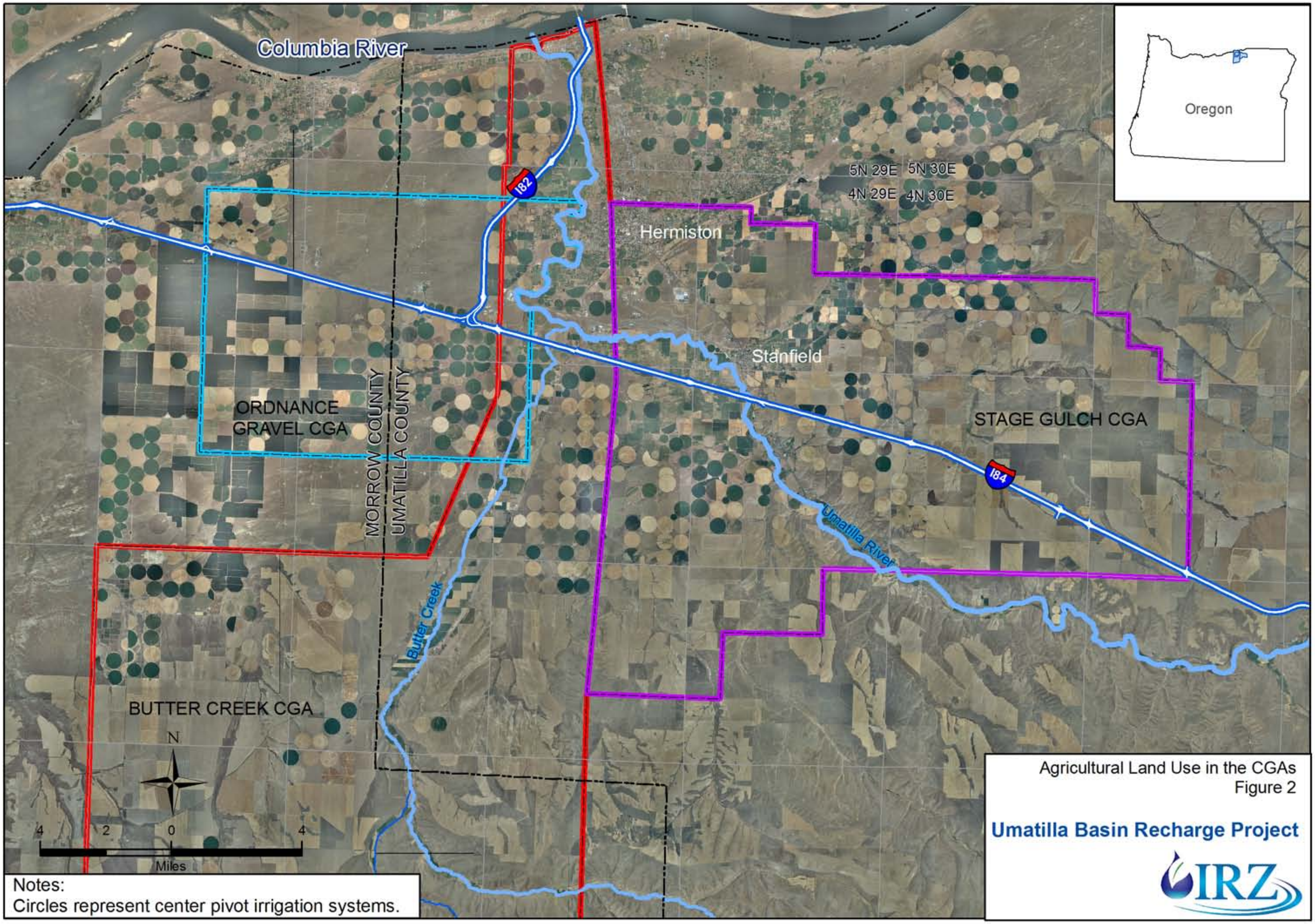
The total economic value of diverting river water to benefit irrigation, fisheries resources, municipal/domestic, and aquifer replenishment uses associated with the SSRD 1 system 55,000 AF, 100,000 AF, and the Full Project scenarios are $383, $373, and $371 per AF, respectively. Compared with the total annualized cost values of $116, $120, and $118 per AF, respectively, the total annual benefit significantly outweigh the total annual cost. The proposed engineering scenarios appear to be economically feasible from the RED perspective.



CGAs Vicinity Map
Figure 1

Umatilla Basin Recharge Project

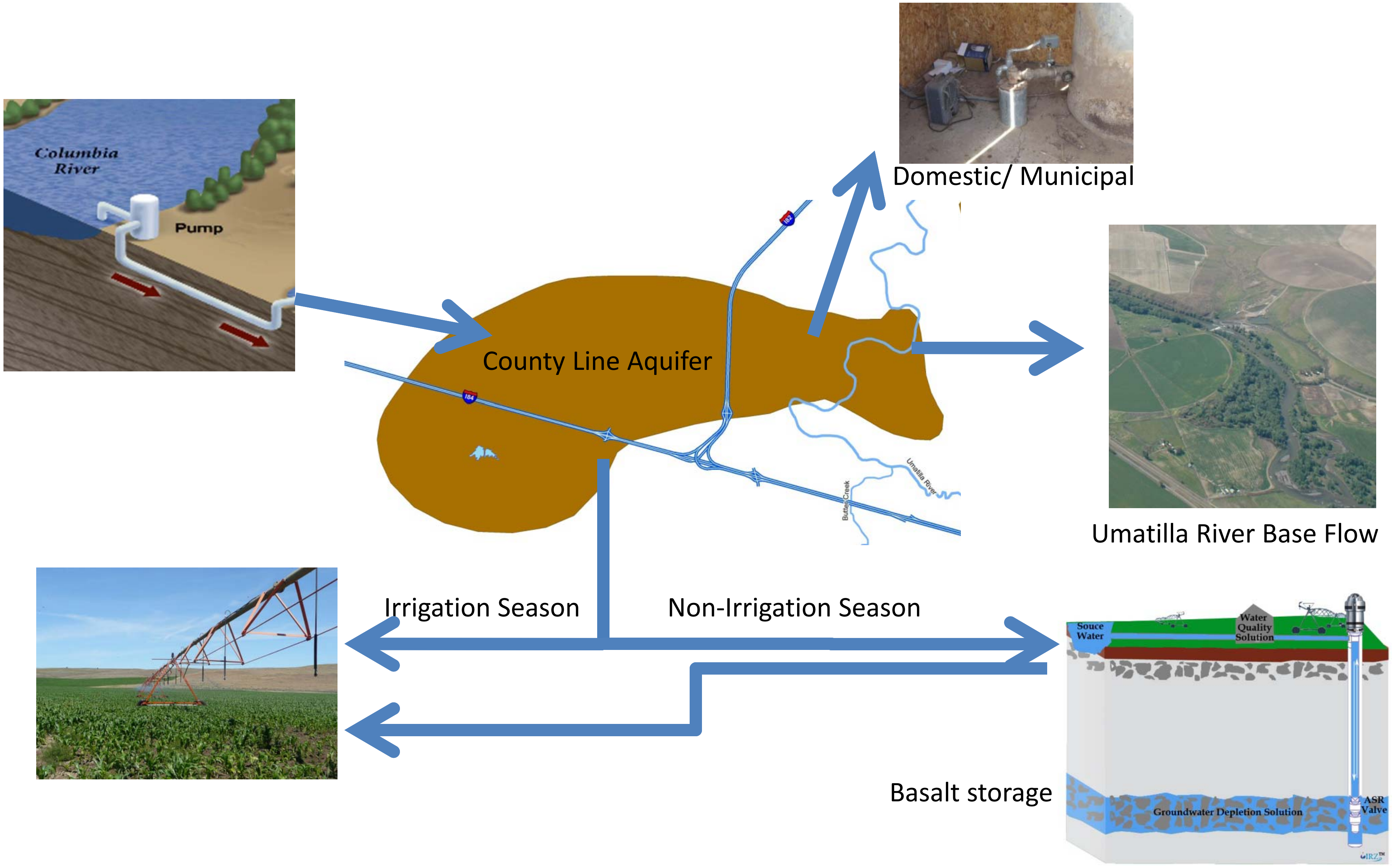
IRZ



Notes:
Circles represent center pivot irrigation systems.

Agricultural Land Use in the CGAs
Figure 2

Umatilla Basin Recharge Project



County Line Aquifer

Domestic/ Municipal

Umatilla River Base Flow

Irrigation Season

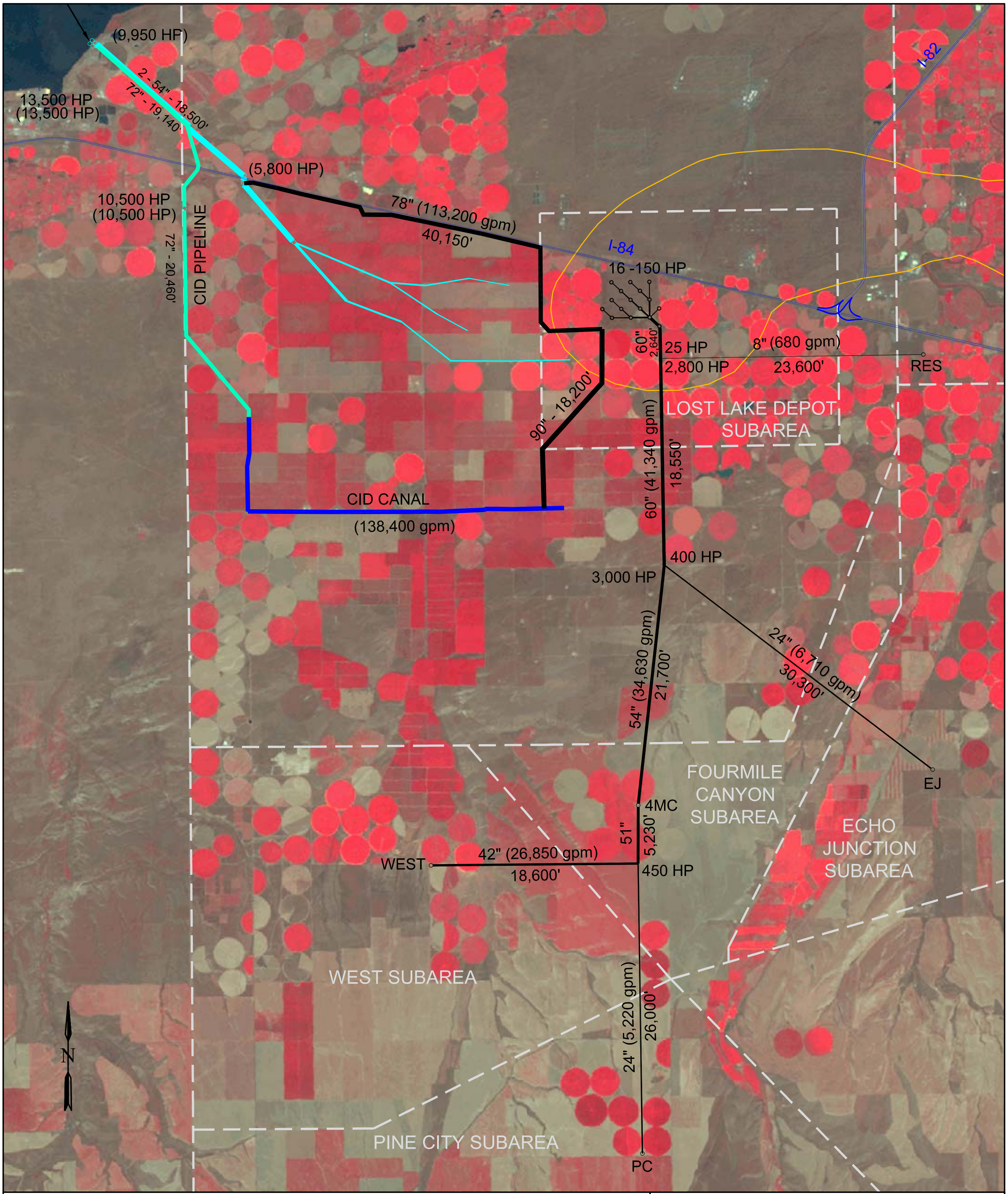
Non-Irrigation Season

Basalt storage

Agricultural ASR Concept
Figure 3

Umatilla Basin Recharge Project

IRZ



0 6,000 12,000 24,000

1" = 12,000 Ft

Legend

Boundary of County Line Aquifer

Notes:

New Pipelines are shown in black.

SSRD 1 System
100,000 Acre feet Option
Figure 4

Umatilla Basin Recharge Project

TECHNICAL MEMORANDUM

TO:	Barry Norris - OWRD	DATE:	24 July 2008
FROM:	Said Amali, Ph.D., PE Fred Ziari	PROJECT:	Umatilla Basin Regional Aquifer Recovery Assessment
SUBJECT:	Task 1.D - Estimate Water Needs	IRZ Project No.: 08-016	

The Oregon Water Resources Department (OWRD) has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

This technical memorandum includes a summary of information and findings regarding the estimated irrigation-season water needs within the CGAs. Figure 1 depicts the boundary of the CGAs.

1.0 EXECUTIVE SUMMARY

The total annual volume of water needed to meet the curtailed groundwater rights, future assumed domestic and municipal supply needs, and the amount to remain in the alluvial and basalt aquifers within the CGAs is approximately 174,000 acre feet (AF). This target volume will restore approximately 127,000 AF of curtailed groundwater rights, allow an additional 2,000 AF of water for domestic and other exempt well uses and 5,000 AF for additional municipal supply, and 24,000 AF to enhance Umatilla River instream flows. No distinction is made in this assessment between storage within the alluvial or basalt aquifers. The decision regarding which aquifer is best suited to meet the various needs will be made following completion of separate assessments of storage potential and engineering factors.

2.0 OBJECTIVES

This assessment includes developing estimates of the following water needs within the CGAs:

- Curtailed irrigation water rights during the irrigation season from March 1 through October 31

- Return flow to augment Umatilla River flow to enhance aquatic habitat
- Domestic/exempt and municipal water supply demands
- Stored water which can't be pumped by law

The total amount of water need from the above categories will be compared with the "available" water volumes in Columbia River. Additionally, the results and findings of this task will be used in other project tasks to make decisions regarding the size of the infrastructure system needed, any additions, modifications, or upgrades to the existing water distribution system, and to assist with the phased design of a water withdrawal and distribution system.

3.0 RESULTS AND FINDINGS

The amount of water need was estimated for each of the four categories presented above, as follows:

3.1 Curtailed Irrigation Water Rights

There are 63,489 acres of farmland within the four CGAs which are irrigated with groundwater pumped from alluvial and basalt aquifers. The total amount of certificated irrigation groundwater rights for this acreage is 190,466 AF (OWRD 2008). However, due to declining levels of water in the alluvial and basalt aquifers in the CGAs, Oregon promulgated OAR 690-507 to define specific levels of groundwater withdrawal volumes within smaller administrative units (sub-areas) in the Butter Creek and Stage Gulch CGAs. These withdrawal limits are known as Sustainable Annual Yields (SAYs). Similarly, the 2 April 1976 Water Right Order stipulated a maximum annual groundwater volume which can be pumped from each sub-area in the Ordnance Gravel CGA and limited the groundwater withdrawals from each sub-area in the Ordnance Basalt CGA to the water rights in effect at the time. The OWRD staff allocates groundwater pumping volumes within each CGA and sub-area so that the total amount of groundwater pumped doesn't exceed the stipulated SAY volumes or total permitted volume in Ordnance Gravel CGA. The CGAs are closed to further appropriation of groundwater other than for exempt and stock watering uses. The boundaries of the sub-areas are shown on Figure 1.

Table 1 contains a summary of the water rights and SAYs by sub-area and CGA. In many sub-areas the SAYs are low enough to result in significant curtailment of the irrigation groundwater rights. The curtailment amount varies from no curtailment (e.g., in Westland Road gravel sub-area) to 94 percent (%) of the total permitted groundwater rights (e.g., in Sub-Area E of the Stage Gulch CGA). For all CGAs combined, the curtailed volume of groundwater rights adds up to a total of 127,038 AF or 67% of the total groundwater rights.

The curtailed volumes and percentages for the sub-areas indicate that the Butter Creek CGA is the most restricted of the areas (82%). Although the total groundwater rights in the Stage Gulch CGA is similar to the Butter Creek CGA, its use is less restricted (66% curtailment). The Ordinance Gravel CGA is the least restricted of the CGAs (35%). Currently, there is no curtailment of the existing groundwater rights from the Ordnance Basalt CGA.

A review of the information summarized in Table 1 indicates that the extent of the impact of the curtailment is not uniform between the sub-areas. Various factors can be used to prioritize the sub-areas in terms of the "severity" of their water right curtailment. If we compare the total amount of issued groundwater rights versus the curtailed volumes, the following sub-areas may be placed in a "high" restriction category based on the total amount of certificated water rights greater than 5,000 AF and the generally high degree of curtailment:

1. Butter Creek Basalt CGA
   - Sub-area West where 39,396 AF of the total 45,066 AF of water rights is curtailed (87%)
   - Sub-area Pine City with 7,658 AF curtailment out of 11,808 AF (65%)
   - Sub-area Echo Junction with 9,846 AF curtailment out of 11,106 AF (89%)
   - Sub-area Four Mile Canyon with 3,764 AF curtailment out of 5,064 AF (74%)
2. Stage Gulch Basalt CGA
   - Sub-area A where 21,521 AF of the total 32,971 AF of water rights is curtailed (65%)
   - Sub-area H with 9,300 AF curtailment out of 18,150 AF (51%)
   - Sub-area G with 9,922 AF curtailment out of 12,672 AF (78%)
   - Sub-area D with 5,549 AF curtailment out of 8,799 AF (63%)
3. Ordnance Gravel CGA
   - Sub-area Lost Lake-Depot with 8,000 AF curtailment out of 17,000 AF (47%)

The following sub-areas may be placed in a second "medium" restriction category:

1. Butter Creek Basalt CGA
   - Sub-area North where 2,443 AF of the total 2,693 AF of water right is curtailed (91%)
   - Sub-area East with 1,650 AF curtailment out of 2,370 AF (70%)
   - Sub-area South with 1,598 AF curtailment out of 2,598 AF (62%)
2. Stage Gulch Basalt CGA
   - Sub-area B with 3,214 AF curtailment out of 3,414 AF (94%)
   - Sub-area C with 2,933 AF curtailment out of 3,333 AF (88%)

The remaining sub-areas either have very small volume of total water rights or no curtailment at this time. These sub-areas may be grouped in a "low" restriction category. The above prioritization will be used to assist with development of the basin-wide recharge water delivery system.

Finally, the groundwater levels in portions of the CGAs have continued to decline since establishment of the SAYs (OWRD 2003). There appears to be general consensus within OWRD that stabilization of the aquifers can only be accomplished if the SAYs were reduced to lower values than currently established.

Reasonable estimates of water budget components for the CGAs are not available at this time. For the purpose of this project, it is assumed that satisfying the total curtailed volume of 127,083 AF in the CGAs will adequately address irrigation water needs.

3.2 Umatilla River Aquatic Habitat Enhancement

The Umatilla River flow decreases to its minimum level during the late summer and early fall months with an accompanying rise in water temperature. The decrease in flow is due partly to natural reduction in snow pack and runoff and partly to summer irrigation withdrawals. Significant flow augmentation occurs from a large storage reservoir located on McKay Creek near Pendleton. However, during parts of the summer this flow augmentation is largely withdrawn from the Umatilla River before it reaches the Columbia River. Observed summer flows increase downstream of the McKay Creek confluence, where nearly 200 cubic feet per second (cfs) of McKay Reservoir water enters the Umatilla River (Oregon Department of Environmental Quality 2001). Umatilla River flows then decrease dramatically between the City of Echo and Westland Road due to irrigation diversions. Below River Mile 26.3, there are areas where Umatilla River flow increases as a result of irrigation and urban drain and groundwater return flows.

A discussion of target flows for the reaches of the Umatilla River within the CGAs is presented in HDR (2009). Computer modeling of flow regimes summarized in DEQ (2001) suggests that a target flow of 200 cfs in addition to “natural flow” conditions would be needed to achieve significant water temperature reductions in Umatilla River downstream of river mile 25 during the months of July and August. The natural flow conditions were defined as flow not affected by management (irrigation withdrawals, McKay Reservoir releases, etc.). Although the model results have not been discussed in detail elsewhere and their validity and ramifications not been ascertained, an additional 200 cfs of flow below River Mile 26.3 is considered in this assessment for river flow enhancement and fish habitat improvement purposes. It is recognized that any flow increase and reduction in water temperature during the low flow months will be of great environmental benefit.

3.3 Other Water Supply Demands

Other sources of water demand considered for this assessment include existing and future domestic exempt groundwater uses and municipal water needs. The draft *Umatilla Sub-Basin 2050 Water Management Plan* (Umatilla County 2008) includes an estimate of approximately 2,000 AF of current exempt domestic water use in the CGAs for both Umatilla and Morrow counties. For the purpose of this assessment, we assume that an additional 2,000 AF of stored groundwater can be allocated to future exempt domestic groundwater users.

The 2050 Plan also contains approximate total water use volumes by the cities of Echo, Hermiston, and Stanfield in 2005. The annual water use volumes add up to a total of approximately 5,000 AF. Although the water use by the City of Irrigon was not included, we assume that the total of 5,000 AF will adequately cover the future potential municipal needs of these cities.

3.4 Stored Water That Can't Be Pumped By Law

Based on OAR 690-350, not all of the recharged water can be available for later withdrawal. Fifteen percent (15%) or more of the alluvial aquifer and up to 5% of basalt aquifer recharge water may be designated by OWRD as permanently needing to remain in storage every year. For AR permits, OWRD can condition to allow recovery up to 85% of the recharged water pursuant to negotiation or 100% (by context) pursuant to a "definitive" groundwater investigation (OAR 690-350-0120(5)(f)). For ASR permits, OWRD can condition them to allow recovery of up to 100% of the injected volume (OAR 690-350-0020(5)(j) and 0030(6)(f)). Since the relative amounts of recharge water to be stored in the alluvial and basalt aquifers are not known at this time, for the purpose of developing an initial estimate of total water need, an average volume of 10% of total imported water will be designated to remain in the aquifers and not recovered.

3.5 Total Estimated Water Need

The total estimated water need of the CGAs is the total of the above specific needs as agreed-upon by the stakeholders. This total is estimated to be 174,000 AF. The water need estimates are summarized in Table 2.

4.0 COMPARISON WITH COLUMBIA RIVER AVAILABLE WATER

The target water need volume of 174,000 AF may be met from a combination of Columbia and Umatilla River sources. The months of September, October, and December through March of each year have been designated as having "water available" for further appropriation (OWRD 2007). Table 3 lists the monthly water availability behind McNary and Bonneville dams as determined by OWRD.

To evaluate potentially suitable water withdrawal times at the needed diversion rates, it was assumed that the total water need of 174,000 AF would be diverted during the months of September, October, January, February, and March (there is no availability in November and December availability is very low to be practical). Further assuming constant withdrawal rates during these five (5) months, a total daily diversion rate of more than 690 cfs (310,000 gallons per minute or gpm) may be estimated from the Columbia River. The largest currently-operating pump station on the Columbia River has a capacity of approximately 144,000 gpm, the smallest one of note approximately 5,000 gpm, and the total pumping capacity from the Columbia River is more than 527,900 gpm. Although many other factors must be considered for initial planning purposes such as pumping heads, pipeline capacity and alignment, operation and maintenance needs, winterization needs, impact of OAR 690-033 (Division 33 rules) on diversion timing, and others, it appears that there is sufficient existing pumping capacity to withdraw water along the reach of the Columbia River near the CGAs.

5.0 REFERENCES

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TABLE 1
Curtailed Groundwater Amounts[a]
Estimate Water Needs

Critical Groundwater Area	Sub-Area	Irrigated Acreage (acres)	Groundwater Right [b] (acre-feet)	SAY [b] (acre-feet)	Curtailment (acre-feet)	Curtailment %
Ordnance Gravel						
	Lost Lake	5,667	17,000	9,000	8,000	47%
	Westland Road	2,000	6,000	6,000	0	0%
Ordnance Basalt	Ordnance Basalt	2,267	6,800	6,800	0	0%
Butter Creek Basalt						
	North	898	2,693	250	2,443	91%
	Section 21	17	52	28	24	46%
	Echo Junction	3,702	11,106	1,260	9,846	89%
	4 Mile Canyon	1,688	5,064	1,300	3,764	74%
	East	790	2,370	720	1,650	70%
	West	15,022	45,066	5,670	39,396	87%
	Pine City	3,936	11,808	4,150	7,658	65%
	South	866	2,598	1,000	1,598	62%
Stage Gulch Basalt						
	A	10,990	32,971	11,450	21,521	65%
	B	1,138	3,414	200	3,214	94%
	C	1,111	3,333	400	2,933	88%
	D	2,933	8,799	3,250	5,549	63%
	E	50	150	150	0	0%
	F	140	420	200	220	52%
	G	4,224	12,672	2,750	9,922	78%
	H	6,050	18,150	8,850	9,300	51%
Totals		**63,489**	**190,466**	**63,428**	**127,038**	**67%**

Notes:

a) Please note that the listed curtailments are "paper" curtailments. Actual curtailments may be less since actual farm practices are usually less than the "paper" groundwater rights. Additionally, the sub-area volume summaries represent both primary and supplemental groundwater rights.

b) Data from OWRD (Doug Woodcock, Personal Communication 2008).

TABLE 2
Estimated Total Water Need In the CGAs
Estimate Water Needs

Water Need	Volume (Acre-Feet)
Curtailed Irrigation Groundwater Rights	127,000(a)
Future Municipal & Domestic exempt Groundwater Use	7,000
Umatilla River Flow Enhancement	24,000(b)
Remain in Aquifer	16,000(c)
Total	**174,000**

Notes:

a) See Table 1. Value rounded to the nearest 1,000 acre foot.
b) This volume is equivalent to 200 cfs of flow for two months.
c) This volume is equivalent to 10 percent of total of other uses, as described in the text, round to the nearest 1,000 acre foot.

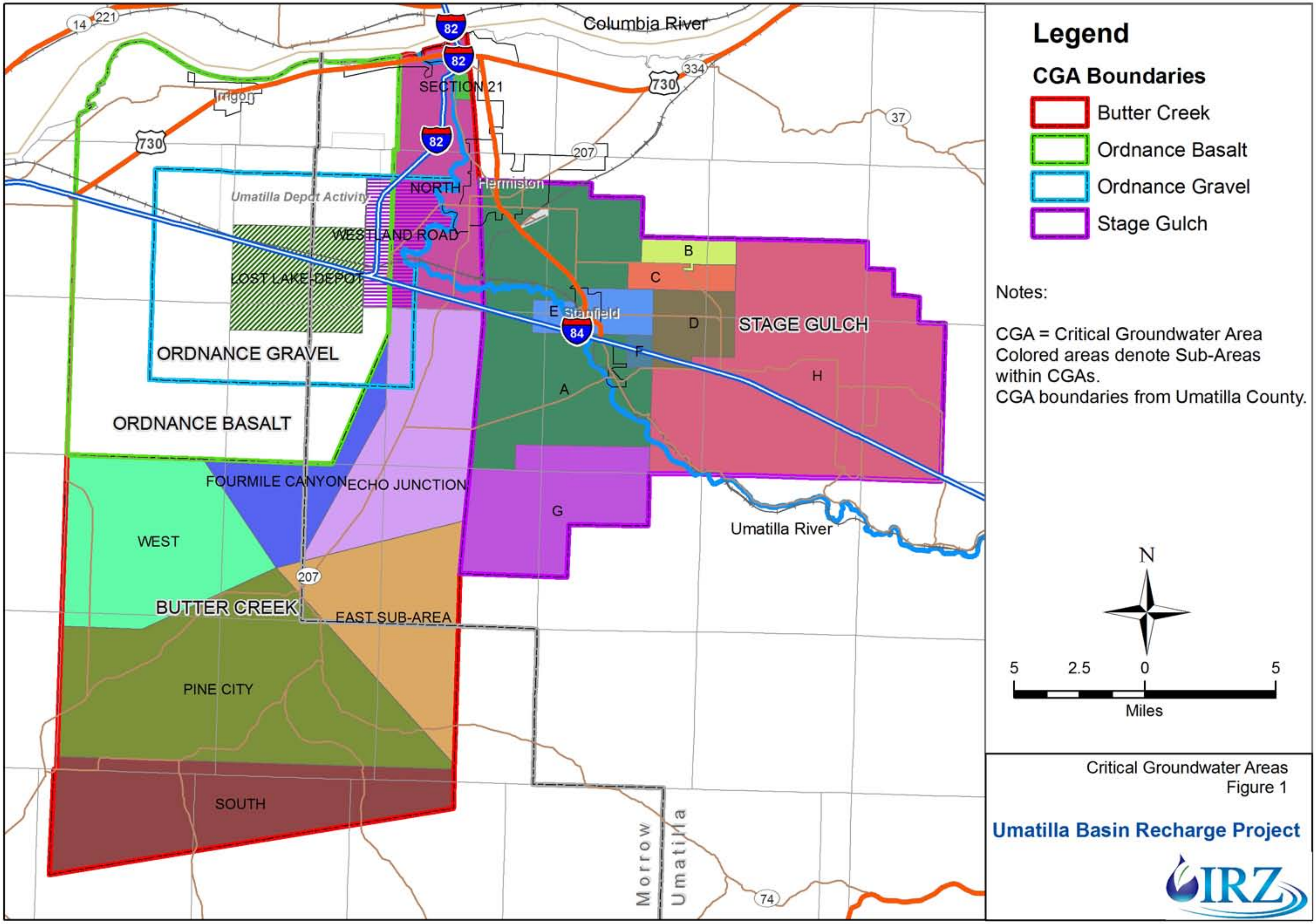
TABLE 3
"Water Availability" in Columbia River[(a)]
Estimate Water Needs

Month	Water Availability (cfs)[(b)]	
	McNary Pool	Bonneville Pool
September	108,000	114,365
October	111,000	118,532
November	No Availability	
December	90	90
January	15,015	15,015
February	24,030	24,030
March	24,744	24,744
Other months	No Availability	

Notes:

(a) Source: OWRD December 2007. Water availability is estimated by subtracting the target stream flows from the 50% exceedance stream flow.

(b) cfs = cubic feet per second



Notes:

CGA = Critical Groundwater Area
Colored areas denote Sub-Areas within CGAs.
CGA boundaries from Umatilla County.

Critical Groundwater Areas
Figure 1

Umatilla Basin Recharge Project

TECHNICAL MEMORANDUM

TO:	Barry Norris - OWRD	DATE:	25 August 2008
FROM:	Paul Wattenburger, Ph.D. PE Said Amali, Ph.D., PE	PROJECT:	Umatilla Basin Regional Aquifer Recovery Assessment
SUBJECT:	Task 1.E – Assess Infrastructure Suitability	IRZ Project No.: 08-016	

The Oregon Water Resources Department (OWRD) has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

This technical memorandum includes a summary of information and findings regarding the types and conditions of the major irrigation water distribution systems in the CGAs, or immediately nearby, which may potentially become part of a system(s) to withdraw surface water, and convey and distribute it to potential aquifer injection points. Figure 1 depicts the boundary of the CGAs.

1.0 EXECUTIVE SUMMARY

Thirteen private, and nine semi-public (e.g. irrigation districts) and public water delivery systems have been identified in and immediately adjacent to the CGAs. The private systems withdraw their water from the Columbia River through pump stations and the other systems from one or both Columbia and Umatilla Rivers through pumping stations or diversion canals. Information regarding components, pumping capacities, carrying capacities of pipelines, and overall condition of these systems are summarized in the attached tables.

The pumping capacities of the private systems on the Columbia River range from 22,000 gallons per minute (gpm) to 122,500 gpm (approximately 50 to 270 cubic feet per second or cfs, respectively). The total pumping capacity of these systems together is 306,500 gpm (approximately 681 cfs). The public and semi-public systems have pumping capacities of 11,000 to 144,000 gpm (approximately 24 to 320 cfs, respectively). The total diversionary capacity (pumps and canals) by these systems is approximately 675,000 gpm (1,500 cfs).

Many of the private systems extend close to or into CGAs providing geographically advantageous alignments and terminal points. These, and the semi-public and public systems, have many more components and laterals which are not presented in this memorandum due to their complexity. However, all components will be considered in the conceptual design of recharge and recovery systems to be completed as part of another task.

2.0 OBJECTIVES

The objective of this assessment is to identify the existing private and the public Bureau of Reclamation (BOR) water diversion and delivery infrastructure, their main components, alignment, capacity and assess their general condition and maintenance needs. The following information regarding the main components of the existing agricultural water supply infrastructure in the CGAs was collected:

- Components, capacity, condition, and operation and maintenance needs of private pumping stations on the Columbia River and existing BOR's Phase I and II systems including pipelines and open canals.
- Operational needs of the private and public systems and opportunities and challenges for "off-season" use for recharge including available capacity, and need for improvements such as additional piping or canals, laterals, pump stations, diversions.
- Construction information for selected existing wells that may be potential basalt recharge wells to determine their suitability for efficient recharge.

This information will be used to incorporate the infrastructure of existing systems in the design of a Umatilla Basin-wide recharge water delivery system. The target volume of water to be recharged in the aquifers has been estimated to be 174,000 acre feet (AF) (IRZ 2008). The results and findings of this task will be used in other project tasks to make decisions regarding the size of the infrastructure system needed, any additions, modifications, or upgrades to the existing water distribution system, and to assist with the phased design of a water withdrawal and distribution system.

3.0 RESULTS AND FINDINGS

There are a number of private irrigation water distribution systems, irrigation districts, and the BOR Umatilla Basin Project Phases I and II water delivery systems currently operating within/near the CGAs. These systems either directly pump water from the Columbia River via pump stations, divert water from Umatilla River through gravity-flow diversion canals, pump water from the canals, or rely on groundwater wells. Thereafter, complex systems of pressurized pipelines, booster pump stations, open canals, laterals, and on-farm piping and ditches are used to convey the water to individual fields. The systems often branch, and their delivery capacities decrease, from the point of water withdrawal toward the fields. Some systems are very localized and either use groundwater wells or pump from the irrigation districts' canals and ditches. Only the main components/segments of the larger irrigation systems are included in this assessment. Once suitable locations for groundwater recharge in both alluvial and basalt aquifers are identified, additional components of specific systems, and other small systems, may be considered.

Table 1 includes the infrastructure capacity information for 13 private systems and Table 2 for the Columbia Improvement District (CID), the Regional Water System (RWS), four irrigation districts, the County Line Water Improvement District (CLWID) and the BOR Phase I and II systems. Figures 2 and 3 show the locations and alignments of these systems.

In reviewing the tabulated information note the following:

- Information and data regarding the private systems was obtained from private client files and is used with their approval. Additional information for these systems may be used to refine the feasibility assessment of selected basin-wide systems once the locations, sizes, and other requirements for the basin-wide systems are identified, and upon obtaining further approval from the system owners.
- The information regarding the irrigation districts and BOR systems was obtained from available public reports as referenced below.
- There are farms that are irrigated with food processing or power generating facility blowdown water. These systems are shown on Figure 2 (with a different color) for completeness and not listed in the summary tables since the regulatory restrictions regarding their use for potable water conveyance makes their inclusion in a basin-wide recharge water delivery system unlikely.
- The RWS supplies water to the Regional Water Treatment plant where water is treated for municipal and industrial users.
- The BOR Phase I Umatilla Basin Project supplies water from the Columbia River to the West Extension Irrigation District (WEID), and Phase II supplies water from the Columbia River to the Stanfield and Hermiston irrigation Districts (SID and HID, respectively).

Other than the RWS, the other private and public irrigation water supply systems may be used during the non-irrigation, and to some extent the "shoulder-irrigation", season for river water withdrawal and conveyance purposes. The BOR is investigating the use of the shoulder-, and off-season capacity of the Umatilla Basin Phase II systems to increase water supplies in the basin in its Umatilla Basin Water Supply Study. The specific systems used for importation and storage of river water in this project are discussed in IRZ (2009). The maintenance, repair, and upgrade needs of these systems are used to estimate the cost of these systems (for instance winterization needs constitute potential system modifications and upgrades).

4.0 INFRASTRUCTURE AVAILABILITY RELATIVE TO SUB-AREA CURTAILMENTS

The infrastructure layout relative to sub-area boundaries is depicted on Figures 2 and 3. The highest priority sub-areas, as defined in IRZ (2008) are located near one or more existing delivery systems. For example, private Systems 1, 2, and 3 extend toward Stage Gulch Basalt CGA sub-areas D and H, the WID Hunt Canal extends through sub-area A, and private System 7 extends toward Ordnance Gravel CGA Lost Lake-Depot sub-area. Additionally, the CID system and private Systems 8 through 11 extend toward/into Butter Creek Basalt CGA high priority sub-areas.

5.0 REFERENCES

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TABLE 1
Information for Private Irrigation Systems[a]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)[b]	Total Capacity (gpm)	Total Head (feet)	Condition[c]	Pipeline/Canal Section[d]	Nominal Diameter (inches)	Length (feet)	Type[e]	Condition[c]
1	River	5,200	26,000	600	Good	RPS to BPS1/2	30	8,630	Steel – CML	Good
	Booster 1	1,000	16,000	160	Good	BPS1 to C1	30	3,230	Steel - CML	Good
						C1 to C2	24	4,100	Steel - CML	Good
	Booster 2	800	10,000	240	Good	BPS2 to C2	24	7,330	Steel - CML	Good
						C2 to C7	24	7,230	Steel - CML	Good
2	River	7,500	43,000	585	Good	RPS to BPS1	48	24,000	Steel - CML	Good
	Booster 1	4,800	43,000	300	Good	BPS1 to J5/BPS2	40	11,150	Steel	Unknown
	Booster 2	1,400	23,000	190	Good	BPS2 to C5	26	5,420	Steel	Unknown
						C5 to C7	22	5,430	Steel	Unknown
						C7 to C8	16	2,330	Steel	Unknown
						J5 to J6	36	1,310	Steel	Unknown
						J6 to C14	24	430	Steel	Unknown
						C14 to C15	24	4,790	Steel	Unknown
						C15 to J7	20	3,440	Steel	Unknown
						J7 to C18	16	2,880	Steel	Unknown
						J5 to J8	36	2,320	Steel	Unknown
						J8 to BPS3	24	1,950	Steel	Unknown
	Booster 3	350	10,900	100	Good	BPS3 to C22	24	4,560	Steel	Unknown
						C22 to C21	20	3,930	Steel	Unknown
						C21 to C20	16	4,590	Steel	Unknown

TABLE 1
Information for Private Irrigation Systems[a]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)[b]	Total Capacity (gpm)	Total Head (feet)	Condition[c]	Pipeline/Canal Section[d]	Nominal Diameter (inches)	Length (feet)	Type[e]	Condition[c]
3	River	2,800	22,000	400	Excellent	RPS to BPS	30	3,050	Steel	Unknown
	Booster	2,800	22,000	315	Excellent	BPS to CL-A	30	10,600	Steel	Unknown
						CL-A to CL-1	24	3,900	Steel	Unknown
						CL1 to CL-3	24	2,750	Steel	Unknown
						CL-3 to CL-6	24	4,580	Steel	Unknown
						CL-6 to CL-7	16	3,270	Unknown	Unknown
4	River	6,000	33,000	600	Poor	River to C22	42	5,850	Steel	Unknown
						C22 to C32	42	2,270	Steel	Unknown
						C32 to C37	36	5,140	Steel	Unknown
						C37 to C54	30	4,940	Steel	Unknown
						C54 to C59	26	5,790	Steel	Unknown
						C37 to C46	24	4,740	Steel	Unknown
5	River	1,500	27,500	180	Poor	River to Sump#2	42	16,050	Steel	Poor
						Canal Sump#2 to Sump#1		5,800	Earthen	Poor
	Sump#2	2,200	14,450	365	Poor	Sump#2 to C5	30	2,385	Steel	Poor
						C5 to C6	26	2,835	Steel	Poor
						C6 to C7	24	2,620	Steel - CML	Good
						C7 to C8	18	2,680	Steel - CML	Good
	Sump#1	2,000	16,650	365	Poor	Sump#1 to C1	30	3,545	Steel	Poor
						C1 to C2	26	2,700	Steel	Poor

TABLE 1
Information for Private Irrigation Systems[a]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	**Station Type**	**Total Size (hp)[b]**	**Total Capacity (gpm)**	**Total Head (feet)**	**Condition[c]**	**Pipeline/Canal Section[d]**	**Nominal Diameter (inches)**	**Length (feet)**	**Type[e]**	**Condition[c]**
						C2 to C3	22	2,550	Steel - CML	Good
6	River	4,000	32,500	292	Good	River to C1	36	10,050	Steel	Unknown
						C1 to C4	30	5,750	Steel	Unknown
						C4 to BPS1	24	5,040	Steel	Unknown
	Booster 1	250	10,800	70	Unknown	BPS1 to BPS2	20	2,850	Steel	Unknown
	Booster 2	150	5,500	94	Unknown	BPS2 to C5	20	4,300	Steel	Unknown
7	River	1,350	122,500	37	Excellent	River to BPS1	60	260	Steel	Good
	Booster 1	8,600	123,800	244	Excellent	BPS1 to BPS2	(2) - 54	18,400	Steel	Good
	Booster 2	7,800	100,000	180	Excellent	BPS2 to BPS3	54	7,200	Steel	Unknown
						BPS2 to BPS3	48	7,200	Steel	Unknown
	Booster 3	5,000	94,000	130	Excellent	BPS3 to J1	36	9,400	Steel	Unknown
						J1 to T	30	3,100	Steel	Unknown
						T to J2	26	2,800	Steel	Unknown
						J2 to W	24	700	Steel	Unknown
						W to Z1	18	3,700	Steel	Unknown
						J1 to U	26	5,200	Steel	Unknown
						U to X	22	3,100	Steel	Unknown
						X to Z2	18	4,200	Steel	Unknown
						BPS3 to J3	54	2,500	Steel	Unknown
						J3 to J4	54	1,000	Steel	Unknown

TABLE 1
Information for Private Irrigation Systems[(a)]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)[(b)]	Total Capacity (gpm)	Total Head (feet)	Condition[(c)]	Pipeline/Canal Section[(d)]	Nominal Diameter (inches)	Length (feet)	Type[(e)]	Condition[(c)]
						J4 to C28	42	3,400	Steel	Unknown
						C28 to J5	36	5,500	Steel	Unknown
						J5 to C35	26	6,000	Steel	Unknown
						C35 to C36	24	5,300	Steel	Unknown
						C36 to C31	22	5,500	Steel	Unknown
						J3 to J	36	3,300	Steel	Unknown
						J to J6	36	3,300	Steel	Unknown
						J6 to L	30	2,100	Steel	Unknown
						L to J7	24	900	Steel	Unknown
						J7 to N	22	3,400	Steel	Unknown
8	Canal	1,050	13,300	250	Unknown	Canal to Pond	36	18,800	CML	Good
	Pond	1,600	16,000	290	Unknown	Pond	30	9,000	Steel	Unknown
9	Canal	2,750	22,000	423	Good	Canal to CL-A	(2) -34	1,340	CML	Good
						CL-A to CL-D	34	7,920	CML	Good
						CL-A to CL-D	30	7,920	CML	Good
						CL-D to BPS	30	13,770	CML	Good
	Booster 1	450	8,300	168	Good	BPS1 to CL-E	20	1,380	CML	Good
						CL-E to CL-F	24	2,530	PVC	Excellent
						CL-F to CL-G	21	2,300	PVC	Excellent
	Booster 2	1,150	11,300	334	Unknown	BPS2 to C1	30	10,100	CML	Unknown

TABLE 1
Information for Private Irrigation Systems[a]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)[b]	Total Capacity (gpm)	Total Head (feet)	Condition[c]	Pipeline/Canal Section[d]	Nominal Diameter (inches)	Length (feet)	Type[e]	Condition[c]
10	Canal	800	8,600	294	Unknown	Canal to 9C2	26	2,000	Steel	Unknown
						9C2 to 9T1	24	3,800	Steel	Unknown
						9T1 to 9C4	20	2,700	Steel	Unknown
						9C4 to 9C6	16	5,400	Steel	Unknown
11	Canal	1,700	15,000	370	Excellent	Canal to BPSs	30	19,800	Steel	Unknown
	Booster 1	300	3,300	300	Excellent					
	Booster 2	200	5,500	140	Excellent					
	Booster 3	120	4,800	80	Excellent					
12	Canal	1,225	13,500	290	Good	Canal to BPS1	24	10,400	PVC	Excellent
						Canal to BPS1	18	10,400	PVC	Excellent
13	Canal	400	5,000	240	Good	Canal to BPS	18	12,750	PVC	Excellent

Notes:

(a) Locations of the systems are shown on Figure 2. See memorandum for specific References cited.
(b) Hp = Horse Power, gpm = gallons per minute
(c) Description of the Condition is based on recent (last 5 years) experience working on the private systems, or based on professional judgement for systems for which we don't have recent information and for public systems.
Excellent = Generally new or otherwise maintained well
Good = Some regular maintenance completed and unit is generally in good condition

TABLE 1
Information for Private Irrigation Systems[a]
Assess Existing Infrastructure

Poor = Unit old and/or limited to no maintenance, or otherwise in poor condition due to soil condition, etc.
Unknown = information not available or very outdated.

(d) RPS = river pumping station listed in the second column
BPS = Booster pump station listed in the second column
C and CL = Cluster points
J, W, U, X, Z = Junction points
SID = Stanfield irrigation District
WTP = Water Treatment Plant
HGC = Hermiston Generating Plant
WEID = West Extension Irrigation District

(e) CML = Cement mortar lined.

TABLE 2
Information for Semi-Private and Public Irrigation Systems[a]
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)[b]	Total Capacity (gpm)	Total Head (feet)	Condition[c]	Pipeline/Canal Section[d]	Nominal Diameter (inches)	Length (feet)	Type[e]	Condition[c]
CID	River[f]	3,000	144,000	65	Excellent	River to BPS1	60	260	Steel	Good
	Booster 1	10,500	144,000	240	Excellent	BPS1 to BPS2	72	19,200	CML	Good
	Booster 2	10,500	144,000	240	Excellent	BPS2 to Canal	72	20,800	CML	Good
						Canal		37,300	Concrete Lined	
BOR I						Dam to Canal	72	1,400	Steel - CML	Excellent
						Canal	—	9,000	Concrete Lined	
	Lift	2,100	61,000	100	Excellent	Canal to WEID	60	3,000	Steel - CML	Excellent
BOR II	River	12,000	107,700	321	Excellent	RPS to Canal	66	5,125	Steel - CML	Excellent
						Canal	—	23,300	Concrete Lined	
						Canal to BPS	66	770	Steel - CML	Excellent
	Booster	1,200	67,300	60	Excellent	BPS to SID	60	6,200	Steel - CML	Excellent
RWS	River	1,200	11,000	310	Excellent	RPS to WTP	42	48,900	Steel - CML	Excellent
						WTP to HGC	18	12,600	PVC	Excellent
						WTP to Calpine	24	4,940	PVC	Excellent
SID			67,500[g]			Furnish Ditch		79,200	Lined and Unlined	Good[h]
			67,500			North Branch			Lined and Unlined	Good[h]
			43,650			Stanfield Branch			Lined and Unlined	Good[h]

TABLE 2
Information for Semi-Private and Public Irrigation Systems(a)
Assess Existing Infrastructure

System	Pumping Stations					Conveyance Structures				
No.	Station Type	Total Size (hp)(b)	Total Capacity (gpm)	Total Head (feet)	Condition(c)	Pipeline/Canal Section(d)	Nominal Diameter (inches)	Length (feet)	Type(e)	Condition(c)
WID			99,000			Hunt Ditch		62,000	Earthen canal	Good
			27,000			A-Line		52,000	Earthen canal	Good
			28,000			B-Line		44,000	Earthen canal	Good
HID			157,500			Feed Canal	—	132,000	Earthen canal	Good
						A-Line	—	54,040	Concrete Lined	Poor to Excellent (h)
			63,000			Maxwell Line	—	42,900	Earthen canal	Poor
WEID	Umatilla River	1,800	27,000		Poor					
	River	500	13,000		Poor					
			168,750			Main	—	142,560	Concrete Lined	Good
CLWID			22,500			WID B-Line to canal	36	6,700	Steel	Unknown
						Canal		12,600	Earthen canal	Excellent (i)

Notes:

(a) Locations of the systems are shown on Figure 2. See memorandum for specific References cited.

(b) Hp = Horse Power, gpm = gallons per minute

TABLE 2
Information for Semi-Private and Public Irrigation Systems[a]
Assess Existing Infrastructure

(c) Description of the Condition is based on recent (last 5 years) experience working on the private systems, or based on professional judgement for systems for which we don't have recent information and for public systems.

Excellent = Generally new or otherwise maintained well

Good = Some regular maintenance completed and unit is generally in good condition,

Poor = Unit old and/or limited to no maintenance, or otherwise in poor condition due to soil condition, etc.

Unknown = information not available or very outdated.

(d) RPS = River pumping station listed in the second column

BPS = Booster pump station listed in the second column

C and CL = Cluster points

J, W, U, X, Z = Junction points

SID = Stanfield irrigation District

WTP = Water Treatment Plant

HGC = Hermiston Generating Plant

WEID = West Extension Irrigation District

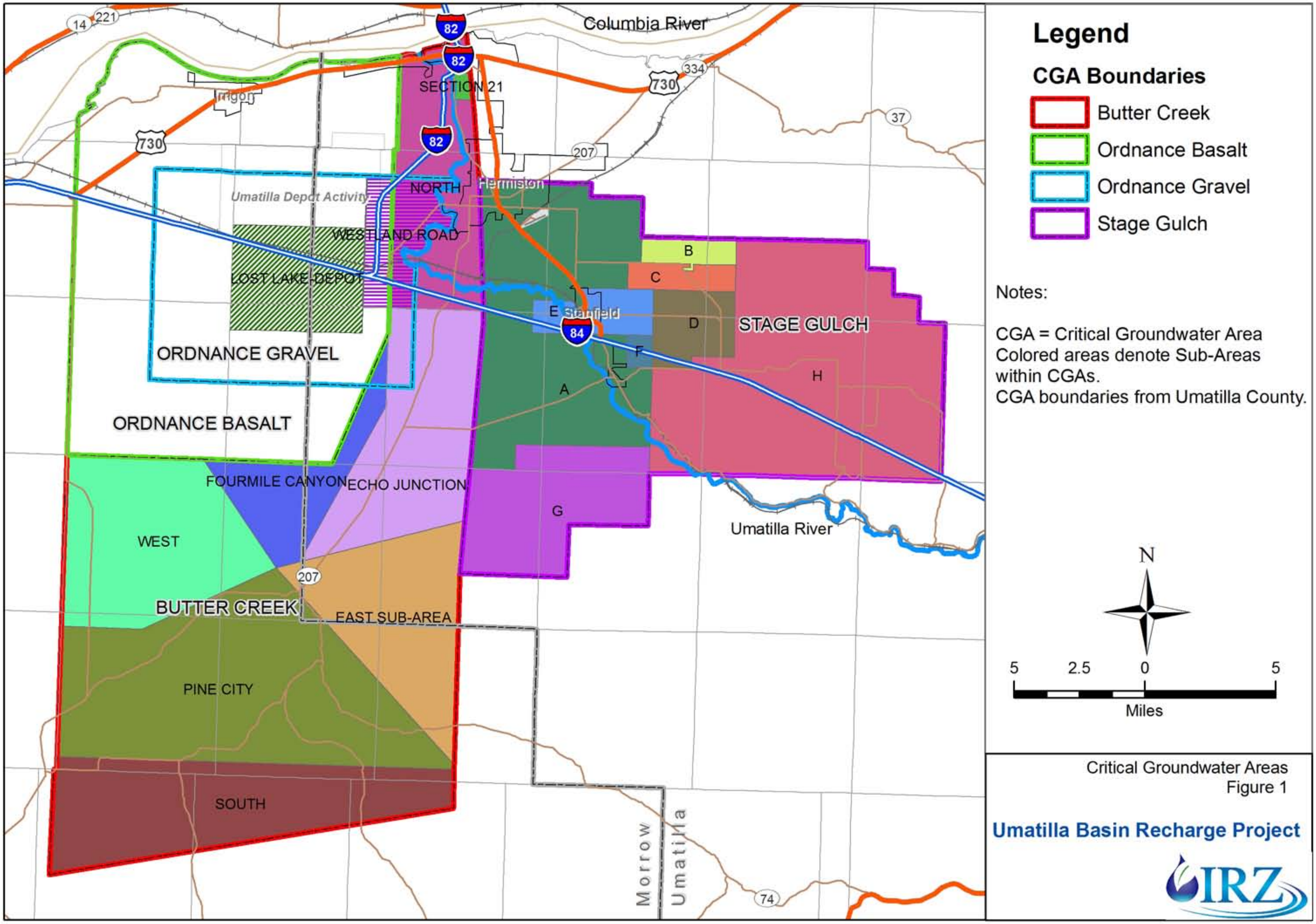
(e) CML = Cement mortar lined.

(f) All river pump stations refer to Columbia River unless otherwise noted.

(g) Capacities for canals are indicated in this column when a pump station is not included.

(h) Sections of canal are in much better condition than others.

(i) The goal of the unlined canal is to recharge the alluvial aquifer through leaking.



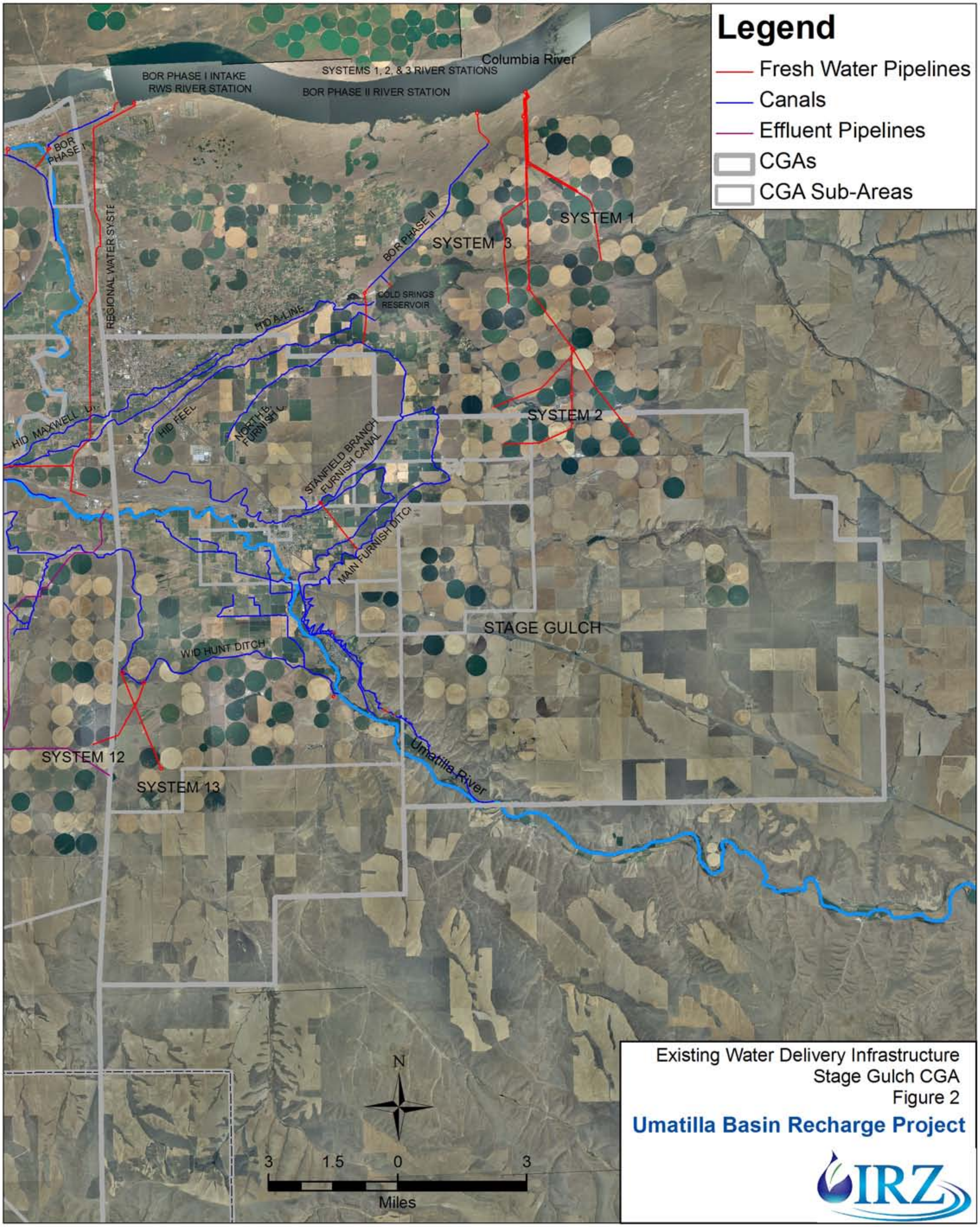
Notes:

CGA = Critical Groundwater Area
Colored areas denote Sub-Areas within CGAs.
CGA boundaries from Umatilla County.

Critical Groundwater Areas
Figure 1

Umatilla Basin Recharge Project

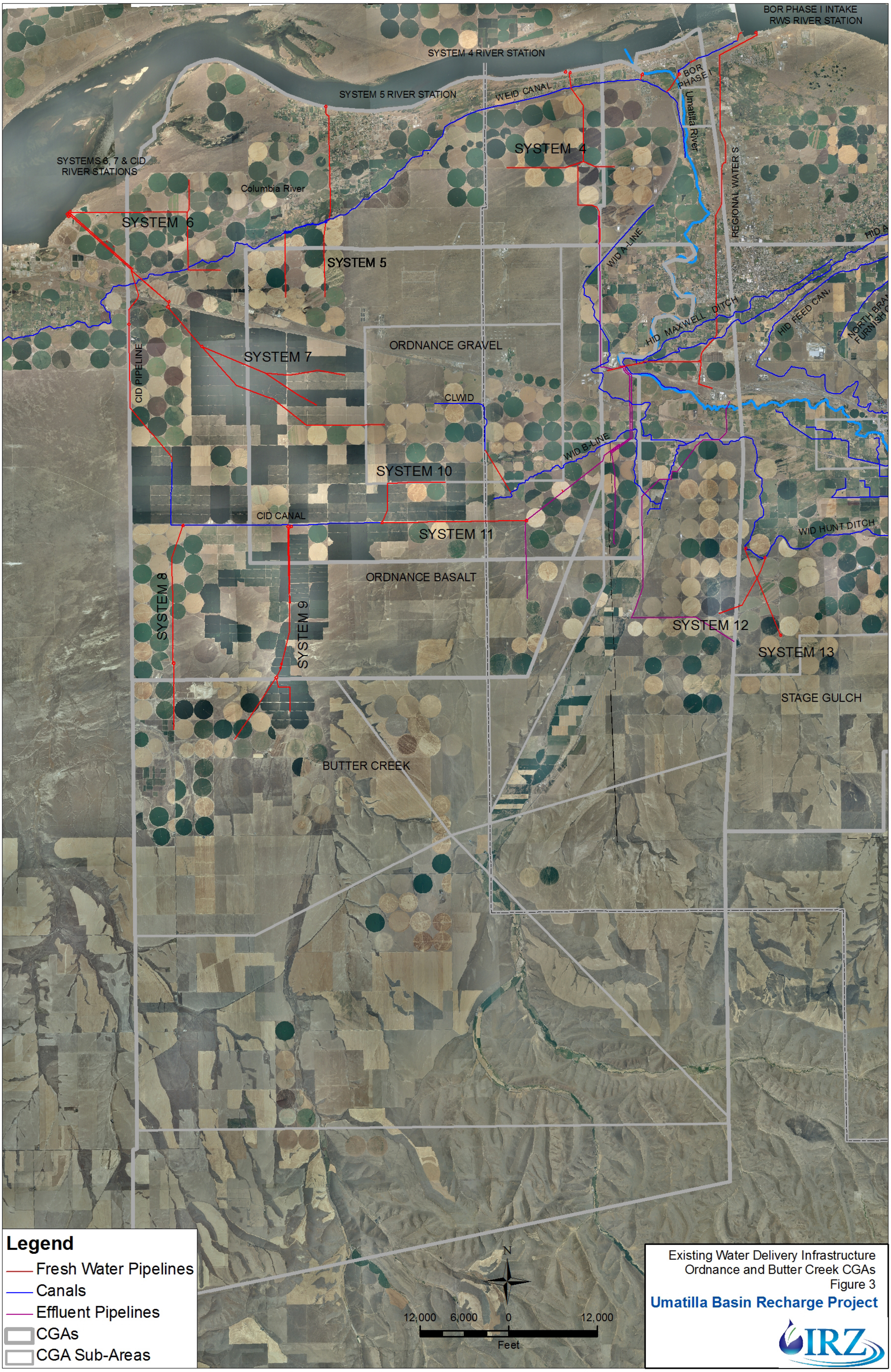
IRZ



Existing Water Delivery Infrastructure
Stage Gulch CGA
Figure 2

Umatilla Basin Recharge Project

IRZ



Existing Water Delivery Infrastructure
Ordnance and Butter Creek CGAs
Figure 3

Umatilla Basin Recharge Project

IRZ

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Technical Memorandum

To:	Said Amali, IRZ Consulting LLC		
From:	Ronan Igloria, PE	Project:	Umatilla Basin Regional Aquifer Recovery Assessment
Date:	January 9, 2009	HDR Project No:	00102-86502-002
Re:	Task 1.G – Flow Regimes and Fisheries Resources – Summary of Available Information		

The Oregon Water Resources Department (OWRD) designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in the CGAs has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. To increase water availability in the CGAs, OWRD has begun a technical assessment of the feasibility of storing water from Columbia River and other surface sources during high flow periods in shallow sediment and deeper basalt aquifers and recovery of the stored water during the irrigation season. The project has been divided into several tasks.

This technical memorandum includes a summary of information regarding the flow regimes and fisheries resources of the Umatilla and Columbia Rivers.

1.0 EXECUTIVE SUMMARY

The source of water for the Umatilla aquifer recovery project is to divert water primarily from the Columbia River, and if available from the Umatilla River, during high flow (winter) periods. As part of the feasibility study, this memorandum includes a review of the water availability associated with these water bodies. This memorandum also reviews the potential fish habitat issues and key water quality constraints (temperature) in a qualitative manner.

Based on existing data, water availability for the Columbia River is discussed in terms of target flows derived for the December 2000 Federal Columbia River Power System (FCRPS) biological assessment (BA), while existing water rights, including the adopted instream right, are the basis for water availability for the Umatilla River. OWRD completed a water availability analysis for the Columbia River using the BA target flows at McNary Dam. The analysis indicates that water is available for diversion at McNary Dam in December, January, February, March, and then in September and October under 50% exceedance flows[1]. OWRD uses the 50% exceedance natural flow values to evaluate the availability of water for

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[1] *50% exceedance flow is the stream flow rate derived statistically from flow records that represents the monthly-averaged flow value with a 50 percent probability of being exceeded in any given year.*

appropriation for storage projects in Oregon. OWRD has an adopted instream water right on the lower Umatilla River, which is largely consistent with the target flows adopted under the Umatilla Basin Project (UBP) annual operations plan. Based on the Umatilla River instream water right and UBP operation target flows, water is available for diversion from January through April under 50% exceedance flows. Based on these instream flow conditions, the approximate available flows under 50% exceedance flow conditions are summarized in the following table.

Table ES-1. Summary of Months with Water Available at 50% Exceedance Flow Conditions (cubic feet per second)

	Jan	Feb	Mar	Apr	Sep	Oct	Dec
Columbia River (at McNary Dam)	15,000	24,000	24,700	N/A	108,000	111,000	90
Umatilla River (at mouth)	13.8	398	519	431	N/A	N/A	N/A

The greatest target diversion volume of 100,000 acre-feet of water for storage in the “County Line” alluvial aquifer is to be achieved through a proposed total diversion rate of approximately 560 cubic feet per second (cfs) over a 90-day period from the Columbia River. Based on the above flows, the Columbia River has sufficient water available to meet the target storage volume of 100,000 acre-feet.

It should be noted that if a water year drier than the 50% exceedance level occurs, the amount of water available from the Columbia or Umatilla rivers would correspondingly be less than the values shown in Table ES-1. The quantities shown in Table ES-1 reflect the maximum diversion rate that would be allowed by OWRD for permitting purposes. Other than December, the amount of water available from the Columbia River is significantly greater (at least an order-of-magnitude) than the desired flow of 560 cfs. Nevertheless, it will be prudent to design the project and facilities to store a greater volume of water than the project needs to increase reliability of flow to the users during years of relatively low flows.

The Oregon Department of Fish and Wildlife (ODFW) has developed a guidance document for assessing peak flow needs for Oregon streams other than main stem Columbia River (ODFW 2007). Peak flows which occur during the high flow periods provide channel maintenance and habitat benefits for fisheries. Since the primary source of storage water supply for the project will be from the Columbia River, the peak flow requirements should not affect project feasibility. However, diversion of Umatilla River water for aquifer storage in the Echo Meadows area may be significantly affected if all high flow events were reserved as peak flows during each and all years and if peak flows were established at significantly high levels. The Umatilla River peak flows are significant to this project in that they occur during the same times as when the water for aquifer storage would be diverted, thereby potentially restricting the flows available for aquifer storage. Further discussions need to occur between all the stakeholders and with ODFW and others regarding whether and how peak flows should be addressed for this project.

Aquifer recharge activities have the potential benefit to increase groundwater discharge and Umatilla river base flows resulting in reduced stream temperatures (ODEQ, 2001). Additionally, some of the augmented Umatilla River flow may return to the Columbia River months later thereby increasing its flow during its lower flow periods. This may be an added benefit to Columbia River fisheries resources. (Note: Some of the water may be diverted as natural flow, depending on the disposition as it is defined under future permitting, and the time of year). Temperature is not considered a constraint in terms of limiting additional diversion of water from the Columbia or Umatilla Rivers during the proposed diversion periods for the project.

2.0 OBJECTIVES

This review is intended to provide a summary of existing information regarding water availability and instream needs for the Columbia and Umatilla Rivers. Instream needs focus on fisheries resources and other existing water quality requirements. This memorandum documents information from the following tasks:

- Review and summarize available information on water availability for diversion from the Columbia and Umatilla Rivers.
- Review existing instream requirements and needs; including input from federal and state agencies.
- Review and summarize available information on target flows for the Columbia and Umatilla Rivers based on fish-management and other water quality needs.
- Review potential impact from project on Columbia and Umatilla river flows and water quality.

Existing information on water availability and instream flow needs will be used to identify constraints on the amount of water that can be diverted from the Columbia and Umatilla Rivers for this project. While the Umatilla Basin is fully appropriated during the summer (irrigation) months, the project intends to divert high (winter) flows in the source waters to supply the storage volume for infiltration/injection to the aquifers. Water availability for the Columbia and Umatilla Rivers are compared to the desired rates to meet the project objectives. In particular, the maximum target diversion volume of 100,000 acre-feet of water for storage in the “County Line” alluvial aquifer is equal to approximately 560 cubic feet per second (cfs) over 90 days of diversion from the Columbia River.

In the sections to follow, the water availability findings are discussed first, followed by the target flow objectives derived from instream beneficial uses (fisheries habitat and water quality).

3.0 WATER AVAILABILITY

In general, water available for new diversions is the flow remaining in the stream after instream and out-of-stream flow requirements are met. For the purposes of this review, water availability is considered in terms of Oregon’s Water Availability Program associated with determining availability of surface water for new appropriations (issuing new water rights permits). Oregon follows the "prior appropriation doctrine" where water goes first to those with the oldest water rights whenever water is limited. The permit simply gives the owner the right to access the quantity of water issued under the permit. It defines the maximum diversion that can be taken from the source water. The amount of water available under the terms of the water right along with the amount that can be beneficially used are the limiting factors as to what can physically be diverted in the field.

Under Oregon rules, water availability is defined in terms of the following equation:

$$WA = Q_{nsf} - ST - CU - IS \qquad \text{(Eqn. 1)}$$

Where WA= water available

Q_{nsf} = Natural (live) streamflow at a specified point on the stream (50% or 80% exceedance level)

ST = storage in or from the stream and its tributaries upstream from the specified point

CU = consumptive uses from the stream and its tributaries upstream from the specified point (calculated based on existing out-of-stream water rights)

IS = instream flow demands for a stream reach that includes the specified point

OWRD maintains a database of the amount of water available for appropriation for most waters in the state. This "Water Availability Reporting System" (WARS) database is used to evaluate applications for new uses of water using Equation (1) shown above. Each of the components of the water availability calculation is determined using methodology documented in the report, "Determining Surface Water Availability in Oregon" (OWRD 2002). The standard methodology (referred to in this report as the "OWRD method") was adopted into rule by the Water Resources Commission in July 1992 (OAR 690-400-010[11][a][A]). Instream demands in the OWRD method are made up of existing instream water rights and scenic waterway flows, which diminish water availability upstream only of the point.

The natural (or live) streamflow used in the equation is meant to represent "unmanaged" streamflow conditions and is not affected by consumptive use or reservoir storage. Furthermore, the natural streamflow is represented by a statistic ("exceedance flow") because stream flow is naturally variable. An exceedance streamflow is the stream flow exceeded a given percent of time (in this case an average for a given month). The percent exceedance flow quantifies how often a rate of flow is present in a stream, and hence how often a rate of flow would be available. For this project in the equation above, OWRD and ODFW agreed to use the 50% exceedance flow values as the basis for determining water availability for appropriation (water rights permit) purposes for this project, as it is used for water storage projects in general (personal communication, Barry Norris, OWRD, December 19, 2008). Therefore, the project can expect use of water 50% of the time at the flow rate determined to be available[2].

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[2] *Oregon rules use 80% exceedance flow for out-of-stream appropriation based on the model that at full appropriation of the surface water source, the most junior (water right) user can expect use of water 80 percent of the time. For instream appropriations from live flow, the 50% exceedance level is used. The 50% exceedance natural flow values are used to evaluate storage projects.*

3.1 Umatilla River

Water availability for the Umatilla River is summarized in **Table 1** based on the WARS database. Based on the data, water is only available for diversion from January through April under 50% exceedance flow conditions. The 80% exceedance data is presented for comparison purposes. There is no water available for appropriation under the 80% exceedance flow level. It should be noted that water availability at the mouth of the Umatilla River does not mean that amount is available at a diversion point somewhere upstream of the mouth. Water availability would be assessed at the next higher WAB.

Table 1. Umatilla River – Water Availability at 50% and 80% Exceedance Flows (cubic feet per second) at Mouth

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Water Available @ 50%	**13.8**	**398**	**519**	**431**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Available @ 80%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Natural Stream flow @ 50%	648	1120	1380	1540	1020	323	106	65.7	74	87.8	173	521
Natural Stream flow @ 80%	292	548	697	984	569	187	82.7	48.1	56.6	67.9	101	215
Consumptive Uses	384	472	611	859	1130	794	421	314	238	138	187	357
Instream Requirements	250	250	250	250	250	250	120	85	250	300	300	250

Notes: N/A = Water is not available
Water Availability is calculated per Equation 1 in this memorandum using data from OWRD WRATS database and methodology.
Instream Requirements are as listed in Table 7 below.

The Umatilla River yields approximately 80,000 acre-feet (from February – April) under the water availability rates shown in Table 1 for the 50% exceedance flow conditions[3]. In other words, there is a 50% probability that 80,000 acre-feet of water is available at the mouth for diversion from the Umatilla River during the period February-April in any given year. It should be noted that if a drier water year occurs (lower flows than the 50% exceedance level), the amount of water available from the Umatilla River would likely be less. **Table 2** lists similar values for the 60% and 70% exceedance flows using linear interpolation, of the 50% and 80% exceedance data. The values in **Table** 2 illustrate how water availability can change under different hydrologic conditions. This assessment provides a basis to design the project and facilities to a level of reliable flow quantity to take advantage of the years when river flow is available to balance the years when flow is insufficient to allow target storage volumes.

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[3] *It should be noted that irrigation diversion by Westland Irrigation District and others begin April 15, and water has not been available in river after that date.*

Table 2. Umatilla River – Total Volume at Different Exceedance Flows at the Mouth				
Month	**50% Exceedance**	**60% Exceedance**	**70% Exceedance**	**80% Exceedance**
January	14 cfs	N/A	N/A	N/A
February	398 cfs	207 cfs	17 cfs	N/A
March	519 cfs	291 cfs	64 cfs	N/A
April	431 cfs	246 cfs	60 cfs	N/A
Total Volume* (acre-feet)	**81,000**	**44,000**	**8,000**	**N/A**

** Sum of the total volume diverted from January – April assuming the diversion rate is the water availability for each month.*

For the purposes of this assessment, water availability on the Umatilla River is based only on live flow. Releases from storage (i.e. McKay Reservoir releases) are not added to water availability. Although out-of-stream and instream appropriations may be allocated from stored water, it is assumed that releases from McKay Reservoir will continue to be operated to fulfill the Umatilla Basin Project objectives and not used for this project.

3.2 Columbia River

Water availability calculations using the OWRD method is only applicable to the Umatilla River. The Columbia River is not included in OWRD's water availability database. OWRD completed a separate water availability analysis of the Columbia River at Bonneville and McNary dams (Cooper 2005 and 2007) based on target flows identified in the NOAA Fisheries FCRPS BA and Biological Opinion (BiOp) of December 2000 ("Target Flows"). The 2000 BiOp was invalidated by the Federal 9th U.S. District Court; however, both the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation submitted their final decision document on the May 2008 FCRPS BiOp in August and September 2008, respectively, which uses the same Target Flows as those in the December 2000 BiOp.

Table 3 includes a summary of the data used by OWRD for the Columbia River at McNary Dam and Bonneville Dam. OWRD used a streamflow period of record from 1975 to 2004 in their analysis. The flow data from the actual period of record was adjusted to the base period (1975-2004) using a method described by Searcy (1959)[4]. The flow values represent stream flows affected by regulation from numerous upstream dams and depletions due to diversion. The water availability is calculated simply as the difference between the 50% (or 80%) exceedance flow less the Target Flow for each month. This analysis departs from the OWRD method in that the natural Columbia River flows at Bonneville and McNary Dam stations are not determined, and subtractions for expected consumptive demands are not calculated between the two points, e.g. the effects of stream regulation by the dams and depletions from diversions are not explicitly evaluated. The analysis is based on the 30 years of flow records at the two locations, and does not necessarily account for new allocations or changing operations.

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[4] *The Searcy method is used in the OWRD water availability methodology report, 'Determining Surface Water Availability in Oregon.'*

Table 3. Columbia River at McNary Dam (USGS 14019200) – 50% and 80% Exceedance Flows (1975-2004) and Target Flows												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
50% Exceedance Flows (cfs)												
Bonneville	175,015	184,030	184,744	206,681	264,345	266,440	172,464	133,581	114,365	118,532	135,269	160,090
McNary	156,000	165,000	167,000	189,000	249,000	259,000	167,000	128,000	108,000	111,000	126,000	146,000
80% Exceedance Flows (cfs)												
Bonneville	137,218	138,229	136,520	152,586	217,312	182,812	121,721	103,120	95,505	98,137	115,799	130,968
McNary	125,000	125,000	124,000	140,000	206,000	179,000	119,000	98,700	88,800	91,100	108,000	120,000
Target Flows Based on FCRPS Biological Opinion (2008) (cfs) (see Section 3.1)												
Bonneville	160,000	160,000	160,000	160,000	None	None	None	None	None	None	160,000	160,000
McNary	None	None	None	260,000	260,000	260,000	200,000	200,000	None	None	None	None

Table 4 includes a summary of the results of the water availability analysis. For the purposes of this analysis, the McNary Dam location is used to represent the project location. Based on the analysis, water is available for diversion from the Columbia River at the project location in December, January, February, March, and then in September and October. Water availability is limited by Bonneville Dam flows in January, February and March, while McNary Dam flows limit the water availability in September and October.

Table 4. Columbia River at McNary Dam – Water Availability at 50% and 80% Exceedance Flows (1975-2004)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Water Availability at 50% Exceedance Flows (cfs)												
50 % Exceedance	**15,015**	**24,030**	**24,744**	N/A	N/A	N/A	N/A	N/A	**108,000**	**111,000**	N/A	**90**
Water Availability at 80% Exceedance Flows (cfs)												
80% Exceedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**88,800**	**91,100**	N/A	N/A

The Columbia River yields over 16,800,000 acre-feet (during the months having water availability) under the water availability rates shown in **Table 4** for the 50% exceedance flow conditions. Again, if a drier water year occurs (lower flows than the 50% exceedance level), the amount of water available from the Umatilla River would correspondingly be less also. **Table 5** includes a list of similar values for the 60% and 70% exceedance flows using linear interpolation, of the 50% and 80% exceedance data. The values in **Table 5** illustrate how water availability can change under different hydrologic conditions. Under all exceedence scenarios, there is significant amount of flow available in the Columbia River to supply the project based on the target flow comparisons in the BA.

Finally, it should be noted that OAR 690-033 (Division 33) rules prevent the withdrawal of water from the Columbia River above Bonneville Dam during the month of September with some exceptions. One of the exceptions is for multipurpose storage projects or other projects with measurable public benefits, such as being considered in this project.

Table 5. Columbia River – Total Volume at Different Exceedance Flows

Month	**50% Exceedance**	**60% Exceedance**	**70% Exceedance**	**80% Exceedance**
January	15,015 cfs	N/A	N/A	N/A
February	24,030 cfs	4,353 cfs	N/A	N/A
March	24,744 cfs	4,496 cfs	N/A	N/A
September	108,000 cfs	101,600 cfs	95,200 cfs	88,800 cfs
October	111,000 cfs	104,367 cfs	97,33 cfs	91,100 cfs
December	90 cfs	N/A	N/A	N/A
Total Volume* (acre-feet)	**16,832,500**	**12,782,400**	**11,480,300**	**10,704,800**

** Sum of the total volume diverted from January – April assuming the diversion rate is the water availability for each month.*

4.0 FLOW OBJECTIVES

The information on flow objectives summarized in this section is the basis for the target flows and instream requirements used previously in Section 2 to derive water availability.

4.1 Columbia River Flow Objectives

The flow objectives for the Columbia River are based on the Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp), which was most recently released by National Oceanic and Aeronautics Administration (NOAA) Fisheries Service on May 1, 2008. The flow objectives used in the BiOp were developed under the FCRPS Biological Assessment (August 2007). The original 2000 BiOp was invalidated by the Federal 9th U.S. District Court, which resulted in the BiOp undergoing a series of remands and revisions but the flow objectives remained intact through the process. Additional details of the history and status of the BiOp are discussed in **Attachment A.**

NOAA Fisheries and the FCRPS Action Agencies have attempted to manage Columbia and Snake River water resources to maintain seasonal flows to meet the wide range of objectives (i.e. flow vs. survival relationships) for different species. The flow objectives shown in **Table 6** are used to guide preseason reservoir planning and in-season flow management with the understanding that their achievement depends on the water resources available in a given year.

Table 6. Seasonal Flow Objectives and Planning Dates for the Mainstem Columbia River				
	Spring		**Summer**	
Location	**Dates**	**Objective (cfs)**	**Dates**	**Objective (cfs)**
Columbia River at McNary Dam	April 10 to June 30	220,000 to 260,000$^{(1)}$	July 1 to August 31	200,000
Columbia River at Bonneville Dam	November 1 to emergence	125,000 to 160,000$^{(2)}$	N/A	N/A

Notes: Table was adopted from FCRPS Biological Assessment (August 2007), Table B.2.1-2.

(1) *Objective varies according to water volume forecasts.*

(2) *Objective varies based on actual and forecasted water conditions*

4.2 Umatilla River Flow Objectives

Umatilla River target flows are based on instream water rights adopted by OWRD. The instream water right under Certificate 59837 has a priority date of November 3, 1983, and specifies minimum flows from McKay Creek to the mouth at Columbia River. The minimum flows were originally set in the Umatilla Basin Program and then converted to instream water rights as a result of passage of the Instream Water Right act in 1987. **Table 7** includes a list of the specific minimum flow requirements by month.

Table 7. Umatilla River Instream Water Right (from McKay Creek to Mouth)
Certificate 59837; Priority Date of November 3, 1983

Period	Target Flow (cfs)
October 1 – November 15	300
November 16 – November 30	250
December 1 – June 30	250
July 1 – July 31	120
August 1 – September 15	85
September 16 – September 30	250

The Umatilla Basin Project (UBP) is operated by the U.S. Bureau of Reclamation (BOR). Under the UBP, BOR developed a Umatilla Basin Annual Operation Plan with defined target flows for McKay Creek to the mouth of the Umatilla River. The target flows were developed under Phases I and II of the UBP to improve stream flows for fishery restoration purposes during each part of the year. Phases I and II included construction of facilities and operations to improve stream flows for anadromous fish primarily through water exchange.

Phase I of the project includes pumping of water from the Columbia River into the West Extension Irrigation District system, to offset diversion of Umatilla River water. The capacity of Phase I is 140 cubic feet per second. This improves flows below the diversion point at Three Mile Dam. Phase II pumping and conveyance exchanges Umatilla River for Columbia River water for Stanfield and Hermiston Irrigation Districts. The capacity of Phase II is 240 cubic feet per second. The Stanfield Irrigation District historically diverted live flow[5] and McKay Reservoir releases, which are now retained in-stream as needed to meet stream target flows for fish passage (USBR, 1998). Phase II can offset diversion from the Umatilla River that would have occurred at and downstream from the Stanfield Dam at river mile 32. **Table 8** includes a list of the Umatilla Basin Project target flows based on the UBP annual operations plan. The target flow values under the UBP are the same as those defined by the instream water rights with the exception that the UBP target flows do not have a minimum flow requirement from July 1 – August 15, but require a higher minimum flow from August 15 – September 15 (see **Table 7**).

Table 8. Umatilla Basin Project Target Flows from McKay Creek to Mouth

Period	Target Flow (cfs)	Notes
October 1 – October 30	300	Instream flows are predominantly from stored water releases for fisheries enhancement. Typically not enough live flow for SID exchange. Return flows provide live flow at Three Mile Diversion Dam for WEID exchange.
November 1 – November 15	300	HID exchange may begin on Nov. 2 or as soon as Feed Canal is operable.
November 16 – June 30	250	Diversions generally begin mid-March. HID diversions are curtailed if necessary; WEID and SID exchanges can begin depending on where water is needed. Stored water releases from McKay Reservoir for fish enhancement typically begins this period.
July 1 – August 15	75	In June 2006 an interim target flow of 75 cfs was adopted so live flow water can be exchanged during July 1 – August 15. Return flows generally result in live flows at Three Mile Diversion for WEID exchange. Stored water is used for flow augmentations and Columbia River water is provided to SID under Phase II (SID used to rely on stored water releases from McKay Reservoir).
August 15 – September 30	250	Typically not enough live flow for SID exchange (historically relied on stored water from McKay Reservoir).

Notes:
HID – Hermiston Irrigation District
SID – Stanfield Irrigation District
WEID – West Extension Irrigation District

5.0 OVERVIEW OF INSTREAM NEEDS

This section provides a qualitative overview of the considerations used to develop the target flows listed in Section 3. The winter water diversions to supply the project from the Columbia River will reduce Columbia River stream flow downstream from the project during the diversion periods. The objective of

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[5] *"Live flow" is the term used for the portion of flow that results from runoff and natural drainage into the stream. It does not include stored water releases from the reservoir*

this project is to divert flows only to the extent that flow objectives for environmental benefits are maintained in the source waters. A portion of the stored water developed under this project is intended for Umatilla River flow augmentation to benefit fisheries.

5.1 Water Quantity Impacts on Fisheries Habitat Quality

Stream flows in both the Columbia River and Umatilla River have changed as a result of flow regulation and water withdrawals. For example, large-scale U.S. and Canadian reservoir storage and flow regulation that began in the 1970s reduced the 2-year flood peak discharge, as measured at The Dalles, Oregon, from 580,000 cfs to 360,000 cfs (USCOE, 2007).

Salmonids in the Umatilla River Basin include salmon, resident rainbow trout, anadramous rainbow trout (steelhead), bull trout and mountain white fish. The Umatilla Basin Project manages flow to maintain and enhance salmonids and lamprey in the Umatilla River Basin. The flow needs report by CTUIR Department of Natural Resources (CTUIR, 1999) includes a succinct summary of salmonid presence in the Umatilla River Basin. **Attachment B** includes a table from the flow needs report illustrating the fish presence and timing for the Umatilla River below Echo (CTUIR, 1999).

Table 9 includes a summary of the three major factors for management of stream flows for fisheries needs: (i) rearing flows; (ii) migration flows; and (iii) channel-maintenance flows. These three flow needs are issues for both the Columbia River and Umatilla River. Typically, minimum instream flow requirements attempt to meet the rearing and migration flows needed by fish-species and life-stages present throughout the year in the water body of interest.

Channel-maintenance flows are different from rearing and migration flows in that they involve short-duration, high peaks in flow. Channel-maintenance flows need to occur every one- to two-years (typically the bank-full discharge) (CTUIR, 1999). They are not typically defined for a specified period when adopting flow requirements, but under natural hydrologic events will typically occur from December through May.

Table 9. Summary of Flow Types for Fisheries Needs

Flow Type	Fisheries Need	Timing
Rearing Flow	Provide adequate volume (space) and stream temperatures throughout the year for adult holding, spawning, egg incubation, fry emergence, rearing, and food supply.	Variable throughout the year
Migration Flow	Higher flows support out-migration of juvenile salmonids to the ocean and provides flows for adult migration upstream over falls and rapids for spawning	Seasonal
Channel-maintenance Flow	Maintain channel features such as width:depth ratio, sinuosity, pool:riffle ration; flushing sediment; inundate riparian vegetation and recharge groundwater	One- to two-year recurrence interval at bank-full discharge

Table 10 includes a comparison of the 50% exceedance flow for the potential diversion periods for the Umatilla River against the migration and channel-maintenance flow benchmarks outlined in the flow needs memorandum prepared by CTUIR (CTUIR, 1999). The migration flow needs can further reduce the amount of water available for diversion to supply the project, e.g. comparing 600 cfs for migration to the 250 cfs minimum flow defined in the instream water right for March and April. The channel-maintenance flow is significantly higher than the 50% exceedance flow, but these are based on bankfull discharge events. ODFW has developed a guidance document titled *"Calculating Channel Maintenance/Elevated Instream Flows When Evaluating Water Right Applications for Out-of-Stream and Storage Water Rights"* for assessing peak flow needs (ODFW, 2007). Further scientific and policy discussions need to occur regarding how peak flows will be considered in projects similar to this one.

Table 10. Comparison of Migration and Channel Maintenance Flow Benchmarks for Umatilla River (Below McKay Creek Confluence)

Month	50% Exceedance Flow (monthly) (cfs)	Migration Flow (cfs)	Channel Maintenance (cfs)	Minimum Instream Flow Right (cfs)
January	648	370	3,700-5,500	250
February	1,120	510	3,700-5,500	250
March	1,380	600	3,700-5,500	250
April	1,540	600	3,700-5,500	250

In the Columbia River, flow affects juvenile migrant travel time and the distribution of fish among the various routes of dam passage. In general, the lower the flow through the series of reservoirs, the longer the travel time of out-migrating juveniles that migrate in-river. The longer juveniles remain in project reservoirs, the greater their exposure to predation, elevated temperatures, disease, and other sources of mortality and injury. The longer juveniles remain in the project reservoirs, the greater the potential that they will stop migrating. Because of this, dam operating protocols designed to improve fish passage survival are often defined in terms of streamflow criteria. The target flows discussed in the previous sections are based in part on managing migrant travel time.

Combined with the influence of reservoirs behind the dams within the migratory corridor, reductions in spring and early summer flows slow juvenile fish emigration, increases their exposure to injury and mortality factors within the reservoirs (e.g. predation, temperature stress, disease, and others), and changes ocean-entry timing. The amount of water proposed for diversion (<600 cfs) during the winter months is significantly smaller than the available water based on the target flow analysis. It is unlikely that the proposed diversions will interfere with these fisheries migration times when flows are on the order of >100,000 cfs during these periods when diversion is proposed.

5.2 Water Quality Impacts on Fisheries – Temperature TMDL on Umatilla River

Water quantity and quality are inter-related when it comes to salmonid impacts. A Total Maximum Daily Load (TMDL) has been established for the Umatilla River for several parameters including temperature, sediment, nitrate, ammonia, bacteria, aquatic weeds, algae and pH (ODEQ, 2001). The most widespread concerns in the Umatilla River Basin are temperature and excess soil erosion which leads to sedimentation and impaired salmonid spawning areas (ODEQ, 2001). For the purposes of this study, temperature is considered the key water quality parameter associated with the potential impacts and benefits of this project.

Additional groundwater inflow from the project would have a cooling effect on summertime stream temperatures. Subsurface water is insulated from surface heating processes and most often groundwater temperatures fluctuate little and are cool. Groundwater inflow not only cools summertime stream temperatures, but also augments summertime flows. Subsurface flow of imported Columbia River and its contribution to increasing groundwater discharge to Umatilla River will also act to dilute the concentrations of other water quality parameters (e.g. nitrate, ammonia, bacteria).

The temperature TMDL for the Umatilla Basin is primarily concerned with the summer low flow periods. The temperature standard for Umatilla River is listed in **Attachment C**. As documented in the Umatilla Basin TMDL, elevated summertime stream temperatures are attributed to non-point sources in the Umatilla River Basin resulting from riparian vegetation disturbance (reduced stream-surface shade), summertime decrease in flow (reduced assimilative capacities) and channel widening (increased stream surface area exposed to solar radiation). To analyze the temperature affects of different management activities on these non-point sources, the Umatilla River Basin TMDL defined "*other appropriate measures*" (or surrogates measures) as provided under EPA regulations. In the TMDL temperature analysis, the surrogates used included: system potential vegetation (i.e. potential effective shade levels from riparian vegetation); near stream disturbance zone (e.g. channel disturbance); and width to depth ratios of the channel.

Stream temperature is generally inversely related to flow volume. As flows decrease, stream temperature tends to increase. Particularly relevant to this project is that low summertime flows decrease the thermal assimilative capacity of the Umatilla River, which allows solar radiation loading to cause larger temperature increases in stream segments where flows are reduced. During parts of the summer, flow augmentation released from McKay Reservoir is largely withdrawn from the Umatilla River for irrigation before it reaches the Columbia River. Analysis results presented in the Umatilla Basin TMDL demonstrate that when flows are depleted in the lower river reaches (including the portion adjacent to the proposed project area), temperatures in excess of 80^{o}F are the lowest achievable.

As part of the TMDL development, simulations were run for a range of conditions that apply the surrogates management activities listed under three flow conditions:

- "Current Flows" occur when flow conditions are those that were measured during August 10, 1998 (flow augmentation from McKay Reservoir, with water withdrawals and return flows);
- "Natural Flows" occur when there is no flow augmentation from McKay Reservoir, no water withdrawals and no irrigation return flows;
- "Flow Augmentation" occurs when there is flow augmentation from McKay Reservoir, no water withdrawals and no irrigation return flows.

The analysis found that maximum potential flows achieve the greatest temperature reductions. In all scenarios, the distribution of incipient lethal temperatures is dramatically reduced from the "current flows" condition. That is, when "natural flows" are simulated and flow augmentation is allowed without water withdrawals, stream temperature become significantly more favorable for fisheries. One of the scenarios specifically evaluated in the Temperature TMDL was to release 200 cfs of hypolimnion water from McKay Reservoir during the August period. The analysis revealed that significant temperature reduction in the Umatilla River can be achieved. The output graph illustrating this result is included in **Attachment D.**

Temperature is not considered a constraint in terms of limiting additional diversion of water from the Columbia or Umatilla Rivers during the proposed diversion periods for the project. Aquifer recharge activities have the potential benefit to increase baseflows in the Umatilla River resulting in reduced stream temperatures (ODEQ, 2001). However, reach-specific modeling is necessary to quantify the extent of the benefits. The Umatilla River TMDL states, "to attain the flows in the lower Umatilla River that are supportive of water quality and habitat needs, ODEQ advocates the use of the Umatilla temperature TMDL and further modeling as needed to assist developing flow goals for a Phase III of the Umatilla Basin Project." The TMDL also notes that benefits of the Umatilla Basin groundwater influences on stream temperatures may provide basis for modification of TMDL allocations in potential future iterations of Umatilla Basin TMDLs.

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Attachment A

HISTORY AND STATUS OF FEDERAL COLUMBIA RIVER POWER SYSTEM BIOLOGICAL OPINION

In response to the listing of several fish species under the Endangered Species Act, NOAA Fisheries Service (NMFS) submitted a biological opinion in 2000 on whether the operation of the Federal Columbia River Power System (FCRPS) was jeopardizing the continued existence of listed salmon. A number of organizations challenged the 2000 BiOp in court saying that the BiOp did not do enough to protect and recover endangered salmon. In June 2003, the US District Court in Oregon invalidated the 2000 FCRPS Biological Opinion. NMFS released its revised Biological Opinion in November 2004 which included an Updated Proposed Action on how the action agencies would run the FCRPS. The 2004 BiOp was again challenged and the courts issued an opinion against the 2004 BiOp.

In August 2007, the FCRPS Action Agencies (U.S. Army Corps of Engineers, Bonneville Power Administration, Bureau of Reclamation) completed an assessment of the biological effects of the FCRPS and the mainstem effects of other hydro projects on listed salmon and steelhead. The FCRPS Action Agencies submitted a biological assessment to NOAA Fisheries on August 21, 2007 for evaluation and consultation. NOAA Fisheries released a draft FCRPS Biological Opinion and Supplemental Comprehensive Analysis (SCA) on October 31, 2007. The current May 2008 FCRPS Biological Opinion includes a 10-year operations and configuration plan for the FCRPS facilities, as well as the mainstem effects for various other hydro projects on Columbia River tributaries operated for irrigation purposes. The FCRPS action includes additional habitat, hatchery, predation management, and harvest actions to mitigate for the adverse effects of the hydro projects. On August 1, 2008 the U.S. Army Corps of Engineers finalized their Record of Consultation and Record of Decision on the May 2008 BiOp. Similarly, on September 1, 2008, the U.S. Bureau of Reclamation finalized their Record of Decision on the May 2008 BiOp. The overall flow objectives developed under the biological assessments did not change through the remand and revision process to the BiOp.

Attachment B

TYPES OF FLOWS, SPECIES AND WATER QUALITY LIMITING PARAMETERS FOR UMATILLA RIVER BELOW ECHO

(taken from "Flow Needs for Salmonids and Other Aquatic Organisms in the Umatilla River." CTUIR Department of Natural Resources. December 1999)

Types of Flows, Species, and Water Quality Limiting Parameters for the Umatilla River below Echo													
Flow	Order	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1. Rearing	CHS	-	-	-	-	-	-	-	-	-	-	-	-
Spawning	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF	CHF	*	*	*
Egg/Incubation	CO	CO	CO	CO	CO	CO	CO	CO	CO	CO	*	*	*
Emergence	STS	STS	STS	STS	STS	STS	STS	STS	STS	STS	*	*	*
Rearing	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	*	*	*
Adult holding	TB	-	-	-	-	-	-	-	-	-	-	-	-
	MW	MW	MW	MW	MW	MW	MW	MW	MW	*	-	-	-
	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP
2. Migration	CHS	-	-	-	-	-	CHS	CHS	CHS	CHS	-	-	-
Juvenile	CHF	CHF	CHF	CHF	-	-	-	CHF	CHF	CHF	CHF	-	*
Adult	CO	CO	CO	CO	-	-	CO	CO	CO	CO	-	-	*
	STS	STS	STS	STS	STS	STS	STS	STS	STS	STS	*	*	*
	TR	-	-	-	-	-	-	-	-	-	-	-	-
	TB	-	-	-	-	-	-	-	-	-	-	-	-
	MW	-	-	-	-	-	-	-	-	-	-	-	-
	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP	LMP
3. Channel Maintenance				X	X	X	X	X	X				
4. Flow Quality		AW/A	Habitat	Habitat	Habitat	Habitat	Habitat	Turb	AW/A	AW/A	AW/A	AW/A	AW/A
303(d) Limited		pH						Habitat	pH	pH	pH	pH	pH
		Sed							Am	Am	Am	Am	Am
		Flow							Turb	Temp	Temp	Temp	Temp
		Habitat							Habitat	Turb	Turb	Flow	Flow
										Flow	Flow	Habitat	Habitat
										Habitat	Habitat		

* Salmonid summer rearing and migration in this reach severely limited by high water temperatures and low flows; found mostly associated with springs or cold water inflow along mainstem.

LMP – Lamprey may be present, but in very low numbers.

1. One or more of these life stages by species is present for the period noted. CHS – spring Chinook; CHF – fall Chinook; CO – Coho; STS – summer steelhead; TR – rainbow trout; TB – bull trout; MW – mountain whitefish; and LMP – Pacific lamprey.

2. Juvenile and/or adult migration by species occurs for the period noted.

3. Seasonal, periodic high flow needed to move bedload and maintain channel/riparian habitat. These flows usually occur during the period noted by an “X.”

4. 303(d) = Clean Water Act 303(d); water quality limited by parameter: AW/A = aquatic weed/algae; Am = ammonia; Temp = temperature; Sed = sedimentation; Turb = turbidity; Flow = flow modification; Habitat = habitat modification; pH = high pH.

Attachment C
UMATILLA BASIN TEMPERATURE STANDARD - OAR 340-041-645(2)(b)(A)

To accomplish the goals identified in OAR 340-041-120(11), unless specifically allowed under a ODEQ-approved surface water temperature management plan as required under OAR 340-041-026(3)(a)(D), no measurable surface water temperature increase resulting from anthropogenic activities is allowed:

(i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0°F (17.8°C);

(ii) In the Columbia River or its associated sloughs and channels from the mouth to river mile 309 when surface waters exceed 68.0°F (20.0°C);

(iii) In waters and periods of the year determined by ODEQ to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C);

(iv) In waters determined by ODEQ to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0°F (10.0°C);

(v) In waters determined by ODEQ to be ecologically significant cold-water refugia;

(vi) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population;

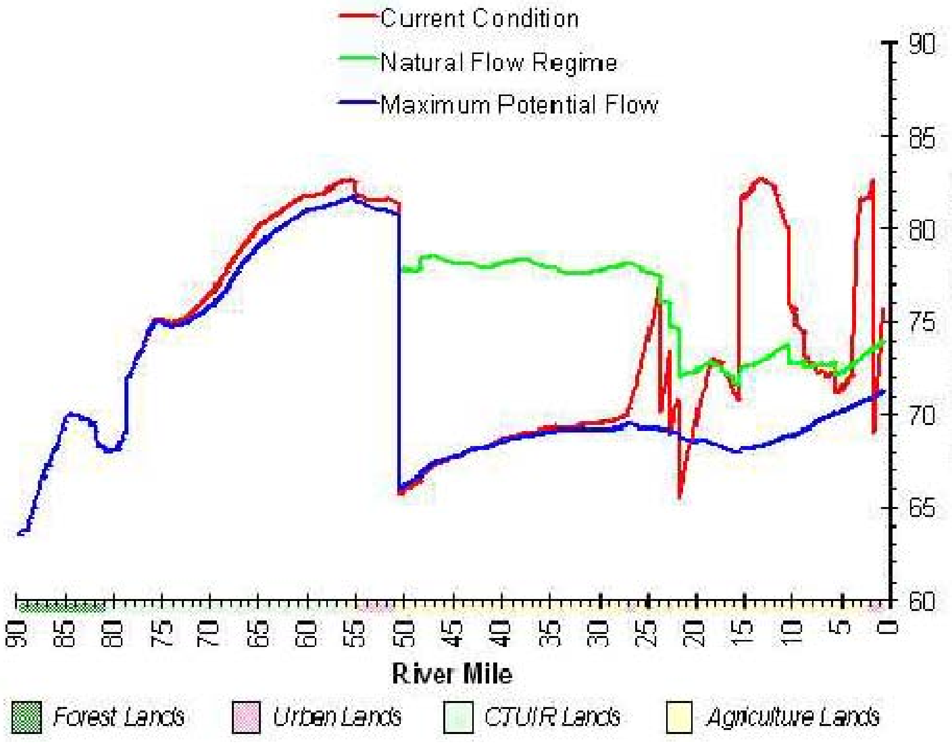
(vii) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/l or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or Basin; and

(viii) In natural lakes.

Attachment D

TEMPERATURE MODELING OUTPUT PLOT OF UMATILLA RIVER STREAM TEMPERATURE UNDER DIFFERENT FLOW SCENARIOS

Taken from Umatilla TMDL (DEQ, 2001) Appendix A-4 – Temperature Analysis (Figure A-54)



Natural Flow: No withdrawals return flows or augmentation from McKay
Flow Augmentation: No withdrawals or return flows with augmentation from McKay

FINAL REPORT
CONCEPTUAL HYDROGEOLOGY OF ALLUVIAL AQUIFERS
&
ECHO MEADOWS AQUIFER RECHARGE ACTIVITIES

Umatilla Basin Regional Aquifer Recovery Assessment
Tasks 1.A & 1.C

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Optimizing Water Resources Through Technology

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

NOMENCLATURE

Ac = acre
ADA = Ammunition Demolition Activity
AF = acre foot and acre feet
AR = Aquifer Recharge
ASR = Aquifer Storage and Recovery
bgs = below ground surface
BOR = Bureau of Reclamation
cfs = cubic feet per second
CGAs = Critical Groundwater Areas
CLWID = County Line Water Improvement District
Depot = Umatilla Army Depot
DO = Dissolved oxygen
EWL = Explosives Washout Lagoon
ft = feet
ft/ft = feet per foot
ft/day = feet per day
gpm = gallons per minute
in/hr = inches per hour
LUBGWMA = Lower Umatilla Basin Groundwater Management Area
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
µg/L = micrograms per liter
MPA = Micro-particulate analysis
MPN/100 ml = Most Probable Number per 100 milliliter
MSL = Mean Sea Level
NPL = National Priority List
NTU = Nephelometric Turbidity Unit
OWRD = Oregon Water Resources Department
ODEQ = Oregon Department of Environmental Quality
ORP = Oxygen reduction potential
RM = River Mile
SID = Stanfield Irrigation District
TDS = Total dissolved solids
USACE = U.S. Army Corps of Engineers
WID = Westland Irrigation District

1.0 EXECUTIVE SUMMARY

INTRODUCTION – The Oregon Water Resources Department has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas due to their documented overdraft. As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

BACKGROUND – Water diverted from the Columbia and Umatilla Rivers is to be stored initially in shallow sediment (alluvial) aquifers. In this report, literature information and additional field data regarding groundwater occurrence and conditions in several alluvial aquifers and overlying land uses in and surrounding the Critical Groundwater Areas were reviewed. The purpose of the review was to identify the most likely opportunities for alluvial aquifer recharge. Two aquifers were identified in this process designated as the Echo Meadows and County Line alluvial aquifers.

ECHO MEADOWS AQUIFER DESCRIPTION – The Echo Meadows aquifer underlies approximately 9,000 acres of farmland located west of The Umatilla River between the town of Echo and the Highway 207 crossing in Umatilla County. The aquifer is comprised of a mixture of mostly sand, gravel, and silt sediments which occur from approximately 50 to 200 feet thick and overlie basalt bedrock. The hydraulic conductivity of the sediments is variable between 230 and 765 feet per day. Groundwater is encountered at depths of between 2 to 12 feet across the aquifer. The groundwater levels remain generally stable seasonally, and on an annual basis, achieve a consistent hydraulic gradient of 0.003 feet per foot. Groundwater and the Umatilla River form an interrelated hydraulic unit along the length of the river. It appears that The Umatilla River loses water to the aquifer along its upstream reach from Echo to north of Stanfield and gains water from the aquifer downstream of this reach. This interaction can be exploited to design an aquifer recharge system to provide river flow augmentation.

ECHO MEADOWS 2008 AQUIFER RECHARGE ACTIVITIES – The aquifer sediments offer a maximum of 6,000 acre feet per year of recharge capacity which will have to be accomplished at multiple locations. The source of recharge water is envisioned to be diversion from the Umatilla River during winter and spring. Following recharge, groundwater may be extracted and conveyed to wells for injection into the basalt aquifer. Recharge operations at Echo Meadows are fully manageable with existing conveyance systems with relatively minor system and field modifications. Existing wells in the area have yields of up to 1,530 gallons per minute.

ECHO MEADOWS WATER QUALITY – Water quality conditions important to aquifer recharge were evaluated through laboratory and field analyses of groundwater and The Umatilla River source water samples. The results indicate that of the analyzed compounds, only nitrate-nitrogen levels were detected in several areas of Echo Meadows at levels that exceed the threshold of 5 milligrams per liter which is used as the standards for injection into basalt aquifers. Aquifer recharge activities should be designed to dilute the current groundwater nitrate levels as much as possible and groundwater pumping systems should be designed to avoid areas with elevated nitrate levels. Field data collected during this study showed that the Echo Meadows soils and sediments provide excellent natural filtration capacity of the recharging surface water with respect to biological constituents.

COUNTY LINE AQUIFER DESCRIPTION – The County Line aquifer is an approximately 13,500 acre area straddling the border of Morrow and Umatilla Counties near Highways I-84 and I-82. The aquifer stretches from approximately the western boundary of the Umatilla Army Depot for eight miles east passed the Umatilla River. The aquifer comprises a significant deposit of coarse sand and gravel sediments with a thickness of between approximately 100 and 200 feet overlying predominantly basalt bedrock or fine-grained sediments which in turn overlie the basalt. The depth to groundwater ranges from approximately 40 to more than 100 feet and appears to have remained fairly stable in recent years. The groundwater table is very flat (<0.0001 feet per foot). The current groundwater levels are approximately 11 feet below levels that existed prior to large scale aquifer development. The hydraulic conductivity of this aquifer is substantial, ranging from 1,000 to 4,000 feet per day.

Aquifer recharge has been conducted successfully in this aquifer since 1970s demonstrating the viability of groundwater storage. The available information and aquifer data suggest that there are potentially tens of thousands of acre feet of storage volume still available. The aquifer is mostly surrounded by fine sand deposits which offer a mechanism for partial hydraulic containment of recharge water as well as additional storage volume.

The coarse sand and gravel deposits are, at places, overlain by eolian sand and silt. However, the sand and gravel approach the ground surface or are at the ground surface over an extensive area. This allows the design of an aquifer recharge system and groundwater extraction facilities to take full advantage of ready access to the aquifer sediments.

Based on the expected elevation of the County Line groundwater table extending to the Umatilla River, the groundwater system has a major flow pathway eastward to the river. The distribution of the sediments and groundwater levels suggest that this connection can be exploited to provide river flow augmentation. Finally, the recharge and extraction systems should be designed to minimize groundwater migration northward and westward into the adjacent finer-grained sediments to prevent land use problems with shallow groundwater levels.

COUNTY LINE AQUIFER WATER QUALITY – Water quality data indicate that, similar to Echo Meadows, elevated nitrate-nitrogen levels have been detected at values of up to 17.4 milligrams per Liter at several locations and one measurement of 47.5 milligrams per Liter was reported for a sample collected in 2003. These concentrations exceed the threshold of 5 milligrams per liter which is used as the standard for injection into basalt aquifers. The design of the recharge and extraction systems will have to consider options to dilute the nitrate concentrations prior to injection into basalt aquifers.

The information available from the site cleanup activities currently underway at the Umatilla Army Depot indicates that munitions-related contaminants remain in a groundwater zone of limited extent underneath a portion of the Depot. Further discussions need to occur with the Army Corps of Engineers regarding the design of the aquifer recharge and the future groundwater cleanup systems so both can be operated in an effective and efficient manner.

STAGE GULCH CGA EVALUATION – No significant aquifer recharge opportunities appear to exist in the Stage Gulch CGA east of the Umatilla River. Exploratory field data obtained in this study did not indicate the presence of alluvial aquifers of sufficient storage capacity to store the volumes of water targeted for that area.

2.0 INTRODUCTION

The Oregon Water Resources Department (OWRD) designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in the CGAs has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. To increase water availability in the CGAs, OWRD has begun a technical assessment of the feasibility of diverting water during high winter and spring flow periods from the Columbia River and other surface sources, and storing it in shallow sediment and deeper basalt aquifers. The stored water may be used directly on irrigated land during the growing season or may remain in storage for subsequent recovery and use.

The study has been divided into several tasks. This report includes a summary of information to characterize the alluvial aquifers that will be the target of aquifer recharge by the imported surface water. The boundaries of the CGAs are shown on Figure 1.

2.1 Background

The main concept underlying the engineering approach employed in this project includes winter-time diversion of water from surface water sources for storage in groundwater aquifers until it is needed during the irrigation season. There is a difference in timing between the period when water can be diverted from the Columbia and the Umatilla Rivers and the period when this water is needed for both irrigation and environmental uses. Based on flow assessment conducted by OWRD, Columbia River excess flow is available only during September, October, December, January, February, and March as summarized in IRZ (2008) and HDR (2009). Additionally, the availability of water withdrawals during September is uncertain due to Oregon regulations. Furthermore, due to unreliability of flow, water diversion for storage from the Umatilla River is envisioned to come through a potential exchange with the County Line Water Improvement District (CLWID), as described in IRZ (2009). Historically, CLWID diversion water had mostly been available during winter and spring months outside of the irrigation season. This timing mis-match requires storage of the diverted water until it can be used for irrigation later in the year.

Both the alluvial and basalt aquifers potentially provide winter storage. However, direct storage of imported surface water in the basalt aquifers is not practical due to two factors. Firstly, Oregon rules require that the source water meets water quality standards for bacteriological amongst other parameters. However, initially storage in the alluvial aquifer may provide a potential means of removal of these constituents and an intervening step for monitoring its quality before it is injected into the basalt aquifer. Secondly, if sufficient storage volume is identified in the alluvial aquifers, the required storage volume in the basalt aquifer will be reduced. This will reduce the overall cost and complexity of the project.

The purpose of this task is to identify the aquifers and their characteristics which are suitable for winter storage. The task includes an assessment of available data and information, augmented by limited additional field data collected during the study. Two types of aquifers are investigated, including shallow alluvial aquifers present in several areas within the CGAs, and deeper basalt aquifers. The results of evaluation of feasibility of storage in basalt aquifers are presented in GSI (2009a). This technical memorandum focuses on evaluation of the alluvial aquifer characteristics.

In 2008, a limited license was approved by OWRD to apply excess winter flow from the Umatilla River to the Echo Meadows alluvial aquifer. The recharge was conducted to augment previous data and findings regarding the potential for winter aquifer recharge for river flow augmentation. This memorandum additionally includes data and information to address the objectives of the 2008 recharge activities.

2.2 Objectives

This technical memorandum is intended to fulfill the deliverable requirements of Tasks 1.A, 1.B, and 1.C of our contract. The specific objectives of these tasks are as follows:

1. Develop conceptual hydrogeology model of alluvial aquifers including:
    - Locations for shallow aquifer recharge that are most promising for recharge and correlate promising recharge areas with the locations of infrastructure that can deliver recharged water
    - Aquifer hydraulic characteristics
    - Potential storage volumes and recovery rates
    - Potential for return flow to the Umatilla River

2. Complete the implementation of the 2008 Echo Meadows recharge study. This study began shortly prior to award of the current contract, and under Limited License No. 1111 applied for by the Westland Irrigation District (WID). A copy of the license is enclosed in Appendix A. The scope of the initial study was modified to better address the study objectives, listed below:
   - Can the target volume of water be diverted during the river high flow period?
   - Can the WID system operation and the recharge methods be managed to allow effective infiltration of the diverted water?
   - What is the subsurface distribution and migration path/rate of recharged ground water?
   - What is the distribution of discharge water along the river?
   - Can the existing ground water flow model be refined for water management purposes?

3. Collect additional geology and hydrogeology data and information in selected areas to augment existing aquifer characterization data. The types of activities completed included the following:
   - Advanced geologic borings
   - Installed monitoring wells
   - Collected groundwater and soil samples for laboratory chemical and physical analyses
   - Conducted additional well water level and the Umatilla River stage monitoring
   - Conducted soil infiltration testing

3.0 REGIONAL OCCURRENCE OF ALLUVIAL DEPOSITS

This section includes an overall description of the hydrogeology of the alluvial deposits which occur within and surrounding the CGAs. The purpose of this description is to provide the framework for selection of those alluvial deposits which can be used as alluvial aquifers for further assessment of recharge. The selection criteria are provided in Section 3.2. The geology and groundwater conditions in the selected aquifers are discussed in Sections 4.0 through 6.0.

A number of reports include information, data, and maps regarding the geologic formations and presence and quality of groundwater in alluvial aquifers within and surrounding the CGAs. For this report, information in Weber(1973), Sceva (1966), Robison (1971), McCall (1975), Bartholomew (1975), Norton and Bartholomew (1984), Oberlander and Miller (1981), Miller (1985), Davies-Smith et al. (1988), King (1987), Zwart (1990), Kreag (1991), Grondin et al. (1995), Wozniak (1995), Meyer (1998), and OWRD (1997, 2003, 2007) was used. Other sources of information and data used herein are referenced throughout the memorandum. Wozniak (1995) contains an excellent description of the area alluvial aquifers and groundwater conditions. This document is used as the primary source of information in this report, and augmented by other references.

3.1 Regional Alluvial Geology and Hydrogeology

The CGAs are located within the Umatilla Basin. The Basin and surrounding highlands are underlain by a thick sequence of Columbia River Basalt flows. Up to 250 feet (ft) of alluvial sediments overlie the basalt flows near the Basin axis. A schematic diagram of the basin stratigraphy, just east of the CGAs is shown on Figure 2 (Davies-Smith et al. 1988, Figure 3).

The principal water-producing zones of the alluvial aquifer occur in glaciofluvial sands and gravels deposited by catastrophic floods during the Pleistocene Epoch (Wozniak 1995). Flood sands and gravels occur in broad tracts of varying thickness or as thin beds encased in silts or clays. The glaciofluvial deposits are found at elevations below 750 ft (Oberlander and Miller 1981). The main productive areas occur in three east- to northeast-trending shallow troughs which are largely filled with coarse sands and gravels. Thin sand and gravel beds also produce moderate quantities of water in areas of the aquifer which are dominated by silt and fine-grained sand. Figure 3 (adapted from Wozniak 1995) depicts the locations and general extent of the three coarse-grained facies of the alluvial aquifer.

Figure 3 also shows the locations of three additional areas in which the potential for aquifer recharge (AR) was evaluated in this project. These areas include the Holocene alluvial deposits within the Echo Meadows reach of the Umatilla River, and two locations within the Umatilla River floodplain north of the WID’s diversion canal (Hunt Canal). The sediments in this area had been mapped by IRZ (2006) as re-worked alluvium extending from a depth of approximately 30 to 150 ft below ground. Further description of this aquifer is provided in Section 3.2.4.

Additionally, an area southwest of Cold Springs Reservoir extending to the northern part of Furnish Gap drainage area was selected for further evaluation. The sediments in this area are composed of loess silts and sands overlying fine-grained Pleistocene flood sediments of lacastrine origin. This area is named the Stage Gulch alluvial deposit and is further described in Section 3.2.6.

Finally, small local deposits of sand and gravel occur along the flood plain of Butter Creek and the lower portion of the Umatilla River north of Hermiston (Bartholomew 1975). In the northern portion of the Butter Creek area the gravel deposits average about 140 ft near the Umatilla River confluence. The shallowest alluvial deposit is composed of poorly sorted, medium-grained sand and gravel that covers the Butter Creek flood plain (Norton and Bartholomew 1984).

3.2 Potentially Suitable Aquifers

The above six alluvial deposits were initially evaluated to identify those with obvious potential for recharge and/or storage and lack of a “fatal flaw” according to the following criteria:

- Hydrogeology characteristics - Potential storage volume, presence of groundwater, groundwater flow direction

- Proximity to existing public and/or private water supply infrastructure and to the CGAs
- Land Use – potential for surface contamination of shallow groundwater, potential for increased urban/industrial development

  The available evidence indicates that water readily infiltrates the soils of the basin and travels rapidly through the unsaturated silts, sands, and gravels which overlie the alluvial aquifer. Therefore, the aquifer is highly susceptible to contamination from activities at the land surface (Wozniak 1995), where land use potentially creates conditions for aquifer contamination (Burck Associates 2002) (Wallulis and Associates 1996)

- Jeopardy to downgradient land uses (flooding, etc.)
- Land Ownership – Density of land ownership as affected by construction, and operation and maintenance needs of the proposed systems.
- Proximity to areas of most need
- Opportunities to achieve environmental benefits

The results of evaluation of each of the six alluvial deposits are provided below.

3.2.1 Deposits Along the Columbia River Between Boardman and Irrigon (Boardman-Irrigon Sediments)

These deposits are located in the northern part of the Ordnance Basalt CGA (Figure 3) and are up to approximately 100 ft thick. The saturated thickness of these deposits ranges between 10 and 40 ft (Wozniak 1995). Shallow groundwater is hydraulically connected, and flows to, the Columbia River. Several existing public and private water supply systems are located within the boundaries of this deposit. The area is subject to additional industrial development within the Port of Morrow industrial area. Land ownership is distributed between relatively large users and small acreage farms along the Columbia River. However, these deposits are not close to the areas of potential use. Finally, opportunity to provide environmental benefits through increased the Umatilla River baseflow is not expected due to groundwater flow to the Columbia River.

3.2.2 Deposits within the Area Bisected By Morrow-Umatilla County Boundary (County Line Sediments)

Based on the description presented in Wozniak (1995), the glaciofluvial sand and gravel deposits in this area comprise a large elongated zone extending from east of the Umatilla River to the western boundary of the Ordnance Depot, and extending north under the Depot. It appears to overly an area where the top of basalt is lower than under surrounding areas. The depression extends south-eastward from under the Depot toward the confluence of the Umatilla River and Butter Creek (Wozniak 1995). In both references, the deepest part of the depression in the top of basalt appears to occur toward approximately the southwestern part of the Depot extending south across I-84. The structure contours of top of basalt from Wozniak (1995) are shown on Figure 4.

The coarse-grained sand and gravel sediments within this deposit range in thickness from approximately 80 to 170 ft with an average thickness of 100 to 125 ft (McCall 1975). The groundwater surface elevations indicate that the saturated sediments are part of a single larger hydraulic unit (Wozniak 1995, OWRD 1997) although some information suggests that there may be zones of fine-grained units within the larger coarse-grained matrix which may delay the hydraulic response of the deposits in some areas (McCall 1975). This point has additionally been recognized locally through drilling irrigation wells (for example near the Morrow-Umatilla County border south of I-84) where they did not produce yields comparable to nearby wells. Groundwater in these deposits appears to principally flow toward the Umatilla River (Wozniak 1995). This flow direction suggests the potential for environmental benefit through increasing Umatilla River base flow.

The County Line deposits are located near the point of use of a number of large public and private agricultural water delivery systems. There is generally a good base of information available on these systems and their potential and limitations to expansion or modification. Given that the County Line deposits are located in the Ordnance Gravel CGA and close to the Butter Creek and Stage Gulch CGAs, it provides a strategically advantageous location for AR storage and supply to areas of need.

Land use near and surrounding the County Line deposits is agricultural. The potential for contamination of shallow groundwater is mainly associated with irrigated agriculture. Data to date show that contamination is limited to elevated presence of nitrate-nitrogen in several wells monitored in the area. The potential for contamination arising from industrial activities in the area does not exist due to the lack of industrial operations. A contaminated site is present on the Depot and is currently undergoing remediation. However, the scale of the impacted media (mass of contamination in groundwater and potentially in soil) present on site appear to be relatively small compared with the volumes of recharge water envisioned for this project.

3.2.3 Hermiston Sand and Gravel Deposits (Hermiston Sediments)

Saturated coarse-grained glaciofluvial deposits occur in a northeast-trending trough between the City of Hermiston and Hat Rock State Park (Figure 3). Located north of the Stage Gulch CGA, the “Hermiston sediments” have filled in a shallow syncline where the top of basalt has further been eroded during the Pleistocene (Missoula) floods (Figure 3). The saturated thickness of the sediments ranges from 40 to 100 ft. Towards the south and west near Hermiston, the water table intercepts the land surface indicating very thin unsaturated thickness and limited to no storage. The water levels indicate the predominant direction of shallow groundwater is westerly toward the the Umatilla River (Wozniak 1995).

There are several water supply canals extending east and south of the Hermiston sediments including the Hermiston Irrigation District canal, the Cold Springs reservoir feed canal, and the Bureau of Reclamation Phase II system. The closest private systems (IRZ 2008) are located nearly 7 miles east of the sediments (IRZ 2008).

Land use in the eastern parts of the Hermiston sediments includes relatively small acreage farms and rural residences. This land use pattern becomes gradually denser as one approaches Hermiston. The City of Hermiston, with a population of approximately 15,000, is located over the southwestern part of the sediments. The available evidence indicates that water readily infiltrates the soils and travels rapidly through the unsaturated silts, sands, and gravels which overlie the alluvial aquifer. Due to further potential development of this area, surface contamination of shallow groundwater from increased urban activities may occur. The contaminated groundwater would then not be suitable for injection into basalt aquifers without costly treatment. An example of such a situation is the contamination of a shallow aquifer where the City of Hermiston designed and operated an aquifer recharge project in the 1990s to provide additional sources of potable water (Wallulis and Associates 1996).

The rural residential land ownership in this area also makes implementation of recharge and recovery activities more complex and will increase the system construction, operation, and maintenance costs.

Due to the relatively shallow groundwater depth and the westerly direction of groundwater flow in the western and southern areas of the Hermiston sediments, the potential exists that recharge occurring upgradient may create high water levels, and exacerbate existing, shallow water conditions potentially creating flooding situations within and surrounding Hermiston. The generally high water table elevation near the river also limits the opportunities to achieve environmental benefits via increasing the Umatilla River base flow.

3.2.4 Echo Meadows Deposits Between Hunt Canal and the Umatilla River

The Echo Meadows deposits are comprised of undifferentiated Holocene alluvium occurring along the Umatilla River between the WID diversion structure and the Highway 207 bridge. Groundwater in these deposits is less that approximately 15 ft, and in some areas within two ft, of the surface. Available data from IRZ (2006) indicates that the direction of groundwater flow is toward the Umatilla River. Although the storage capacity of these deposits is relatively lower than other deposits described above, the opportunities for augmenting the Umatilla River flows, as well as providing recharge water to basalt aquifers south of the Hunt Canal have been the subject of various demonstration projects since the late 1990s. The Echo Meadows deposits provide relatively good potential AR opportunities due to the following factors:

- Relative success of the previous recharge demonstrations (450 AF in 2001 and 600 AF in 2008).
- The strategic location of the Echo Meadows area being in the middle of this part of Stage Gulch CGA

- Demonstrated storage need
- Presence of a major water delivery system (the Hunt Canal)
- Cooperative property owners
- Proximity to basalt aquifer injection opportunities in this part of the Stage Gulch CGA.

Land use in the Echo Meadows area includes irrigated farming, irrigated pastureland, and low density rural residences. The current land uses indicate no potential for contamination with industrial chemicals and very limited potential for contamination with agricultural chemicals. Previous data, supported by data collected in this project, indicate localized presence of elevated nitrate levels. No evidence of other contamination has been identified.

Due to locally high water table levels, the potential for downgradient flooding does exist if recharge activities are not managed properly. Great cooperation from local land owners will be significant to construct, operate, and maintain recharge systems to avoid flooding.

3.2.5 Deposits Along Butter Creek (Butter Creek Sediments)

Poorly sorted, medium-grained alluvial sands and gravels have been deposited over the floodplain of the Butter Creek drainage (Norton and Bartholomew 1984). The floodplain is approximately 1 mile wide and extends for a distance of approximately 12 miles northward from the Butter Creek junction (Figure 3). The alluvium is generally very thin and contains large amounts of reworked wind-blown silt and loess deposits. The volume of storage available from these deposits appears to be very small relative to the volumes needed for this project. These deposits do provide a limited amount of water for two local aquifer storage projects.

3.2.6 Deposits in the Stage Gulch Area (Stage Gulch Sediments)

In addition to the Hermiston sediments, an area was selected for further evaluation within the Stage Gulch CGA (Figure 3). This area was selected when the evaluation of the Hermiston sediments above indicated no real opportunity for aquifer recharge. This “Stage Gulch sediments” area occupies a topographic high approximately in the middle of Sections 15, 16, 21, and 22 of Township 4 North, Range 29 East, descending towards Furnish Gap on the south and to the Hermiston sediments on the north and west. The Stanfield Irrigation District (SID) Furnish Canal runs along most of its eastern and southern boundaries.

Our search did not identify wells within this immediate area so no information on the sediment lithology was available. Literature information indicates that Pleistocene fine-grained deposits of silt and sand occur in this area and represent a slack-water facies of the glaciofluvial deposits (Zwart 1990). Quaternary-age windblown loess deposits of silt to fine sand mantle the entire area. Together the slackwater and windblown deposits cover the underlying basalt bedrock. Information on logs of wells surrounding this area indicates these sediments are 60 to approximately 250 ft thick underlying basalt bedrock.

The proximity of this area to existing SID and Bureau of Reclamation (BOR) water supply systems, non-irrigated and light rural land use, expected low saturation of the sediments, and proximity to areas of most need were factors considered to evaluate this area further for its potential for AR suitability and opportunities for environmental benefit.

3.3 Selected Deposits

Based on the above evaluation, the County Line and Echo Meadows aquifers, and the Stage Gulch sediments were selected for further detailed evaluation in this memorandum. The characteristics of the other deposits do not make them suitable for consideration as potential AR sites due to either low storage capacity, groundwater flow toward Columbia River, distant location, and/or relatively more intensive urban land use.

4.0 ECHO MEADOWS ALLUVIAL AQUIFER

The Echo Meadows, as defined in this technical memorandum, includes approximately 9,000 acres (Ac) of land north and east of WID’s Hunt Canal and south and west of the Umatilla River. The WID’s Hunt Canal diversion structure at approximately River Mile (RM) 27.5 forms the upstream boundary of the area and the Highway 207 Bridge over the Umatilla River at approximately RM 16 forms its downstream boundary. The area consists of mostly pivot-irrigated fields, some flood-irrigated fields, and unfarmed areas of low elevation forming natural ponds. Figure 5 shows a vicinity map of Echo Meadows.

4.1 Geology and Soils

The Echo Meadows is underlain by the Columbia River Basalt Group (basalt) as the basement rock (Wozniak 1995). To the west, the basalt is exposed at the ground surface at Emigrant Butte. The Emigrant Butte is a volcanic ridge and a portion of the Service Butte Anticline. Across Echo Meadows, the basalt is generally found at an elevation of 450 ft in the north to 600 ft near Highway 395 at Echo (Figure 4). Geologic cross sections based on well logs indicate a V-shaped contour of the top of basalt along the present course of the Umatilla River. The top of basalt may have an additional V-shaped dip along Spike Gulch. Geologic cross sections were developed based on logs of wells obtained from OWRD online database. Figure 6 shows the cross section locations and Figures 7 and 8 depict the cross sections.

In most of Echo Meadows, the basalt bedrock is covered by poorly-sorted sand and gravel sediments deposited by the Pleistocene catastrophic floods and Holocene alluvial sediments from shifting course of the Umatilla River comprising mostly of micaceous silt, sand, and gravel (Wozniak 1995). In most areas the sediments are largely composed of reworked loess soils, reworked catastrophic flood sediments, and basaltic gravels washed from the upper reaches of local stream drainages. Based on the elevation of the top of basalt and the well log information shown on cross sections, the alluvial sediments in the Echo Meadows are approximately 30 to 35 ft deep in the south part of the area north of the Hunt Canal and deepening to as much as 150 ft toward the north and northwest of the area. Because of similarities in composition, the subsurface contact between Holocene alluvium and underlying flood deposits cannot generally be determined with confidence based on the sediment descriptions on well logs (Wozniak 1995). The current Oregon surficial geology map (Release 4) depicts the general distribution of Holocene alluvium (Qal) and flood deposits (Qmf), shown on Figure 9.

During this study, a cemented gravel layer was encountered at an elevation of approximately 624 ft Mean Sea Level (MSL) (8 ft below ground surface (bgs)) during advancement of piezometer CPPZ1 located in the southwestern part of the area, an approximate elevation of 584 ft MSL (15 ft bgs) in the excavation cavity of pit well DMPW1 located in the southern part of Echo Meadows, an elevation of approximately 571 ft (9 ft bgs) during advancement of piezometer JMPZ2 in the center of the area, and at an elevation of approximately 545 ft MSL at the Umatilla River bank at the location of river staff Gauge URSW10. The presence of this layer in other areas of Echo Meadows is inferred based on conversations with area irrigators. The lateral extent and competency of this layer and therefore, its hydraulic influence on migration of shallow groundwater are not clear. Most of the wells whose water levels were used in this report to construct the potentiometric maps appear to have penetrated through the cemented layer. There is likely vertical hydraulic communication across this layer at the locations of the area wells. Therefore, the groundwater elevations measured in wells in Echo Meadows are believed to integrate groundwater hydraulic heads from both zones.

The alluvial sediments are mantled by windblown fine to medium sand (or loess) in parts of the southern and western areas of Echo Meadows, such as near wells UMAT 1177 and UMAT 1176 (Figures 5 & 9). This unit may range up to 30 ft thick in places in the vicinity of Echo Meadows (Wozniak 1995) but appears to be less than 10 ft thick in the area subject of this project.

The surficial soils in Echo Meadows are primarily formed in alluvial or windblown loess deposits. The primary soils are comprised of silt loams along the course of the Umatilla River, and silt loam, loamy fine sand, and fine sandy loam in areas west and on terraces (U.S. Department of Agriculture 1988). The silt loam soils have generally poor drainage due to high water levels but have moderate permeability values ranging from 0.6 to 2 inches per hour (in/hr) (U.S. Department of Agriculture 1988). Figure 10 depicts the soil distribution in Echo Meadows. Table 1 lists the descriptions of the individual soil series shown on Figure 10.

Soils in the southern and western parts of the area along Hunt Canal are comprised of loamy fine sand, apparently formed in eolian (windblown) sand deposits migrating from the west with prevailing wind direction. The permeability of these soils was reported to range from 6 to 20 in/hr (U.S. Department of

Agriculture 1988). During this study, surface infiltration tests were conducted according to ASTM D3385–03 Double Ring infiltrometry test procedures in three areas, and three locations in each area, as shown on Figure 5. The results of tests conducted in an area northwest of well UMAT 1776 (Field 6) were 9.56, 9.68, and 5.46 ft/day (or 4.8, 4.8, and 2.7 in/hr, respectively). In an area north of the canal (designated Field 5) the measured values were generally lower at 1.44, 4.8, and 6.8 ft/day (0.72, 2.4, and 3.4 in/hr).

Immediately north of Hunt Canal along White House Road, a section of fine sandy loam is present within an area designated as Field 1 on Figure 11. Underlying this soil, a lower permeability soil was noted by U.S. Department of Agriculture (1988) with thickness of 20 to 40 inches, apparently developed in lacastrine (lake) deposits. The permeability of surface soil in this area was noted to be moderate ranging between 2 and 6 in/hr (U.S. Department of Agriculture 1988). The infiltration test results conducted on this soil during this study were lower at 2, 0.48, and 0.48 ft per day (1, 0.24, and 0.24 in/hr) compared to values presented above.

4.2 Groundwater Occurrence and Aquifer Characteristics

Groundwater in Echo Meadows is present within the alluvial aquifer that extends from the Umatilla River west and south toward the Hunt Canal. The alluvial aquifer thins towards south and west with the rising basalt surface, and thickens towards the Umatilla River (see geologic cross sections on Figures 7 and 8). A borehole was advanced south of the canal along White House Road in this study on 16 April 2008. It penetrated 48 ft of sediments before reaching the top of basalt. Groundwater was not encountered in the sediments. It is possible that the sediments along the eastern portion of the canal are not saturated or only seasonally saturated, possibly due to canal elevation. The location of this borehole is shown on Figure 5. The boring log is provided in Appendix B.

Groundwater potentiometric maps have been developed based on water level data collected across Echo Meadows in 2008 and 2009, as shown on Figures 12 through 15. Groundwater levels remain seasonally consistent during 2008-2009. Groundwater level elevations range from a high of approximately 640 ft MSL near WID Diversion Canal (well JSPW2 and URSW1) to a low of approximately 530 ft MSL at the Highway 207 bridge over the Umatilla River (URSW8).This represents a decrease of nearly 110 ft across Echo Meadows and an overall horizontal gradient of approximately 0.003 ft/ft. The data collected by IRZ (2006) shows that the groundwater elevations measured between 1998 and 2003 are also consistent with this study. Table 2 includes the groundwater level data collected in 2008 and 2009.

The predominant direction of groundwater flow was northwesterly in 2008 and 2009, generally paralleling the river course. This same general direction is depicted in IRZ (2006) for data collected between 1998 and 2003. The potentiometric maps also indicate an inflow of groundwater through Spike Gulch. Spike Gulch appears to be a drainage course allowing water from an upstream sub-watershed to flow toward Echo Meadows. As mentioned before, groundwater was not encountered during advancement of the borehole at White House Road and Hunt Canal. However, the log of well UMAT 56241 installed approximately 2,000 ft east of the borehole in October 2008 indicated the presence of groundwater at a static level of 30 ft bgs (top of basalt at 50 ft bgs). It appears that south of Hunt Canal, groundwater may be seasonally present in areas adjacent to Spike Gulch. Figure 16 depicts the topography of the area of Echo Meadows showing the location of Spike Gulch within the landscape. The log of well UMAT 56241 is included in Appendix B.

In developing the potentiometric maps, wells which were pumping at the time of data collection were noted and their data was not used. At the scale of Figures 12 through 15, the effect of localized pumping on groundwater contour shape appears to be generally minimal. Therefore, the groundwater level contours predominantly reflect the natural groundwater flow system. It should also be noted that the wells whose data are used for contouring all penetrate through the cemented gravel layer and likely provide for migration of groundwater across this layer through well bores. It is therefore assumed that the groundwater levels measured across Echo Meadows are combinations of the levels in the two layers.

Based on the potentiometric levels, the horizontal groundwater gradient across Echo Meadows remained seasonally consistent at a value of 0.003 ft per foot (ft/ft) in 2008 and 2009. The average horizontal groundwater gradient estimated by IRZ (2006) for the water level data measured between 1998 and 2003 was also 0.003 ft/ft. As previously mentioned, the flow direction and horizontal gradient of the groundwater system remains remarkably consistent on seasonal and annual bases. The reasons for this consistency are explained in the discussion of recharge and discharge mechanisms presented below.

The unsaturated soil thickness across Echo Meadows is different between wells and varies from approximately 2 to 10 ft between wells north of Hunt Canal to approximately 1 to 7 ft south of Highway I-84 where the topography levels out. The unsaturated soil thickness between Highway I-84 and the Umatilla River varies from about 1 to 12 ft in various wells. Figures 17a through 17c depict changes in unsaturated soil thickness between March 2008 and April 2009 in wells north of Hunt Canal, in the middle of Echo Meadows, and between I-84 and the Umatilla River, respectively. Figures 18a through 18c depict groundwater level elevations for the same wells. Table 2 includes unsaturated soil thickness values in these wells. The greatest thickness of unsaturated soils approaches approximately 30 ft in a relatively small area surrounding wells UMAT 1177 and UMAT 1176 located on a high terrace in the western part of Echo Meadows. The thickness of unsaturated soils in this area remains fairly constant throughout the year.

Assuming an unsaturated soil thickness of between 2 and 10 ft across Echo Meadows (Figures 17), a maximum specific yield of 0.2 based on IRZ (2006) and the types of soils present, and providing for a 5-ft unsaturated depth to support crop root zone, a maximum available storage capacity of 1 acre foot per acre (AF/Ac) of land can be estimated for Echo Meadows. This capacity is larger on the western terraced area and decreases toward Hunt Canal and the Umatilla River. The value of 1 AF/Ac of land should be considered a theoretical maximum as it changes across Echo Meadows and also seasonally. Therefore, theoretically, Echo Meadows has a maximum storage capacity of 9,000 AF. The actual recharge volume which can be achieved is lower than this since it is not only a function of storage capacity but also on soil infiltration rate and rate of groundwater flow. A deeper unsaturated zone allows a larger mound and larger recharge volumes per acre of land to develop. A higher infiltration rate reduces the amount of land area needed to recharge a unit water volume. Finally, greater groundwater flow rates allow faster dissipation of the mound and greater recharge volumes. Based on our understanding of the lands that may be offered for recharge and overall recharge rates that may be accomplished, and practical aspects of the management of recharge, we estimate that the total recharge capacity at Echo Meadows is up to 6,000 AF per year.

Based on data from 52 wells, IRZ (2006) calculated an average yield of 143 gallons per minute (gpm) and a maximum pumping rate of 1,530 gpm for well depths ranging from 20 to 135 ft and averaging 63 ft. Hydraulic conductivity values calculated from aquifer tests and dye-tracer tests ranged from about 17 to 44 ft/day for wells completed within the fine sediments in the northern portion of Echo Meadows to greater than 1,000 ft/day at well UMAT 1269 in the south. The specific yield of the sediments at well UMAT 1269 was estimated at 0.2.

A pump test was conducted in October 2008 in well UMAT 1195 located in the central portion of Echo Meadows. Two observation piezometers were installed at distances of 50 and 250 ft. Drawdown data was collected from these wells during a constant flow aquifer test using pressure transducers and automatic data loggers. Using Theis curve matching technique, a hydraulic conductivity of 230 ft/day and specific yield of 0.22 was calculated for the 50-ft observation well. A hydraulic conductivity of 765 ft/day and specific yield of 0.29 was calculated for the 250-ft observation well. Additionally, continuous water level data was collected with a pressure transducer in well UMAT 1271 located in the southern part of Echo Meadows near well UMAT 1269. Based on data collected during an irrigation event from this well and well UMAT 1269, a hydraulic conductivity of 356 ft/day and specific yield of 0.091 was estimated for sediments in the area of these two wells. The aquifer test report is provided in Appendix C.

It appears that most areas within Echo Meadows have hydraulic conductivity values ranging between 100 and 400 ft/day corresponding to well-sorted sand and gravel based on Fetter (2000) classification. Hydraulic conductivity values tend to increase toward the town of Echo to between 500 and 1,000 ft/day.

Based on an average horizontal hydraulic gradient of 0.003 ft/ft, low and high conductivity values of 230 and 765 ft/day corresponding to sediments in the middle to southern portions of Echo Meadows (closer to where potential recharge would occur), and an assumed effective porosity of 0.2, groundwater flow velocity is estimated at between approximately 3.5 and 11.5 ft/day. At these rates natural groundwater travel times between well DMPW2 along White House Road and the Umatilla River north of well DMDW2 (a distance of approximately 4 miles along the flow path) range from approximately 5 to 16 years. Additionally, a groundwater flux rate of approximately 9 to 30 cfs (or 18 to 60 AF/day) can be estimated based on this data. In the absence of additional groundwater pumping, this flux is assumed to recharge the Umatilla River along its course downstream of Dillon Dam.

It should be noted that the estimated groundwater migration rates represent the natural groundwater system. There are springs, subsurface drains, drainage canals, and irrigation water delivery canals that are expected to locally influence natural groundwater migration rates. Although this study did not attempt to quantify the impact of these factors, their immediate impact is to convey part of the groundwater to the Umatilla River much faster than its subsurface travel time indicates.

4.3 Recharge and Discharge Mechanisms

Groundwater recharge mechanisms in Echo Meadows include inflow from the Umatilla River and groundwater inflow from Spike Gulch and Stage Gulch east of the river (Figure 16). Similar to Spike Gulch, Stage Gulch allows migration of groundwater from upland areas to the Umatilla River. Leakage from unlined irrigation canals and ditches and applied irrigation water provide additional mechanisms for inflow of river water. Precipitation is a relatively small portion of total recharge. Natural precipitation recharges the aquifer during years when soil moisture levels remain high and are followed by heavy precipitation. This was observed in one year (2002-2003) out of five (1998-2003) by IRZ (2006). Hansen et al. (1994) estimated that groundwater recharge in the lower Umatilla Basin including Echo Meadows was about 0.02 to 1 inches per year in the pre-development period (1850's). Wozniak (1995) cites average annual recharge depths from precipitation of 0.2 to 2 inches, occurring predominantly during winter months.

The Umatilla River stage and flow rate between Echo and Highway 207 Bridge are significantly influenced by the depth to basalt bedrock and the high level of river management. Due to its geology, the Umatilla River enters Echo Meadows within the narrow Echo gap just upstream of the town of Echo where the river and shallow groundwater are bounded by the basalt bedrock on all sides. The river and groundwater exit Echo Meadows in an area similarly bounded by basalt at and upstream of Highway 207 Bridge. Between the two points, basalt bedrock forms a generally shallow bottom flow boundary causing the overlying sediments to be saturated to near river levels. Upstream of Stanfield Bridge, the WID and Dillon diversion structures control the river stage throughout the year. Downstream of Stanfield Bridge the backwater pool behind Maxwell dam, located approximately 0.5 miles downstream of Highway 207 Bridge, extends miles into the lower parts of Echo Meadows. These structures work to maintain the river stage within a narrow range throughout the year. Finally, water releases from McKay Reservoir during summer time exert additional control over river water levels.

Based on the above discussion and groundwater flow direction depicted on Figures 12 through 15, natural groundwater discharge from Echo Meadows is expected to principally be to the Umatilla River. Figure 19 depicts changes in the Umatilla River stage along Echo Meadows in 2008-2009. The figure does not show high flood stages reached during storms or rapid snow melt events because of times of sampling. Figure 19 indicates that above Dillon Dam (URSW5 and 6), the water levels during the irrigation season are higher than other times due to setup of diversion boards. Below Dillon Dam, changes in water levels throughout the year are minimal. In general, seasonal river stage fluctuation is less than approximately 5 ft. The groundwater flow pattern in nearby wells and piezometers (Figure 18c) generally followed the stage levels. Additionally, Figures 20a and 20b show river stage and groundwater levels measured in wells close to the river for 4 November 2008 and 25 February 2009, respectively. Due to project constraints most of the river stage measurement points and wells were selected from what was available and do not necessarily provide paired observations. Nevertheless, the data from both events indicates that groundwater levels are very similar to river level and, therefore, assumed to directly interact along all of the river's reach.

As discussed above, groundwater levels in Echo Meadows appear to respond predominantly to the Umatilla River stage fluctuations due to geology and river flow management. Weber (1973) reached a similar conclusion after evaluating the major factors contributing to soil drainage problems in the area. IRZ (2006) provides infrared aerial imagery showing several specific locations along the river where groundwater clearly discharges to the river. Kreag (1991) concluded that the reach of the river from Echo to approximately the location of Dillon dam is a losing reach and the reach below is a gaining reach. It is not clear from the 2008-2009 data whether there is a clear demarcation of the gaining versus losing reaches of the river. However, based on the preponderance of evidence regarding the overall behavior of the groundwater system and the river stage, it appears that the reach of the river below Dillon Dam is a predominantly gaining reach and the reach between WID dam and Dillon Dam is a predominantly losing reach.

4.4 Water Quality

Water quality data were collected at Echo Meadows during this study as part of shallow aquifer recharge activities and follow-up sampling events. The specific objectives of the water quality sampling events were as follows:

- Assess the quality of the Umatilla River water as aquifer recharge source water.
- Assess the capacity of soil and sediment at Echo Meadows to treat the Umatilla River recharge water for its potential use as Aquifer Storage and Recovery (ASR) source water.
- Augment previous data and information regarding the spatial distribution of compounds that are of interest to aquifer recharge and groundwater recovery for ASR.

Water samples were collected from selected locations during March, April, May, June, July, and October 2008. The March and April samples were collected immediately prior to aquifer recharge activities. Other samples were collected during and after completion of recharge. Some of the later samples were collected to augment available results or to address identified data gaps.

Samples were collected from wells and from locations along the Umatilla River and Hunt Canal. Samples from the Umatilla River and Hunt canal were collected as grab samples from near-shore locations and from a depth corresponding to approximately one third of the water profile depth. Groundwater samples were collected from a mix of irrigation, domestic, and unused wells. Samples from irrigation and domestic wells were collected from spigots at the wellhead during well pumping. For these wells, samples were collected after at least 20 minutes of continuous pumping or when field parameters including pH, temperature, and specific conductance were stabilized to within 10 percent. At several wells oxidation-reduction potential (ORP) and dissolved oxygen (DO) were also measured and were used to aid in decisions regarding stability of field parameters. Unused wells were sampled by use of a stainless steel Grundfos pump and dedicated tubing. Since these wells were former large diameter irrigation wells, they were purged for at least 20 minutes followed by stabilization of field parameters prior to sample collection.

The samples were collected in bottles supplied by the laboratory and retained in coolers with ample ice for temperature control. The samples were analyzed for one or a combination of bacteriological agents and organic and inorganic compounds. Field parameters were measured during sampling. Samples from selected wells were additionally analyzed for radionuclides. Figure 5 shows the sampling locations. Tables 3 and 4 list the laboratory and field sample results for the alluvial aquifer water samples collected in this study. The samples were shipped under Chain-of-Custody protocol to the laboratories listed in the footnotes to Table 3. The chain-of-custody forms, lab log in forms, and laboratory analytical reports are enclosed as Appendix D.

The sampling results indicate the following:

- Analysis of fecal coliform bacteria was performed in samples collected from Hunt Canal at locations designated HCSW1 and HCSW2. The sample results were up to a value of 80 Most Probable Number per 100 milliliter (MPN/100 ml). During sampling it was observed that water fowl were present near the sampling location and water was turbid. Measured coliform bacteria levels in wells ranged from less than detection limit of 2 to a maximum of 30 MPN/100 ml. It should be noted that the three wells which exhibited elevated coliform levels include pit wells DMPW2 and JSPW1, and the unused irrigation well UMAT 1177 which are open to access by small animals and windblown vegetation. The detection of high coliform levels in these wells is perhaps associated with the presence of dead field mice, birds, insects, and other fauna and/or vegetation in various stages of decay.

The turbidity of the canal water measured in the sample collected from HCSW2 on 20 May was relatively high at 42.6 Nephelometric Turbidity Unit (NTU). The Umatilla River during this time was also observed to be turbid due to recent snow melt water runoff. As a result canal water was carrying a lot of sediments from the WID diversion point past the HCSW2 location.

- The levels of nitrate and nitrite (as nitrogen) in Hunt Canal water samples ranged up to a maximum of 0.219 milligrams per liter (mg/L). Nitrate as nitrogen was detected in all the wells sampled. Nitrite as nitrogen was only detected in some wells. The concentration of nitrate as nitrogen in groundwater wells ranged from a minimum of 0.354 mg/L in well UMAT 1198 to a maximum of 16.4 mg/L in pit well DMPW2.

  Two soil samples SS-EM-FD1-D and SS-EM-FD1-W were collected on 29 September 2008, one from outside and one inside of the area inundated during Field 1 recharge, respectively. The samples were collected at locations shown on Figure 11 by compositing the top one foot of soil collected using a stainless steel soil probe. The samples were sent to Agri-Check, Inc. laboratory in Umatilla, Oregon, for analysis of nitrate nitrogen by Oregon State University “Methods of Soil Analyses - #89:4”. The laboratory results were 29 and 7 pounds per acre of nitrate nitrogen, or 7.25 and 1.75 milligrams per kilogram (mg/kg) dry soil basis, for SS-EM-FD1-D and SS-EM-FD1-W samples, respectively. These results indicate that surficial soil in Field 1 potentially contained greater than 4 times the nitrate levels prior to recharge. The elevated nitrate nitrogen levels in well DMPW2 samples may be partly the result of flushing of soil nitrate nitrogen by infiltrating recharge water. Soil analytical results are enclosed in Appendix D.

  The Oregon Department of Environmental Quality (ODEQ) sampled several wells in and around Echo Meadows in September 2003 as part of the Lower Umatilla Basin Groundwater Management Area activities. Within Echo Meadows, ODEQ sampled wells UMAT 1269 and UMAT 1325 (CHDW1 on Figure 5). The nitrate plus nitrite nitrogen in these wells were reported to be 3.13 and 1.45 mg/L, respectively (ODEQ 2006). The nitrate plus nitrite nitrogen concentrations detected in well UMAT 1269 during this Echo Meadows recharge study ranged from 7.39 to 8.39 mg/L.

- The samples were analyzed for herbicides 2,4-D, Thifensulfuron methyl , Tribenuron methyl , Metsulfuron methyl , MCPA (Clearmax) , and Diacamba (Banvel). These herbicides were selected after consultation with Mary Corp of Oregon State University Extension Service in Pendleton regarding common agricultural crops upstream of Echo Meadows, and the 2007 CPR Book on the types of herbicides typically used on these crops in the area and their active ingredients, and environmental mobility, use rates, and relative human and ecological toxicity levels for the active ingredients. The sample results were all less than the detection limits.

- Surface water sample HCSW2 collected from Hunt Canal and groundwater samples collected from wells DMPW2 and UMAT 1269 in May 2008, and groundwater samples collected from wells MLPW1 and TCDW1 in October 2008 were sent to Anatek Labs, Inc. laboratory in Moscow, Idaho for analyses of Oregon drinking water constituents. These constituents included disinfection byproducts, disinfectants, geochemical parameters, metals, synthetic organic compounds, volatile organic compounds, and radionuclides. The drinking water constituents also included color, corrosivity, foaming agents, odor, ultra violet light absorbance at 254 nanometer wavelength (for some samples), and total suspended solids. Other than occasional exceedance of total dissolved solids and pH, other analyzed compounds did not exceed their drinking water standards.

Additional discussions of water and soil quality results are presented in the section below.

4.5 2008 Alluvial Aquifer Recharge Activities

Recharge of the Echo Meadows alluvial aquifer was conducted in 2008 to assess aquifer potential to augment the Umatilla River flow rate, enhance its water quality, and provide opportunities to treat recharged surface water for later storage in a basalt aquifer. Initial assessments of river flow augmentation potential were completed through several years of groundwater recharge studies in Echo Meadows between 1998 and 2003 (IRZ 2006). The maximum amount of water that was diverted and recharged was 368 AF which was diverted in 2003. The findings of these studies provided good initial information regarding the practicality of this approach. The findings included options to use the existing WID irrigation system of canals, headgates, and gages to convey and regulate flow of diverted water to fields. The findings also included data and information on hydrogeology and recharge water mounding, water quality, river flow gains, and water temperature. An initial groundwater flow model was developed based on the available information and data.

Due to the limited scope of the previous projects, their findings are also limited. Beginning in March 2008, IRZ began a more comprehensive study to evaluate the process, logistical requirements, and benefits of recharging the Echo Meadows alluvial aquifer with the Umatilla River excess winter flow. This study was conducted under Limited License Number 1111 (Appendix A). This section includes the methodology and findings of the 2008 recharge study.

4.5.1 Recharge Study Objectives

The study was designed to provide information and data to answer the following specific questions:

- Can the target volume of water be diverted during the river high flow period?
- Can the WID system operation and the recharge methods be managed to allow effective infiltration of the diverted water?

- What is the subsurface distribution and migration path/rate of recharged groundwater?
- What is the distribution of discharge water along the river?
- Can the existing groundwater flow model be refined for water management purposes?

4.5.2 Water Delivery System

the Umatilla River water diverted into WID's Hunt Canal through WID's diversion works was used for recharge. Based on current water rights, 250 cubic feet per second (cfs) of river flow during the recharge period is dedicated to instream uses, 75 cfs is diverted to CLWID recharge system through Hunt Canal, and 220 cfs is allocated to fill Cold Springs Reservoir through the feed canal. Therefore, only river flow greater than 545 cfs was available for recharge in this study. The amount of water to be diverted on a daily basis was determined through continuous consultation with the OWRD Watermaster in the Pendleton Office.

The maximum rate at which river flow can be diverted for recharge during this or future studies is equal to the carrying capacity in Hunt Canal less its irrigation service needs and CLWID diversionary needs. The carrying capacity of the canal is rated at 125 cfs. Due to CLWID system capacity, its historical average diversion rate has been approximately 50 cfs. Therefore, on an average basis, up to approximately 75 cfs of water can be diverted from the river, if other irrigation uses have not begun yet and river flow exceeds 545 cfs as measured at the Umatilla gage. As irrigation in the WID service area begins, the canal's available capacity decreases until it is fully used, typically sometime in June. The actual daily diversion rates achieved for this project were much less than 75 cfs due to a variety of factors. This flow rate was adequate to achieve most of our objectives.

Hunt Canal is unlined and is approximately 20 to 30 ft wide by 4 ft deep. The canal extends to Service Butte where it splits into two segments (the "A" and "B" Line Canal). The segment of canal between the river and the split (referred to as the Echo Meadows reach) was used for recharge. In this reach, the canal has a series of headgates that allow diversions to fields north of the canal. The flow through the headgates is measured by noting the water elevation, headgate opening, and the duration of flow. The approximate locations of the headgates are shown on Figure 5.

Water from the headgates flowed to the recharge fields through existing unlined irrigation ditches. This existing distribution system, with minor modifications to remove accumulated debris or other minor obstructions, efficiently conveyed water to fields.

4.5.3 Recharge Locations, Rates, Periods

Six "recharge fields" were targeted for water application, as shown on Figure 5. These fields were selected based on their use in previous studies, their proximity to the Hunt Canal source of recharge water, lack of active farming in the recent past and in 2008, and landowner willingness. Due to limited availability of recharge water and other logistical issues, water was only applied to portions of Fields 1, 2, and 6 designated “water application areas“ (hatch-marked) on Figure 5. The water application areas had not been irrigated or farmed within the last few years and were not irrigated in 2008. The water application areas were flooded without any berming or other engineered ponding structure, except Field 1 at which a cutoff trench had to be constructed to keep the water from overflowing onto a nearby cropped field.

The water application area in Field 1 comprised of approximately 20 Ac of land. The canal water was conveyed by opening headgate number G6 between 18 April and 20 May (equivalent of 24 actual recharge days). The total recharge volume amounted to 58 AF. The approximate overall recharge rate achieved in the field can be estimated at 0.12 ft/day based on the volume recharged, the actual area of recharge, and the number of days of recharge. This value is less than the soil infiltration rate of 0.48 ft/day measured in this study. This difference is believed to be from periodic interruptions in water application, changing application rate, and expanding soil recharge area. Figure 21 shows the aerial images of recharge fields at their maximum extent. Table 5 summarizes recharge periods and volumes for Field 1 and other fields.

The water application area in Field 2 comprised of approximately 37 Ac of land. The canal water was conveyed through opening headgate number G13 between 18 April and 31 May, amounting to a total recharge volume of 25.6 AF. Based on these values, an approximate overall recharge rate of 0.13 ft/day can be estimated. This value is similar to Field 1 and is expected due to the generally similar types of soils present in these fields.

The water application area in Field 6 comprised of two parcels of land. The smaller parcel comprised of approximately 59 Ac of land located on a terrace next to Hunt Canal. The recharge water was supplied through periodically opening headgate number G21 between 25 April and 30 May amounting to a total recharge volume of approximately 450 AF. Based on these values, an approximate overall recharge rate of 0.68 ft/day (1.4 in/hr) is estimated for this field. This is lower than the measured soil infiltration rates of 9.56, 9.68, and 5.46 ft/day and the range of 6-20 in/hr reported by U.S. Department of Agriculture (1988). This pattern is similar to what was observed in Field 1 and indicates that with land preparation and improved management of recharge operation the volume of water which can be recharged can significantly increase.

The larger parcel of Field 6 comprised of land located below the terrace in an area which annually forms several ponds. A total of approximately 66 AF of water was conveyed to the ponds through periodically opening headgate number G20 between 25 April and 30 May. Recharge water was supplied through gravity flow in an irrigation pipe which extended to the southern-most pond. The recharge water flowed into water already present in the ponds. The area of the pond is variable and expands rapidly with inflowing water.

Management of recharge involved effective coordination of activities by land owners, OWRD Watermaster, WID staff, and study personnel. Significant coordination was needed to apply recharge water during the times when river water was available, when the canal could be used while other water users were serviced, canal headgates operated at appropriate times and rates, recharge fields flooded without jeopardizing adjacent cropped farms, and water flow and quality data collected to satisfy the limited license requirements.

In total, approximately 600 AF of water was recharged in 2008. This is greater than the total amount of 368 AF which was applied in 2003. The field observations from the 2008 recharge event indicate that significantly greater volumes of water can be applied to the recharge fields, especially Field 6, with certain operational modifications. The modifications include longer application period before other canal users begin, and increased area of application through additional land area, land grading, infiltration basin preparation, and berming. It is expected that with these modifications, the volume of recharge water can increase to potentially as high as 3,000 AF per year or greater. Additional acreage will need to be considered for AR if the maximum recharge potential of 6,000 AF is to be achieved.

*4.5.*4 Recharged Groundwater Flow

Field 1 was used for evaluation of recharge in this study. Existing wells surrounding this field included DMPW2, located adjacent and cross-gradient to the recharge field and UMAT 1269 located downgradient of the recharge field. Other nearby wells include UMAT 1271 and JSPW1 (Figure 5 and 12 through 15). Wells DMPW2, UMAT 1269, and JSPW1 were monitored routinely between March 2008 and March 2009 for groundwater level. Additionally, automatic water level sensors were placed in these wells and operated from March through July 2008.

Based on the potentiometric contour lines shown on Figures 12 through 15, wells DMPW2 and UMAT 1269 are located downgradient of the recharge mound. Figure 22 depicts groundwater levels measured by the pressure transducers in the monitored wells. Water levels in well DMPW2 indicate rapid rise in response to recharge. This well is the closest to the application area. Groundwater levels are beginning to rise in this area due to water leakage from Hunt Canal and the Umatilla River rising in response to spring flow increase and operation of irrigation diversion dams. As result, water level changes in wells UMAT 1269 associated with recharge cannot be distinguished from the overall groundwater rise.

It is clear that a mound was generated under Field 1 based on response in groundwater levels in well DMPW2 and ponding that occurred within the application area. The pond persisted for several days following cessation of recharge. The recharged groundwater is expected to follow the direction and flow rate of area-wide groundwater flow.

The project plan included an attempt to evaluate groundwater return flow (location and rate) to the Umatilla River associated with the recharge activity. The recharge volume that was achieved was relatively minimal compared with the total volume of groundwater in Echo Meadows and the flow increase in the Umatilla River resulting from it would not be measurable.

*4.5.*5 Water Quality Monitoring Results and Findings

The quality of recharge source water and the receiving alluvial groundwater was monitored for possible introduction of contaminants during recharge. The findings of IRZ (2006) show that groundwater quality remained very good during and following previous river water recharge events. In addition, sampling was conducted for analyses of soil physical and chemical parameters associated with aquifer natural treatment capacity.

In this study, samples of recharge source water were collected from Hunt Canal prior to recharge on 6 March and 17 April at HCSW1 upstream of Field 1, and during and following recharge at HCSW2 on 20 May, 3 June, and 22 July 2008. Groundwater samples were collected from wells DMPW2, UMAT 1269, and JSPW1 prior to recharge in March and on 17 April, during recharge on 20 May, and following recharge on 3 June and 22 July 2008. Sampling locations are shown on Figure 5. Sampling results are summarized in Tables 3 and 4. Laboratory analytical reports are enclosed in Appendix D.

The water quality data for samples obtained from Hunt Canal shows that, other than fecal coliform bacteria and turbidity (see Section 4.5), the analyzed parameters were not detected or did not exceed the drinking water quality or other applicable standards. Nitrate nitrogen ranged from a low of less than the detection limit of 0.1 mg/L to a high of 0.219 mg/L. None of the herbicides analyzed in these samples were detected above their laboratory detection limits. Water quality data collected during the 2001-2002 recharge study indicated that the Umatilla River's water quality was similarly good. The coliform counts ranged between 28 and 103 colony counts per 100 ml and with one exception, nitrate-nitrogen concentrations were less than 1 mg/L (IRZ 2006).

The pre-recharge groundwater sample results indicate a higher mineral content in groundwater sampled at DMPW2, UMAT 1269, and JSPW1 compared with Hunt Canal water, as is expected. There are higher concentrations of total dissolved solids (TDS), alkalinity, and hardness, as well as generally higher pH, higher specific conductance, and lower dissolved oxygen. The groundwater samples did not contain the analyzed herbicides at detectable levels. Groundwater samples collected during and following recharge were analyzed for the same parameters. The results showed no presence of herbicides. The geochemical parameters suggest an approximately 30 percent mixture of the imported water into native groundwater (HDR 2009).

Nitrate nitrogen concentrations in well DMPW2 ranged from a pre-recharge value of 13.2 mg/L to values of 16.3, 15.4, and 13.7 mg/L in May, June, and July sampling events. The reasons for this increase are not clear. One would expect that recharge of canal water containing much lower nitrate nitrogen concentrations near this well would reduce the concentrations in this well. The contrary trend points toward a nearby source of nitrate. Two shallow soil samples designated SS-EM-FD1-D and SS-EM-FD1-W were collected from the water application area in Field 1 for analysis of nitrate nitrogen. The laboratory results indicated a nitrate nitrogen concentration of 7.25 mg/kg outside the application area and 1.75 mg/kg inside. These results indicate that surficial soil in Field 1 potentially contained greater than 4 times the nitrate levels before and after recharge. The elevated nitrate nitrogen levels in well DMPW2 samples may be partly the result of flushing of soil nitrate nitrogen by infiltrating recharge water. This point should be considered during future selections of fields for aquifer recharge. The laboratory report is enclosed in Appendix D.

4.5.6 Natural Soil Filtration Capacity

The potential of aquifer soils and sediments to provide natural filtration treatment of recharging surface water was evaluated through soil sieve analysis on selected samples and Micro Particulate Analyses (MPA) of canal and groundwater samples. The evaluation methodology, results, and findings are presented in HDR (2009).

The recharge system at Echo Meadows was operated for a period of about 40 days. Based on chemical comparisons of native ground water, surface water, and well samples, the well sample is inferred to contain about 30% surface water. Despite containing surface water, the sample did not contain the organisms initially present in surface water (no MPA organisms were detected in the sampled well water). This indicates that the native soil horizon may effectively filter the applied surface water in the recharge system tested. The Echo Meadows site contains relatively fine-grained soils and appears to provide effective filtration. The fine soils may present a hydraulic limitation for recharge and could require frequent maintenance for permeability.

*4.5.*7 Groundwater Flow Modeling

IRZ (2006) presented the results of a regional computer groundwater model of the alluvial aquifers in the lower Umatilla basin which included the Echo Meadows aquifer. The model was used to simulate observed groundwater heads in Echo Meadows to within 5 ft. Since much of the seasonal variation in groundwater levels in this area is on the order of 5 ft or less, the model domain and input data need to be refined to allow predictions at higher resolutions. Due to budget constraints, the project resources were focused on collecting the field data and information needed to allow future model improvements. As explained in preceding sections, the field data and information obtained in this study have included comprehensive groundwater level elevations, geologic structure of the Echo Meadows sediments, additional aquifer hydraulic properties, and the influence of the Umatilla River stage on groundwater levels. A groundwater flow model based on improved data and understanding will provide a management tool to predict appropriate locations and times for groundwater recharge, select groundwater extraction rates, and locations for out-of-stream uses. Additionally, the model could estimate the extent of discharge to the river under varying recharge scenarios, changing land use patterns, and future changes in recharge objectives. A preliminary groundwater flow model has been developed for the Echo Meadows aquifer and is presented in GSI (2009b).

5.0 COUNTY LINE ALLUVIAL AQUIFER

The County Line alluvial aquifer, as defined in this technical memorandum, includes approximately 13,500 Ac of land straddling the northern boundary of Morrow and Umatilla Counties, and extending east passed the Umatilla River (Figure 3). This aquifer appears to provide the most suitable groundwater reservoir for AR activities in this area. Similar to Echo Meadows, the area overlying this aquifer consists of mostly pivot-irrigated and some flood-irrigated fields. The Umatilla Army Depot (Depot) overlies a large portion of the aquifer north of Highway I-84 and west of Highway I-82. Figure 22 shows a vicinity map of the County Line aquifer.

5.1 Geology and Soils

The area of the County Line aquifer is underlain by sedimentary deposits that overly the basalt bedrock (Davies-Smith et al. 1988). The aquifer area is structurally bounded by Service Anticline on the east side and the Willow Creek monocline to the south. These features affect the regional elevation and shape of the top of the basalt surface (Davies- Smith et al. 1988). The basalt surface regionally dips from south to north towards the Columbia River. Superimposed on this general trend, a basalt ridge exists in the middle of the Depot (Robison 1971). Well data also suggests a southeast-northwest trending elongated depression (or trough) south of the ridge (McCall 1975). The axis of the trough appears to dip in a northwesterly direction. South of the trough, the basalt surface rises again to the Willow Creek monocline. The basalt surface is shown in Wozniak (1995) and reproduced on Figure 4.

The sediments overlying the basalt include lenticular deposits of sand, gravel, silt, and clay (Sceva 1966). The trough in the basalt surface contains a significant accumulation of Pleistocene coarse-grained sand and gravel sediments. The presence of the trough and the coarse sediments appears to be the result of main-channel scouring and deposition from the Missoula floods (Wozniak 1995). The coarse sediments rest on the scoured basalt surface or on a floor of fine-grained flood sediments. The fine-grained sediments include the Alkali Canyon Formation and other sediments which were laid down during times when the outflow of the ancestral Columbia River was blocked causing an ephemeral lake to form in the area. The fine-grained deposits occur beneath the coarse sediments in the areas mapped in this project. Towards the west and north, extensive fine to medium sand deposits occur adjacent to coarse sediments. Together the finer-grained deposits provide a depositional boundary to the coarse sediments. Exposures of coarse deposits can be seen in many quarries in the area, as shown on Figure 23.

The lateral and vertical extent, and the hydraulic properties of, the coarse sediments are the primary factors that are important to alluvial aquifer recharge and recovery. The surrounding finer-grained sediments are composed of poorly stratified silt, sand, and clay and have low permeability except where thin sand units allow moderate transmittal of water to wells (Miller 1985). The presence of the finer-grained sediments works to retard the subsurface outflow of groundwater from the coarse sediments.

Wozniak (1995) developed an approximate lateral extent of the coarse sediments stretching in a 1.5 to 3 mile-wide band from west to east across the Morrow-Umatilla County border and to the Umatilla River. His map is based on the water well logs and literature description available at the time, and information from the well and borehole drilling activities on the Depot area. His map is reproduced for use in this study with proposed modifications as described further below. Dames & Moore (1993) discussed the presence of the 50-ft Coyote Coulee escarpment, running approximately from northeast to southwest in the middle of the Depot, as shown on Figure 22. Coarse sands, gravels, and cobbles occur to the east of the coulee, extending from the surface (approximately 600 ft MSL) to almost the basalt contact at approximately 460 ft MSL (a thickness of 140 ft). West of the coulee, the flood deposits are typically fine to coarse sand and gravel to an approximate elevation of 480 ft MSL. Beneath this is a sequence of silts, clays, and fine sand approximately 20 ft thick that caps the basalt. In general, the coarse Pleistocene deposits overlie the finer-grained lake deposits or basalt below a ground elevation of 650 ft MSL (Miller 1985).

Three groundwater monitoring wells were placed during this study at the locations shown on Figure 24. Well L93717 was installed at the boundary of Sections 29 and 32, Township 4 North, Range 27 East. The borehole was advanced to a depth of 108.5 ft bgs (464.2 ft MSL). Sediments encountered included fine to medium sand to a depth of 16 ft bgs followed by mostly medium to extremely coarse sands and gravel mix to a depth of 100 ft bgs. The coarse sand and gravel layer is determined to be the Pleistocene coarse sediments based on location, depth, and lithology. Below the coarse sediments, fine-grained sediments were encountered to the top of basalt encountered at the bottom of the borehole.

The second well L93716 (MORR 51690) was installed in the northwest quarter of Section 24 Township 4 North, Range 26 East, north of Highway I-84. The borehole was advanced to a depth of 97 ft bgs (447.3 ft MSL). Sediments encountered to a depth of 80 ft bgs included predominantly fine sand. Below 80 ft bgs, the sediments became much finer with depth. Although the top of basalt was not encountered in this borehole, the fine grained sediments at depth are assumed to reside over basalt, as indicated by literature descriptions. The third well L93718 (MORR 51692) was installed in the middle of Section 23, approximately ¾ of a mile to the southwest of well L93716 (MORR 51690). The borehole for this well penetrated similarly fine sand sediments to the final depth of 156 ft bgs. Logs for the three new wells are enclosed in Appendix B.

The lithologic information from the new wells and well log information from selected existing wells were used to develop three geologic cross sections across the area, locations of which are shown on Figure 25. The cross sections A-A’, B-B’, and C-C’ are depicted on Figures 26, 27, and 28, respectively. Along cross section C-C’ the basalt surface begins at an elevation of 464 ft MSL at the new well L93717 and is found approximately 90 ft deeper to 374 ft bgs at wells MORR 951 and MORR 949. It then rises to an elevation of approximately 462 ft MSL at well UMAT 5858 in the middle of the Depot. This represents the depression in the basalt surface shown on Figure 4 (discussed previously). Along cross section A-A', which traverses the area longitudinally, the top of basalt decreases from an elevation of approximately 437 ft MSL to the lowest elevation represented herein of approximately 369 ft MSL at MORR 946. The top of basalt gradually rises eastward toward the Umatilla River and attains an elevation of approximately 410 ft MSL at well UMAT 2420. The cross sections indicate that the top of basalt attains a lower elevation of approximately 410 ft MSL at the Umatilla River compared to 437 ft MSL at well MORR 50985 located near the eastern boundary of the aquifer. Logs for the wells used to construct the cross sections are enclosed in Appendix B.

The cross sections indicate that the coarse sand and gravel (designated SP/GP on cross sections) which was observed in well L93717 was not encountered in the other two new wells. Based on log information for these wells (L93716 and L93718), for well MORR 50985, and for a row of wells located further east, the western edge of the coarse-grained sediments in Wozniak (1995) was moved eastward to the approximate boundary shown on Figure 22. The coarse sand and gravel sediments are truncated, and appear to grade rather abruptly to fine sand, between wells MORR 946 and MORR 50985 (Cross section A-A').

To the south of the central trough, the coarse sediments appear to continue laterally past the location of well MORR 616 as they thin out and rise over a fine sediment layer (Cross section B-B'). As will be discussed in the next section, the groundwater level observed in well L93717 in February 2009 appears to be at approximately the elevation of the bottom of the coarse sediments at well MORR 976. South of this well, the water table is at a lower elevation than the bottom of the coarse sediments. Allowing for potentially up to 20 ft of rise from recharge, it is possible that well MORR 611 will intercept the recharge water. Therefore, in this study the southern extent of the coarse sand and gravel sediments defining the alluvial County Line aquifer is selected to reside at well MORR 611.

The cross sections further indicate that the coarse sand and gravel sediments appear to be the thickest near well MORR 951/MORR 949 (191 ft). To the north, they thin with rising basalt surface and over a similarly-rising fine sand layer (Cross section C-C'). As a result, the bottom surface of the coarse sand and gravel layer appears to rise significantly in elevation northward. No wells were identified in the north part of the Depot to estimate the elevation of the top of basalt in that area.

Finally, the coarse sediments may locally be overlain by fine sand (SP/SM) at the ground surface, with a thickness of typically less than approximately 20 ft. The mantle of fine sediments may locally be thick and was observed at approximately 75 ft at well MORR 960. The presence of the surficial fine sediments offers lower infiltration rates than the underlying sand and gravel. The measured water infiltration rates in the fine sand layer near the CLWID recharge overflow ponds were 14.4 and 26.6 ft/day, compared with a value of more than 500 ft/day measured in the sand and gravel layer within the pond area.

As the descriptions above demonstrate, the coarse sediments are bounded on many sides by the fine sand deposits, especially on the west and north. These deposits provide a lower permeability zone which will reduce the flow of recharged water out of the County Line aquifer compared to its rate of flow within the County Line aquifer. Recharged groundwater will migrate into these deposits under an imposed gradient, such as would be generated from a recharge mound. Migration of recharge water into these deposits should not be automatically construed as water "lost" to the system. These deposits provide additional storage capacity. The extent and hydraulic properties (permeability and saturated thickness) of these deposits can be incorporated into the design of the groundwater recovery system by strategically placing recovery wells and selecting appropriate pumping rates.

We should point out the following regarding development of the geologic cross sections:

- The surficial fine-grained sediments including fine sand and silt, usually associated with wind-blown deposits, are only shown where they were clearly reported on well logs and where they were relatively thick. Generally, the thickness of this layer less than approximately 5 ft was ignored in developing the cross sections due to accuracy of elevation measurements in the area. Figure 29 includes the surficial geology of the area and presents a more detailed mapping of the surface sediments.
- In interpreting the well log information submitted by drilling companies, the presence of thin interbeds or laterally limited gradations were ignored when these features occurred within a clearly dominant matrix. As such, we followed the "lumping" approach rather than a "splitting" stratigraphic approach for this study. Where such units occurred in significant quantities, for example near the Umatilla River or near the margins of the coarse sedimentary units, they are shown on the cross sections.
- The cross sections should be interpreted with the objectives of this study in mind. They will have to be refined further with surveyed elevation controls across the area. As such, the cross sections should be considered work-in-progress which will be refined with future data. Still, the information they convey provides a significant source of clarity regarding the three-dimensional extent of the sediments, relative groundwater elevations and thickness of unsaturated zone, and potential storage opportunities.

5.2 Groundwater Occurrence and Aquifer Characteristics

The coarse sand and gravel sediments define the "County Line alluvial aquifer" for the purpose of aquifer recharge in this study. The subsurface boundaries of this aquifer do not project directly to the ground surface everywhere since in some areas they are overlain by, or are inter-fingered within the surrounding, finer sedimentary units. Figure 22 shows the interpreted lateral extent of the aquifer based on the information contained in the geologic cross sections and approximate groundwater elevations measured in this study in November 2008 and February 2009 (discussed further below). The total area of the County Line aquifer shown on Figure 22 which would store and convey the recharge water is approximately 13,500 Ac. Approximately 10,000 Ac reside west of, and the remaining 3,500 Ac east of, Highway I-82.

The coarse deposits depicted on geologic cross sections provide the highest yields to wells in the area. Sceva (1966) reported the yield of many wells to exceed 1,000 gpm and some exceed 2,000 gpm. However, he reported that several wells had been completed partially in finer- grained sediments and achieved yields of only a few hundred gpm's or less. In the Westland Road Sub-area, many wells have capacities of over 1,000 gpm and two wells greater than 3,000 gpm, averaging 1,800 gpm (McCall 1975). Wozniak (1995) reported well yields of between 1,000 to 4,000 gpm in coarse sand and gravel deposits. Specific capacity of the high producing wells ranges from 25 to over 100 gpm/ft (King 1987).

The high well yields further indicate high hydraulic conductivity of the County Line aquifer sediments. Dames & Moore (1993) reported conductivity values from slug tests of between 200 and 1,000 ft/day in one area of the Depot and 1,571 and 1,955 ft/day in another. Dames & Moore (1992) reported an average permeability value of 585 ft/day and a high of 2,721 ft/day based on test, also conducted on the Depot. Miller (1985) estimated that within a half-mile distance from the CLWID canal groundwater flow rates away from the recharge mound were in excess of 500 ft/day and may approach 1,000 ft/day. Wozniak (1995) provides a summary table of hydraulic parameters for the coarse and fine-grained sediments, and is enclosed in Appendix E. Hydraulic conductivity values reported by Wozniak for the coarse sediments range from 1,000 to 4,000 ft/day, and for storage coefficients from 0.15 to 0.25.

Groundwater also resides within the fine sand and other fine-grained sediments surrounding the County Line aquifer. However, the fine-grained sediments have significantly lower permeability than the coarse deposits (Wozniak 1995). Dames & Moore (1992) report an average permeability value of 27 ft/day and a maximum of 503 ft/day for fine-grained sediments encountered in the northern part of the Deport beyond the aquifer boundaries. The lower permeability of fine-grained sediments surrounding the aquifer is expected to result in much lower rates of groundwater flow through the fine-grained deposits and lower yields to wells. For example, well log information indicates that well MORR 50985 located west of the County Line aquifer could be pumped at 600 gpm after drilling while well MORR 51131 was pumped at 1,475 gpm with no drawdown and well MORR 971 which was pumped at 2,000 gpm had only 1 ft of drawdown. Therefore, although the aerial extent of the saturated sediments is large, the County Line aquifer sediments form the primary volume of easily storable and recoverable groundwater for AR purposes and the Umatilla River flow augmentation.

In this study, the depth to water was measured in 17 wells in November 2008 and an additional 5 wells in February 2009. These wells are completed in the alluvial sediments and include 18 active or abandoned irrigation wells, one domestic well, and the three new monitoring wells. The earlier event corresponds seasonally to the-low-water-table time of the year following the end of irrigation season and the second event to the high-water-table time of the year before the next irrigation season begins. The timing for these events was selected to coincide with the water level measurements routinely conducted by OWRD each year. The measuring points of these wells were surveyed to an accuracy of 0.1 ft. Figures 30 and 31 show the measured water table elevations for the two events. Table 6 lists the water level elevations.

Wozniak (1995) depicts the water table surface in the area based on data collected in February 1991. Across the area of the aquifer, the groundwater surface depicted in Wozniak (1995, Figure 2.4) is flat at approximately an elevation of 500 ft MSL. The water table elevations in the area of the County Line aquifer were also flat ranging between elevations of approximately 496 to 498 ft MSL during the 2008 and 498 to 500 ft MSL during the 2009 monitoring event. Groundwater levels increased up to 3.9 ft (an average rise of 2.2 ft) from November 2008 to February 2009. This rise is likely mostly from natural recharge since the CLWID recharge canal had received only about 2,000 AF of water, other irrigation canals were not operating at the time, and no other man-made recharge sources are present in the area. Note that the depth to water measured in well UMAT 1568 in November 2008 and in well L76841 in both events appear to be anomalous.

A slight northwestward gradient appears to exist based on water levels measured in well L93716 relative to other wells. However, the spatial water level data in this area is insufficient to estimate a gradient. McCall (1975) indicated a general direction of groundwater flow to the northwest with a horizontal gradient of 12 ft per mile. Miller (1985) indicated the direction of groundwater flow was principally to the northeast toward the Umatilla River with some component to the northwest. Based on presence of groundwater near the ground surface and subsurface drains in the area northwest of well L93716, it is likely that northwest migration of groundwater does occur. Additionally, although groundwater level data within the Depot area was not measured in our study, Dames & Moore (1992) indicates that the direction of groundwater flow under the Depot is northerly to northwesterly during non-irrigation season and reverses when irrigation wells, located south of the Depot, begin pumping. Therefore, a northerly flow direction apparently exists.

To the east, the high groundwater surface elevation of around 499 ft MSL measured in this study appears to be higher than the elevation of the Umatilla River at approximately 485 ft MSL at a location north of Cottonwood Bend near well UMAT 2420. A groundwater surface elevation of 499 ft MSL depicting an area-wide “representative” water table elevation in February 2009 is shown on the geologic cross sections (Figures 26, 27, and 28). The Umatilla River water elevation appears to be lower than groundwater levels by approximately 14 ft. Miller (1985) states that alluvial wells in the Westland Road Sub-area near Cottonwood Bend appear to have benefited from the CLWID aquifer recharge activities. Similarly, Miller (1997a) and (1997b) further point out the hydraulic continuity of the groundwater system between the recharge location and the river. Bartholomew (1974) concludes that the Ordnance Gravel CGA sediments are hydraulically connected but the rate of groundwater movement between the CLWID recharge area and locations toward the Umatilla River depends on the extent and location of the “intervening pockets of coarse-grained deposits inter-bedded within areas of fine grains”. Finally, Wozniak (1995) concludes that the coarse sand and gravel unit is part of a single hydraulic system but that groundwater flow in this area is fairly complex. The information generated in this study suggests that groundwater recharged in the middle of the aquifer would spread out in all directions with northwesterly and northerly flow components and an easterly to northeasterly component toward the Umatilla River. More accurate wellhead surveys and additional field borehole information will be needed between Highway I-82 and the Umatilla River to refine our understanding of groundwater flow components and quantify flow rates.

The total thickness of the County Line aquifer sediments is variable due to the varying elevation of the top of basalt and thickness of overlying fine-grained sediments across the area. Based on the geologic cross sections, the thickness of sediments in the aquifer varies from a low of approximately 64 ft at well MORR 976, located near the southern boundary of the aquifer, to a high of approximately 191 ft at wells MORR 951 and 949, in the center of the area.

The thickness of the unsaturated sediments decreases toward the Umatilla River as the land surface elevation decreases. At well UMAT 2420, the thickness of unsaturated sediments is expected to be greater than approximately 30 ft based on a groundwater elevation of less than approximately 499 ft MSL. Elsewhere within the County Line aquifer, the minimum thickness of unsaturated sediments is observed to be approximately 40 ft at well MORR 946 in the western part of the aquifer. The thickness of the unsaturated sediments within the County Line aquifer varies to a high of 94 ft at well MORR 1543 but was mostly between 70 and 90 ft in November 2008 and February 2009. Aquifer recharge will use the unsaturated thickness of the sediments for storage.

Historically, groundwater levels in the area of the County Line aquifer have been as high as approximately 511 ft MSL in late 1950s before significant pumping began. This level likely reflects pre-development natural equilibrium levels and some artificial recharge from the previously-unlined WID irrigation canal paralleling Highway I-82 which was constructed prior to the 1950s. Figure 32 depicts the historical groundwater elevations for several wells based on data reported by OWRD. Well locations are shown on Figure 24. Based on the high February 2009 measured levels of approximately 500 ft MSL, the current high water levels are approximately 11 ft lower than historical equilibrium levels. The geologic cross sections indicate that groundwater levels can potentially rise even higher than pre-1950s levels to provide additional groundwater storage volumes.

The rise in groundwater levels from the lowest levels observed in mid- to late 1970s appears to correlate well with CLWID recharge events beginning in 1978 and with total annual precipitation. The total annual recharge volume is plotted with the groundwater levels on Figure 32. The recharge occurs following winter precipitation and spring melt runoff when there is adequate live flow in the Umatilla River, typically during higher precipitation years. The CLWID has achieved recharge volumes of up to 10,240 AF with an annual average of more than 6,000 AF. The total annual precipitation measured at two stations in Hermiston and one located at the Pendleton Experiment Station are shown with total CLWID annual recharge volumes on Figure 33. The recharge volume fluctuation with time correlates well with total precipitation in the area, which in turn correlates with groundwater levels. This data supports Miller (1985) statement that the rise in groundwater levels in their assessment was associated with CLWID recharge as well as natural recharge. This data alone cannot be used to provide an estimate of the relative contributions of the two mechanisms to total groundwater storage. However, based on relatively low precipitation depths in the area, the groundwater rise is deemed to be mostly the result of CLWID, and previously WID canal, recharge.

The response of the County Line aquifer to CLWID recharge appears to be rapid. Figure 34 depicts the mean daily flow in the CLWID recharge canal measured by OWRD at Station No. 14030820 and groundwater levels measured in this study in wells L93717 and UMAT 55720. Well L93717 is located at the end of the recharge canal and well UMAT 55720 is located more than a mile northeast. The first recharge in the 2009 water year began on 8 January and ended 28 January 2009 for a total of approximately 2,050 AF. The water level in well L93717 appears to begin rising on the same day. The amplitude of the water level response in well UMAT 55720 is less drastic but the response begins within a few days after the beginning of recharge. This behavior in area water levels is very consistent with a highly permeable aquifer and extensive lateral continuity. This same behavior was reported by Miller (1985).

Miller (1985) suggested that a 1 ft water rise in alluvial wells in the area corresponds to approximately 7,500 AF of groundwater storage, based on an analysis of recharge volumes from CLWID and natural sources, and groundwater level data over time. Based on Miller’s estimated unit storage and a potential 11-ft rise in groundwater levels, it may be expected that storage of up to 75,000 AF of water can be considered in the County Line aquifer. Additional rise of groundwater levels beyond 11 ft may result in even more storage. Assuming an additional 30 ft of rise in water levels (maximum unsaturated soil thickness of 40 ft), a 10,000-acre area of aquifer for storage of recharge water, and a specific yield of approximately 0.30 for the coarse sediments of the aquifer, an additional storage capacity of 90,000 AF appears to be available. The actual rise in groundwater levels corresponding to this volume of storage is expected to be less than 30 ft due to continuous aquifer pumping, groundwater spreading within the coarse sediments which exist beyond the boundary shown on Figure 22, and groundwater migration into, and additional storage in, adjacent finer-grained sediments. These estimates are not used in this study to indicate actual storage volumes but to establish a maximum theoretical limit on storage volume within the sand and gravel aquifer material. The actual recharge volume achieved will be critically dependant on recovery system design and limitations associated with groundwater levels rising too close to ground surface.

5.3 Recharge and Discharge Mechanisms

Natural recharge to the County Line aquifer is principally from CLWID recharge canal and historically from the WID A-Line irrigation canal. Natural recharge from precipitation is understood to be small. Recharge from the Umatilla River doesn’t appear to occur as the level of the river north of Cottonwood

Bend (approximately 485 ft MSL) is lower than County Line aquifer groundwater levels (at 496 to 500 ft MSL).

Currently, the CLWID recharge canal is the primary source of recharge of the aquifer. As described above, the rise in groundwater levels from the lowest levels observed in mid- to late 1970s appears to correlate well with CLWID recharge events beginning in 1978 and with total annual precipitation. The rise in groundwater levels is likely mostly the result of CLWID, and previously WID canal, recharge, and secondarily from precipitation recharge. The CLWID has achieved recharge volumes of up to 10,240 AF with an annual average of more than 6,000 AF.

King (1987) concluded that direct recharge from precipitation on the lower river basin is small. Miller (1985) was able to document aquifer water level responses, on the order of inches, to precipitation recharge. Wozniak (1995) indicated that 2 inches of recharge is a “liberal” estimate of long term precipitation recharge for the area. Using the 13,500 acre area of the aquifer, this amounts to 2,250 AF of recharge volume as a “liberal” long term average. Compared with the CLWID recharge, the natural recharge contribution to total recharge is only secondary.

The WID A-Line canal extending northwest of Cottonwood Bend in the Umatilla River was in operation prior to the 1950s. Portions of the A-Line canal were lined and portions were piped in the early 1980s to reduce canal leakage. Based on preliminary estimates made since the 1980s, the total leakage was estimated at between approximately 2,200 and 11,000 AF per year (Wozniak 1995, Miller 1985). There is no independent verification of the accuracy of these values. It is expected that canal leakage was a source of aquifer recharge along the course of the canal but that this recharge mechanism has been reduced in extent over time.

Discharge of the County Line aquifer groundwater is through natural pathways including subsurface discharges in northerly and northwesterly directions to the surrounding fine-grained sediments and easterly to the Umatilla River, and through irrigation and domestic pumping. By far, irrigation pumping constitutes the most significant groundwater discharge from the County Line aquifer. However, with the start of aquifer recharge with imported Columbia River water, the natural discharge pathways become increasingly important as these pathways provide alternate migration routes out of aquifer storage. These pathways will need to be managed through operation of the recharge and recovery systems in such a way to maximize storage for irrigation and outflow to the Umatilla River and minimize flow elsewhere.

The northerly and northwesterly subsurface discharge of groundwater from the County Line aquifer cannot be estimated at this time due to flat horizontal hydraulic gradients in our study area. These flow rates will need to be estimated to allow an efficient design of the recharge and recovery systems. Likewise, the extent of groundwater discharge to the Umatilla River between Cottonwood Bend and Bridge Road where the river penetrates the coarse sediments will need to be assessed.

5.4 Water Quality

Available groundwater quality data includes samples collected from four wells in this study, results from the LUBGWMA sampling events conducted in 2003, and the results of sampling conducted on the Depot as part of site cleanup activities. The results and findings from these sampling programs are presented below.

5.4.1 Sampling Conducted in This Study

Groundwater samples were collected from four alluvial well including MORR 972 on 21 May 2008 and MORR 968, MORR 956, and UMAT 1571 on 22 October 2008. These samples were collected from access ports on the wellhead during irrigation pumping, or if the pump was shutoff, after running the pump for at least 20 minutes. Field parameters including pH, temperature, specific conductivity, oxygen-reduction potential (ORP), and dissolved oxygen were monitored during purging. Samples were collected once stabilization of the parameters was achieved. In most cases, there was fluctuation in the values of ORP and dissolved oxygen, and so stability in the other parameters was used to indicate the end of purging. Following collection, the samples were labeled, logged on a chain of custody form, and stored in coolers containing ice. The samples were shipped to Anatek Laboratories in Moscow, Idaho for analysis. Copies of chain of custody forms, laboratory log-in forms, and laboratory reports are enclosed in Appendix D.

The sample results are summarized in Tables 7 and 8. Of the parameters analyzed, nitrate as nitrogen, total dissolved solids (TDS), and dissolved iron were detected in some samples above water quality standards. Nitrate as nitrogen was detected at a concentration of 0.314 mg/L in well MORR 972 but was higher than the standard of 10 mg/L in wells UMAT 1571 at 17.4 mg/L, MORR 968 at 16.7 mg/L, and MORR 956 at 15.8 mg/L (Table 8). TDS was detected at values slightly greater than its standard of 500 mg/L in wells MORR 968 at 526 mg/L and MORR 956 at 504 mg/L (Table 8). Dissolved iron was detected at values slightly greater than its standard of 0.3 mg/L in wells UMAT 1571 at 0.454 mg/L, MORR 968 at 0.43 mg/L, and MORR 956 at 0.406 mg/L (Table 7).

5.4.2 LUBGWMA 2003 Synoptic Sampling Event

In 2003, ODEQ conducted sampling of a number of wells as part of their LUBGWMA groundwater nitrate monitoring activity (ODEQ 2006). Several wells within or surrounding the County Line aquifer were sampled including MORR 946 (ODEQ UMA168), UMAT 1565 (ODEQ UMA183), MORR 613 (ODEQ UMA133) and four wells located on the Depot including MW-4 (ODEQ UMA218),well 4-16 (ODEQ UMA228), well 4-1 (ODEQ UMA224), and well 4-18 (ODEQ UMA225). These samples were analyzed for geochemical parameters, nitrate plus nitrite nitrogen, and a few other parameters. The concentrations of nitrate plus nitrite as nitrogen were 3.28 mg/L in MORR 946, between 7.31 and 8.59 in the Depot wells sampled, 13.3 mg/L in MORR 613, and 47.5 mg/L in UMAT 1565. The tabulated results of the synoptic sampling and a map showing the locations of the wells sampled are enclosed in Appendix F.

The results of the sampling conducted in this study and the LUBGWMA results indicate that nitrate-nitrogen levels in the County Line aquifer groundwater are mostly higher than the drinking water standard of 10 mg/L. However, the spatial distribution of the wells containing elevated nitrate-nitrogen concentrations does not fit a systematic contour pattern. The concentration range contains two low values of 3.28 and 0.314 mg/L and one high value of 47.5 mg/L. It is possible that the presence of nitrate in groundwater is due to localized effects. The design of the aquifer recharge system has to include provisions for adequate dilution of the nitrate nitrogen concentrations before ASR injection into the basalt aquifers can be conducted.

5.4.3 Depot Cleanup Activities

The Depot is a 19,728-acre military reservation established in 1941 as an ordnance depot whose hazardous waste activities have been associated with munitions (USACE 2004). Following extensive environmental investigations conducted in late 1970s through 1988, the site was placed on the National Priority List (NPL) in August 1987. Further work and cleanup activities have been conducted on the Operable Units (study areas) at the site. Currently, cleanup work continues at the Explosives Washout Lagoon (EWL) and the 1,750-acre Ammunition Demolition Activity (ADA) Area located in the northwestern corner of Depot. These two areas, and soil from 15 ft bgs to groundwater under the EWL, are of interest to this study and will be evaluated further in this section. The other Operable Units have either been cleaned or did not exhibit detectable levels of contaminants (See ODEQ Depot website at *http://cfpub.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.ous&id=1000546*). The Depot location and boundary are shown on Figure 22. Locations of the EWL and ADA are shown on Figure 35.

The ADA was used between 1945 and 1992 to dispose of ordnance. Identified contamination at the ADA includes soil contamination with metals and explosive residues and the presence of unexploded munitions in soil (USACE 2004). Groundwater beneath this unit did not contain contaminants of concern. A portion of the impacted soil was cleaned up through excavation, treatment, and onsite disposal. An additional volume of impacted soil was identified during the initial excavations. Further evaluation of remedial options is planned once the future land use of the ADA is determined (USACE 2004). This site doesn’t appear to be of concern to the aquifer recharge activities since it is located at an area with higher ground elevations than a potential rise in area groundwater levels would intercept.

Groundwater beneath the EWL is under remediation to principally remove hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and 2,4,6-trinitrotoluene (TNT) (SCS Engineers 2008). The data available from the remediation system demonstrates that the overall footprint of the most highly contaminated groundwater zones have decreased in size (SCS Engineers 2008). However, contaminants still remain in groundwater necessitating continuation of groundwater remediation activities. USACE is in the process of developing and implementing additional remediation technologies to more effectively affect impacted EWL groundwater. Maps showing groundwater distribution of RDX and TNT beneath EWL are enclosed in Appendix G.

The RDX, TNT and other contaminants reached groundwater via migration through unsaturated soils beneath the unlined former washout lagoons (USACE 1998). The upper 20 ft of lagoon soils were cleaned up to acceptable risk-based levels through excavation and ex situ treatment (SCS Engineers 2008). Potential presence of contaminants in the soil between 20 ft bgs and groundwater, at an approximate depth of 47 ft, is of concern. If area groundwater levels rise as a result of aquifer recharge, the rising groundwater table may intersect and mobilize contaminants in previously dry sediments. Continuing groundwater remediation efforts at EWL should take into account the potential changes in direction and horizontal gradient of local groundwater flow, as well as rise in area water levels.

5.5 Natural Soil Filtration Capacity

The potential of aquifer soil and sediment to provide natural filtration treatment of recharging surface water was evaluated through soil sieve analysis on samples collected from the area of the discharge pond and MPA analysis of canal and groundwater samples at the CLWID recharge site. The evaluation methodology, results, and findings are presented in HDR (2009).

The CLWID aquifer recharge system has been in operation for many years and is assumed to be at a pseudo-steady-state condition with respect to surface water mixing with native groundwater at the sampling location. A sample of native groundwater (unmixed) was not available so it was not possible to infer the degree of surface water mixing. Based on an assumed percentage of surface water at the well of 100%, log removal of all organisms was between 2.3 (99.5% removal) and 7.2 (greater than 99.99999% removal). This site contains relatively finer-grained surficial fine sand grading to coarse sand and gravel. Between infiltration through the surficial soils and percolation through the underlying sand and gravel sediments to groundwater, it appears that effective filtration of the recharging canal water occurs. The finer-grained surficial soils could be a hydraulic limitation for recharge and could require frequent maintenance to maintain permeability.

6.0 STAGE GULCH ALLUVIAL DEPOSITS

The general nature of the sediments surrounding and within the area bounded by the SID's Furnish Canal was discussed in Section 3.2.6. Three exploratory boreholes, designated SG-BH1, SG-BH2, and SG-BH3, were advanced in October 2008 in this area at the locations shown on Figure 36. The boreholes were advanced to obtain site-specific lithologic information. All the boreholes encountered silty sand (SM/ML) at the ground surface. Borehole SG-BH1 penetrated 47 ft of silty sand followed by gravel from 47 to 52 ft bgs, and silt from 52 to 72 ft bgs. Borehole SG-BH2 encountered 23 ft of silty sand followed by 7 ft of gravelly sand followed by 7 ft of silty sand to bottom of borehole at 47 ft bgs. Borehole SG-BH3 encountered 28 ft of silty sand before it was terminated at 28 ft bgs.

The presence of the silty sand appears to correspond to the Quaternary age windblown deposits of silts and fine sands (loess) which blanket the area (Zwart 1990). The deeper silty sand layer at SG-BH1 may correspond to fine-grained silts and sands of the Pleistocene flood deposits, as mapped out by Wozniak (1995 – See his discussion and geologic cross section E-E'). Although a 7-ft thickness of gravel was encountered at SG-BH1, it was present at a depth of 47 ft bgs and if present in the other boreholes, would be at similar depths, and contained no water. Finally, three infiltrometer tests were performed within this area at locations shown on Figure 36. The measured infiltration rates were 6.5, 9.5, and 12 ft/day. Based on the lithology encountered and the available information on hydraulic properties the sediments at this location do not appear to provide a ready opportunity for aquifer recharge of the volumes of water under consideration in this study.

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TABLES

TABLE 1
Soil Series Descriptions[(a)]
Alluvial Aquifers Hydrogeologic Conceptual Model

Symbol	Description
1B	Adkins fine sandy loam, 0 to 5 percent slopes
1C	Adkins fine sandy loam, 5 to 25 percent slopes
2C	Adkins fine sandy loam, gravelly substratum, 5 to 25 percent slopes
3A	Adkins fine sandy loam, wet, 0 to 3 percent slopes
14B	Burbank loamy fine sand, 0 to 5 percent slopes
15B	Burke silt loam, 1 to 7 percent slopes
15C	Burke silt loam, 7 to 12 percent slopes
15E	Burke silt loam, 12 to 30 percent slopes
17A	Catherine variant-Catherine silt loams, 0 to 3 percent slopes
23	Dune land
27A	Esquatzel silt loam, 0 to 3 percent slopes
28A	Freewater gravelly silt loam, 0 to 3 percent slopes
42A	Kimberly fine sandy loam, 0 to 3 percent slopes
47B	Koehler loamy fine sand, 0 to 5 percent slopes
65A	Pedigo loamy fine sand, 0 to 3 percent slopes
66A	Pedigo silt loam, 0 to 3 percent slopes
70	Pits, gravel
72A	Powder silt loam, 0 to 3 percent slopes
74B	Quincy fine sand, 0 to 5 percent slopes
75B	Willis silt loam, 2 to 5 percent slopes
75E	Quincy loamy fine sand, 5 to 25 percent slopes
76B	Quincy loamy fine sand, gravelly substratum, 0 to 5 percent slopes
77C	Quincy loamy fine sand, 0 to 25 percent slopes, eroded
85F	Rock outcrop-Xeric Torriorthents complex, 10 to 70 percent slopes
87B	Sagehill fine sandy loam, 2 to 5 percent slopes
87C	Sagehill fine sandy loam, 5 to 12 percent slopes
88B	Shano very fine sandy loam, 2 to 7 percent slopes
88C	Burke silt loam, 7 to 12 percent slopes
89B	Shano silt loam, 2 to 7 percent slopes
89C	Shano silt loam, 7 to 12 percent slopes
89D	Shano silt loam, 12 to 25 percent slopes
91A	Stanfield silt loam, 0 to 3 percent slopes
92A	Stanfield silt loam, reclaimed, 0 to 3 percent slopes
93B	Taunton loamy fine sand, 2 to 5 percent slopes
119A	Wanser loamy fine sand, 0 to 3 percent slopes
120C	Wanser-Quincy complex, 0 to 12 percent slopes
126A	Xerofluvents, 0 to 3 percent slopes
128A	Yakima silt loam, 0 to 3 percent slopes

Symbol	Description
W	Water

Notes:

(a) Legend for Figure 11 of the technical memorandum. Source U.S. Department of Agriculture (1988).

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			3/10/2008		5/13/2008		5/27-29/08		6/3-4/08	
Location	**MP Elev.**[a]	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**[b]	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
URSW8	520.00	--[c]	--	--	--	--	532.07	--	531.89	--
DMDW2	558.85	563.85	551.77	12.1	555.93	7.9	554.39	9.5	554.1	9.8
DMRP1	555.31	555.31	--	--	548.08	7.2	--	--	--	--
URSW10	550.24	--	--	--	--	--	--	--	--	--
DMPZ4	562.17	561.67	--	--	--	--	--	--	--	--
DMPW3	560.94	560.11	553.36	6.7	555.21	4.9	554.78	5.3	553.98	6.1
DMRP2	567.69	564.85	554.35	10.5	561.06	3.8	556.02	8.8	555.75	9.1
URSW9	560.11	--	--	--	--	--	--	--	--	--
FMPW1	572.14	569.47	567.47	2.0	566.91	2.6	567.91	1.6	567.22	2.3
XXDW1	586.23	584.08	--	--	--	--	--	--	--	--
UCDW1	590.56	595.57	--	--	--	--	--	--	--	--
URSW2	599.91	--	--	--	--	--	583.16	--	583.45	--
NTDW1	603.07	602.40	595.2	7.2	595.61	6.8	595.59	6.8	595.3	7.1
MLPW1	603.20	602.70	594.2	8.5	597.55	5.1	--	--	600.24	2.5
DMPW4	605.14	603.14	--	--	--	--	600.41	2.7	600.31	2.8
JSPW1	609.95	609.12	598.87	10.2	603.74	5.4	604.51	4.6	604.03	5.1
U1269	606.39	604.89	597.74	7.1	599.97	4.9	600.82	4.1	600.92	4.0
DMPW2	606.89	604.55	599.8	4.8	601.68	2.9	602.14	2.4	601.34	3.2
DMPW1	600.53	599.53	596.16	3.4	--	--	594.6	4.9	585.93	13.6
DMDW1	611.18	610.72	--	--	--	--	607.12	3.6	606.6	4.1
DMPZ2	609.86	608.69	--	--	--	--	--	--	--	--
DMPZ1	620.16	619.74	--	--	--	--	--	--	--	--
DMDW3	636.15	628.40	--	--	--	--	--	--	--	--
CPDW1	616.25	616.25	--	--	613.79	2.5	614.44	1.8	614.5	1.8
CPPZ1	632.22	631.14	--	--	--	--	--	--	--	--
U1198	606.65	606.65	--	--	--	--	603.8	2.9	603.13	3.5
TCPW1	600.79	599.04	--	--	597.17	1.9	--	--	597.17	1.9
U1176	623.72	623.72	--	--	--	--	587.1	36.6	586.18	37.5
U1177	620.03	620.03	--	--	585.76	34.3	586.53	33.5	587.03	33.0

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			3/10/2008		5/13/2008		5/27-29/08		6/3-4/08	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
JMPZ1	584.40	582.90	--	--	--	--	--	--	--	--
JMPZ2	582.23	580.06	--	--	--	--	--	--	--	--
U1194?	587.82	586.07	582.91	3.2	--	--	582.41	3.7	582.76	3.3
LLPW1	588.57	586.98	586.04	0.9	585.46	1.5	--	--	585.4	1.6
BSPW1	606.72	604.09	--	--	--	--	--	--	--	--
URSW5	612.68	--	--	--	--	--	605.51	--	605.51	--
URSW6	605.31	--	--	--	--	--	603.48	--	603.48	--
DCRP1	614.58	611.78	--	--	--	--	--	--	--	--
BAPW1	611.99	611.99	606.62	5.4	607.6	4.4	608.29	3.7	607.85	4.1
CHDW1	647.70	642.78	--	--	--	--	--	--	--	--
URSW1	646.47	--	--	--	--	--	636.87	--	636.97	--
DSPW1	632.90	631.48	--	--	--	--	623.65	7.8	622.98	8.5
U1317	632.20	631.20	622.7	8.5	624.85	6.4	--	--	619.96	11.2
DSPW3	627.96	625.79	--	--	--	--	--	--	618.54	7.3
DSPW4	631.55	628.97	--	--	--	--	--	--	--	--
URSW4	648.40	--	--	--	--	--	625.11	--	625.15	--
JSPW2	649.99	648.99	--	--	--	--	--	--	--	--

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			6/17-18/08		6/29/2008		7/9/2008		7/22/2008	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
URSW8	520.00	--	--	--	529.67	--	529.95	--	528.95	--
DMDW2	558.85	563.85	553.63	10.2	552.77	11.1	554.25	9.6	553.35	10.5
DMRP1	555.31	555.31	548.03	7.3	546.31	9.0	545.77	9.5	545.31	10.0
URSW10	550.24	--	--	--	--	--	--	--	--	--
DMPZ4	562.17	561.67	--	--	--	--	--	--	--	--
DMPW3	560.94	560.11	553.71	6.4	552.61	7.5	552.54	7.6	552.14	8.0
DMRP2	567.69	564.85	555.72	9.1	553.69	11.2	553.75	11.1	553.02	11.8
URSW9	560.11	--	--	--	--	--	--	--	--	--
FMPW1	572.14	569.47	566.6	2.9	565.89	3.6	565.36	4.1	564.94	4.5
XXDW1	586.23	584.08	--	--	--	--	--	--	--	--
UCDW1	590.56	595.57	--	--	--	--	--	--	--	--
URSW2	599.91	--	582.91	--	581.07	--	580.71	--	580.21	--
NTDW1	603.07	602.40	595.53	6.9	595.24	7.2	594.97	7.4	594.32	8.1
MLPW1	603.20	602.70	599.39	3.3	599.7	3.0	599.45	3.2	599.4	3.3
DMPW4	605.14	603.14	599.47	3.7	599.85	3.3	599.46	3.7	599.54	3.6
JSPW1	609.95	609.12	603.1	6.0	603.83	5.3	600.28	8.8	600.45	8.7
U1269	606.39	604.89	599.99	4.9	599.64	5.2	600.68	4.2	598.59	6.3
DMPW2	606.89	604.55	601.47	3.1	601.49	3.1	601.79	2.8	596.19	8.4
DMPW1	600.53	599.53	--	--	586.08	13.5	585.67	13.9	585.63	13.9
DMDW1	611.18	610.72	606.62	4.1	606.26	4.5	608.28	2.4	607.18	3.5
DMPZ2	609.86	608.69	--	--	--	--	--	--	--	--
DMPZ1	620.16	619.74	--	--	--	--	--	--	--	--
DMDW3	636.15	628.40	--	--	--	--	--	--	--	--
CPDW1	616.25	616.25	613.44	2.8	613.29	3.0	613.32	2.9	612.8	3.5
CPPZ1	632.22	631.14	--	--	--	--	--	--	--	--
U1198	606.65	606.65	601.86	4.8	601.34	5.3	600.5	6.1	600.95	5.7
TCPW1	600.79	599.04	595.29	3.8	595.21	3.8	594.85	4.2	594.99	4.1
U1176	623.72	623.72	586.06	37.7	585.85	37.9	585.52	38.2	585.26	38.5
U1177	620.03	620.03	586.57	33.5	586.69	33.3	586.43	33.6	586.63	33.4

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			6/17-18/08		6/29/2008		7/9/2008		7/22/2008	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
JMPZ1	584.40	582.90	--	--	--	--	--	--	--	--
JMPZ2	582.23	580.06	--	--	--	--	--	--	--	--
U1194?	587.82	586.07	582.41	3.7	558.26	27.8	582.42	3.7	556.92	29.2
LLPW1	588.57	586.98	585.25	1.7	584.27	2.7	583.82	3.2	583.27	3.7
BSPW1	606.72	604.09	--	--	--	--	--	--	--	--
URSW5	612.68	--	605.26	--	605.43	--	605.38	--	605.38	--
URSW6	605.31	--	603.14	--	602.73	--	602.58	--	602.21	--
DCRP1	614.58	611.78	--	--	--	--	--	--	--	--
BAPW1	611.99	611.99	607.68	4.3	608.45	3.5	608.04	4.0	607.93	4.1
CHDW1	647.70	642.78	--	--	--	--	--	--	--	--
URSW1	646.47	--	636.57	--	638.57	--	638.47	--	638.07	--
DSPW1	632.90	631.48	--	--	622.94	8.5	621.75	9.7	613.9	17.6
U1317	632.20	631.20	621.28	9.9	622.28	8.9	620.05	11.2	619.57	11.6
DSPW3	627.96	625.79	615.92	9.9	614.29	11.5	613.13	12.7	608.72	17.1
DSPW4	631.55	628.97	--	--	--	--	--	--	--	--
URSW4	648.40	--	624.48	--	622.56	--	622.1	--	620.9	--
JSPW2	649.99	648.99	643.47	5.5	642.72	6.3	641.04	8.0	641.67	7.3

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			8/6/2008		8/25/2008		10/1/2008		11/4/2008	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
URSW8	520.00	--	529.1	--	529.10	--	529.61	--	529.99	--
DMDW2	558.85	563.85	552.15	11.70	552.25	11.60	553.1	10.75	553.53	10.32
DMRP1	555.31	555.31	545.16	10.2	545.11	10.20	545.41	9.90	545.91	9.40
URSW10	550.24	--	--	--	--	--	--	--	545.79	--
DMPZ4	562.17	561.67	--	--	--	--	557.91	3.76	558.45	3.22
DMPW3	560.94	560.11	551.79	8.3	551.84	8.27	552.14	7.97	551.99	8.12
DMRP2	567.69	564.85	552.79	12.1	552.69	12.17	553.03	11.83	553.43	11.43
URSW9	560.11	--	--	--	--	--	--	--	555.07	--
FMPW1	572.14	569.47	565.54	3.9	566.54	2.93	565.18	4.29	566.58	2.89
XXDW1	586.23	584.08	--	--	--	--	575.68	8.40	574.35	9.73
UCDW1	590.56	595.57	--	--	--	--	585.30	10.27	585.48	10.09
URSW2	599.91	--	580.01	--	580.01	--	580.46	--	581.04	--
NTDW1	603.07	602.40	594.27	8.1	594.47	7.93	594.75	7.65	593.95	8.45
MLPW1	603.20	602.70	599.00	3.7	599.50	3.20	599.15	3.55	599.59	3.11
DMPW4	605.14	603.14	599.04	4.1	599.64	3.50	599.31	3.83	599.74	3.40
JSPW1	609.95	609.12	599.35	9.8	600.65	8.47	601.40	7.72	603.34	5.78
U1269	606.39	604.89	599.74	5.1	599.74	5.15	598.33	6.56	600.84	4.05
DMPW2	606.89	604.55	601.69	2.9	595.49	9.07	602.58	1.98	602.49	2.07
DMPW1	600.53	599.53	585.33	14.2	586.68	12.85	587.13	12.40	596.67	2.86
DMDW1	611.18	610.72	607.88	2.8	606.08	4.64	--	--	606.25	4.47
DMPZ2	609.86	608.69	--	--	--	--	605.32	3.37	604.32	4.37
DMPZ1	620.16	619.74	--	--	--	--	616.11	3.63	615.77	3.97
DMDW3	636.15	628.40	--	--	--	--	624.88	3.52	624.98	3.42
CPDW1	616.25	616.25	612.75	3.5	612.95	3.30	613.13	3.12	613.15	3.10
CPPZ1	632.22	631.14	--	--	--	--	624.87	6.27	624.49	6.65
U1198	606.65	606.65	600.75	5.9	601.15	5.50	601.63	5.02	602.33	4.32
TCPW1	600.79	599.04	597.79	1.3	595.09	3.95	595.87	3.17	596.35	2.69
U1176	623.72	623.72	581.18	38.9	584.52	39.20	583.87	39.85	584.02	39.70
U1177	620.03	620.03	589.92	33.8	586.33	33.70	585.90	34.13	586.41	33.62

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			8/6/2008		8/25/2008		10/1/2008		11/4/2008	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
JMPZ1	584.40	582.90	--	--	--	--	576.60	6.30	578.55	4.35
JMPZ2	582.23	580.06	--	--	--	--	573.97	6.09	575.73	4.33
U1194?	587.82	586.07	556.82	29.3	557.12	28.95	--	--	582.47	3.60
LLPW1	588.57	586.98	582.97	4.0	583.97	3.02	--	--	584.37	2.62
BSPW1	606.72	604.09	--	--	--	--	599.47	4.63	600.41	3.68
URSW5	612.68	--	605.38	--	605.38	--	605.51	--	604.38	--
URSW6	605.31	--	602.21	--	602.21	--	602.21	--	602.33	--
DCRP1	614.58	611.78	--	--	--	--	--	--	601.67	10.11
BAPW1	611.99	611.99	607.79	4.2	607.29	4.70	607.30	4.69	606.48	5.51
CHDW1	647.70	642.78	--	--	--	--	636.35	6.43	636.03	6.75
URSW1	646.47	--	640.67	--	646.47	--	639.27	--	638.51	--
DSPW1	632.90	631.48	621.50	10.0	623.90	7.58	613.78	17.70	620.80	10.68
U1317	632.20	631.20	619.80	11.4	618.60	12.60	620.08	11.12	619.32	11.88
DSPW3	627.96	625.79	616.36	9.4	612.21	13.58	616.10	9.69	616.56	9.23
DSPW4	631.55	628.97	--	--	--	--	621.39	7.58	620.28	8.69
URSW4	648.40	--	620.90	--	620.80	--	621.00	--	621.40	--
JSPW2	649.99	648.99	642.59	6.4	638.44	10.55	640.76	8.23	--	--

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			12/3/2008		1/6/2009		2/3/2009		2/25/2009	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
URSW8	520.00	--	529.38	--	531.29	--	529.05	--	530.19	--
DMDW2	558.85	563.85	--	--	--	--	--	--	--	--
DMRP1	555.31	555.31	545.54	9.77	547.31	8.00	546.36	8.95	546.60	8.71
URSW10	550.24	--	545.61	--	546.83	--	546.24	--	546.53	--
DMPZ4	562.17	561.67	558.32	3.35	560.17	1.50	559.69	1.98	559.77	1.90
DMPW3	560.94	560.11	552.24	7.87	553.48	6.63	552.46	7.65	552.57	7.54
DMRP2	567.69	564.85	553.09	11.77	555.26	9.60	554.13	10.73	554.09	10.77
URSW9	560.11	--	555.09	--	556.19	--	553.29	--	553.96	--
FMPW1	572.14	569.47	567.00	2.47	568.31	1.16	567.49	1.98	567.56	1.91
XXDW1	586.23	584.08	572.73	11.35	575.60	8.48	575.32	8.76	574.63	9.45
UCDW1	590.56	595.57	585.11	10.46	586.73	8.84	585.86	9.71	585.82	9.75
URSW2	599.91	--	580.51	--	582.13	--	581.06	--	581.45	--
NTDW1	603.07	602.40	593.02	9.38	594.29	8.11	593.39	9.01	593.28	9.12
MLPW1	603.20	602.70	597.78	4.92	597.20	5.50	596.87	5.83	596.41	6.29
DMPW4	605.14	603.14	597.94	5.20	597.35	5.79	597.00	6.14	596.54	6.60
JSPW1	609.95	609.12	600.80	8.32	599.66	9.46	599.73	9.39	599.10	10.02
U1269	606.39	604.89	600.19	4.70	599.88	5.01	599.20	5.69	598.78	6.11
DMPW2	606.89	604.55	602.07	2.49	602.11	2.45	601.74	2.82	601.14	3.42
DMPW1	600.53	599.53	596.53	3.00	596.95	2.58	596.78	2.75	596.28	3.25
DMDW1	611.18	610.72	605.67	5.05	606.46	4.26	605.83	4.89	605.35	5.37
DMPZ2	609.86	608.69	604.10	4.59	604.46	4.23	604.52	4.17	604.01	4.68
DMPZ1	620.16	619.74	615.11	4.63	616.17	3.57	615.34	4.40	615.11	4.63
DMDW3	636.15	628.40	623.92	4.48	624.32	4.08	623.20	5.20	564.29	64.11
CPDW1	616.25	616.25	612.76	3.49	613.96	2.29	613.27	2.98	613.11	3.14
CPPZ1	632.22	631.14	624.27	6.87	624.22	6.92	624.53	6.61	624.60	6.54
U1198	606.65	606.65	601.97	4.68	603.94	2.71	601.81	4.84	602.38	4.27
TCPW1	600.79	599.04	596.29	2.75	597.09	1.95	596.51	2.53	596.40	2.64
U1176	623.72	623.72	583.77	39.95	583.69	40.03	583.49	40.23	583.40	40.32
U1177	620.03	620.03	586.28	33.75	585.84	34.19	586.05	33.98	585.92	34.11

TABLE 2
Echo Meadows Groundwater Elevations and Soil Thickness Values
Alluvial Aquifers Hydrogeologic Conceptual Model

			12/3/2008		1/6/2009		2/3/2009		2/25/2009	
Location	**MP Elev.**	**Ground Elev.**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**	**Groundwater Elev.**	**Soil Thickness**
JMPZ1	584.40	582.90	578.70	4.20	579.78	3.12	579.47	3.43	579.54	3.36
JMPZ2	582.23	580.06	575.98	4.08	577.36	2.70	577.10	2.96	577.22	2.84
U1194?	587.82	586.07	582.47	3.60	583.23	2.84	569.79	16.28	582.45	3.62
LLPW1	588.57	586.98	585.97	1.02	586.06	0.93	586.05	0.94	586.14	0.85
BSPW1	606.72	604.09	598.29	5.80	598.17	5.92	597.31	6.78	596.89	7.21
URSW5	612.68	--	604.28	--	603.83	--	603.00	--	603.14	--
URSW6	605.31	--	602.21	--	603.50	--	602.84	--	603.00	--
DCRP1	614.58	611.78	600.32	11.46	601.01	10.77	600.23	11.55	599.76	12.02
BAPW1	611.99	611.99	602.25	9.74	601.30	10.69	601.80	10.19	601.07	10.92
CHDW1	647.70	642.78	635.40	7.38	637.31	5.47	636.65	6.13	636.67	6.11
URSW1	646.47	--	639.01	--	637.51	--	638.37	--	638.57	--
DSPW1	632.90	631.48	619.29	12.19	621.01	10.47	621.06	10.42	621.19	10.29
U1317	632.20	631.20	616.04	15.16	617.48	13.72	617.45	13.75	618.04	13.16
DSPW3	627.96	625.79	615.86	9.93	617.73	8.06	616.75	9.04	616.81	8.98
DSPW4	631.55	628.97	619.65	9.32	621.56	7.41	620.55	8.42	620.54	8.43
URSW4	648.40	--	621.72	--	623.78	--	622.59	--	623.03	--
JSPW2	649.99	648.99	641.34	7.65	643.24	5.75	642.67	6.32	642.65	6.34

Notes:

(a) Elev = Elevation. All elevations were surveyed to within an accuracy of 3 inches, in feet Mean Sea Level.

(b) Thickness of unsaturated soil in feet below ground surface.

(c) -- = Not measured.

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		HCSW1		HCSW2			URSW1	URSW2	URSW3
Analytes	**Unit**	**Standard**	**3/6/08**	**4/17/08**	**5/20/08**	**6/3/08**	**7/22/08**	**5/19/08**	**5/19/08**	**5/19/08**
Micro-organisms										
Total Coliform Bacteria	MPN/100 ml(a)	<1(b)	--(c)	--	--	--	--	--	--	--
Fecal Coliform Bacteria	MPN/100 ml	<1	**9**	--	**80**	**60**	--	--	--	--
Geochemical Parameters										
Bicarbonate	mg/L(d)	None	**34**	--	**18.4**	**30.1**	**45.5**	--	--	--
Calcium	mg/L	None	**6.99**	--	**4.15**	**4.09**	**7.47**	--	--	--
Carbonate	mg/L	None	<20	--	<5	<10	<5	--	--	--
Chloride	mg/L	250	**2.04**	--	**0.72**	**1.03**	**2.95**	--	--	--
Magnesium	mg/L	None	**2.76**	--	**1.5**	**1.64**	**3.08**	--	--	--
Nitrate (measured as N(e))	mg/L	10	**0.214**	--	<0.1	**0.075**	**0.219**	--	--	--
Nitrite (measured as N)	mg/L	1	<0.025	--	<0.1	**0.026**	--	--	--	--
Potassium	mg/L	None	**16.4**	--	**1.44**	**1.37**	**1.98**	--	--	--
Sodium	mg/L	None	**5.01**	--	**2.72**	**2.63**	**5.4**	--	--	--
Sulfate	mg/L	250	**2.09**	--	**0.967**	**1.19**	**2.72**	--	--	--
TDS(f)	mg/L	500	**88.74**	--	--	--	**71**	--	--	--
Alkalinity (as CaCO3)	mg/L	None	**34**	--	--	--	--	--	--	--
Hardness (as CaCO3)	mg/L	None	**28.8**	--	--	--	--	--	--	--
BOD(g)	mg/L	None	<2	--	**2.24**	<2	--	--	--	--
Field Parameters										
pH	pH	6.5-8.5	**7.2**	**6.9**	**5.65**	**4.22**	--	**8**	**8.2**	**7.6**
Temperature	°C	None	**7.7**	**14.4**	**10.3**	**13**	--	**14.2**	**14.4**	**18.1**
Specific Conductivity	µs/cm(h)	None	**90**	**69**	**43**	**60-215**(i)	--	**59**	**43**	**45**
ORP(j)	mV(k)	None	--	--	**71**	**162**	--	--	--	--
Dissolved Oxygen	mg/L	None	**8.2**	--	**8.6**	**12.6**	--	**8.8**	**8.6**	**8.4**

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		HCSW1			HCSW2		URSW1	URSW2	URSW3
Analytes	Unit	Standard	3/6/08	4/17/08	5/20/08	6/3/08	7/22/08	5/19/08	5/19/08	5/19/08
Herbicides										
2,4-D	µg/L(l)	70	--	<0.08	<0.1	--	--	--	--	--
Thifensulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--	--	--	--
Tribenuron methyl	µg/L	None	--	--	<0.08	--	--	--	--	--
Metsulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--	--	--	--
MCPA (Clearmax)	µg/L	None	--	<0.08	<0.1	--	--	--	--	--
Diacamba (Banvel)	µg/L	None	--	<0.08	<0.1	--	--	--	--	--

	Sample Identification		Pond	DMPW2				
Analytes	Unit	Standard	7/22/08	3/11/08	4/17/08	5/20/08	6/3/08	7/22/08
Micro-organisms								
Total Coliform Bacteria	MPN/100 ml	<1	--	--	--	--	--	--
Fecal Coliform Bacteria	MPN/100 ml	<1	--	**17**	--	**2**/<2	<2	--
Geochemical Parameters								
Bicarbonate	mg/L	None	**43.4**	**132**	--	**188/175**	**136**	**140**
Calcium	mg/L	None	**6.81**	**57.3**	--	**60.7/70.1**	**49.2**	**82.4**
Carbonate	mg/L	None	<4	<20	--	<5/<5	<10	<5
Chloride	mg/L	250	**2.69**	**59**	--	**66.3/68.4**	**65.1**	**56.8**
Magnesium	mg/L	None	**2.77**	**23.6**	--	**24/27.6**	**19.8**	**34.1**
Nitrate (measured as N)	mg/L	10	<0.1	**13.2**	--	**16.3/16.4**	**15.4**	**13.7**
Nitrite (measured as N)	mg/L	1	--	<0.025	--	<0.1/<0.1	<0.01	--
Potassium	mg/L	None	**1.82**	**4.42**	--	**3.98/4.36**	**3.47**	**6.1**
Sodium	mg/L	None	**5.23**	**46.2**	--	**45.3/50.6**	**37.4**	**68.1**
Sulfate	mg/L	250	**2.31**	**64.1**	--	**78.9/81.5**	**77.8**	**72.5**

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		Pond	DMPW2				
Analytes	**Unit**	**Standard**	**7/22/08**	**3/11/08**	**4/17/08**	**5/20/08**	**6/3/08**	**7/22/08**
TDS	mg/L	500	**84**	**117.1**	--	--	--	**506**
Alkalinity (as CaCO3)	mg/L	None	--	**132**	--	--	--	--
Hardness (as CaCO3)	mg/L	None	--	**240**	--	--	--	--
BOD	mg/L	None	--	<2	--	<2/<2	<2	--
Field Parameters								
pH	pH	6.5-8.5	**6.1**	**6.7**	**8.5**	**8.5**	**5.73**	**7.3**
Temperature	°C	None	**25**	**13.3**	**16.1**	**16.1**	**12.7**	**15.1**
Specific Conductivity	µs/cm	None	**112**	**670**	**680**	**680**	**745**	**709**
ORP	mV	None	**280**	--	--	--	**154**	**241**
Dissolved Oxygen	mg/L	None	**6.1**	**4.5**	--	--	**8.25**	**7.45**
Herbicides								
2,4-D	µg/L	70	--	--	<0.08	<0.1/<0.1	--	--
Thifensulfuron methyl	µg/L	None	--	--	<0.008	<0.08/<0.08	--	--
Tribenuron methyl	µg/L	None	--	--	--	<0.08/<0.08	--	--
Metsulfuron methyl	µg/L	None	--	--	<0.008	<0.08/<0.08	--	--
MCPA (Clearmax)	µg/L	None	--	--	<0.08	<0.1/<0.1	--	--
Diacamba (Banvel)	µg/L	None	--	--	<0.08	<0.1/<0.1	--	--

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		U1269(m)				
Analytes	**Unit**	**Standard**	**3/5/08**	**4/17/08**	**5/20/08**	**6/3/08**	**7/22/08**
Micro-organisms							
Total Coliform Bacteria	MPN/100 ml	<1	--	--	--	--	--
Fecal Coliform Bacteria	MPN/100 ml	<1	<2	--	<2	<2/<2	--
Geochemical Parameters							
Bicarbonate	mg/L	None	**253**	--	**229**	**215**	**194**
Calcium	mg/L	None	**72.8**	--	**67.8**	**51.8**	**50.5**
Carbonate	mg/L	None	<20	--	<5	<10	<5
Chloride	mg/L	250	**64.6**	--	**53.8**	**52.7**	**50.7**
Magnesium	mg/L	None	**35**	--	**30.4**	**23.1**	**23.4**
Nitrate (measured as N)	mg/L	10	**8.34**	--	**7.57**	**7.32/7.29**	**7.48**
Nitrite (measured as N)	mg/L	1	**0.046**	--	<0.1	**0.104/0.104**	--
Potassium	mg/L	None	**11.2**	--	**10.4**	**8.65**	**8.89**
Sodium	mg/L	None	**55**	--	**52.5**	**40.1**	**43.5**
Sulfate	mg/L	250	**83.3**	--	**76.5**	**75.4**	**70.7**
TDS	mg/L	500	**588.5**	--	--	--	**517**
Alkalinity (as CaCO3)	mg/L	None	**253**	--	--	--	--
Hardness (as CaCO3)	mg/L	None	**326**	--	--	--	--
BOD	mg/L	None	<2	--	<2	<2/<2	--
Field Parameters							
pH	pH	6.5-8.5	**7.7**	**7.3**	--	**6.14**	**6.7**
Temperature	°C	None	**14.5**	**16**	--	**12.7**	**15.5**
Specific Conductivity	µs/cm	None	**860**	**810**	--	**790**	**697**
ORP	mV	None	--	--	--	**88**	**129**
Dissolved Oxygen	mg/L	None	**0.6**	--	--	**2.58**	**2.9**

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

		Sample Identification			U1269		
Analytes	**Unit**	**Standard**	**3/5/08**	**4/17/08**	**5/20/08**	**6/3/08**	**7/22/08**
Herbicides							
2,4-D	µg/L	70	--	<0.08	<0.1	--	--
Thifensulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--
Tribenuron methyl	µg/L	None	--	--	<0.08	--	--
Metsulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--
MCPA (Clearmax)	µg/L	None	--	<0.08	<0.1	--	--
Diacamba (Banvel)	µg/L	None	--	<0.08	<0.1	--	--

		Sample Identification		JSPW1			DMPW4	
Analytes	**Unit**	**Standard**	**3/6/08**	**4/17/08**	**5/20/08**	**7/22/08**	**3/10/08**	**4/17/08**
Micro-organisms								
Total Coliform Bacteria	MPN/100 ml	<1	--	--	**30**	--	--	--
Fecal Coliform Bacteria	MPN/100 ml	<1	<2	--	--	--	<2	--
Geochemical Parameters								
Bicarbonate	mg/L	None	**117**	--	**112**	**114**		--
Calcium	mg/L	None	**33.7**	--	**33.8**	**24.5**		--
Carbonate	mg/L	None	<20	--	<5	<5		--
Chloride	mg/L	250	**12.1**	--	**13.5**	**8.37**	**5.39**	--
Magnesium	mg/L	None	**14.1**	--	**14.1**	**10.7**		--
Nitrate (measured as N)	mg/L	10	**3.62**	--	**4.14 (a)**	2.1	**2.03**	--
Nitrite (measured as N)	mg/L	1	<0.025	--		--	<0.025	--
Potassium	mg/L	None	**7.97**	--	**8.34**	**6.92**		--
Sodium	mg/L	None	**13.6**	--	**13.7**	**11.7**		--
Sulfate	mg/L	250	**20.3**	--	**18.1**	**14.5**	**6.59**	--

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		JSPW1				DMPW4	
Analytes	**Unit**	**Standard**	**3/6/08**	**4/17/08**	**5/20/08**	**7/22/08**	**3/10/08**	**4/17/08**
TDS	mg/L	500	**230.4**	--	--	**230**	--	--
Alkalinity (as CaCO3)	mg/L	None	**117**	--	--	--	--	--
Hardness (as CaCO3)	mg/L	None	**142**	--	--	--	--	--
BOD	mg/L	None	<2	--	<2	--	<2	--
Field Parameters								
pH	pH	6.5-8.5	**6.7**	**6.9**	**6.84**	**6.4**	**6.7**	**7.3**
Temperature	°C	None	**12**	**14.5**	**14**	**14.5**	**12.9**	**14.3**
Specific Conductivity	µs/cm	None	**345**	**390**	**290**	**310**	**185**	**147**
ORP	mV	None	--	--	**20.3**	**291**	--	--
Dissolved Oxygen	mg/L	None	**1.3**	--	**7.27**	**5.11**	**0.8**	--
Herbicides								
2,4-D	µg/L	70	--	<0.08	<0.1	--	--	<0.08
Thifensulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--	<0.008
Tribenuron methyl	µg/L	None	--	--	<0.08	--	--	--
Metsulfuron methyl	µg/L	None	--	<0.008	<0.08	--	--	<0.008
MCPA (Clearmax)	µg/L	None	--	<0.08	<0.1	--	--	<0.08
Diacamba (Banvel)	µg/L	None	--	<0.08	<2	--	--	<0.08

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		U1317		U1193	U1177	U1198	TCDW1		MLPW1
Analytes	**Unit**	**Standard**	**6/3/08**	**7/22/08**	**6/3/08**	**6/3/08**	**6/3/08**	**7/22/08**	**10/22/08**	**10/22/08**
Micro-organisms										
Total Coliform Bacteria	MPN/100 ml	<1	--	--	--	--	--	--	<2	**2**
Fecal Coliform Bacteria	MPN/100 ml	<1	<2	--	<2	**23**	<2	--	<2	**2**
Geochemical Parameters										
Bicarbonate	mg/L	None	**33.4**	**40**	**189**	**154**	**236**	**251**	**241**	**65**
Calcium	mg/L	None	**8.23**	**6.86**	**57**	**61.9**	**57.6**	**56.4**	**63.4**	**13.4**
Carbonate	mg/L	None	<10	<5	<10	<10	<10	<5	<5	<5
Chloride	mg/L	250	**4.84**	**3.17**	**14.1**	**48.8**	**34.3**	**22.3**	**18.7**	**3.78**
Magnesium	mg/L	None	**3.31**	**2.81**	**15.8**	**14.5**	**18.6**	**19.6**	**20.5**	**5.75**
Nitrate (measured as N)	mg/L	10	**1.6**	**0.603**	**8.77**	**14.3**	**0.354**	**3.38**	**2.98**	**1.22**
Nitrite (measured as N)	mg/L	1	<0.01	--	<0.01	**0.055**	<0.01	--	<0.1	<0.1
Potassium	mg/L	None	**2.06**	**2.08**	**3.53**	**4.04**	**2.61**	**3.06**	**3.7**	**3.44**
Sodium	mg/L	None	**5.72**	**6.15**	**10.3**	**27.4**	**27.4**	**20.4**	**25.1**	**8.3**
Sulfate	mg/L	250	**8.96**	**3.77**	**22.5**	**52.1**	**30.6**	**34**	**28**	**4.86**
TDS	mg/L	500	--	**115**	--	--	--	**416**	**389**	**146**
Alkalinity (as CaCO3)	mg/L	None	--	--	--	--	--	--	**241**	**65**
Hardness (as CaCO3)	mg/L	None	--	--	--	--	--	--	**243**	**57.2**
BOD	mg/L	None	<2	--	<2	<2	<2	--	--	--
Field Parameters										
pH	pH	6.5-8.5	**6.11**	**6.3**	**8.98**	**10.6**$^{(n)}$	**11.41**$^{(n)}$	**7.1**	**7.66**	**6.66**
Temperature	°C	None	**13.3**	**18.5**	**15.6**	**14.9**	**12.1**	**17.1**	**13.6**	**14.4**
Specific Conductivity	µs/cm	None	--	**107**	**521**	**660**	**595**	**602**	**821**	**240**
ORP	mV	None	**116**	**323**	**12.9**	**-92**	**-116**	**283**	**455**	**557**
Dissolved Oxygen	mg/L	None	**8.77**	**6.3**	**6.58**	**7.78**	**1.28**	**7.3**	**4.44**	**3.04**

TABLE 3
Echo Meadows Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

	Sample Identification		U1317		U1193	U1177	U1198	TCDW1		MLPW1
Analytes	**Unit**	**Standard**	**6/3/08**	**7/22/08**	**6/3/08**	**6/3/08**	**6/3/08**	**7/22/08**	**10/22/08**	**10/22/08**
Herbicides										
2,4-D	µg/L	70	--	--	--	--	--	--	<0.01	<0.01
Thifensulfuron methyl	µg/L	None	--	--	--	--	--	--	<0.08	<0.08
Tribenuron methyl	µg/L	None	--	--	--	--	--	--	<0.08	<0.08
Metsulfuron methyl	µg/L	None	--	--	--	--	--	--	<0.08	<0.08
MCPA (Clearmax)	µg/L	None	--	--	--	--	--	--	<0.1	<0.1
Diacamba (Banvel)	µg/L	None	--	--	--	--	--	--	<1	<1

Notes:

(a) MPN/100 ml =
(b) "<" designates when measurement was less than the indicated laboratory detection or method detection limit.
(c) -- = Not measured.
(d) Mg/L = milligrams per liter
(e) N = Nitrogen
(f) TDS = Total dissolved solids
(g) BOD = biological oxygen demand
(h) µs/cm = micro Seimens per centimeter
(i) Rapid fluctuations occurred when measuring this parameter.
(j) ORP = oxidation-reduction potential
(k) mV = Milli Volts
(l) µg/L = micrograms per liter
(m) U designates UMAT well number
(n) Potential problems with meter readings.

TABLE 4
Echo Meadows Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			HCSW2	DMPW2	U 1269(a)	MLPW1	TCDW1
Analyte	**Unit**	**Standard**	**5/20/2008**	**5/20/2008**	**5/20/2008**	**10/22/2008**	**10/22/2008**
Micro-organisms							
Turbidity	NTU(b)	1	**42.6**	**0.44**/<0.1(c)(d)	**32.1**	**0.71**	**0.4**
Disinfection Byproducts							
Haloacetic acids (HAA5)	mg/L(e)	0.06	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
dichloroacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
trichloroacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
monochloroacetic acid	mg/L	None	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002
bromoacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
dibromoacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Total Trihalomethanes (TTHMs)	mg/L	0.08	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
bromodichloromethane	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
bromoform	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
dibromochloromethane	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
chloroform	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Disinfectants							
Chloramines (as Cl_2)	mg/L	4	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05
Chlorine (as Cl_2)	mg/L	4	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05
Geochemical Parameters							
Cyanide (as free cyanide)	mg/L	0.2	<0.01	<0.01/<0.01	<0.01	<0.01	<0.01
Fluoride	mg/L	2	**0.116**	**0.487/0.475**	**0.188**	**0.268**	**0.753**
Silica	mg/L	None	**13.2**	**24.7/23.4**	**19.9**	**21.6**	**24.2**
Total Organic Carbon	mg/L	None	**2.37**	**1.42/1.39**	**2.43**	**1.49**	**2.26**

TABLE 4
Echo Meadows Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			HCSW2	DMPW2	U 1269	MLPW1	TCDW1
Analyte	Unit	Standard	5/20/2008	5/20/2008	5/20/2008	10/22/2008	10/22/2008
Metals							
Aluminum	mg/L	None	**0.45**	<0.01/<0.01	<0.01	<0.01	<0.01
Antimony	mg/L	0.006	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.01	<0.001	**0.00409/0.00417**	<0.001	<0.001	**0.00598**
Barium	mg/L	2	**0.0197**	**0.0382/0.0384**	**0.0769**	**0.0218**	**0.0567**
Beryllium	mg/L	0.004	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.005	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Chromium (total)	mg/L	0.1	<0.001	**0.00115/0.00114**	**0.00143**	<0.001	**0.002**
Copper	mg/L	1.3	**0.00124**	**0.00128/<0.001**	<0.001	**0.00485**	**0.00289**
Iron (Total)	mg/L	None	**0.751**	**0.352/0.343**	**2.02**	**0.0824**	**0.383**
Iron (Dissolved)	mg/L	0.3	**0.111**	**0.31/0.329**	**0.0997**	**0.0689**	**0.344**
Lead	mg/L	0.05	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Manganese (Total)	mg/L	None	**0.0198**	<0.001/<0.001	**0.0887**	<0.001	**0.00109**
Manganese (Dissolved)	mg/L	0.05	**<0.001**	<0.001/<0.001	**0.00185**	<0.001	**0.00117**
Mercury (inorganic)	mg/L	0.002	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Selenium	mg/L	0.01	<0.001	**0.00699/0.00706**	**0.00448**	<0.001	<0.001
Silver	mg/L	0.05	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Thallium	mg/L	0.002	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	5	**0.00142**	**0.071/0.0563**	**0.00193**	**0.00579**	**0.0444**
Miscellaneous							
Color	CU(f)	15	**10**	<5/<5	**10**	**5**	**5**
Corrosivity	units	-- (g)	**-2.61**	**0.306/0.232**	**-0.00539**	**-2.16**	**0.11**
Foaming Agents	mg/L	0.5	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05

TABLE 4
Echo Meadows Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			HCSW2	DMPW2	U 1269	MLPW1	TCDW1
Analyte	Unit	Standard	5/20/2008	5/20/2008	5/20/2008	10/22/2008	10/22/2008
Odor	TON	3	<1	<1/<1	<1	<1	<1
UV Absorbance at 254 nm	cm^{-1}	None	**0.091**	**0.024/0.024**	**0.05**	--	--
Total Suspended Solids	mg/L	None	**100**	<5/<5	**6.54**	<1	<1
Synthetic Organic Compounds (SOCs)							
Alachlor	mg/L	0.002	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	<0.0004
Atrazine	mg/L	0.003	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002
Benzo(a)pyrene (PAHs)	mg/L	0.0002	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005
Carbofuran	mg/L	0.04	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002
Chlordane	mg/L	0.002	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	<0.0004
2,4-D	mg/L	0.07	<0001	<0.0001/<0.0001	<0001	<0001	<0001
Dalapon	mg/L	0.2	<0001	<0.0001/<0.0001	<0001	<0001	<0001
1,2-Dibromo-3-chloropropane (DBCP)	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005
Di(2-ethylhexyl) adipate	mg/L	0.4	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002
Di(2-ethylhexyl) phthalate	mg/L	0.006	<0.0006	<0.0006/<0.0006	<0.0006	<0.0006	<0.0006
Dinoseb	mg/L	0.007	<0001	<0.0001/<0.0001	<0001	<0001	<0001
Diquat	mg/L	0.02	<0.00008	<8e-005/<8e-005	<0.00008	<0.00008	<0.00008
Endothall	mg/L	0.1	<0.01	<0.01/<0.01	<0.01	<0.01	<0.01
Endrin	mg/L	0.0002	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005
Ethylene dibromide (EDB)	mg/L	0.00005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005
Glyphosate	mg/L	0.7	<0.009	<0.009/<0.009	<0.009	<0.009	<0.009
Heptachlor	mg/L	0.0004	<8e-005	<8e-005/<8e-005	<8e-005	<8e-005	<8e-005
Heptachlor epoxide	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005
Hexachlorobenzene	mg/L	0.001	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002
			HCSW2	DMPW2	U 1269	MLPW1	TCDW1

TABLE 4
Echo Meadows Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	5/20/2008	5/20/2008	5/20/2008	10/22/2008	10/22/2008
Hexachlorocyclopentadiene	mg/L	0.05	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002
Lindane (BHC-gamma)	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005
Methoxychlor	mg/L	0.04	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002
Oxamyl (Vydate)	mg/L	0.2	<0.004	<0.004/<0.004	<0.004	<.004	<0.004
Polychlorinated biphenyls (PCBs)	mg/L	0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Pentachlorophenol	mg/L	0.001	<8e-005	<8e-005/8e-005	<8e-005	<8e-005	<8e-005
Picloram	mg/L	0.5	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001
Simazine	mg/L	0.004	<0.00015	<0.00015/<0.00015	<0.00015	<0.00015	<0.00015
Toxaphene	mg/L	0.003	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002
2,4,5-TP (Silvex)	mg/L	0.01	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001
Volatile Organic Compounds (VOCs)							
Benzene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Carbon tetrachloride	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Chlorobenzene (monoclorobenzene)	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
o-Dichlorobenzene (1,2-Diclorobenezene)	mg/L	0.6	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
p-Dichlorobenzene (1,4-Dichlorobenzene)	mg/L	0.075	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloroethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,1-Dichloroethylene	mg/L	0.007	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
cis-1,2-Dichloroethylene	mg/L	0.07	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
trans-1,2-Dichloroethylene	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Dichloromethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloropropane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
			HCSW2	**DMPW2**	**U 1269**	**MLPW1**	**TCDW1**

TABLE 4
Echo Meadows Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	5/20/2008	5/20/2008	5/20/2008	10/22/2008	10/22/2008
Epichlorohydrin	mg/L	TT	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/L	0.7	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Styrene	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Tetrachloroethylene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Toluene	mg/L	1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,2,4-Trichlorobenzene	mg/L	0.07	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,1,1-Trichloroethane	mg/L	0.2	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
1,1,2-Trichloroethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Trichloroethylene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Vinyl chloride	mg/L	0.002	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Xylenes (total)	mg/L	10	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005
Radionuclides							
Gross Alpha	pCi/L[h]	15	--	--	--	<3	**3.2**
Gross Beta	pCi/L	50	--	--	--	**3.81**	**3.4**

Notes:

(a) U designates UMAT well number.
(b) NTU = Nephelometric Turbidity Units
(c) First value is sample results followed by duplicate sample results.
(d) "<" designates when measurement was less than the indicated laboratory detection or method detection limit
(e) mg/L = milligrams per liter
(f) CU = Color Units
(g) -- = Not measured.
(h) pCi/L = pico Curries per liter.

TABLE 5
Echo Meadows 2008 Recharge Periods and Volumes
Alluvial Aquifers Hydrogeologic Conceptual Model

	Start		End		Flow	Duration	Total Flow
Field No.	Date	Time	Date	Time	(cfs)[(a)]	(min)	(AF)[(b)]
1	18-Apr	8:25	18-Apr	10:51	5	146	1.0
	24-Apr	11:45	24-Apr	17:30	3	345	1.4
	25-Apr	11:00	25-Apr	18:00	1.5	420	0.9
	28-Apr	10:00	28-Apr	20:00	1	600	0.8
	29-Apr	8:00	29-Apr	20:00	1.5	2,760	5.7
	1-May	8:00	1-May	20:00	1.5	720	1.5
	2-May	8:15	2-May	18:00	1.5	585	1.2
	3-May	8:00	3-May	18:00	1.5	600	1.2
	4-May	8:00	4-May	16:00	1.5	480	1.0
	5-May	8:00	5-May	20:30	1	750	1.0
	7-May	7:30	7-May	19:00	2	690	1.9
	7-May	19:00	8-May	7:30	1	750	1.0
	8-May	7:30	8-May	20:00	2	750	2.1
	8-May	20:00	10-May	8:30	1	2,190	3.0
	10-May	8:30	12-May	20:00	1.5	3,570	7.4
	12-May	20:00	13-May	8:00	1	720	1.0
	13-May	8:00	14-May	7:50	1.5	1,430	3.0
	14-May	7:50	14-May	14:00	1	370	0.5
	19-May	12:00	19-May	17:00	1	300	0.4
	20-May	7:15	31-May	9:00	1	15,945	22.0
					TOTAL:	**34,121**	**58**
2	18-Apr	8:45	18-Apr	11:09	5	144	1.0
	18-Apr	11:09	24-Apr	9:45	0	8,556	0.0
	24-Apr	9:45	24-Apr	7:45	5	1,320	9.1
	24-Apr	7:45	1-May	7:30	0	10,065	0.0
	1-May	7:30	1-May	20:00	2	750	2.1
	1-May	20:00	21-May	18:00	0	28,680	0.0
	21-May	18:00	23-May	17:00	2	2,820	7.8
	23-May	17:00	24-May	8:00	0	900	0.0
	24-May	8:00	31-May	9:30	1.5	2,760	5.7
					TOTAL:	**55,995**	**26.0**
6	25-Apr	12:05	26-Apr	14:45	5	1,600	11.0
	28-Apr	15:00	1-May	10:30	5	4,050	27.9
	1-May	10:30	1-May	20:30	7	600	5.8
	1-May	20:30	2-May	8:30	8.5	720	8.4
	2-May	8:30	4-May	6:30	5	2,760	19.0
	4-May	6:30	4-May	11:00	10	270	3.7
	4-May	11:00	6-May	20:00	9	3,420	42.4
	6-May	20:00	9-May	7:30	5	3,570	24.6

TABLE 5
Echo Meadows 2008 Recharge Periods and Volumes
Alluvial Aquifers Hydrogeologic Conceptual Model

	Start		End		Flow	Duration	Total Flow
Field No.	Date	Time	Date	Time	(cfs)[a]	(min)	(AF)[b]
	9-May	7:30	12-May	7:30	10	4,320	59.5
	12-May	7:30	14-May	14:30	8.5	3,300	38.6
	14-May	14:30	17-May	20:10	6.5	5,100	45.7
	18-May	8:10	19-May	16:00	6.5	1,910	17.1
	19-May	16:00	20-May	8:00	5	960	6.6
	20-May	8:00	26-May	8:00	7.5	8,640	89.3
	26-May	8:00	28-May	8:00	5	2,880	19.8
	28-May	8:00	29-May	16:30	7.5	1,950	20.1
	28-May	16:30	28-May	19:50	6.3	200	1.7
	29-May	19:50	30-May	16:30	5	1,240	8.5
					TOTAL:	**47,490**	**450**

Notes:

(a) cfs = cubic feet per second

(b) AF = acre feet

TABLE 6
November 2008 and February 2009 Groundwater Elevations, County Line Aquifer Alluvial Aquifers
Hydrogeologic Conceptual Model

				11/19/2008			2/26-27/09		
Well	MP(a) Elevation	Elevation Accuracy	Ground Elevation	Depth to Water	Groundwater Elev.	Unsat. Soil Thickness	Depth to Water	Groundwater Elev.	Unsat Soil Thickness
	ft MSL(b)	ft	ft MSL	ft below MP	ft MSL	ft	ft below MP	ft MSL	ft
UMAT1568	585.20	0.090	588.38	67.8	517.40	71.0	85.5	499.7	88.7
UMAT1559	583.63	0.077	580.64	86.1	497.49	83.2	84.4	499.3	81.4
L82868 - UMAT55721	588.40	0.063	586.12	--(e)	--	--	89.3	499.1	87.0
UMAT1569	580.74	0.058	579.69	84.1	496.64	83.1	81.7	499.1	80.6
UMAT1565	587.24	0.076	585.58	90.5	496.71	88.9	88.5	498.8	86.8
L82869	584.55	0.087	583.57	86.8	497.80	85.8	83.8	500.7	82.9
UMAT1571	583.93	0.126	583.39	87.3	496.67	86.7	85.1	498.8	84.6
UMAT55720	577.85	--	576.55	81.3	496.60	80.0	79.1	498.8	77.8
MORR 955	590.63	0.097	591.09	93.8	496.82	94.3	91.4	499.3	91.8
MORR 956	566.85	0.099	566.72	--	--	--	67.0	499.9	66.9
MORR 953	574.37	0.092	573.10	76.4	497.96	75.1	74.2	500.2	72.9
MORR 960	575.28	0.073	575.25	--	--	--	76.2	499.1	76.2
MORR 51131	559.14	0.077	559.67	--	--	--	67.0	492.1	67.6
L93717	571.60	0.071	569.55	75.1	496.50	73.1	71.7	499.9	69.6
MORR 972	574.22	0.076	573.58	78.2	496.04	77.5	74.3	499.9	73.7
MORR 963	582.79	0.068	583.04	86.2	496.64	86.4	83.4	499.4	83.6
MORR 1478	586.58	0.128	587.62	--	--	--	86.5	500.1	87.5
MORR 966	549.82	0.063	548.69	52.7	497.12	51.6	50.2	499.6	49.1
L76841	541.69	0.059	538.85	66.3	475.39	63.5	62.4	479.3	59.6
MORR 50985	546.33	0.064	544.18	49.7	496.63	47.6	49.0	497.4	46.8
L93718 - MORR 51692	555.67	0.105	552.83	56.2	499.47	53.4	56.2	499.5	53.4
L93716 -MORR 51690	545.60	0.081	543.05	49.5	496.10	47.0	49.4	496.2	46.8

Notes:

(a) MP = Measuring Point on the well
(b) Ft MSL = Feet relative to Mean Sea Level
(c) -- = not measured.

TABLE 7
County Line Aquifer Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			U 1571(a)	MORR 968	MORR 956	MORR 972	CLWID B-Line
Analyte	**Unit**	**Standard**	**10/22/2008**	**10/22/2008**	**10/22/2008**	**5/21/2008**	**5/21/2008**
Micro-Organisms							
Turbidity	NTU(b)	1	**0.54**	**0.3/0.81(c)**	**0.5**	**0.33**	**20.1**
Disinfection Byproducts							
Haloacetic acids (HAA5)	mg/L(d)	0.06	<0.001(e)	<0.001/<0.001	<0.001	<0.001	--(f)
dichloroacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	--
trichloroacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	--
monochloroacetic acid	mg/L	None	<0.002	<0.002/<0.002	<0.002	<0.002	--
bromoacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	--
dibromoacetic acid	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	--
Total Trihalomethanes (TTHMs)	mg/L	0.08	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Bromodichloromethane	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Bromoform	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Dibromochloromethane	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Chloroform	mg/L	None	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Disinfectants							
Chloramines (as Cl_2)	mg/L	4	<0.05	<0.05/<0.05	<0.05	<0.05	--
Chlorine (as Cl_2)	mg/L	4	<0.05	<0.05/<0.05	<0.05	<0.05	--
Geochemical Parameters							
Cyanide (as free cyanide)	mg/L	0.2	<0.01	<0.01/<0.01	<0.01	<0.01	--
Fluoride	mg/L	2	**0.527**	**0.341/0.351**	**0.433**	**0.22**	--
Silica	mg/L	None	**28.9**	**24.5/22.2**	**28.8**	**16**	--
Total Organic Carbon	mg/L	None	**1.89**	**2.41/2.43**	**1.92**	**1.82**	--
Metals							
Aluminum	mg/L	None	<0.01	<0.01/<0.01	<0.01	<0.01	--

TABLE 7
County Line Aquifer Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			U 1571[a]	MORR 968	MORR 956	MORR 972	CLWID B-Line
Analyte	**Unit**	**Standard**	**10/22/2008**	**10/22/2008**	**10/22/2008**	**5/21/2008**	**5/21/2008**
Antimony	mg/L	0.006	<0.001	<0.001/<0.001	<0.001	<0.001	--
Arsenic	mg/L	0.01	**0.00548**	**0.00521/0.00530**	**0.00457**	**0.00352**	--
Barium	mg/L	2	**0.0722**	**0.0714/0.0724**	**0.0545**	**0.0111**	--
Beryllium	mg/L	0.004	<0.001	<0.001/<0.001	<0.001	<0.001	--
Cadmium	mg/L	0.005	<0.001	<0.001/<0.001	<0.001	<0.001	--
Chromium (total)	mg/L	0.1	**0.00276**	**0.00118/0.00109**	**0.00185**	<0.001	--
Copper	mg/L	1.3	**0.00216**	**0.00149/0.00119**	**0.00252**	**0.00106**	--
Iron (Total)	mg/L	None	**0.508**	**0.47/0.470**	**0.415**	**0.0907**	**0.593**
Iron (Dissolved)	mg/L	0.3	**0.454**	**0.43/0.429**	**0.406**	**0.0704**	**0.12**
Lead	mg/L	0.05	<0.001	<0.001/<0.001	<0.001	<0.001	--
Manganese (Total)	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	**0.00705**
Manganese (Dissolved)	mg/L	0.05	<0.001	<0.001/<0.001	<0.001	<0.001	**0.00131**
Mercury (inorganic)	mg/L	0.002	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	--
Nickel	mg/L	None	<0.001	<0.001/<0.001	<0.001	<0.001	--
Selenium	mg/L	0.01	<0.001	<0.001/<0.001	<0.001	<0.001	--
Silver	mg/L	0.05	<0.001	<0.001/<0.001	<0.001	<0.001	--
Thallium	mg/L	0.002	<0.001	<0.001/<0.001	<0.001	<0.001	--
Zinc	mg/L	5	**0.00153**	<0.001/<0.001	<0.001	<0.001	--
Miscellaneous							
Color	CU[g]	15	**5**	**5/5**	**5**	**5**	**15**
Corrosivity			**0.16**	**0.26/0.28**	**0.4**	**-0.279**	--
Foaming Agents	mg/L	0.5	<0.05	<0.05/<0.05	<0.05	<0.05	--
Odor	TON	3	<1	<1/<1	<1	<1	--
UV Absorbance at 254 nm	cm^{-1}[h]	None	--	--	--	**0.028**	**0.032**

TABLE 7
County Line Aquifer Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

			U 1571[a]	MORR 968	MORR 956	MORR 972	CLWID B-Line
Analyte	**Unit**	**Standard**	**10/22/2008**	**10/22/2008**	**10/22/2008**	**5/21/2008**	**5/21/2008**
Total Suspended Solids	mg/L	None	<1	<1/<1	<1	<5	--
Synthetic Organic Compounds (SOCs)							
Alachlor	mg/L	0.002	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	--
Atrazine	mg/L	0.003	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	--
Benzo(a)pyrene (PAHs)	mg/L	0.0002	<2e-005[i]	<2e-005/<2e-005	<2e-005	<2e-005	--
Carbofuran	mg/L	0.04	<0.002	<0.002/<0.002	<0.002	<0.002	--
Chlordane	mg/L	0.002	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	--
2,4-D	mg/L	0.07	<0001	<0.0001/<0.0001	<0001	<0001	--
Dalapon	mg/L	0.2	<0001	<0.0001/<0.0001	<0001	<0001	--
1,2-Dibromo-3-chloropropane (DBCP)	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	--
Di(2-ethylhexyl) adipate	mg/L	0.4	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	--
Di(2-ethylhexyl) phthalate	mg/L	0.006	<0.0006	<0.0006/<0.0006	<0.0006	<0.0006	--
Dinoseb	mg/L	0.007	<0001	<0.0001/<0.0001	<0001	<0001	--
Diquat	mg/L	0.02	<0.00008	<8e-005/<8e-005	<0.00008	<0.00008	--
Endothall	mg/L	0.1	<0.01	<0.01/<0.01	<0.01	<0.01	--
Endrin	mg/L	0.0002	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	--
Ethylene dibromide (EDB)	mg/L	0.00005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	--
Glyphosate	mg/L	0.7	<0.009	<0.009/<0.009	<0.009	<0.009	--
Heptachlor	mg/L	0.0004	<8e-005	<8e-005/<8e-005	<8e-005	<8e-005	--
Heptachlor epoxide	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	--
Hexachlorobenzene	mg/L	0.001	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	--
Hexachlorocyclopentadiene	mg/L	0.05	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	--
Lindane (BHC-gamma)	mg/L	0.0002	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	--
Methoxychlor	mg/L	0.04	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	--

TABLE 7
County Line Aquifer Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	U 1571$^{(a)}$ 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008	MORR 972 5/21/2008	CLWID B-Line 5/21/2008
Oxamyl (Vydate)	mg/L	0.2	<0.004	<0.004/<0.004	<0.004	<0.004	--
Polychlorinated biphenyls (PCBs)	mg/L	0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Pentachlorophenol	mg/L	0.001	<8e-005	<8e-005/8e-005	<8e-005	<8e-005	--
Picloram	mg/L	0.5	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	--
Simazine	mg/L	0.004	<0.00015	<0.00015/<0.00015	<0.00015	<0.00015	--
Toxaphene	mg/L	0.003	<0.002	<0.002/<0.002	<0.002	<0.002	--
2,4,5-TP (Silvex)	mg/L	0.01	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	--
Volatile Organic Compounds (VOCs)							
Benzene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Carbon tetrachloride	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Chlorobenzene (monoclorobenzene)	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
o-Dichlorobenzene (1,2-Diclorobenzene)	mg/L	0.6	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
p-Dichlorobenzene (1,4-Dichlorobenzene)	mg/L	0.075	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,2-Dichloroethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,1-Dichloroethylene	mg/L	0.007	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
cis-1,2-Dichloroethylene	mg/L	0.07	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
trans-1,2-Dichloroethylene	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Dichloromethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,2-Dichloropropane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Epichlorohydrin	mg/L	TT	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Ethylbenzene	mg/L	0.7	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Styrene	mg/L	0.1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Tetrachloroethylene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--

TABLE 7
County Line Aquifer Drinking Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	U 1571(a) 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008	MORR 972 5/21/2008	CLWID B-Line 5/21/2008
Toluene	mg/L	1	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,2,4-Trichlorobenzene	mg/L	0.07	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,1,1-Trichloroethane	mg/L	0.2	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
1,1,2-Trichloroethane	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Trichloroethylene	mg/L	0.005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Vinyl chloride	mg/L	0.002	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Xylenes (total)	mg/L	10	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	--
Radionuclides							
Gross Alpha	pCi/L	15	**6.01**	**4.34/7.21**	**8.39**	--	--
Gross Beta	pCi/L	50	**5.71**	**5.14/5.1**	**5.37**	--	--

Notes:

(a) U designates UMAT well number.
(b) NTU = Nephelometric Turbidity Units
(c) First value is sample results followed by duplicate sample results.
(d) mg/L = milligrams per liter
(e) "<" designates when measurement was less than the indicated laboratory detection or method detection limit
(f) -- = Not measured.
(g) CU = Color Units
(h) cm^{-1} = 1/centimeter
(i) e = power 10, e.g., 2e-005 = 2 x 10^{-5} = 0.00002
(j) pCi/L = pico Curries per liter.

TABLE 8
County Line Aquifer Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	MORR 972	U 1571[a]	MORR 968	MORR 956	CLWID-B Line
			5/21/2008	10/22/2008	10/22/2008	10/22/2008	5/21/2008
Micro-Organisms							
Total Coliform Bacteria	MPN/100ml[b]	<1[c]	<2	<2	<2/<2[d]	<2	--[e]
Fecal Coliform Bacteria	MPN/100ml	<1	<2	<2	<2/<2	<2	--
Geochemical Parameters							
Bicarbonate	mg/L[f]	None	**70.4**	**265**	**167/172**	**212**	**7.34**
Calcium	mg/L	None	**18.6**	**82.3**	**85.6/76.9**	**87.3**	**4.22**
Carbonate	mg/L	None	<5	<5	<5/<5	<5	<5
Chloride	mg/L	250	**1.95**	**30**	**34.1/34.0**	**29.1**	**0.67**
Magnesium	mg/L	None	**5.36**	**28.4**	**26.1/23.4**	**28.5**	**1.53**
Nitrate (as Nitrogen)	mg/L	10	**0.314**	**17.4**	**16.7/16.6**	**15.8**	<0.1
Nitrite (as Nitrogen)	mg/L	1	<0.1	<0.1	<0.1/<0.1	<0.1	--
Potassium	mg/L	None	**2**	**4.98**	**4.81/4.85**	**4.85**	**1.44**
Sodium	mg/L	None	**6.64**	**32.4**	**27.4/24.6**	**39.5**	**2.86**
Sulfate	mg/L	250	**2.56**	**49.6**	**86.7/86.4**	**50.1**	**0.874**
TDS	mg/L	500	**98**	**549**	**526/499**	**504**	**45**
Alkalinity (as $CaCO_3$)	mg/L	None	**70.4**	**265**	**167/172**	**212**	--
Hardness (as $CaCO_3$)	mg/L	None	**68.6**	**323**	**322/289**	**336**	**16.9**
Biological Oxygen Demand	mg/L	None	<2	--	--	--	--
Field Parameters							
pH	pH	6.5-8.5	**7.2**	**7.53**	**7.94**	**7.98**	**7.3**
Temperature	°C[g]	None	**16.3**	**15.1**	**14.3**	**12.7**	**12.8**
Specific Conductivity	µs/cm[h]	None	**145**	**986**	**1051**	**1026**	**65**
ORP[i]	mV[j]	None	**29.9**	**352**	**191**	**214**	**56**
Dissolved Oxygen	mg/L	None	**7.6**	**8.44**	**6.22**	**8.32**	**7.6**

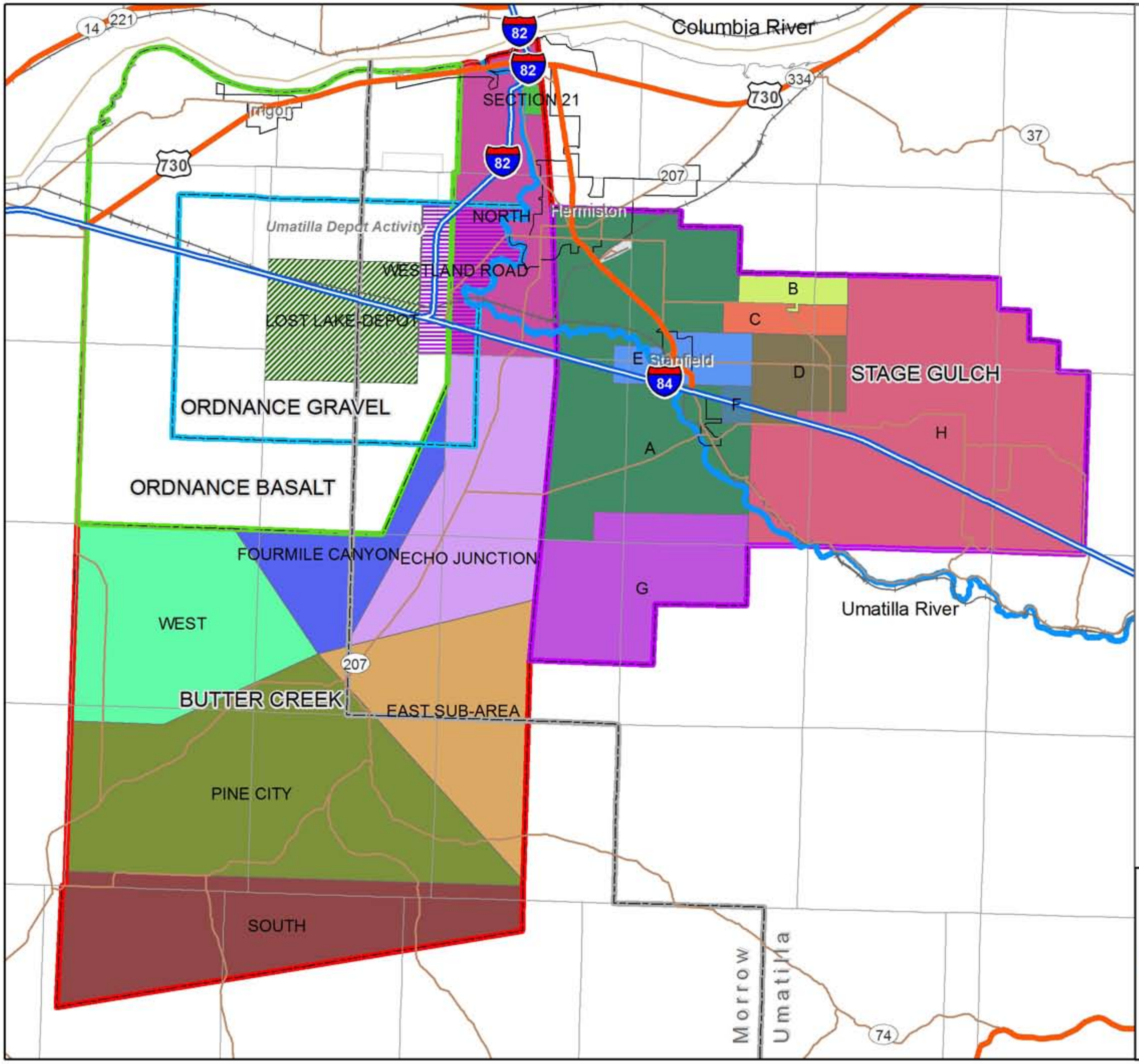
TABLE 8
County Line Aquifer Water Quality Results
Alluvial Aquifers Hydrogeologic Conceptual Model

Analyte	Unit	Standard	MORR 972	U 1571	MORR 968	MORR 956	CLWID-B Line
			5/21/2008	10/22/2008	10/22/2008	10/22/2008	5/21/2008
Herbicides							
2,4-D	µg/L(k)	70	<0.1	<0.01	<0.01/0.01	<0.01	--
Thifensulfuron methyl	µg/L	None	--	<0.08	<0.08/<0.08	<0.08	--
Tribenuron methyl	µg/L	None	--	<0.08	<0.08/<0.08	<0.08	--
Metsulfuron methyl	µg/L	None	--	<0.08	<0.08/<0.08	<0.08	--
MCPA (Clearmax)	µg/L	None	--	<0.1	<0.1/<0.1	<0.1	--
Diacamba (Banvel)	µg/L	None	<0.1	<1	<1/<1	<1	--

Notes:

(a) U designates UMAT well number
(b) MPN/100 ml =
(c) "<" designates when measurement was less than the indicated laboratory detection or method detection limit.
(d) Sample results/duplicate sample results
(e) -- = Not measured.
(f) mg/L = milligrams per liter
(g) degrees Centigrade
(h) µs/cm = micro Seimens per centimeter
(i) ORP = oxidation-reduction potential
(j) mV = Milli Volts
(k) µg/L = micrograms per liter

FIGURES



Legend

CGA Boundaries

- 🟥 Butter Creek
- 🟩 Ordnance Basalt
- 🟦 Ordnance Gravel
- 🟪 Stage Gulch

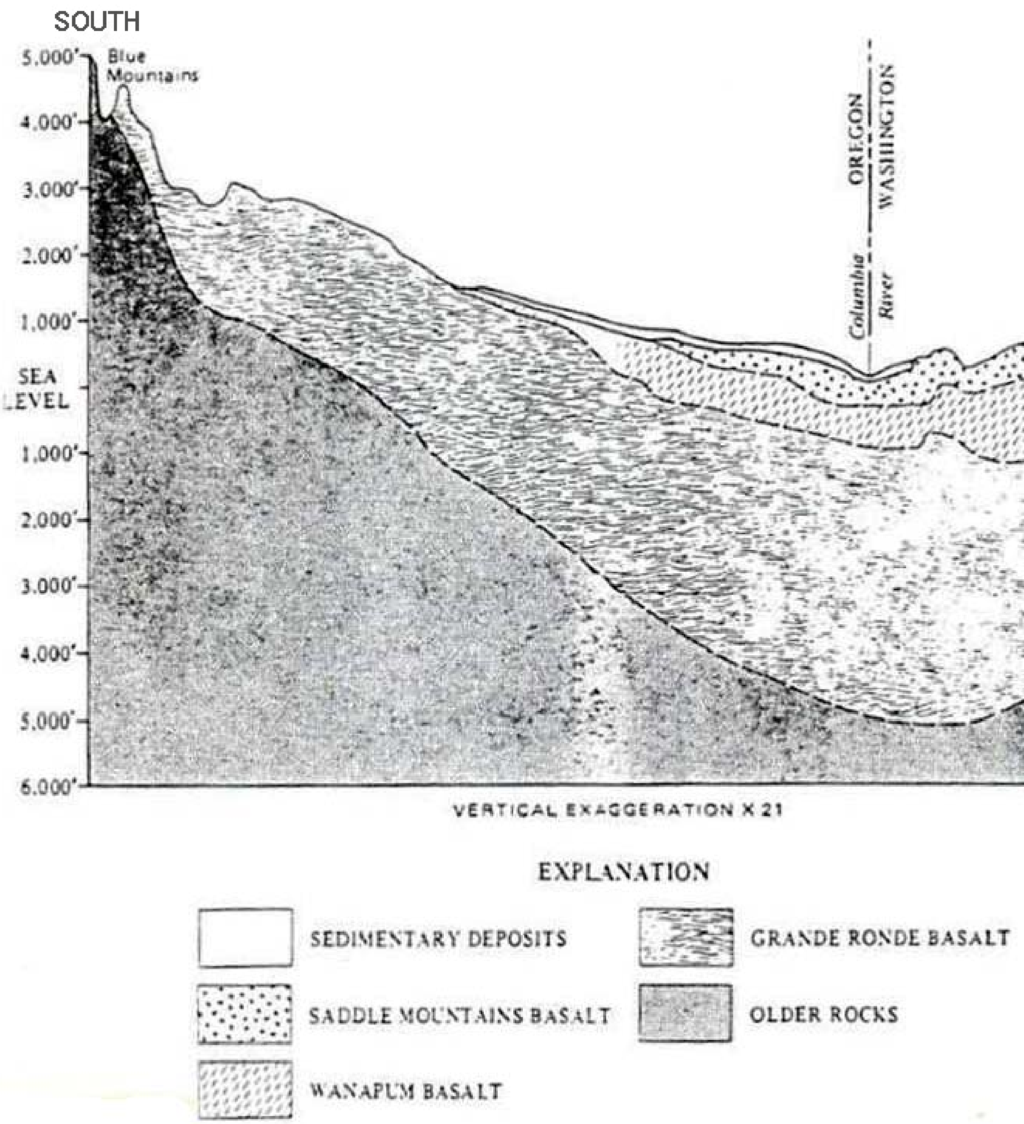
Notes:

CGA = Critical Groundwater Area
Colored areas denote Sub-Areas within CGAs.
CGA boundaries from Umatilla County.

Critical Groundwater Areas
Figure 1

Umatilla Basin Recharge Project

IRZ

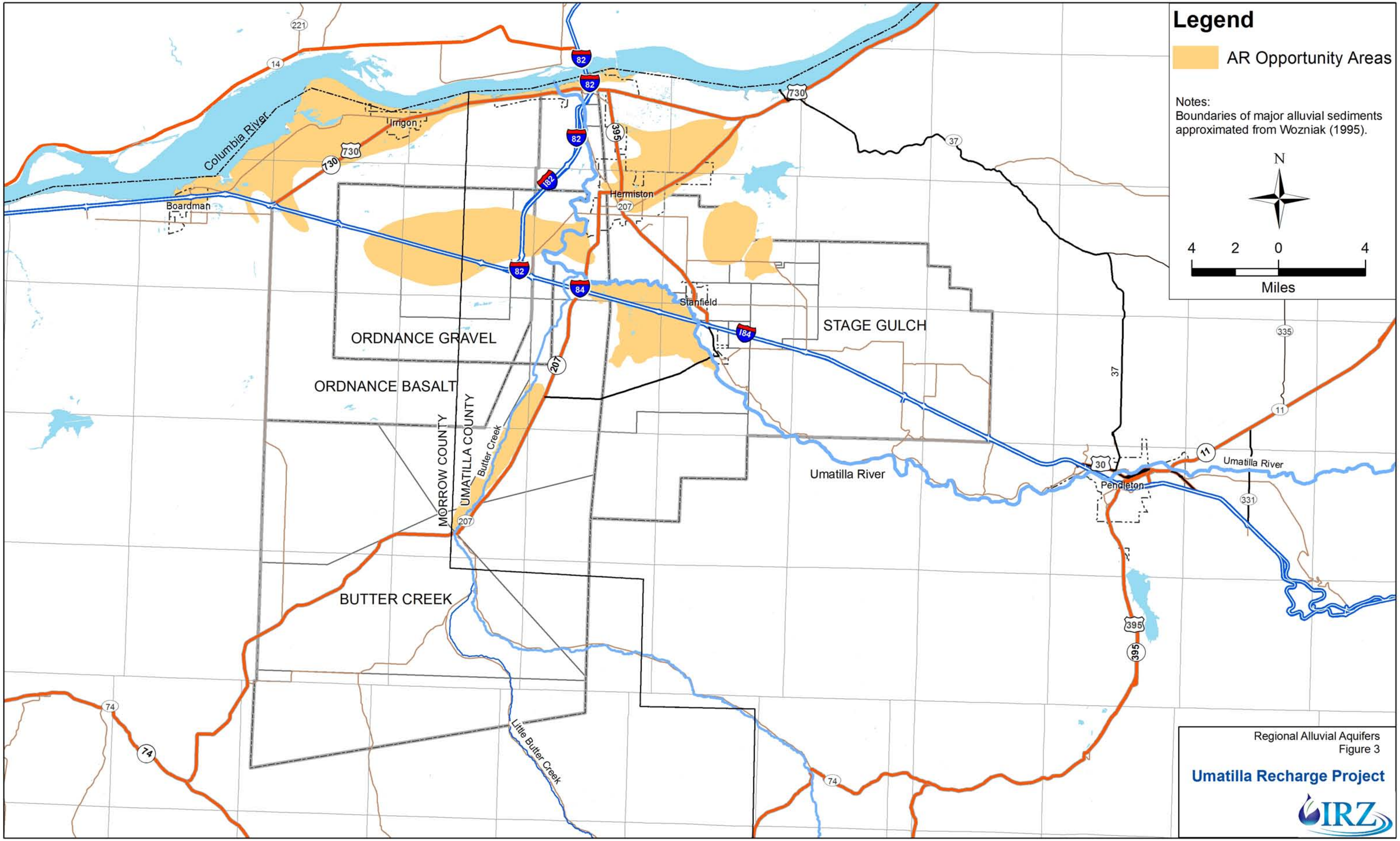


Source: Excerpted from Davies-Smith et al. 1988

Schematic Diagram of Basin Stratigraphy
Figure 2

Umatilla Basin Recharge Project

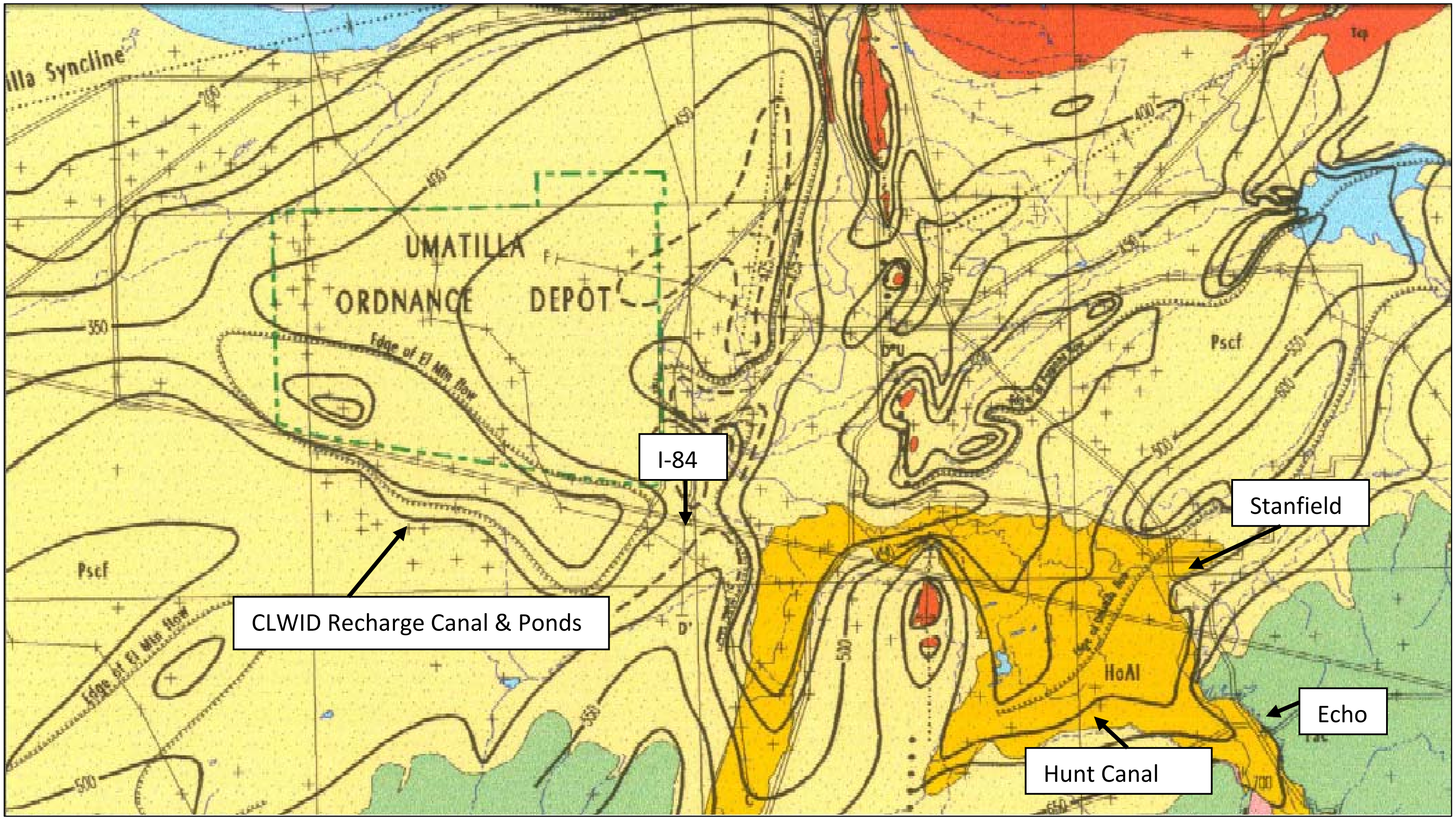
IRZ



Regional Alluvial Aquifers
Figure 3

Umatilla Recharge Project

IRZ

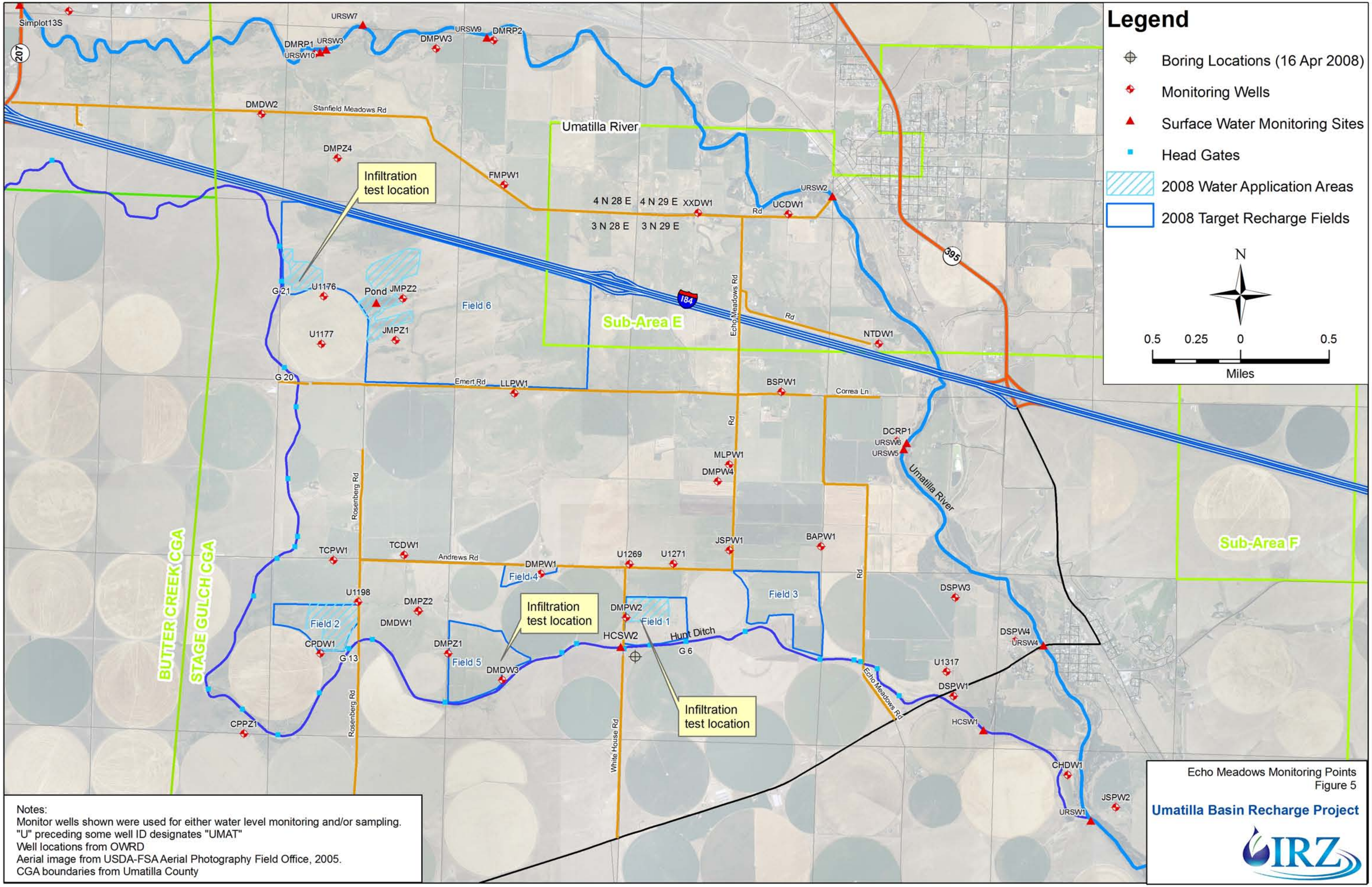


Structure Contour of Top of Basalt
Figure 4

Umatilla Basin Recharge Project

IRZ

Notes:
Contours shown depict the erosion surface on the top of basalt.
Source: Excerpted from Wozniak (1995)

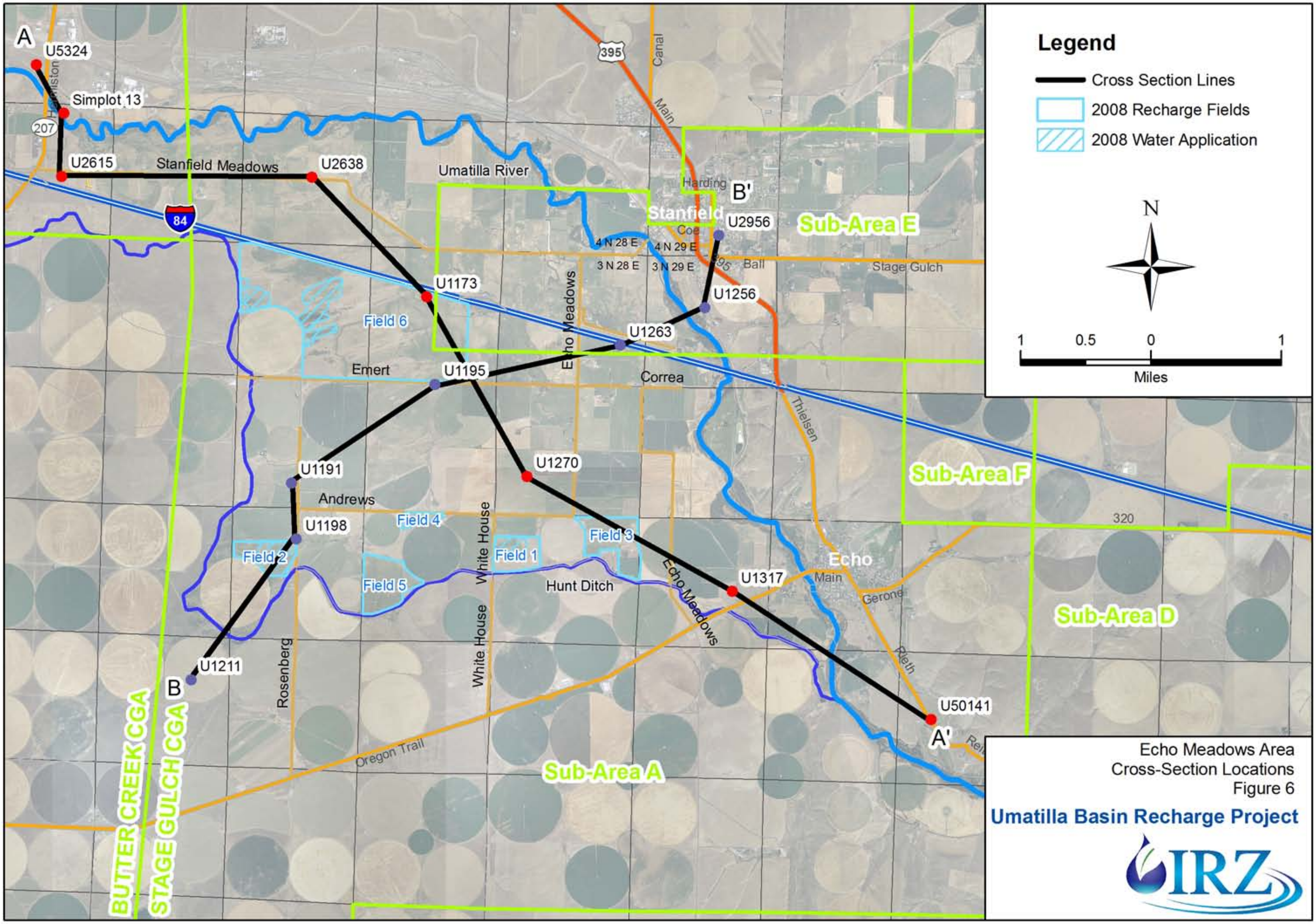


Notes:
Monitor wells shown were used for either water level monitoring and/or sampling.
"U" preceding some well ID designates "UMAT"
Well locations from OWRD
Aerial image from USDA-FSA Aerial Photography Field Office, 2005.
CGA boundaries from Umatilla County

Echo Meadows Monitoring Points
Figure 5

Umatilla Basin Recharge Project

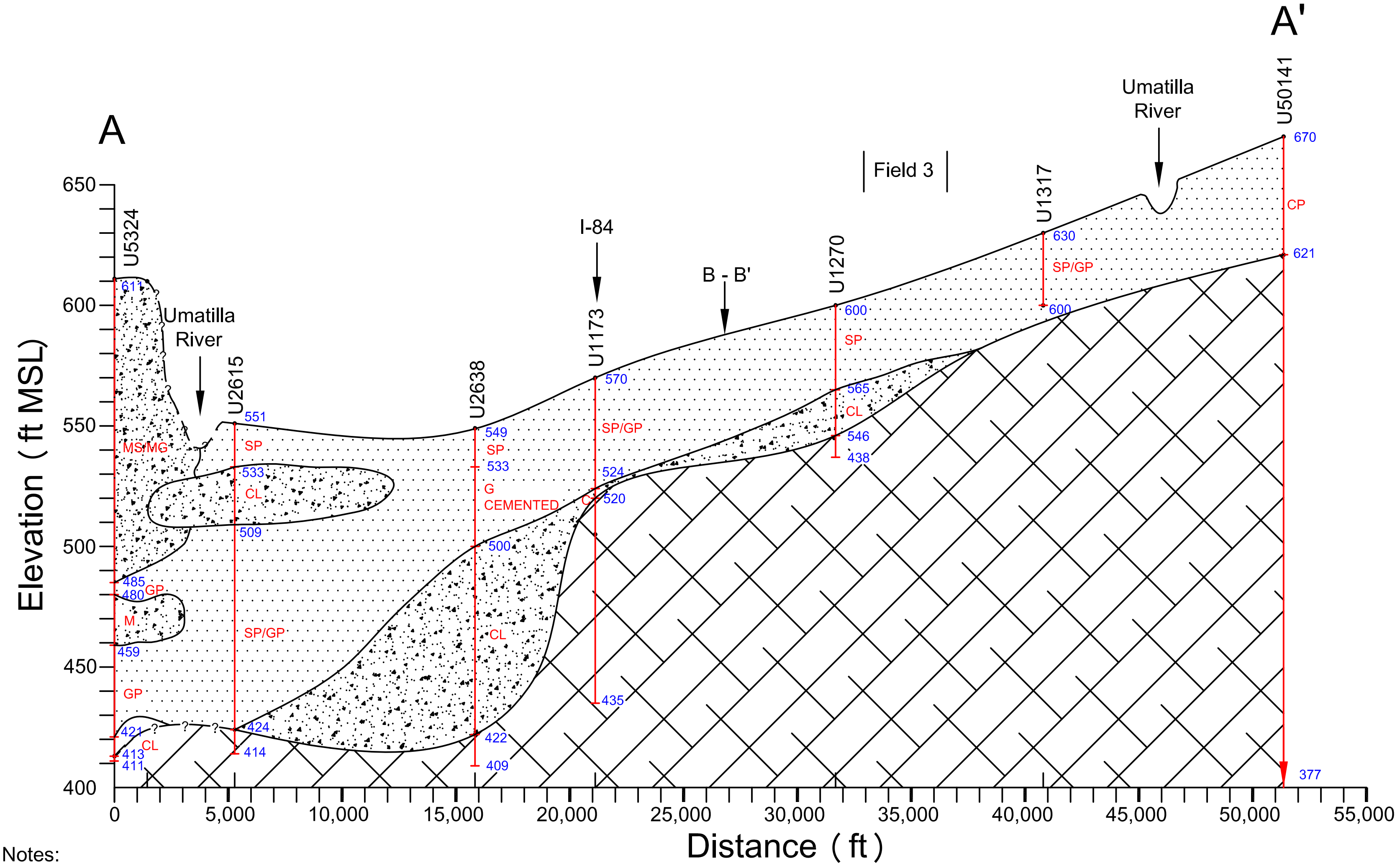
IRZ



Echo Meadows Area
Cross-Section Locations
Figure 6

Umatilla Basin Recharge Project

IRZ



Notes:

▨ Basalt Bedrock

░ Sand and gravel

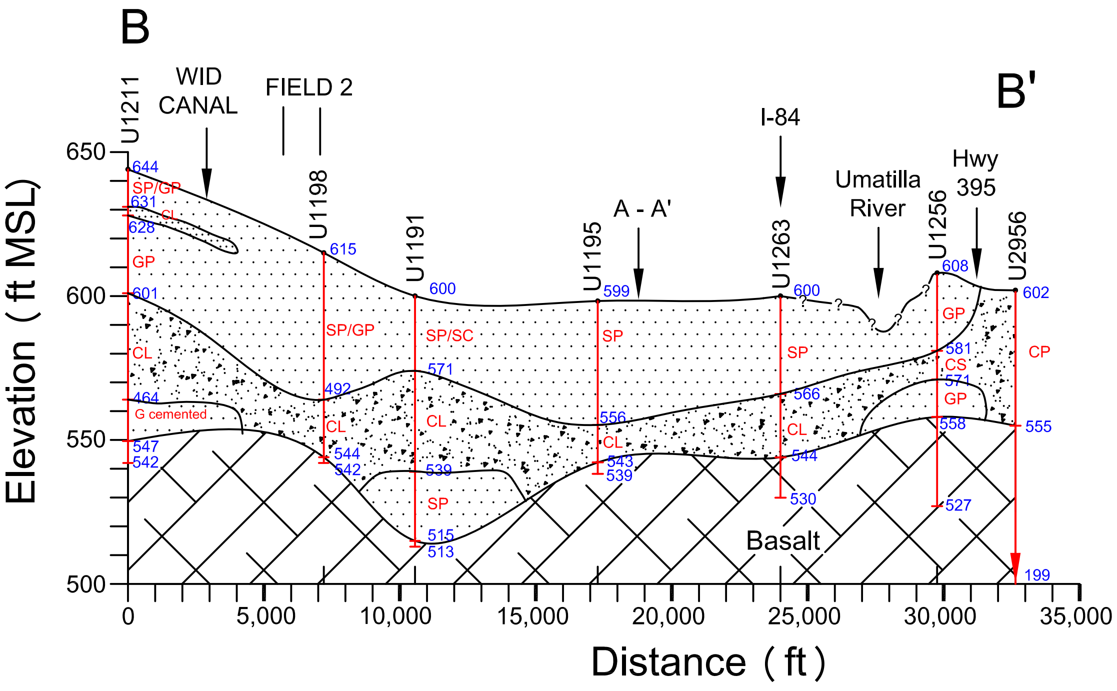
▒ Fine-grained deposits

Elevation accuracies are ±10 ft.
Umatilla River Channel is shown for illustration purposes only.
CL - clay; CP - poorly-sorted clay; CS - clay with sand; GP - poorly-sorted gravel; GP - gravel;
M - silt; MG - silt with gravel; MS - silt with sand; SC - sand with clay; SP - poorly-sorted sand.

Geologic Cross-Section A-A'
Echo Meadows
Figure 7

Umatilla Basin Recharge Project

IRZ



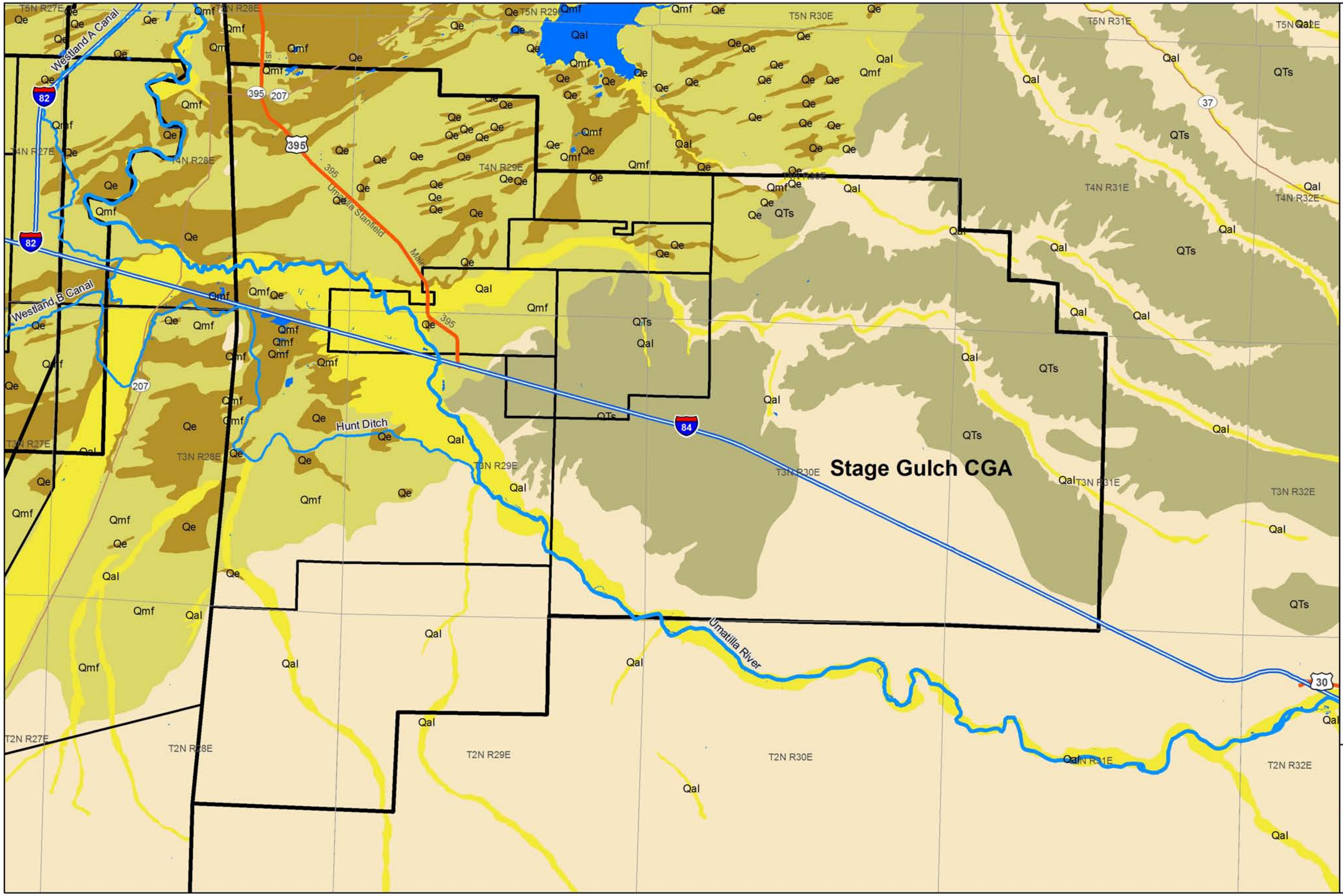
Notes:

- ▩ Basalt Bedrock
- ░ Sand and gravel
- ▒ Fine-grained deposits

Note:
Elevation accuracies are ±10 ft.
Umatilla River Channel is shown for illustration purposes only.
CL - clay; CP - poorly-sorted clay; CS - clay with sand; GP - poorly-sorted gravel; GP - gravel;
M - silt; MG - silt with gravel; MS - silt with sand; SC - sand with clay; SP - poorly-sorted sand.

Geologic Cross-Section B-B'
Echo Meadows
Figure 8

Umatilla Basin Recharge Project



Legend

Geology

▨	QTs, Older loess
🟨	Qal, Alluvium
▨	Qe, Eolian sand and ash
▨	Qmf, Missoula Flood deposits
▨	Basalt

N

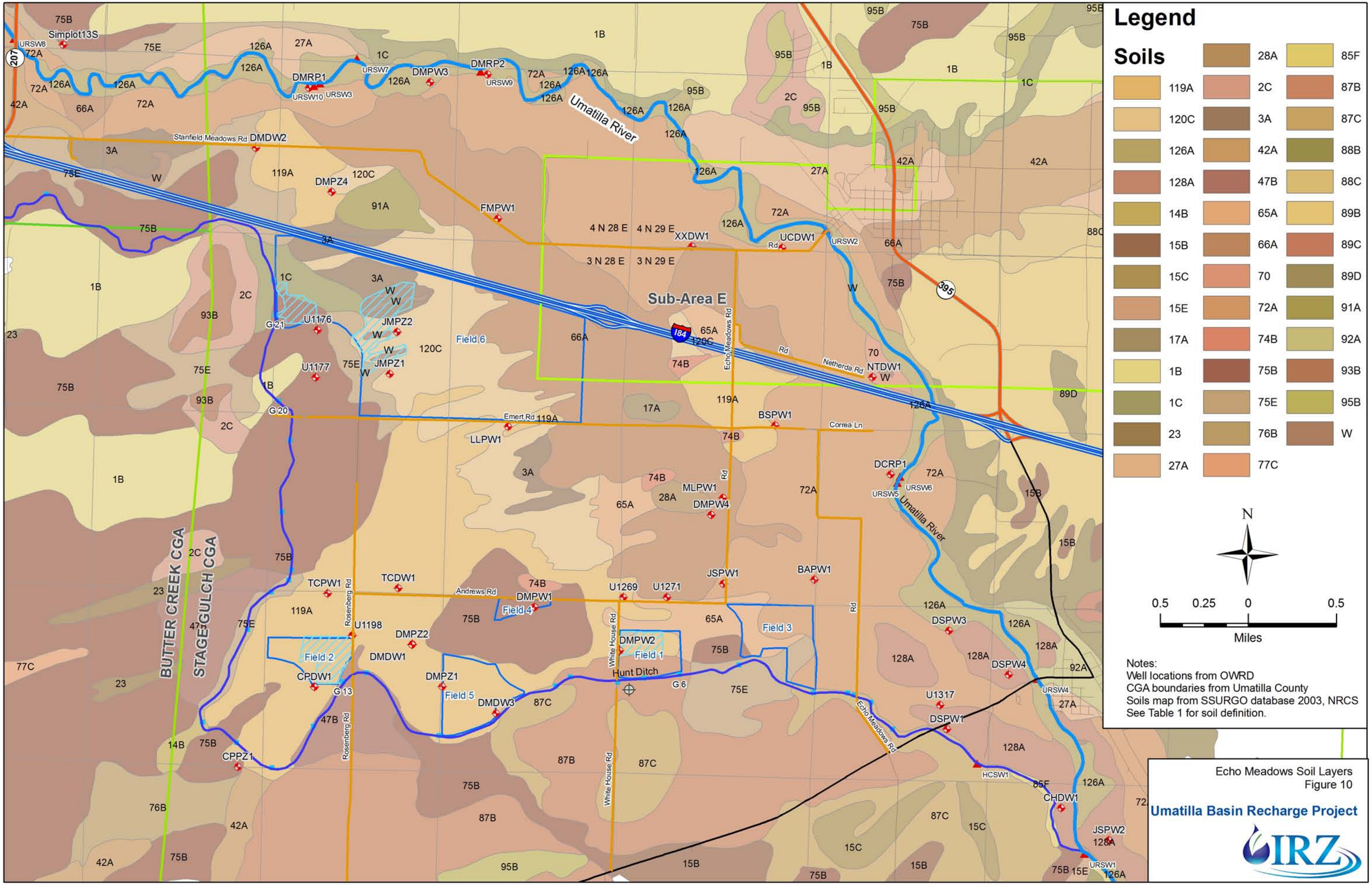
2 1 0 2
Miles

Notes:
CGA boundaries from Umatilla County
Geology map from
Oregon Geologic Data Compilation v.4

Surface Geology
Stage Gulch CGA
Figure 9

Umatilla Basin Recharge Project

IRZ

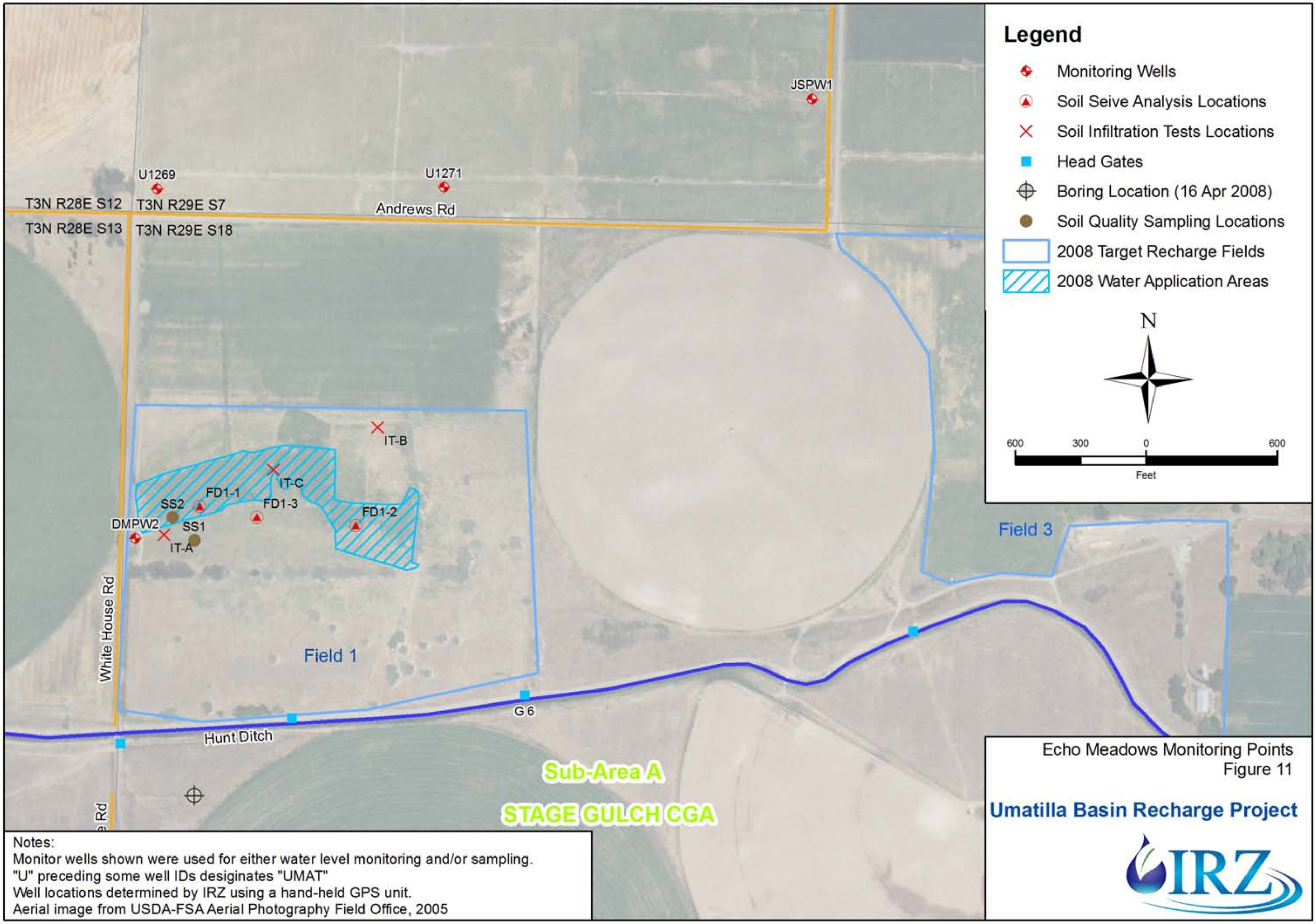


Notes:
Well locations from OWRD
CGA boundaries from Umatilla County
Soils map from SSURGO database 2003, NRCS
See Table 1 for soil definition.

Echo Meadows Soil Layers
Figure 10

Umatilla Basin Recharge Project

IRZ

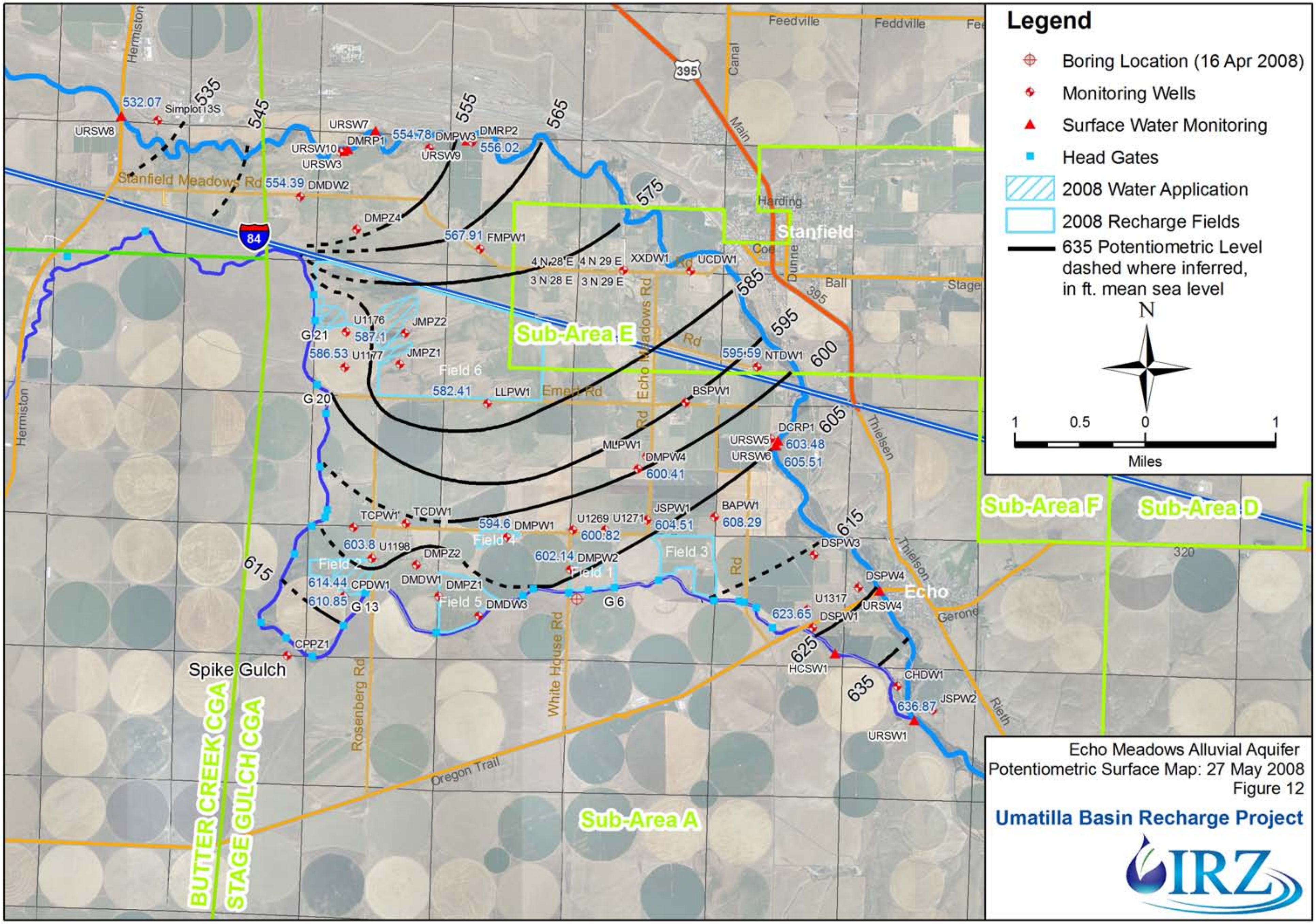


Echo Meadows Monitoring Points
Figure 11

Umatilla Basin Recharge Project

IRZ

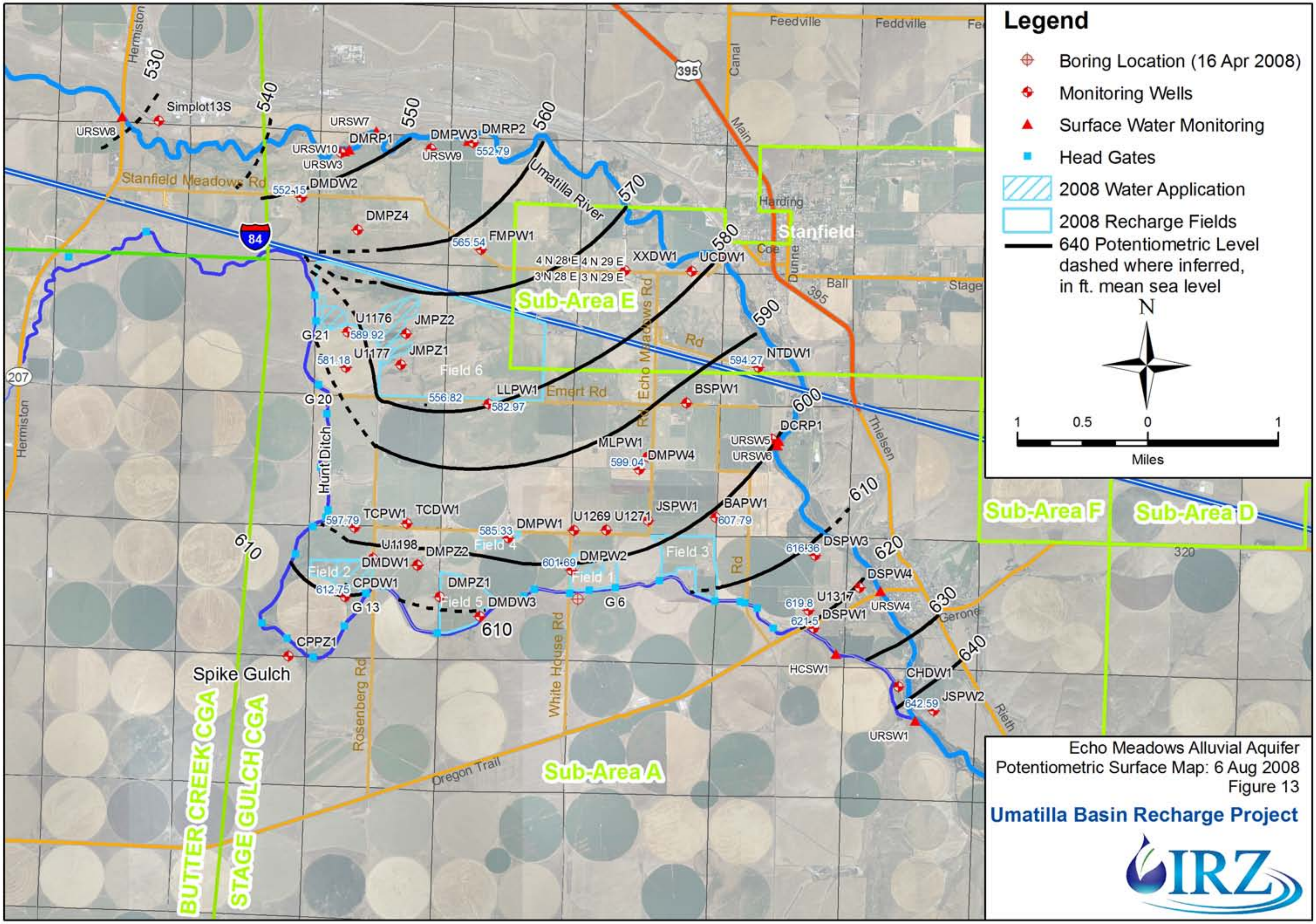
Notes:
Monitor wells shown were used for either water level monitoring and/or sampling.
"U" preceding some well IDs desiginates "UMAT"
Well locations determined by IRZ using a hand-held GPS unit.
Aerial image from USDA-FSA Aerial Photography Field Office, 2005



Echo Meadows Alluvial Aquifer
Potentiometric Surface Map: 27 May 2008
Figure 12

Umatilla Basin Recharge Project

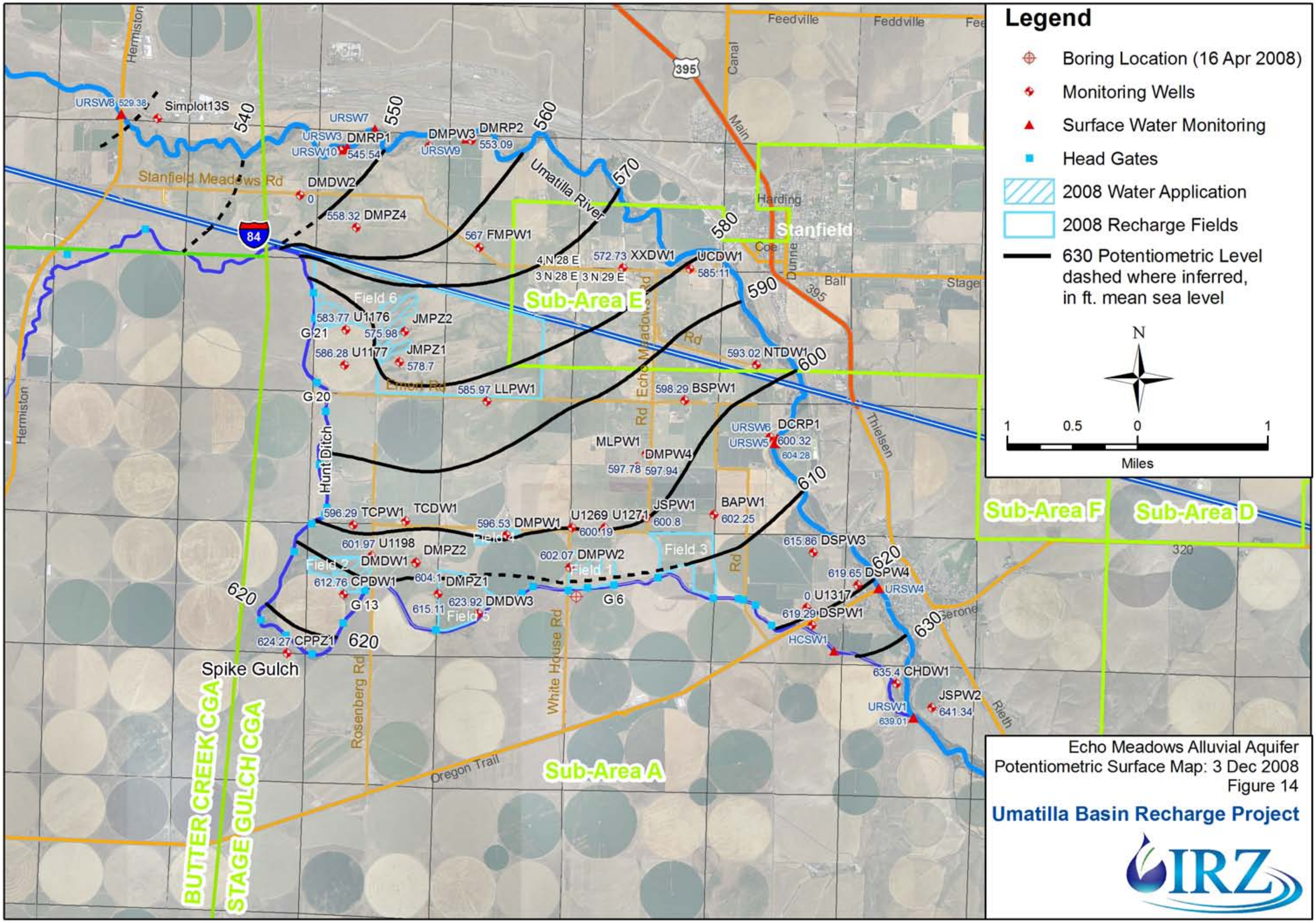
IRZ



Echo Meadows Alluvial Aquifer
Potentiometric Surface Map: 6 Aug 2008
Figure 13

Umatilla Basin Recharge Project

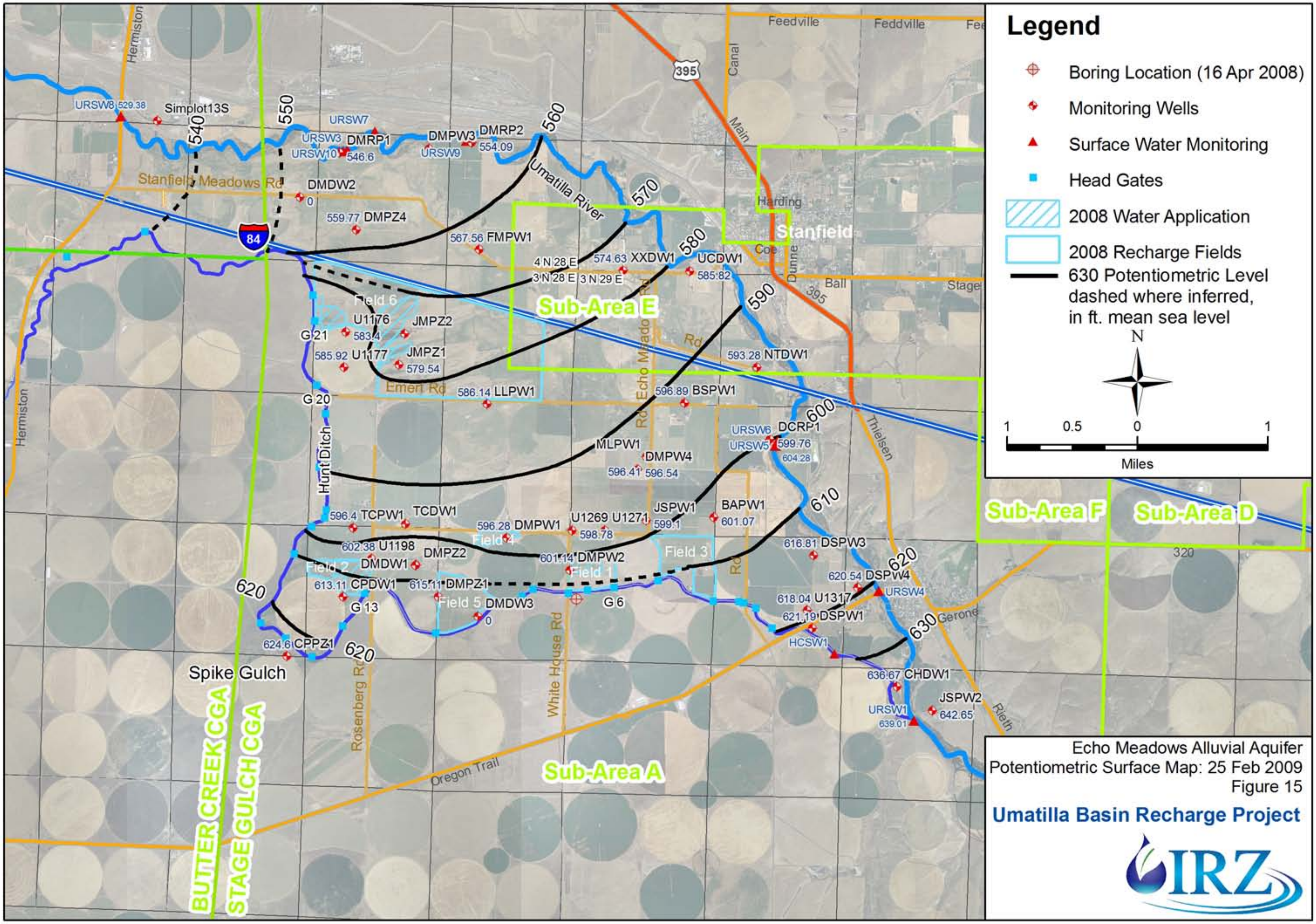
IRZ



Echo Meadows Alluvial Aquifer
Potentiometric Surface Map: 3 Dec 2008
Figure 14

Umatilla Basin Recharge Project

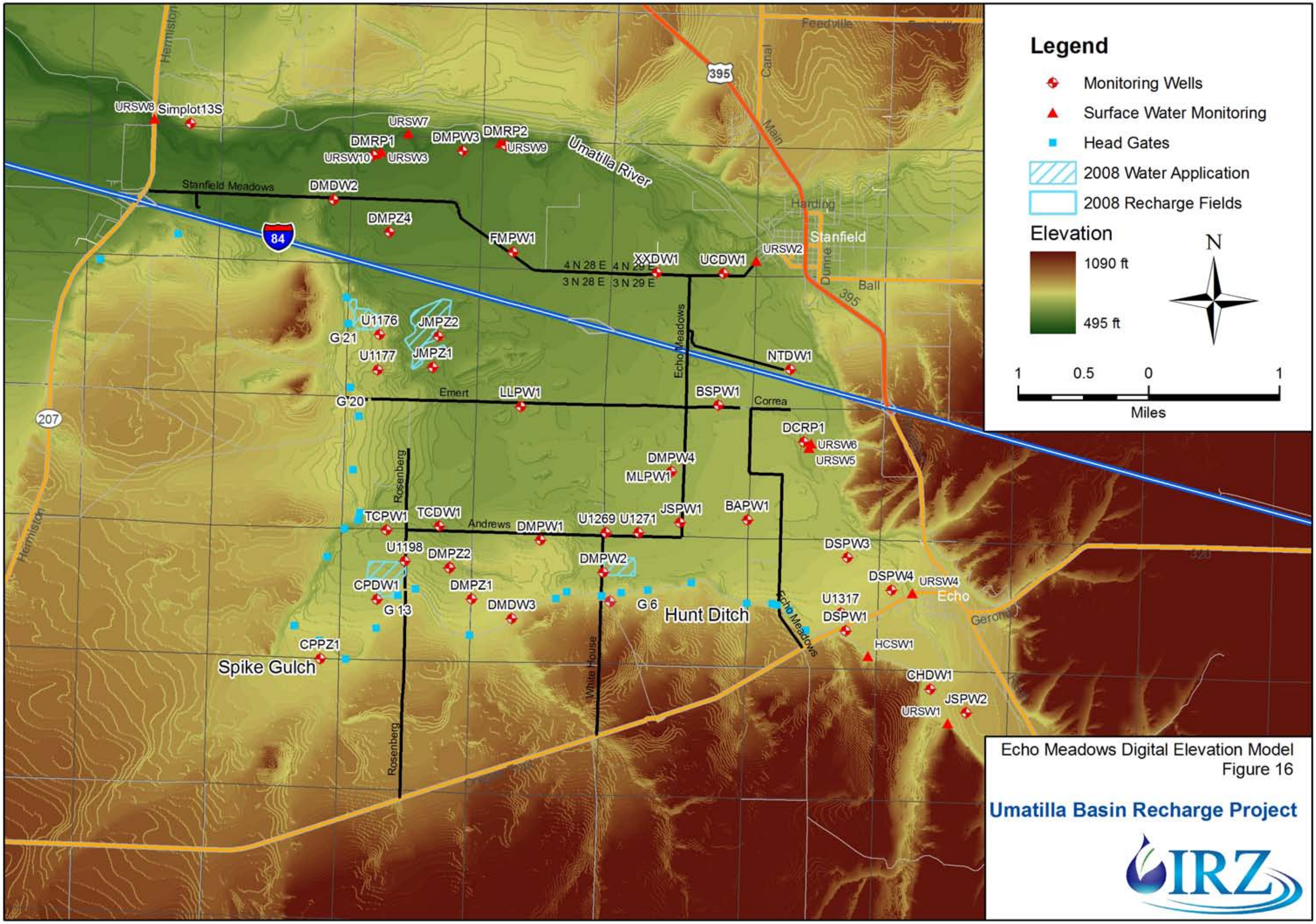
IRZ



Echo Meadows Alluvial Aquifer
Potentiometric Surface Map: 25 Feb 2009
Figure 15

Umatilla Basin Recharge Project

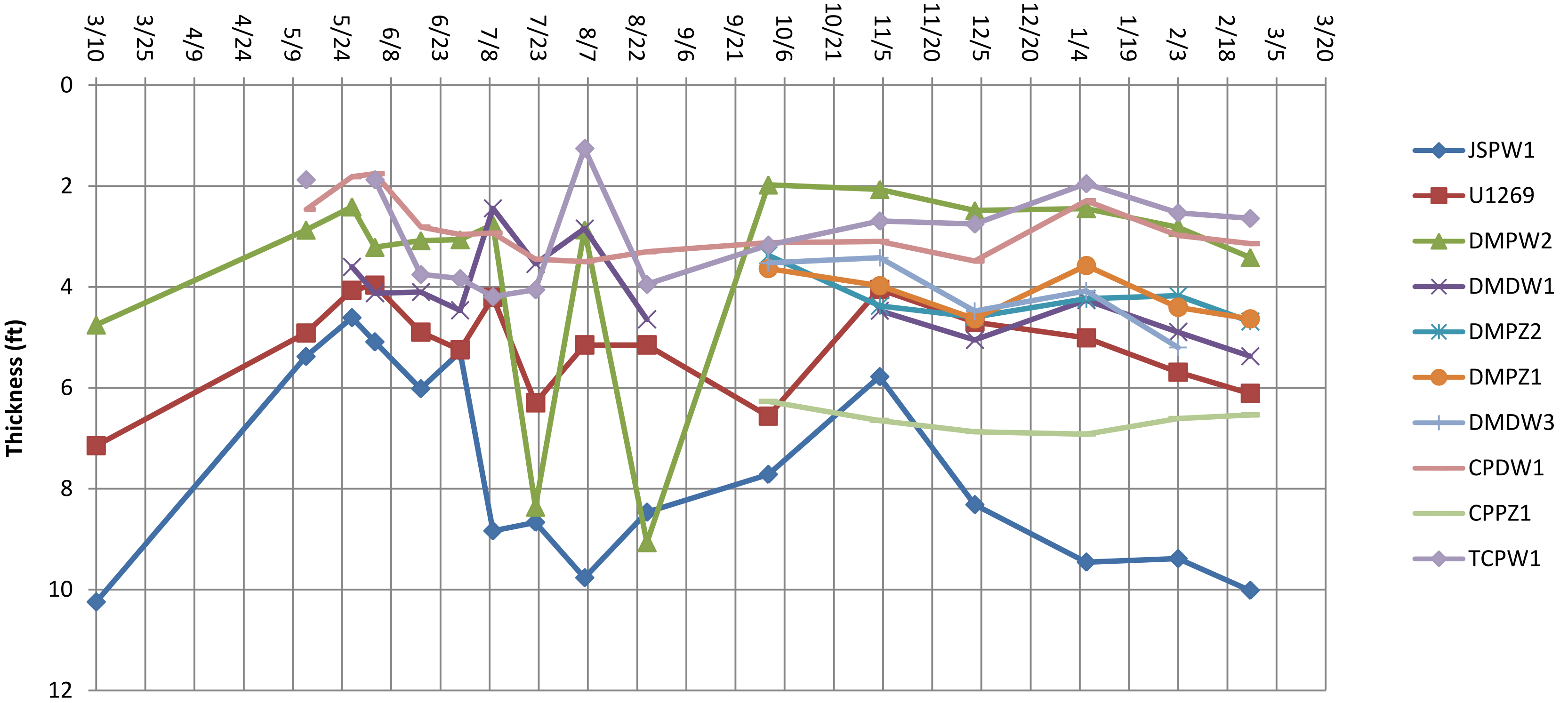
IRZ



Echo Meadows Digital Elevation Model
Figure 16

Umatilla Basin Recharge Project

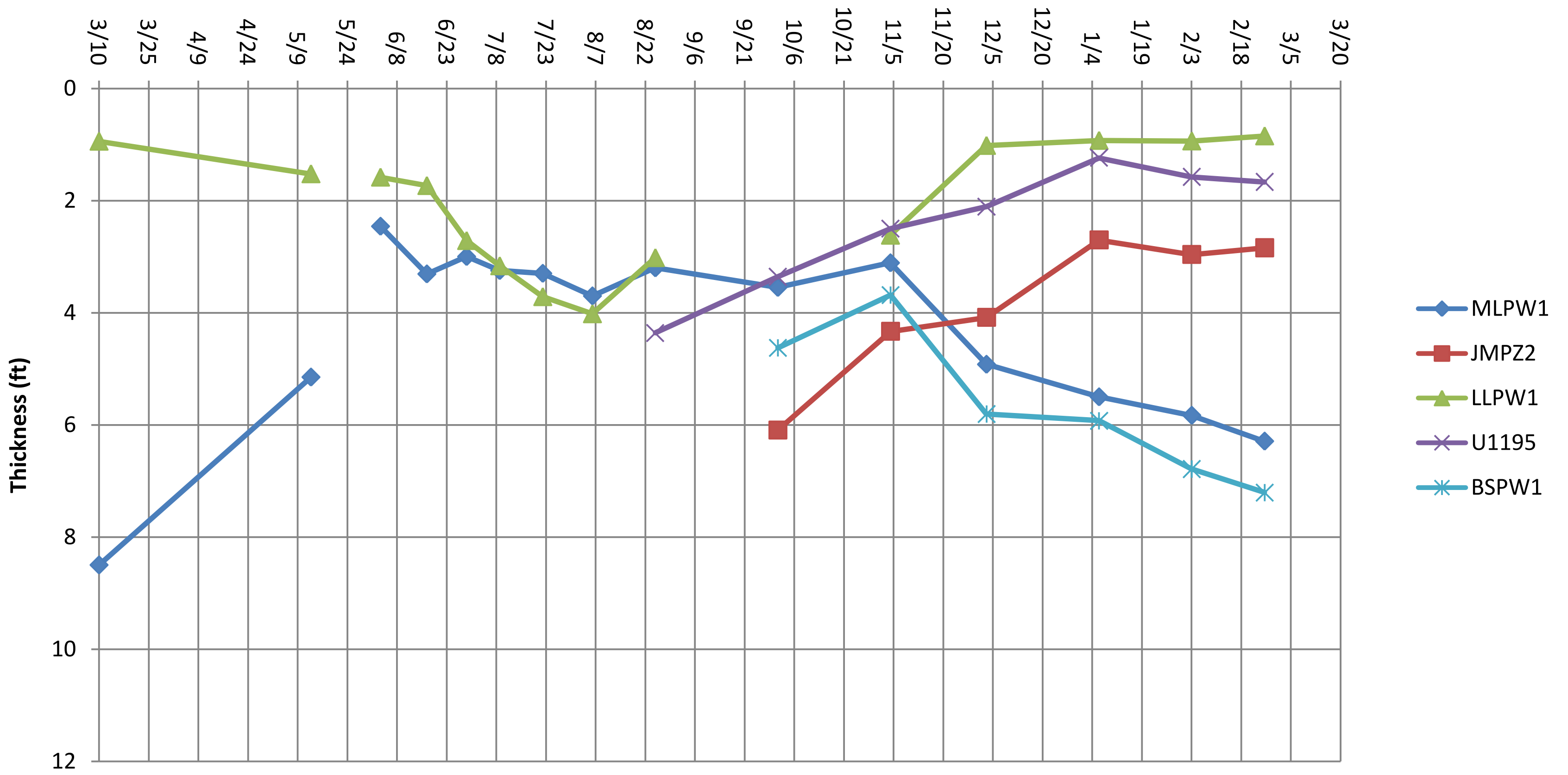
IRZ



Echo Meadows
Unsaturated Soil Thickness in Wells North of Hunt Canal, 2008-2009
Figure 17a

Umatilla Basin Recharge Project

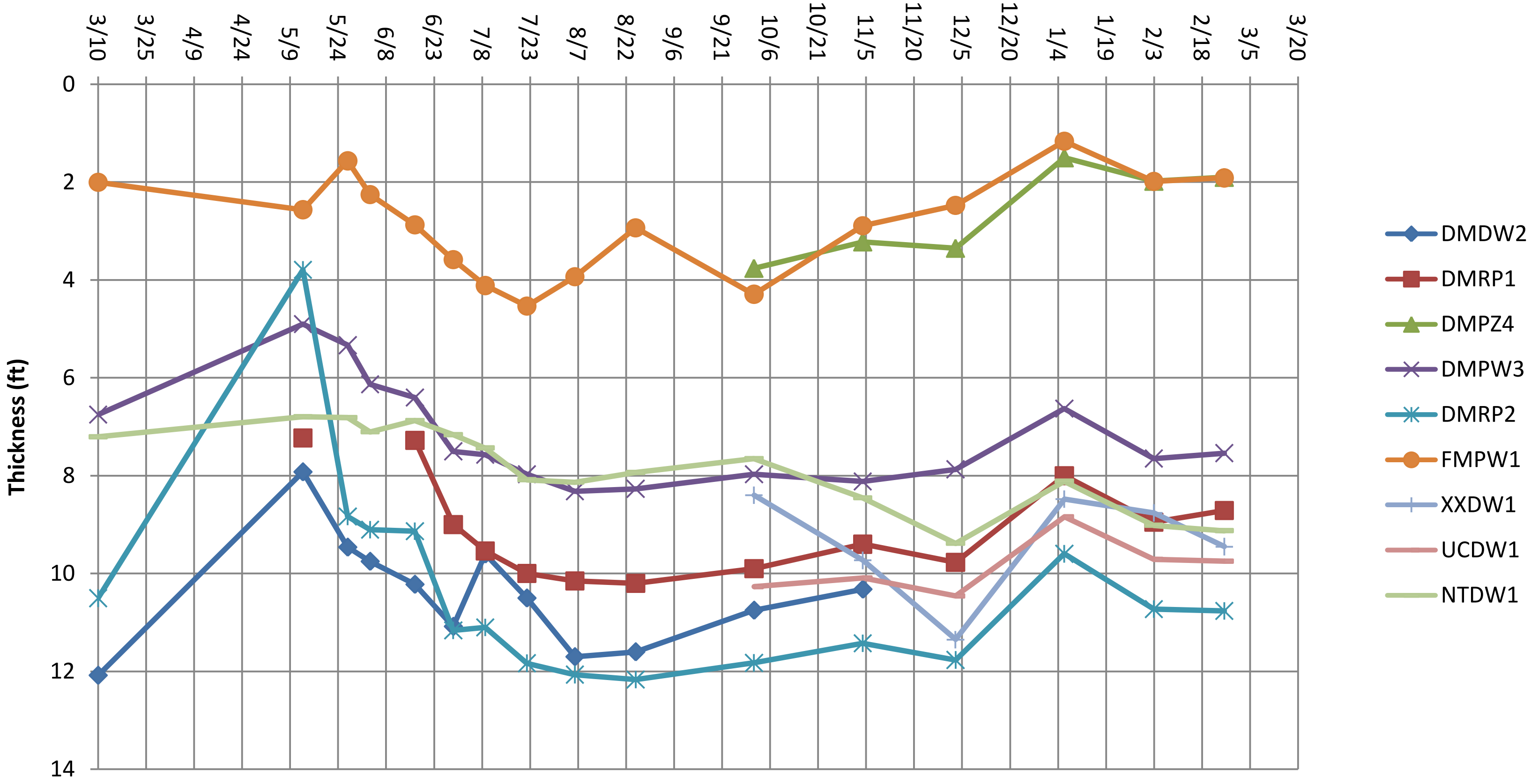
IRZ



Echo Meadows
Unsaturated Soil Thickness in Wells Middle of Echo Meadows, 2008-2009
Figure 17b

Umatilla Basin Recharge Project

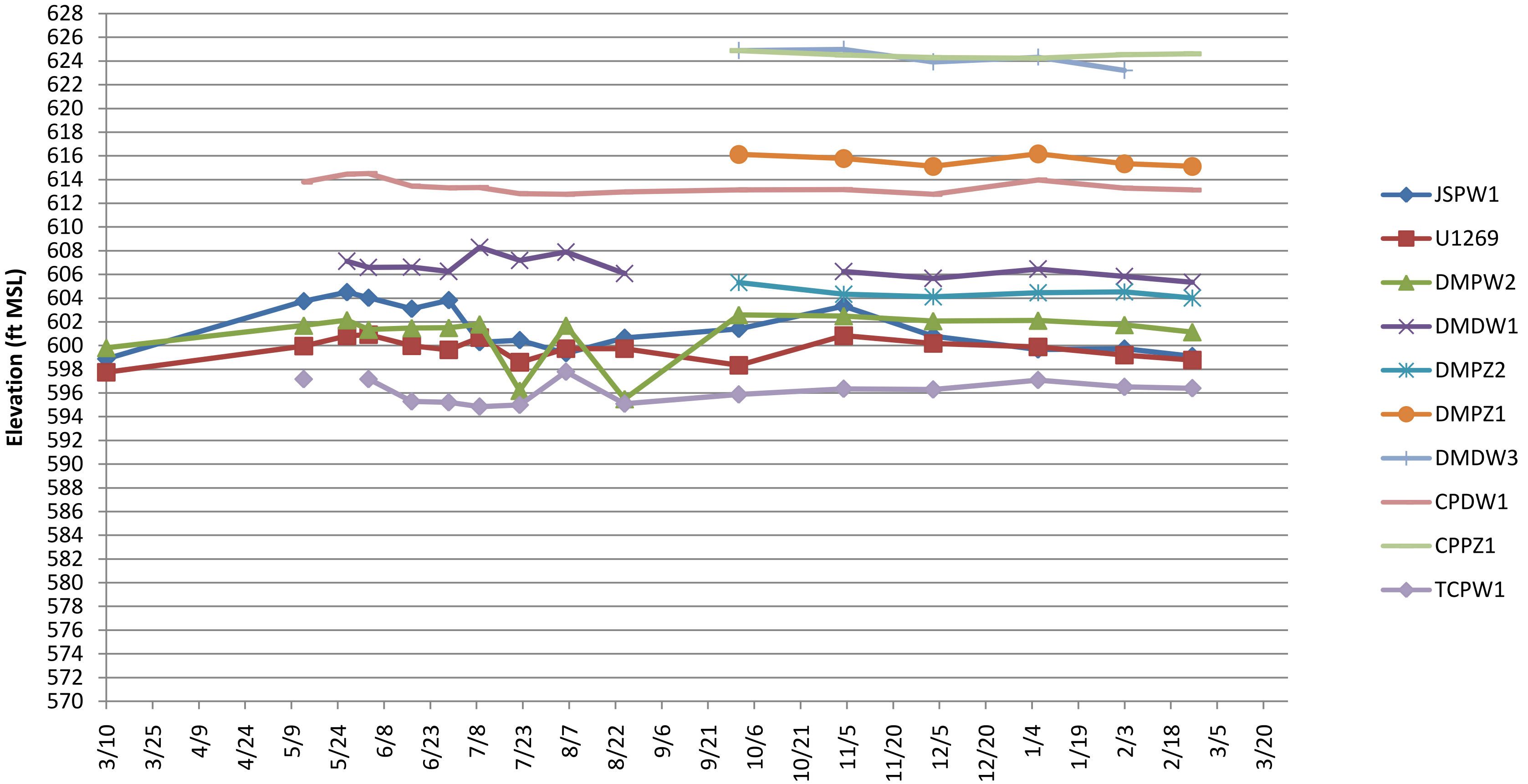
IRZ



Echo Meadows
Unsaturated Soil Thickness in Wells Along Umatilla River, 2008-2009
Figure 17c

Umatilla Basin Recharge Project

IRZ



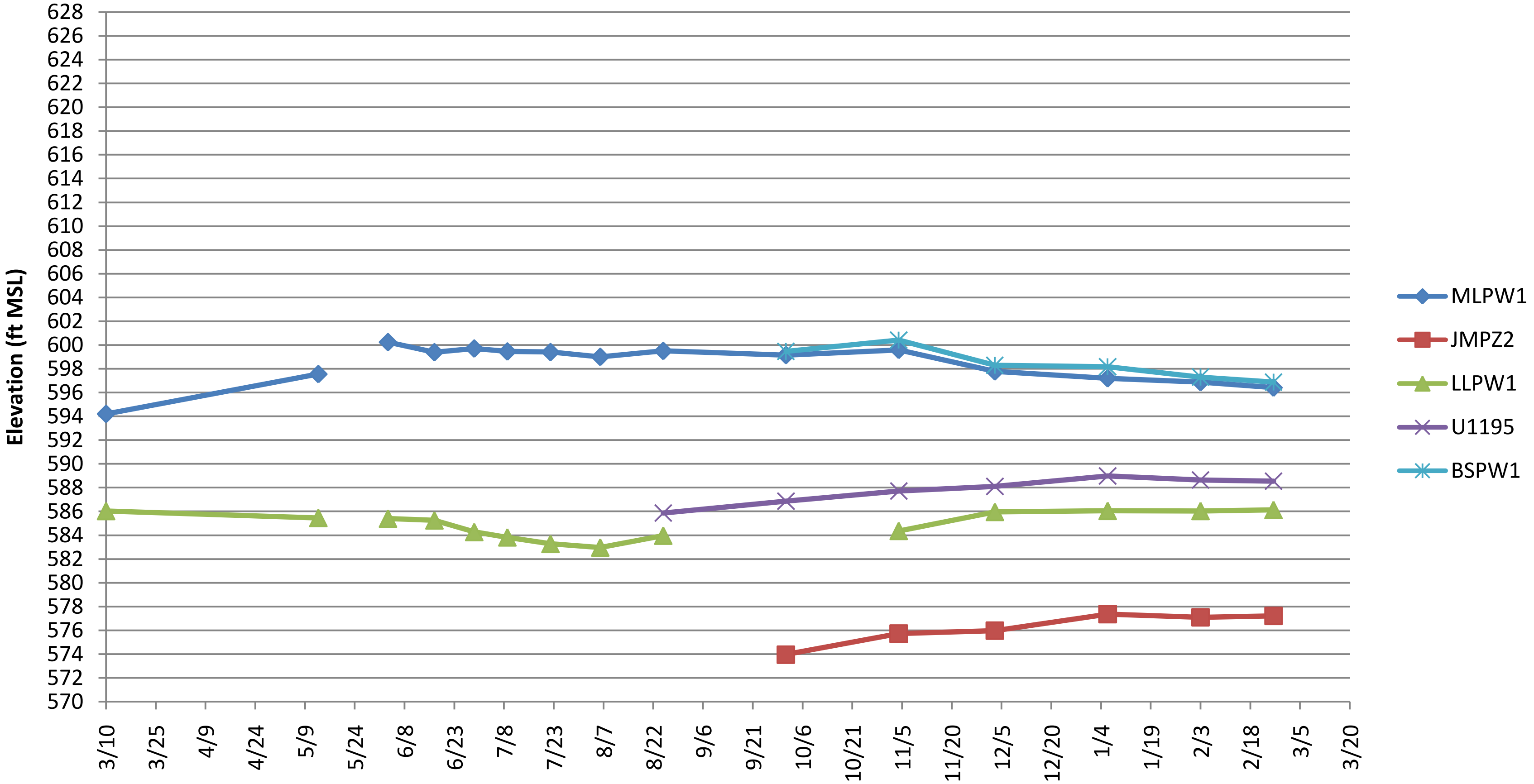
Echo Meadows

Groundwater Level Elevations in Wells North of Hunt Canal, 2008-2009

Figure 18a

Umatilla Basin Recharge Project

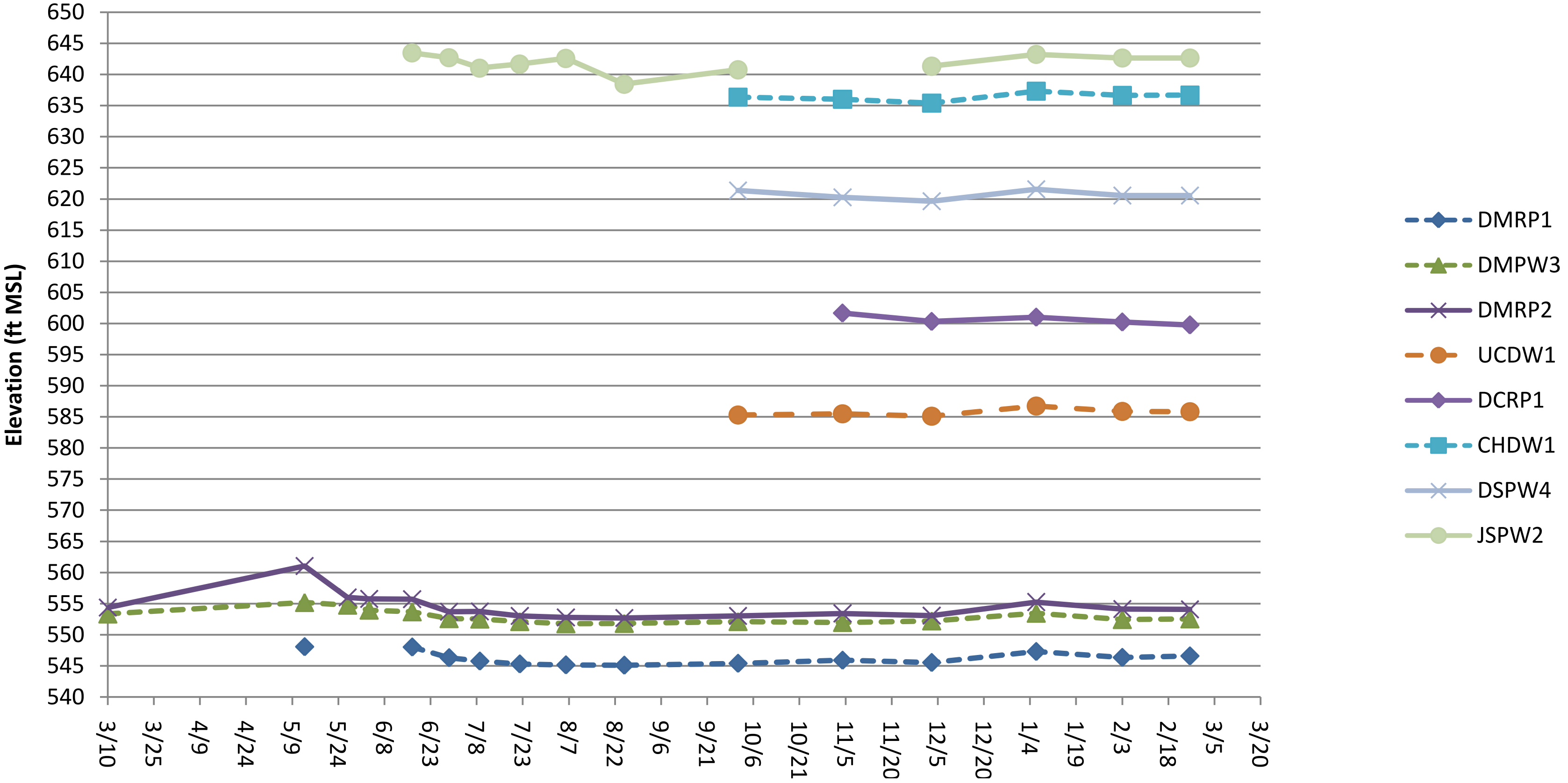
IRZ



Echo Meadows
Groundwater Level Elevations in Wells Middle Echo
Meadows, 2008-2009
Figure 18b

Umatilla Basin Recharge Project

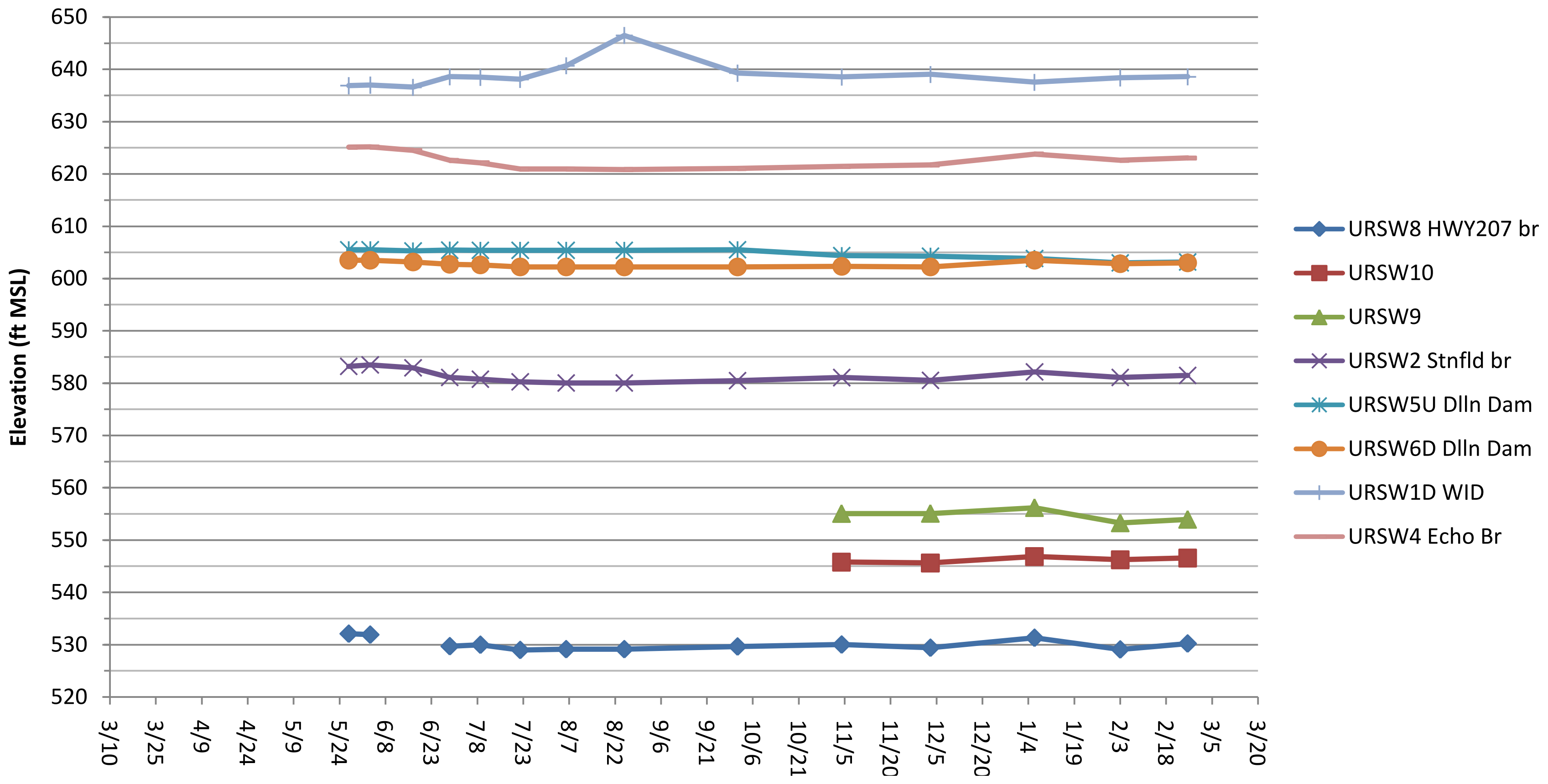
IRZ



Echo Meadows
Groundwater Level Elevations in Wells Along Umatilla
River, 2008-2009
Figure 18c

Umatilla Basin Recharge Project

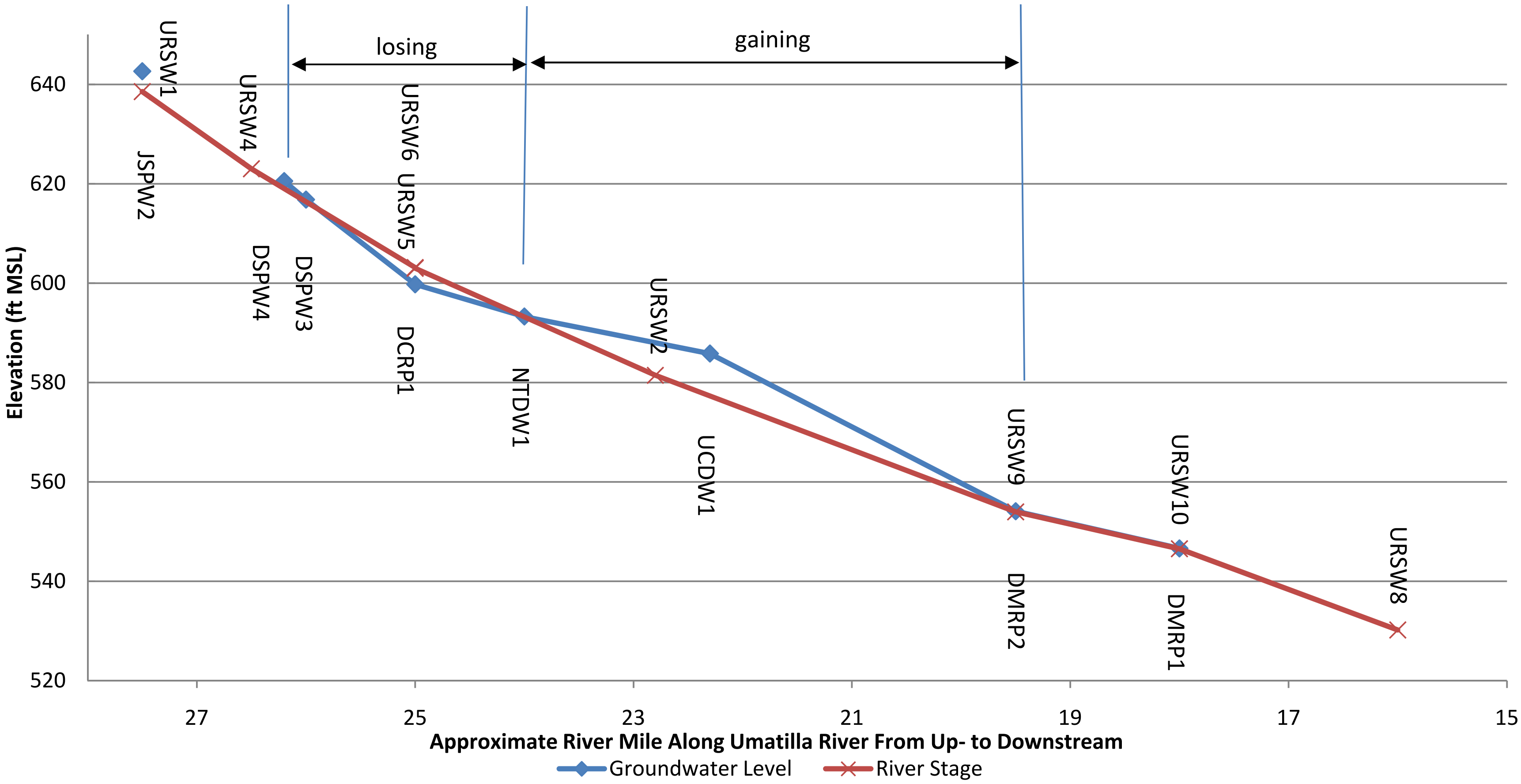
IRZ



Echo Meadows
Umatilla River Stage Elevations, 2008-2009
Figure 19

Umatilla Basin Recharge Project

IRZ



Echo Meadows

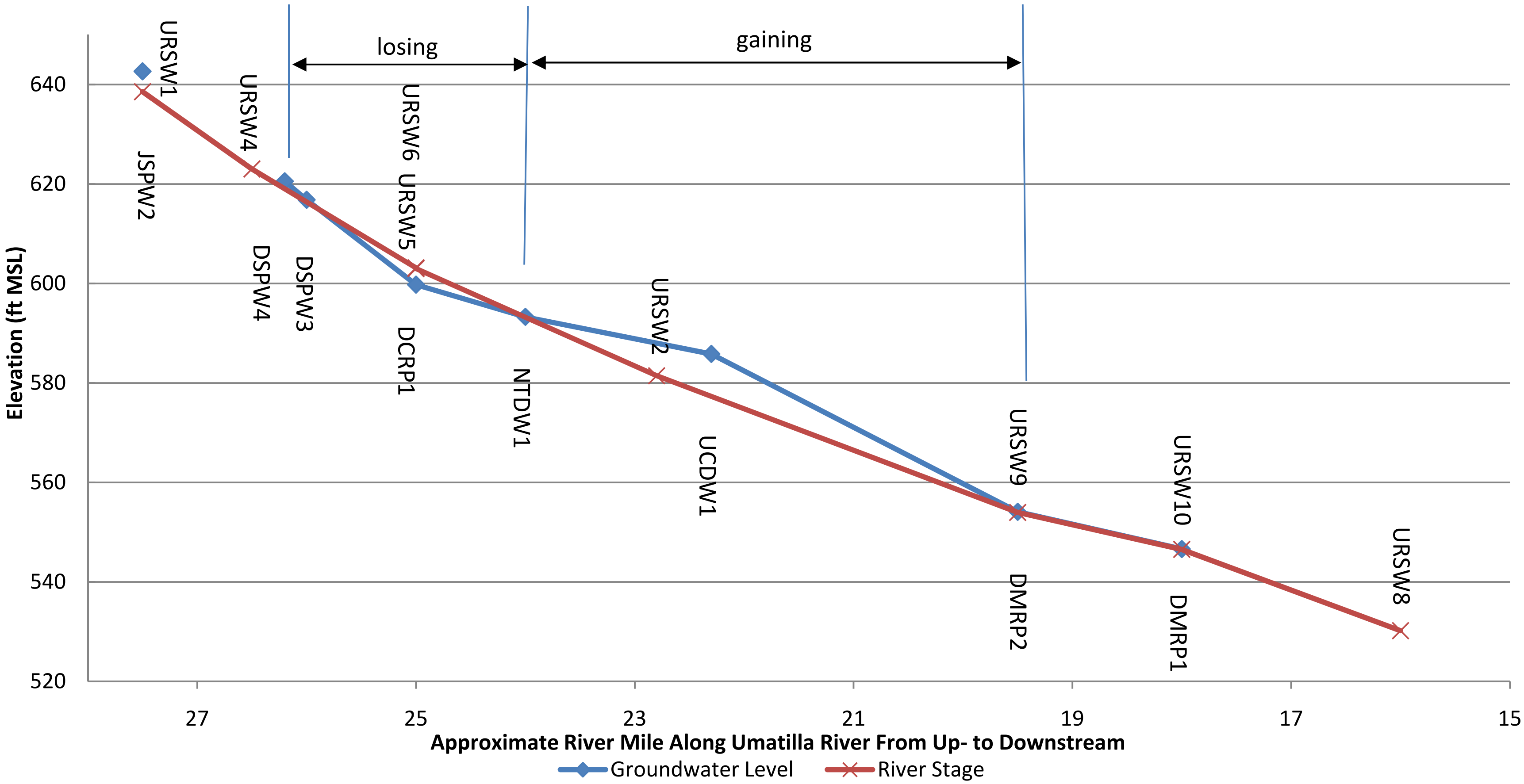
Echo Meadows River Stage and Piezometer Levels,

25 February 2009

Figure 20a

Umatilla Basin Recharge Project

IRZ



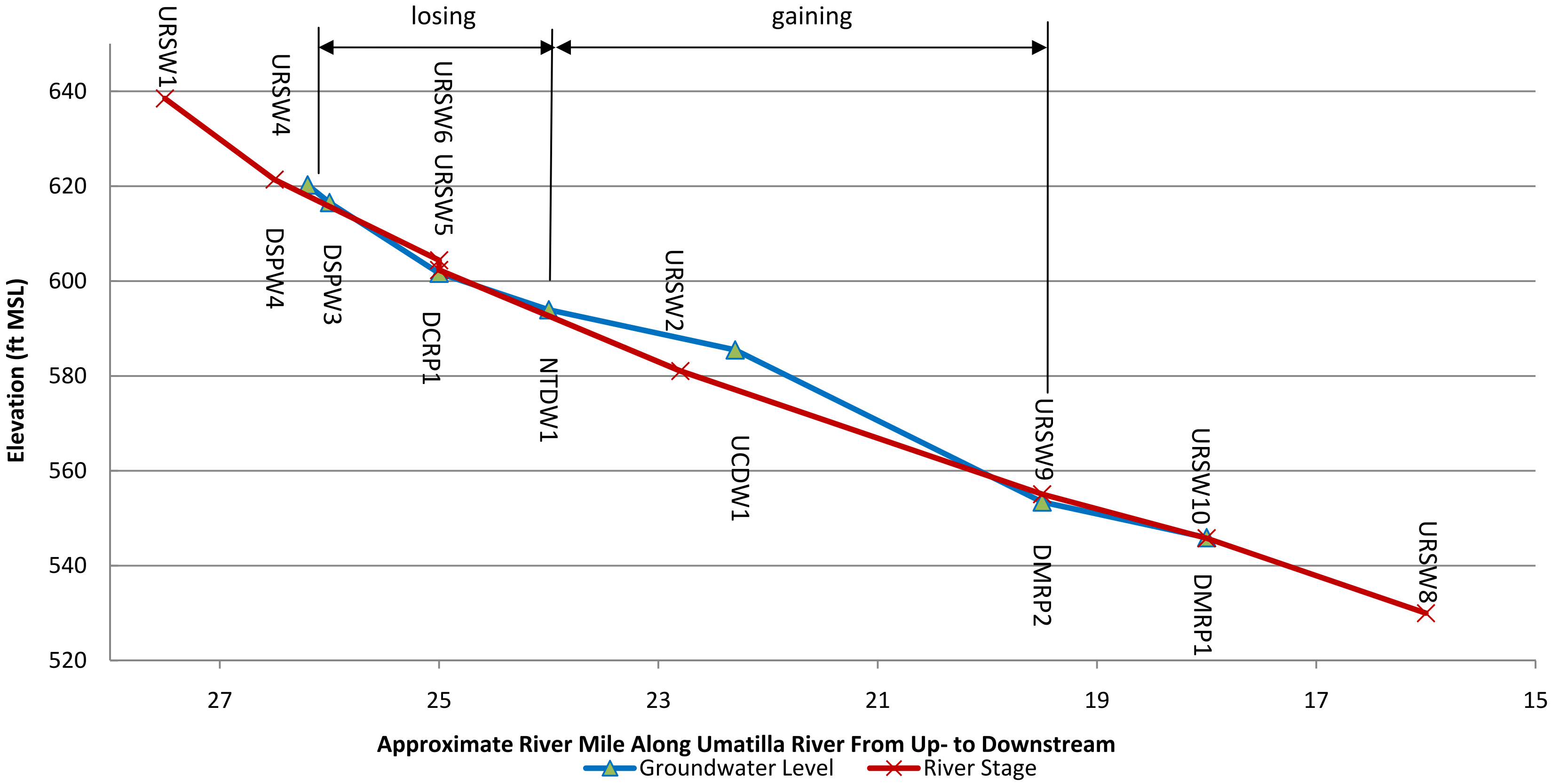
Echo Meadows

Echo Meadows River Stage and Piezometer Levels,

25 February 2009

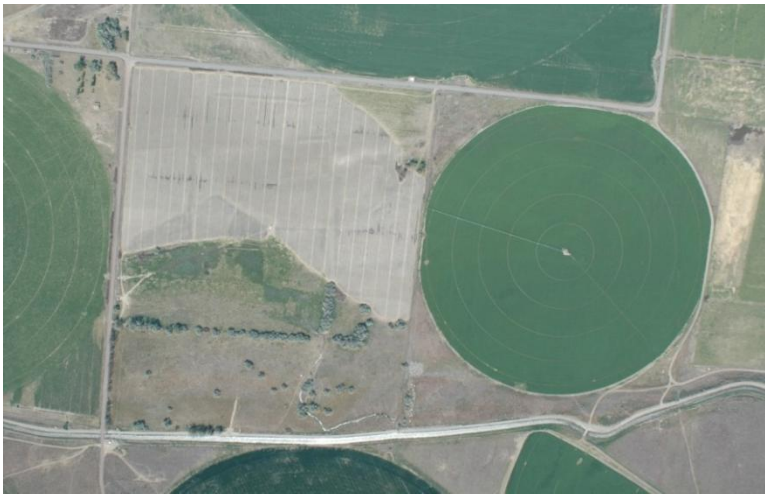
Figure 20a

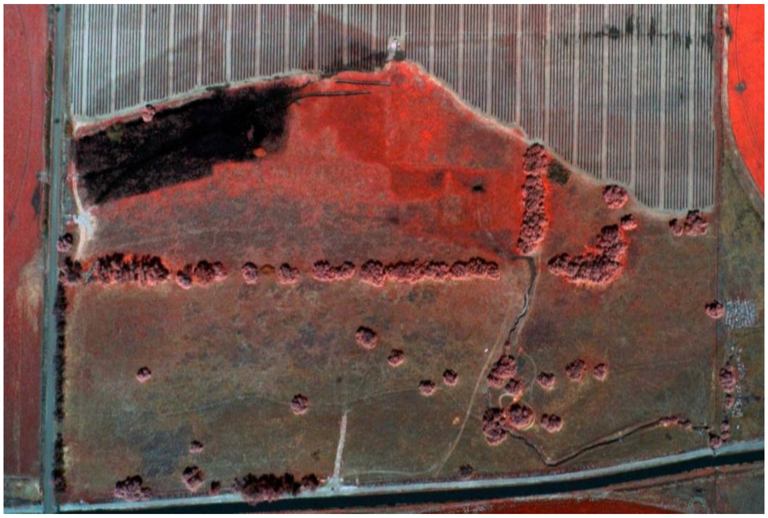
Umatilla Basin Recharge Project

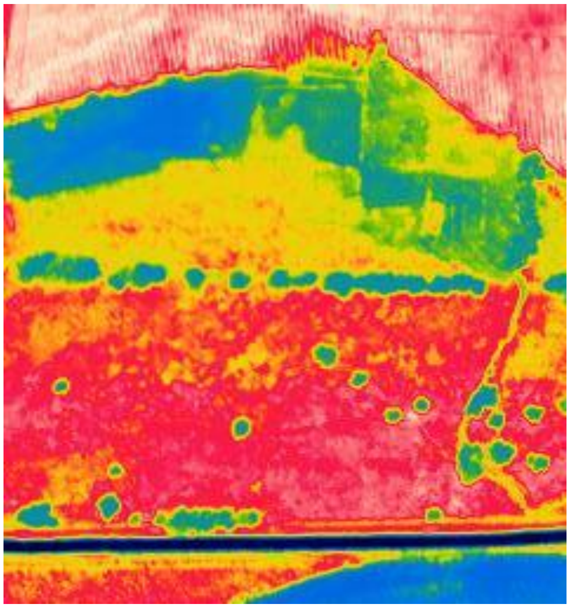


Echo Meadows
Echo Meadows River Stage and Piezometer Levels,
4 November 2008
Figure 20b

Umatilla Basin Recharge Project


True Color


Near Infrared

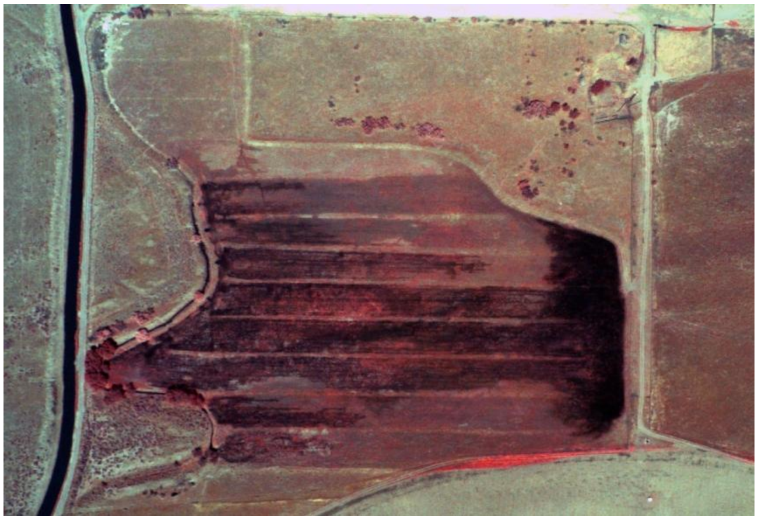

Thermal Infrared

Source: IRZ archives

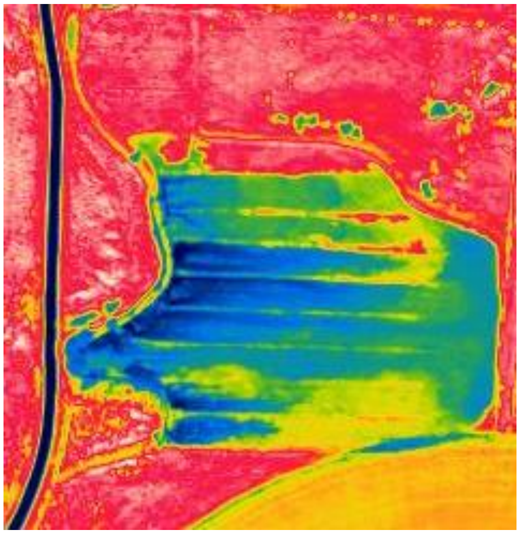
Echo Meadows
Aerial Image - 2008 Recharge Field 1
Figure 21a

Umatilla Basin Recharge Project

True Color



Near Infrared



Thermal Infrared

Source: IRZ Archives

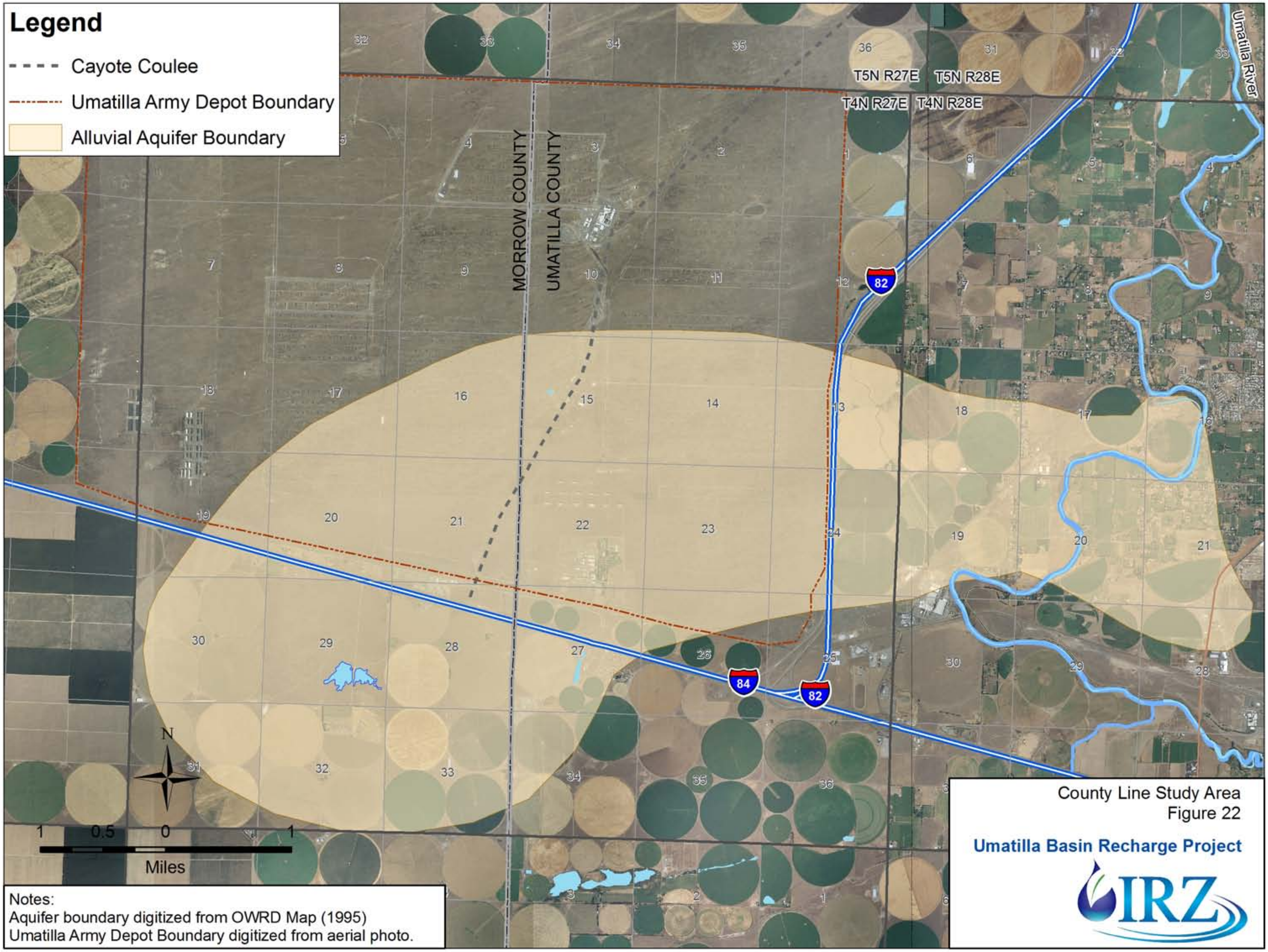
Echo Meadows

Aerial Image - 2008 Recharge Field 6

Figure 21b

Umatilla Basin Recharge Project

IRZ



Legend

- - - - Cayote Coulee

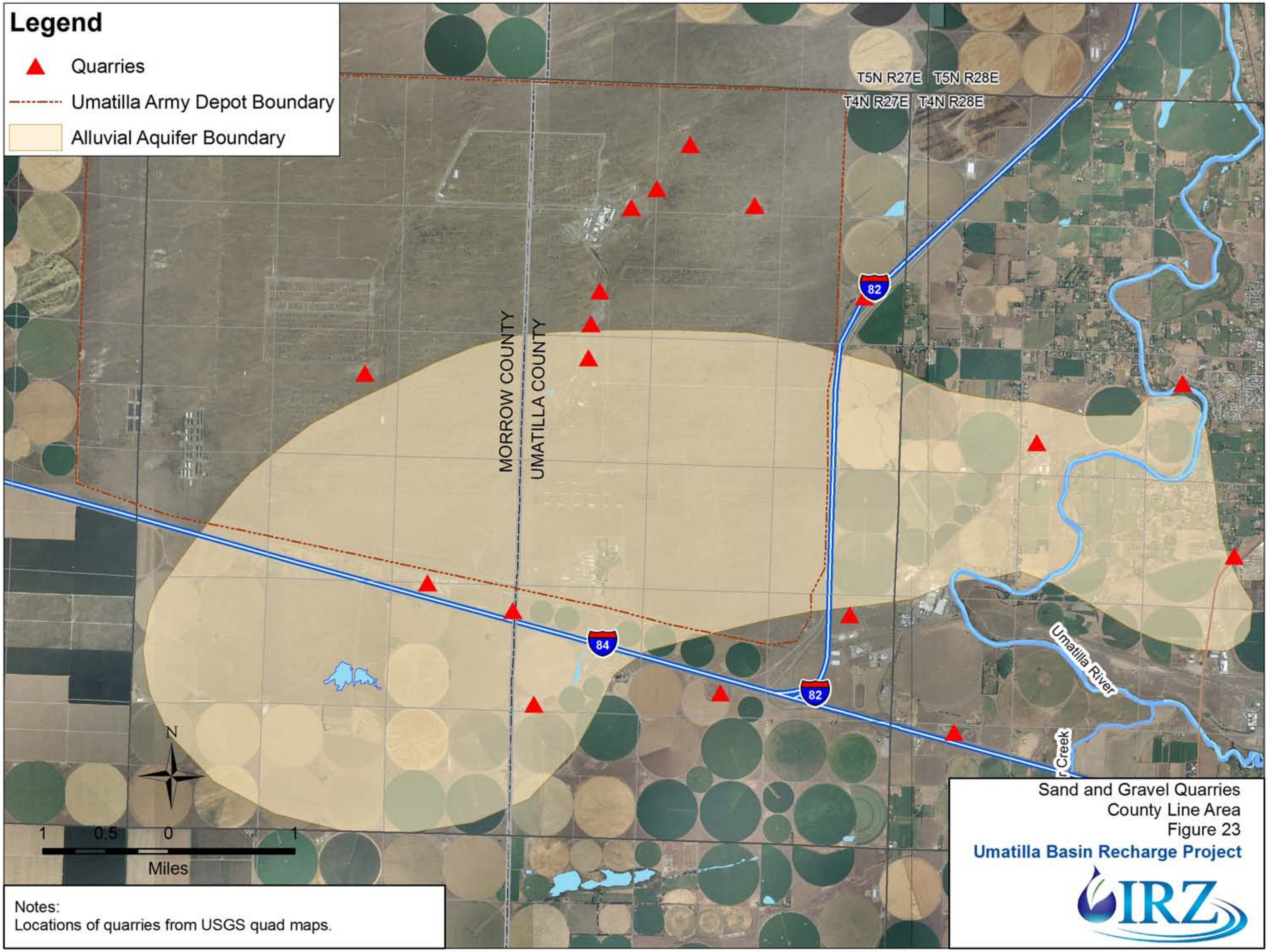
-·-·-·- Umatilla Army Depot Boundary

▨ Alluvial Aquifer Boundary

County Line Study Area
Figure 22

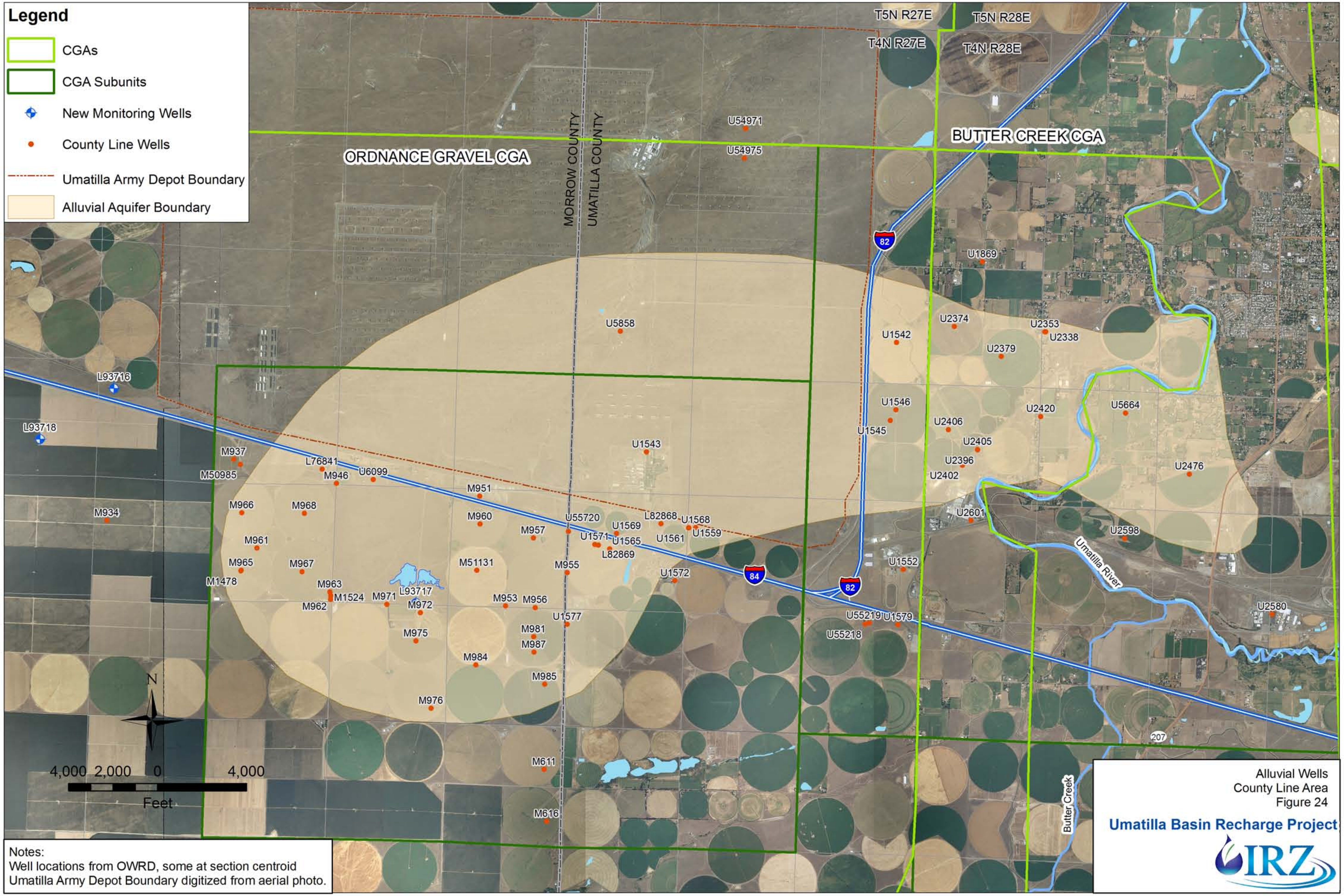
Umatilla Basin Recharge Project

Notes:
Aquifer boundary digitized from OWRD Map (1995)
Umatilla Army Depot Boundary digitized from aerial photo.



Notes:
Locations of quarries from USGS quad maps.

Sand and Gravel Quarries
County Line Area
Figure 23
Umatilla Basin Recharge Project
IRZ

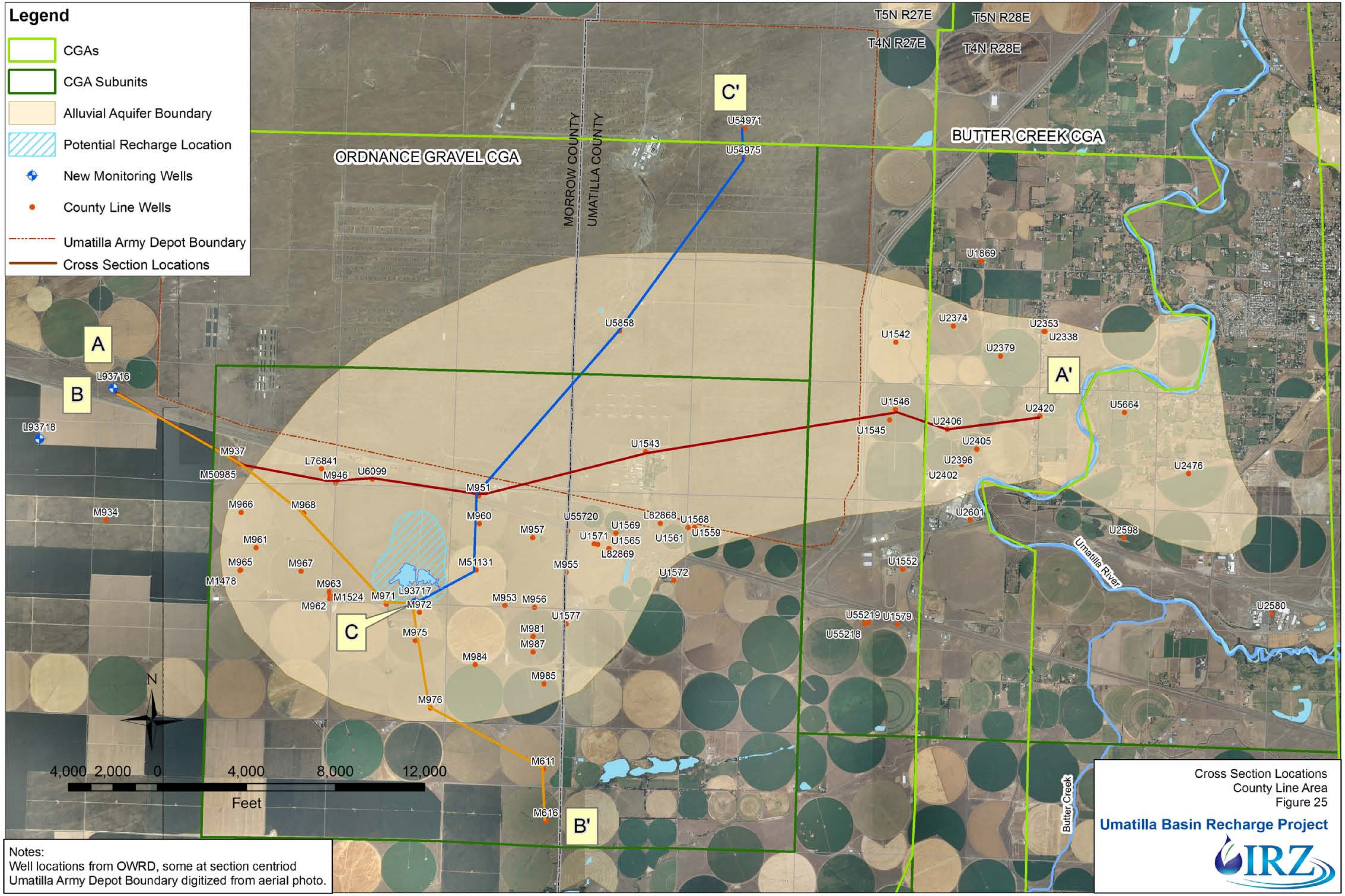


Notes:
Well locations from OWRD, some at section centroid
Umatilla Army Depot Boundary digitized from aerial photo.

Alluvial Wells
County Line Area
Figure 24

Umatilla Basin Recharge Project

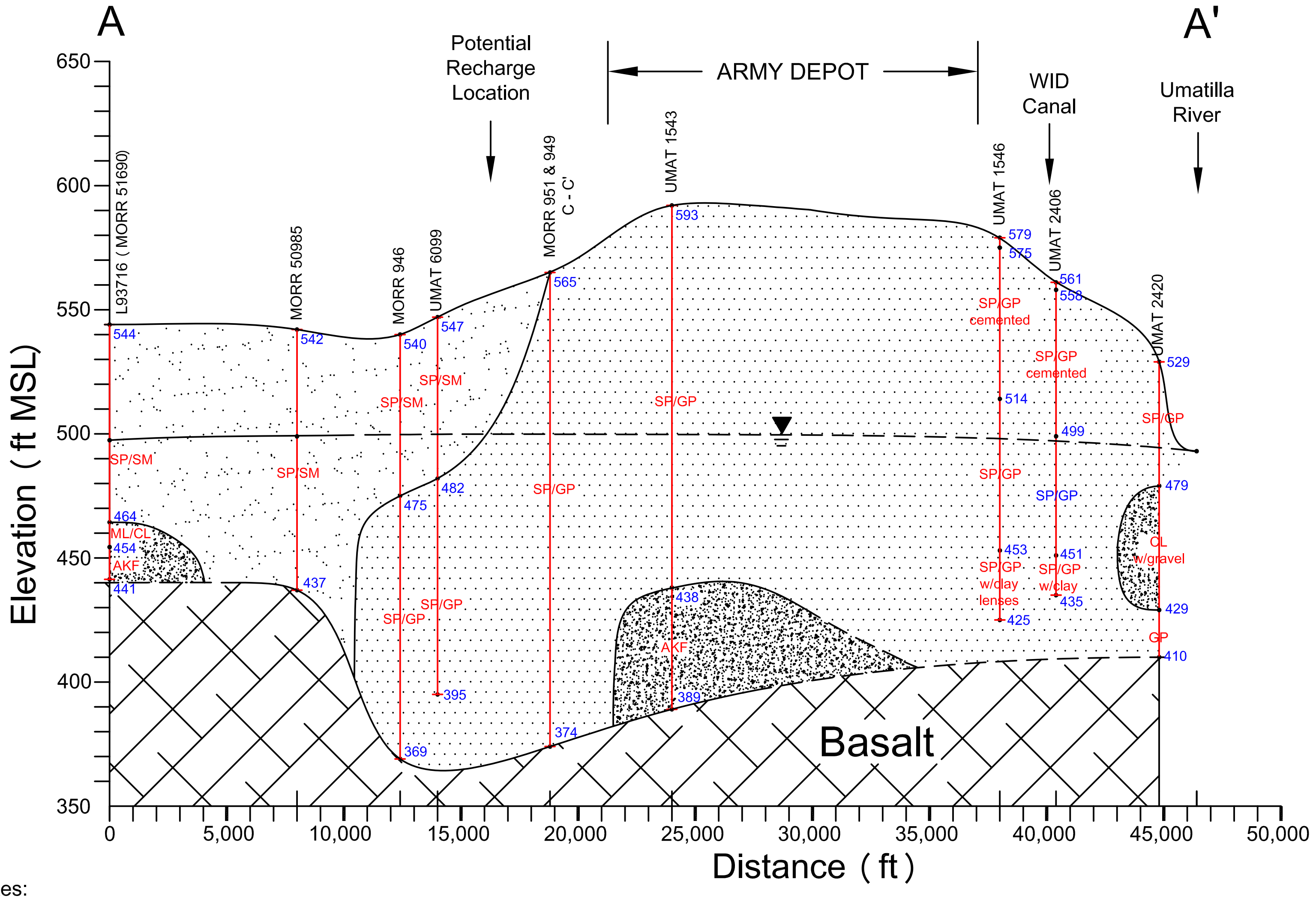
IRZ



Notes:
Well locations from OWRD, some at section centriod
Umatilla Army Depot Boundary digitized from aerial photo.

Cross Section Locations
County Line Area
Figure 25

Umatilla Basin Recharge Project



Notes:

AKF = Alkalai Canyon Formation

▨ Basalt Bedrock

░ Coarse-grained Pleistocene sand and gravel

░ Fine-grained Pleistocene deposits

▓ AKF or other fine-grained deposits

▼ Groundwater level shown is approximately at 499 ft. MSL and declines near the Umatilla River. This elevation is used to conceptually interpret the thickness of the unsaturated zone.

Elevation accuracies are +/- 0.1 ft. for wells used for water level monitoring in this study and +/- 5 ft. for others.

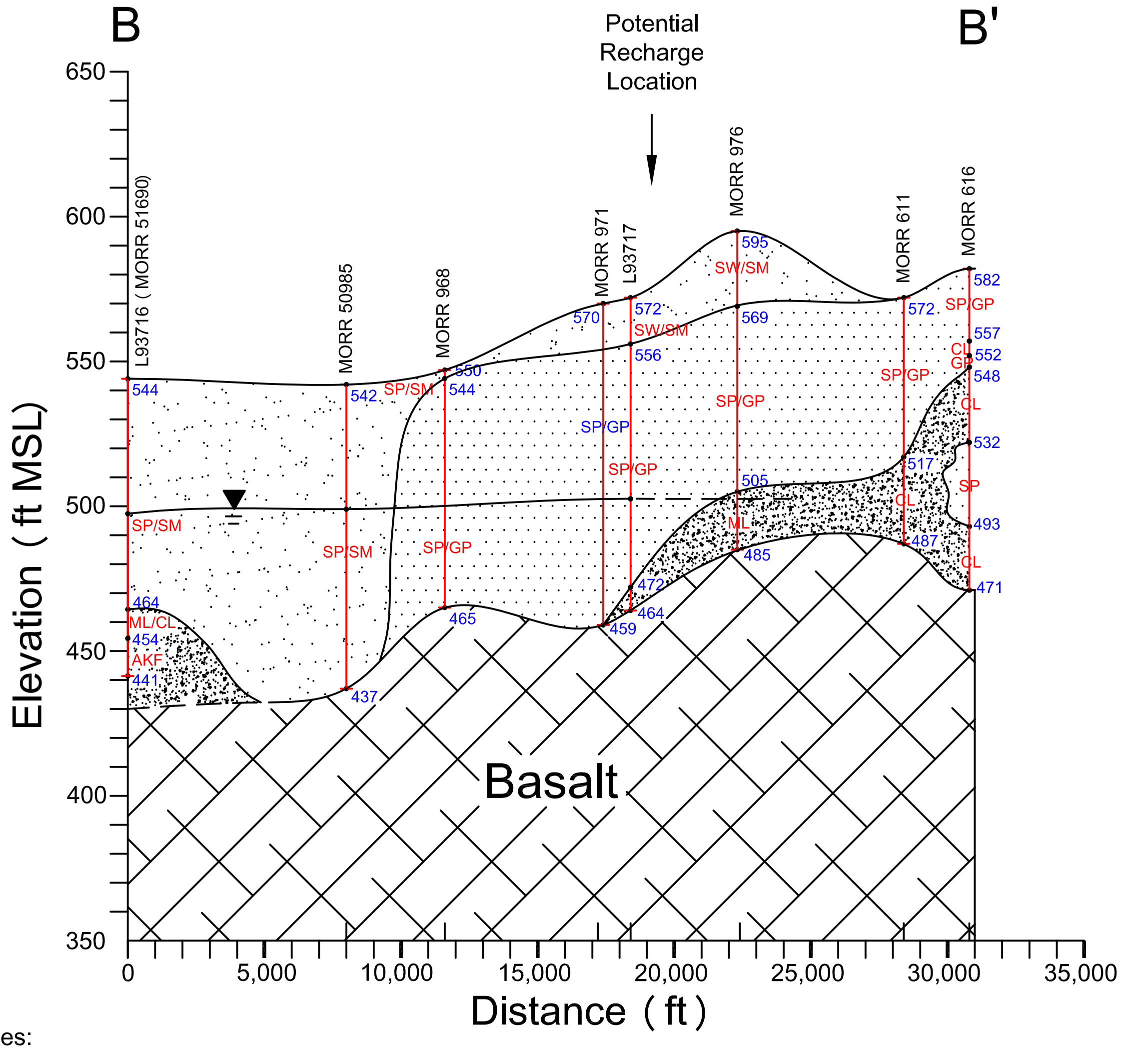
CL - clay; CP - poorly-sorted clay; CS - clay with sand; GP - poorly-sorted gravel; GP - gravel; M - silt; MG - silt with gravel; MS - silt with sand; SC - sand with clay; SP - poorly-sorted sand.

Geologic Cross-Section A-A'
County Line

Figure 26

Umatilla Basin Recharge Project

IRZ



Notes:

AKF = Alkalai Canyon Formation

- ▨ Basalt Bedrock
- ░ Coarse-grained Pleistocene sand and gravel
- ▒ Fine-grained Pleistocene deposits
- ▓ AKF or other fine-grained deposits
- ▼ Groundwater level shown is approximately at 499 ft. MSL and declines near the Umatilla River. This elevation is used to conceptually interpret the thickness of the unsaturated zone.

Elevation accuracies are +/- 0.1 ft. for wells used for water level monitoring in this study and +/- 5 ft. for others.

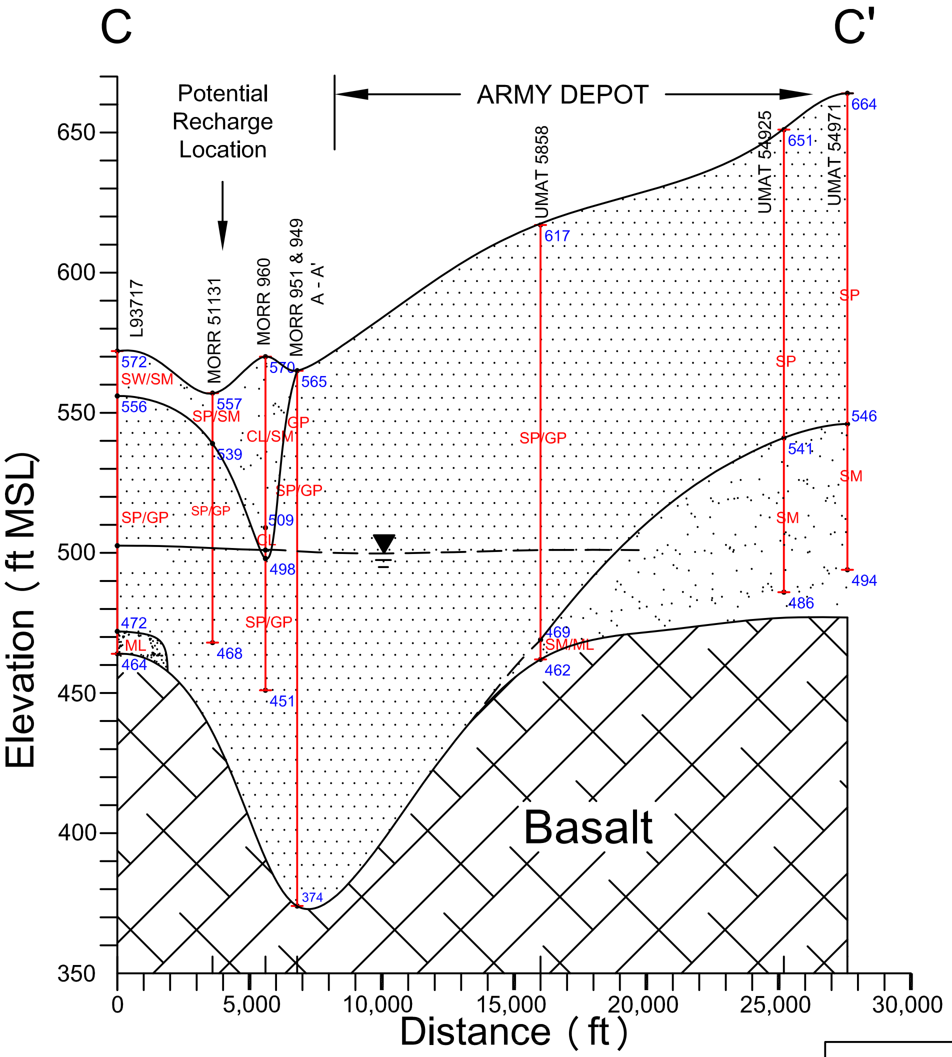
CL - clay; CP - poorly-sorted clay; CS - clay with sand; GP - poorly-sorted gravel; GP - gravel; M - silt; MG - silt with gravel; MS - silt with sand; SC - sand with clay; SP - poorly-sorted sand.

Geologic Cross-Section B-B'
County Line

Figure 27

Umatilla Basin Recharge Project

IRZ



Notes:

AKF = Alkalai Canyon Formation

▨ Basalt Bedrock

▒ Coarse-grained Pleistocene sand and gravel

▒ Fine-grained Pleistocene deposits

▓ AKF or other fine-grained deposits

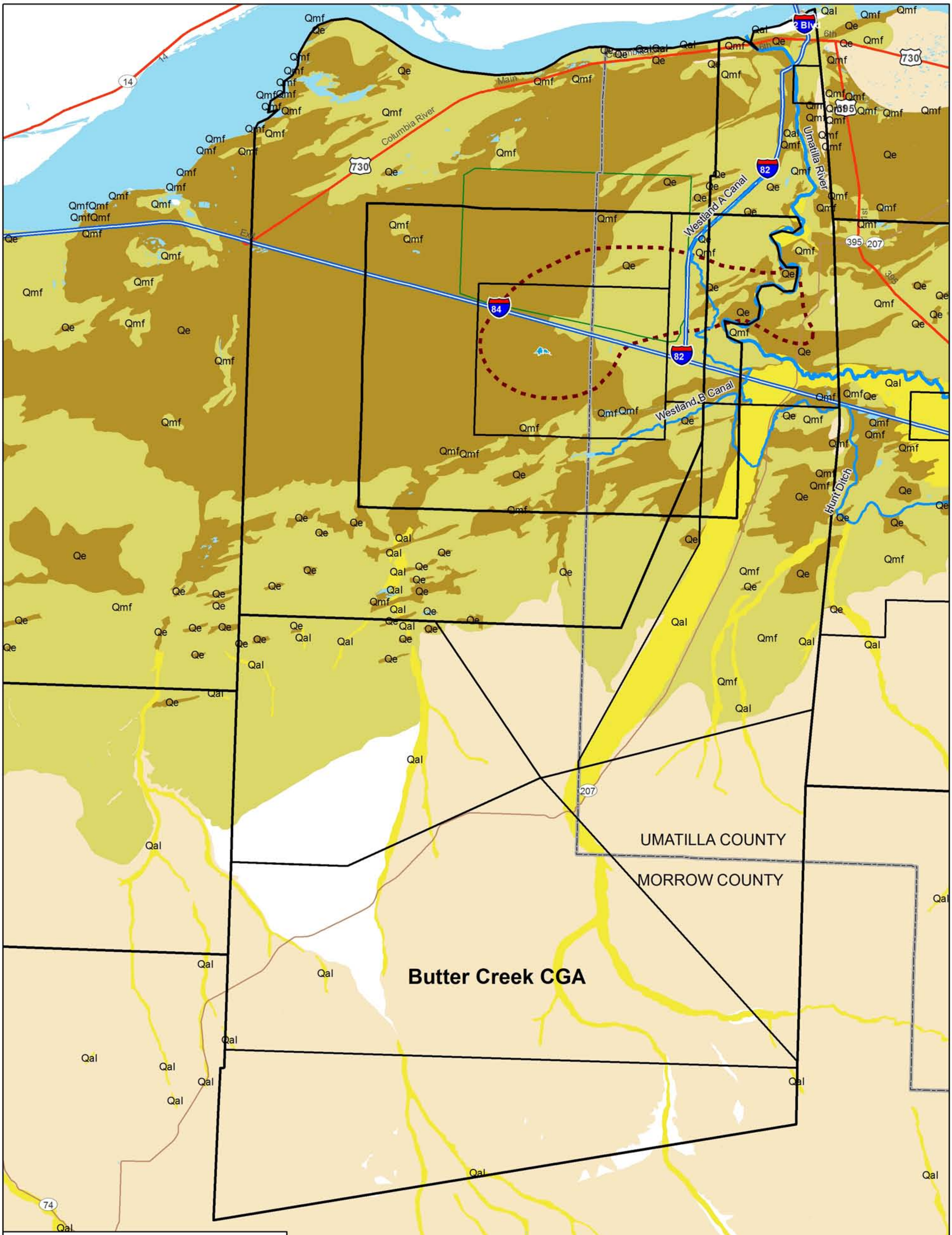
▼ Groundwater level shown is approximately at 499 ft. MSL and declines near the Umatilla River. This elevation is used to conceptually interpret the thickness of the unsaturated zone.

Elevation accuracies are +/- 0.1 ft. for wells used for water level monitoring in this study and +/- 5 ft. for others.
CL - clay; CP - poorly-sorted clay; CS - clay with sand; GP - poorly-sorted gravel; GP - gravel; M - silt; MG - silt with gravel; MS - silt with sand; SC - sand with clay; SP - poorly-sorted sand.

Geologic Cross-Section C-C'
County Line

Figure 28

Umatilla Basin Recharge Project



Notes:
CGA boundaries from Umatilla County Geology map
from Oregon Geologic Data Compilation v.4

N

2.5 1.25 0 2.5
Miles

Legend

Geology

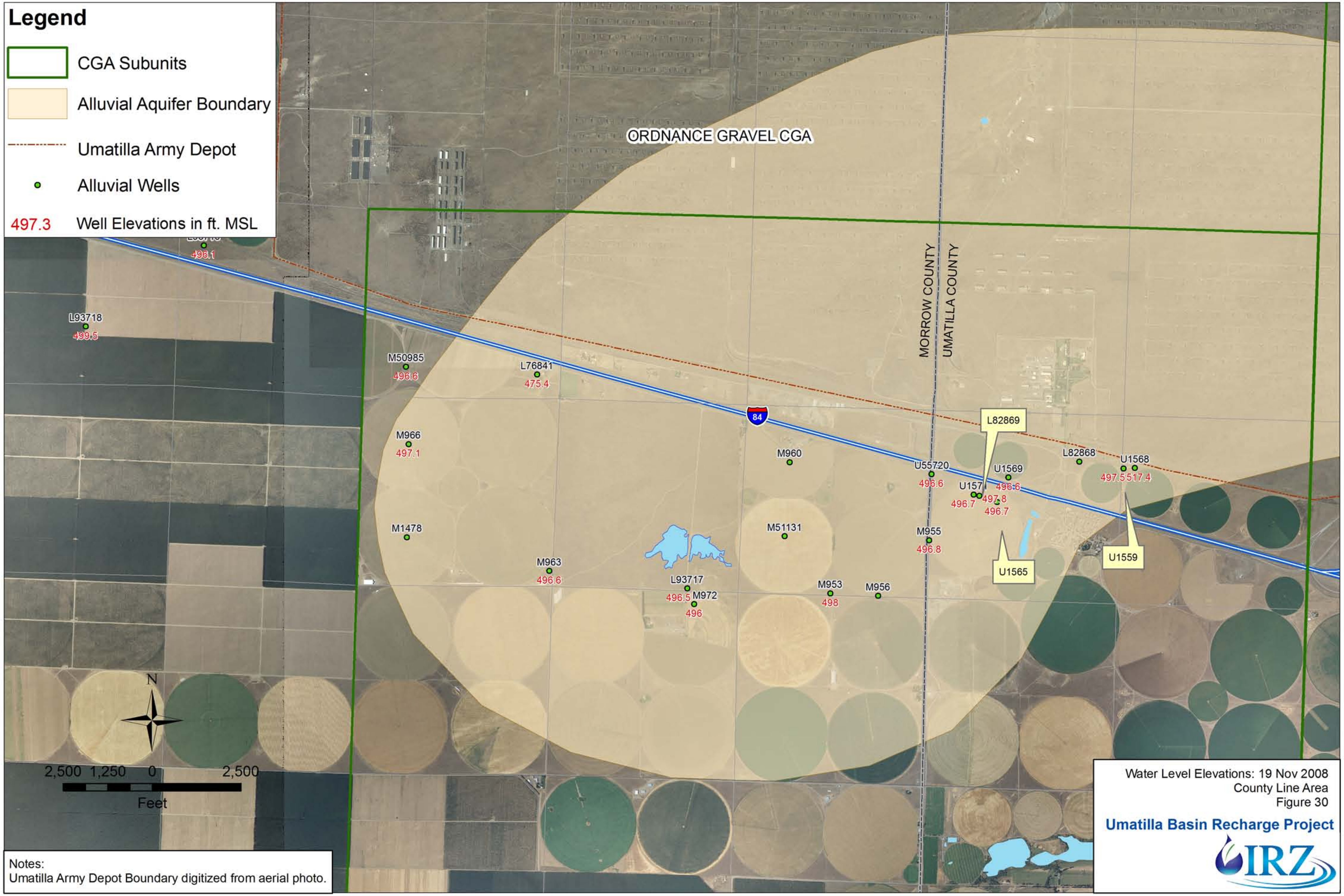
- ▨ QTs, Older loess
- ▨ Qal, Alluvium
- ▨ Qe, Eolian sand and ash
- ▨ Qmf, Missoula Flood deposits
- ▨ Basalt

- - - Umatilla Army Depot Boundary
- - - Alluvial Aquifer Boundary

Surface Geology
Ordnance and Butter Creek CGAs
Figure 29

Umatilla Basin Recharge Project

IRZ

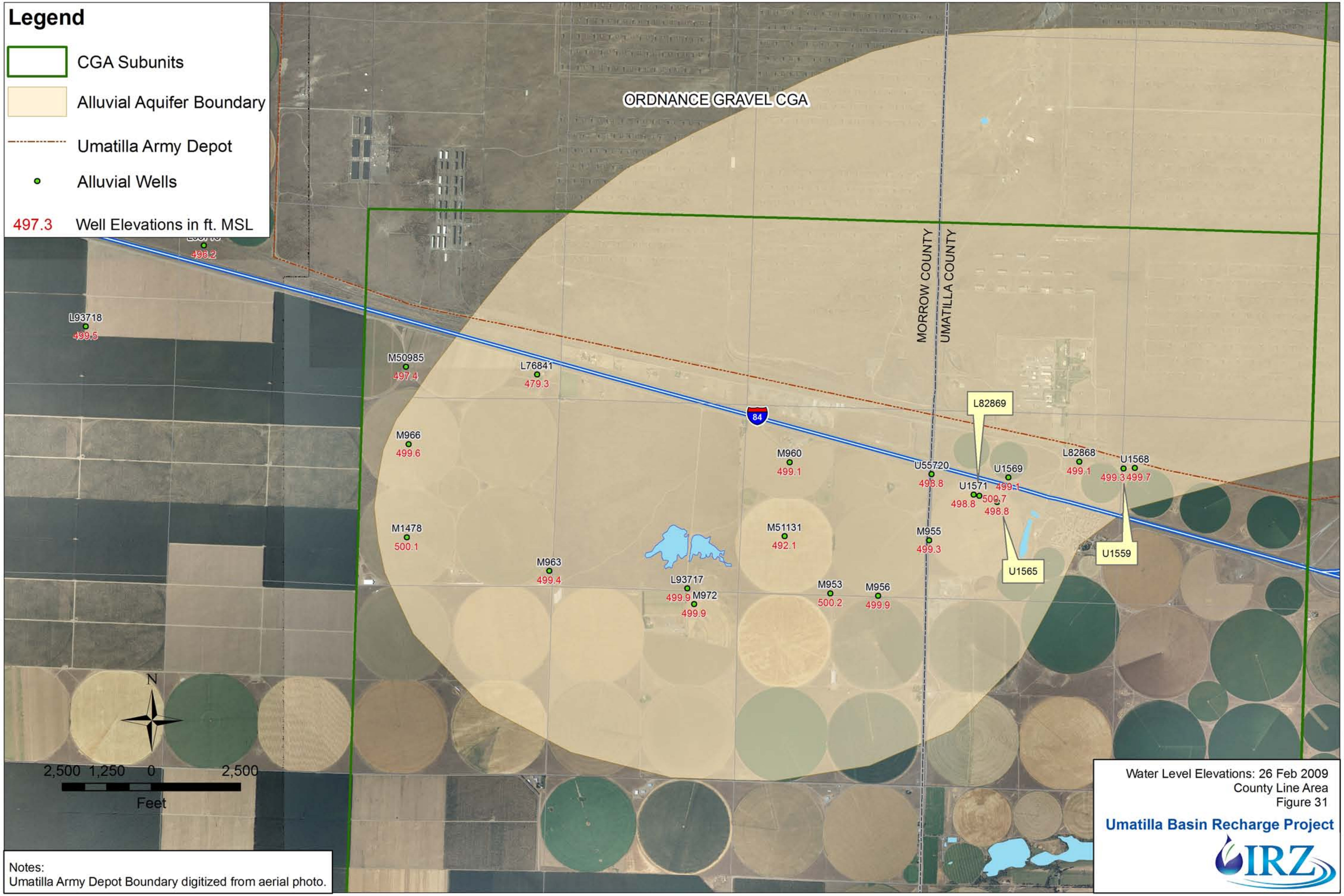


Water Level Elevations: 19 Nov 2008
County Line Area
Figure 30

Umatilla Basin Recharge Project

IRZ

Notes:
Umatilla Army Depot Boundary digitized from aerial photo.

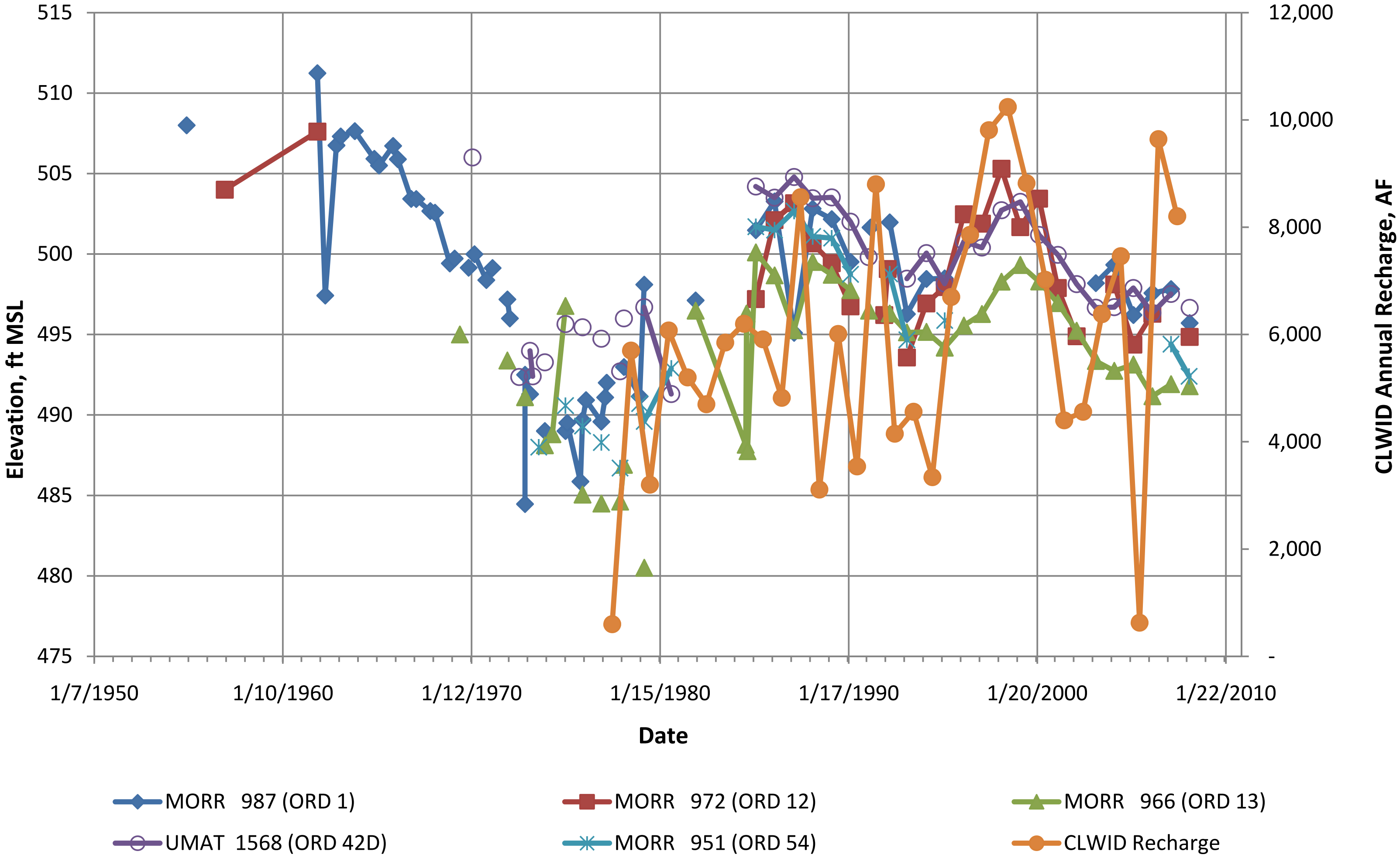


Water Level Elevations: 26 Feb 2009
County Line Area
Figure 31

Umatilla Basin Recharge Project

IRZ

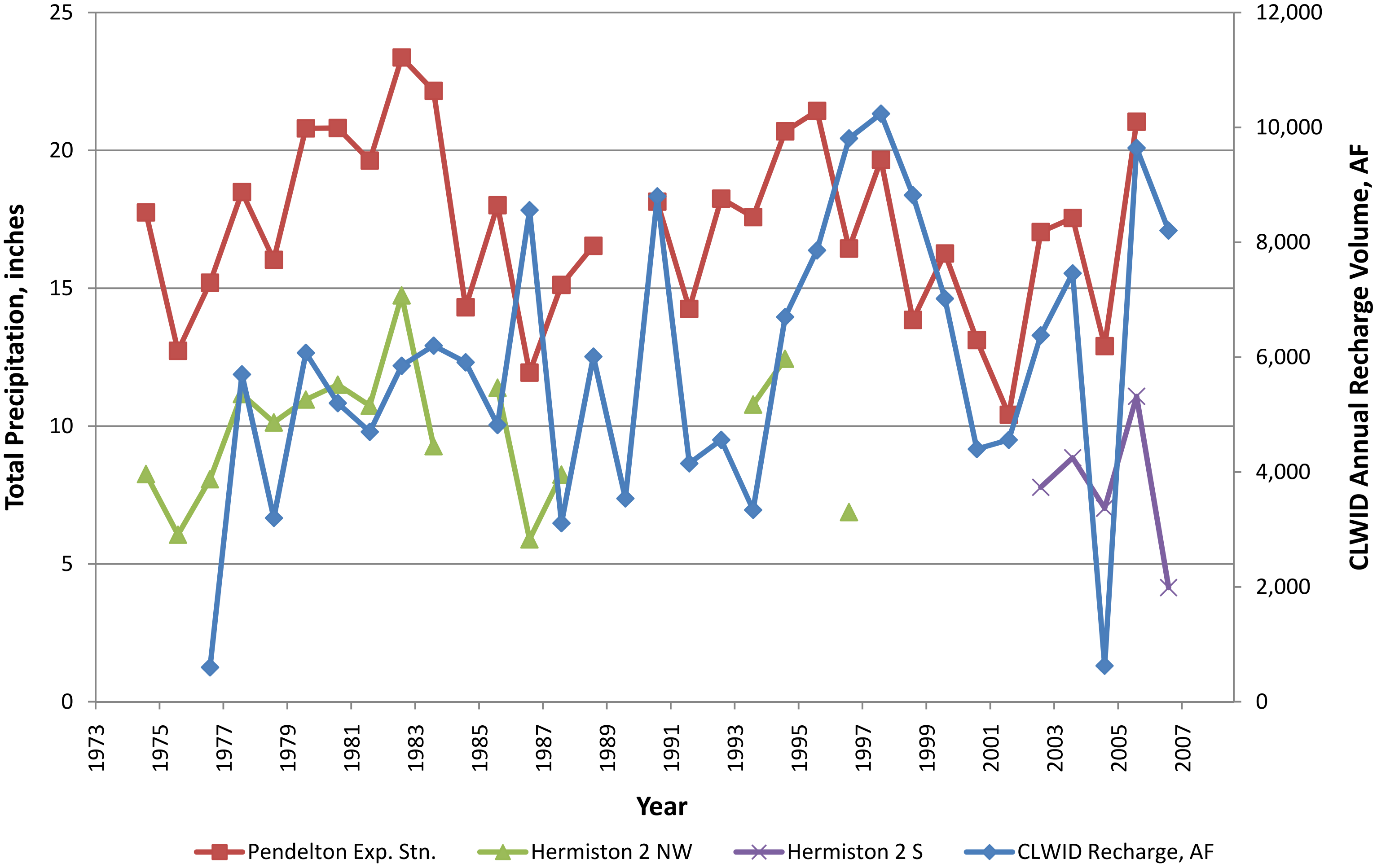
Notes:
Umatilla Army Depot Boundary digitized from aerial photo.



Historical Groundwater Elevations
County Line aquifer
Figure 32

Umatilla Basin Recharge Project

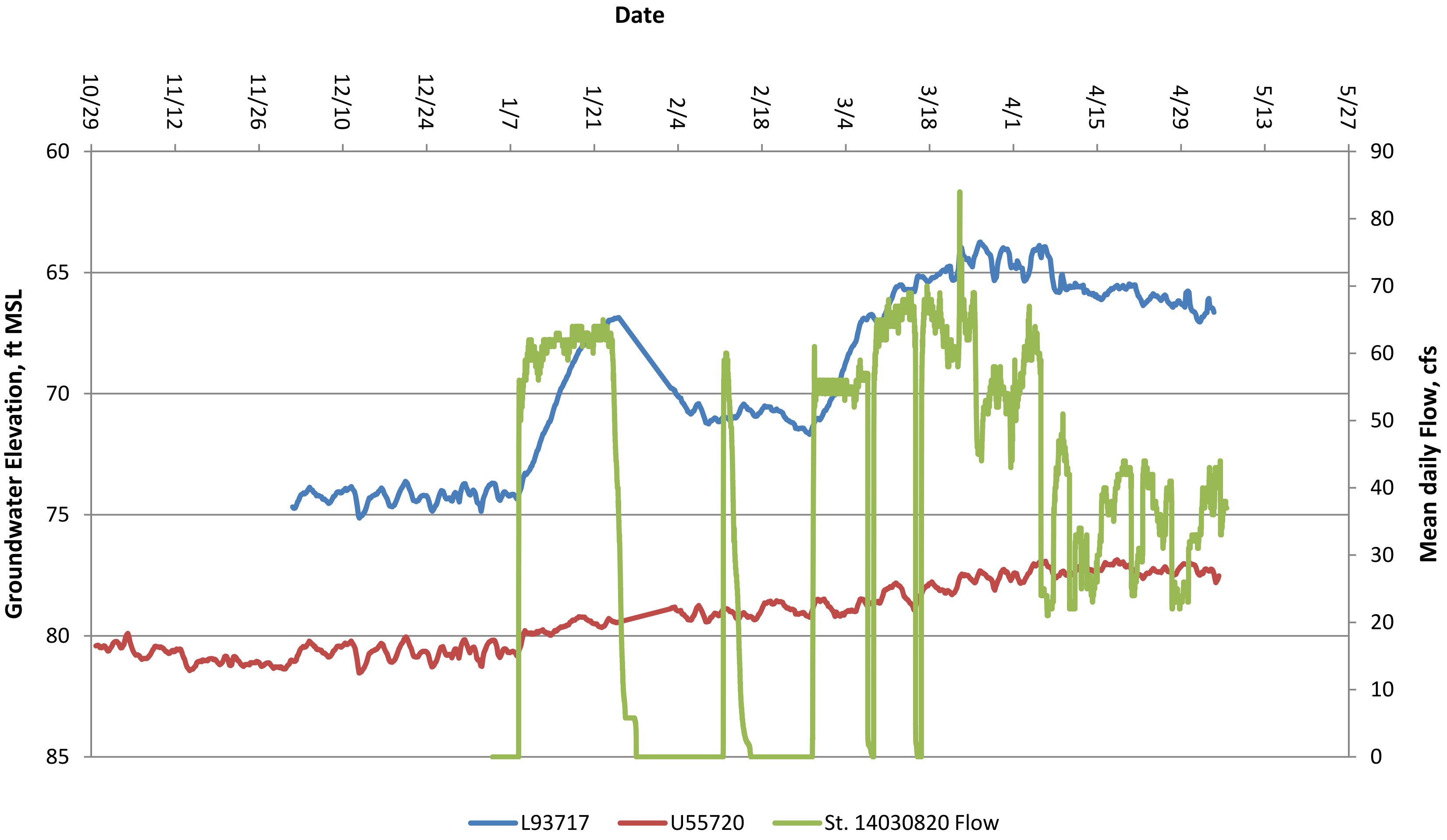
IRZ



Annual Precipitation Depth & CLWID
Recharge Volume
Figure 33

Umatilla Basin Recharge Project

IRZ

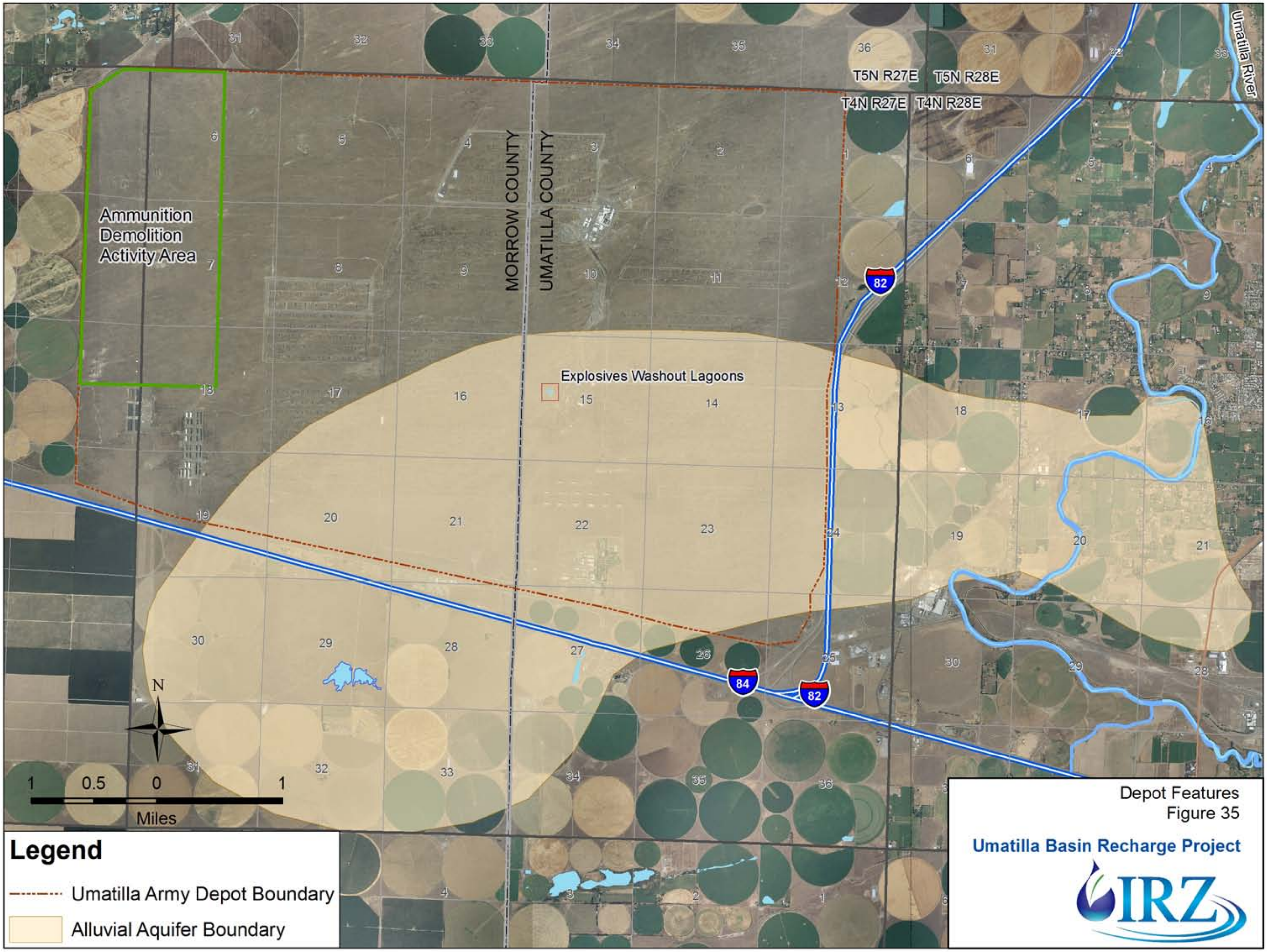


Groundwater Response to CLWID Recharge

Figure 34

Umatilla Basin Recharge Project

IRZ



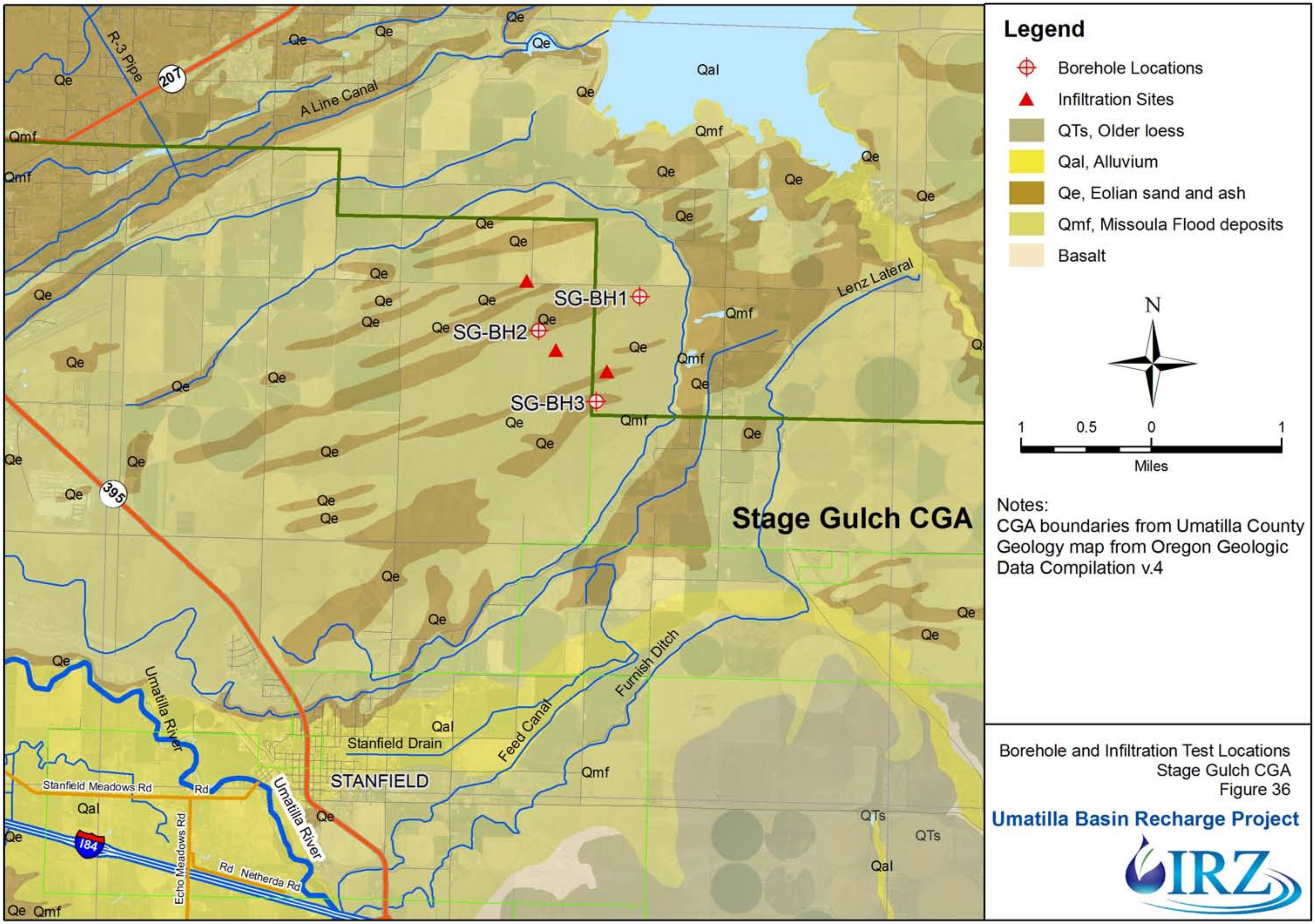
Legend

- - - -	Umatilla Army Depot Boundary
▨	Alluvial Aquifer Boundary

Depot Features
Figure 35

Umatilla Basin Recharge Project

IRZ



Notes:
CGA boundaries from Umatilla County
Geology map from Oregon Geologic Data Compilation v.4

Borehole and Infiltration Test Locations
Stage Gulch CGA
Figure 36

Umatilla Basin Recharge Project

IRZ

APPENDIX A

Limited License 1111

Limited License "Completeness" Checklist

Minimum Requirements (OAR 690-340-030) (ORS 537.143)

LL- 1111

Received Date: 2·15·2008
Public Notice Date: 2·19·2008
Earliest Issue Date: 3·5·2008
Source: UMATILLA RIVER
Amount: 125 cfs
Duration: 3·1·2008 → 5·31·2008
County: UMATILLA
Basin:

Township: 3 N
Range: 29E
Section: 21
POD Loc: SE NW
Watermaster: TONY JUSTUS #5
ODFW:
DEQ:

✓ **Applicant/Organization Name, Mailing Address ,Telephone Number, and Contact Person.**
Signature in ink. Original "wet" signature required.

✓ **Source** listed? UMATILLA RIVER

N/A **If source is groundwater**...are well log(s) or sufficient information for the Department to determine aquifer, well depth, well seal, open interval, etc. included ? Was the intended aquifer identified?. If for multiple wells, each map location shall be clearly tied to a well log.

✓ **Proposed Use of the water**....is each proposed use identified? GROUNDWATER AQUIFER RECHARGE

N/A **If source is stored water....** Is there a contract for delivery of stored water. Must have a copy

N/A **If use is supplemental**...is the primary water right listed?

✓ **Amount of water** from each source listed in GPM, CFS or AF? 125

N/A **Acreage** being proposed, if applicable.

✓ **Duration of Limited License** being requested by applicant.

✓ **Project schedule...** Date when water use will start and date when water use will be completed

✓ **Is the application signed in ink** by the applicant(s) or by the authorized agent with title or authority if an organization or corporation?

✓ **Water Master Report...** Is the local Water Masters report on water availability included?

ARRIVING TODAY 2/26 @ 11:15
2·15·2008

✓ **Land Use Form...** Is the Land Use Form completed by local planning officials included?
Signature must be within the last 12 months. Signature must be an original "wet" signature.

CONTINUED ON BACK

☑ Does the **map meet requirements** of OAR 690-340-030? If map is larger than 11 x 17, four copies must be submitted.

- ☑ Township, Range, Section
- ☑ Reference corner on map
- ☑ Scale of the Map, not less than 2" = 1 mile
- ☑ Other topographical features such as roads, streams, railroads, etc, which may be helpful in locating the diversion points in the field.
- ☑ Location of each diversion point, well or dam
- ☑ Each POD coordinate by reference to a recognized public land survey corner

○ **Fees** enclosed?

Base Fee Water Amount

$150.00 including the first point of diversion 150^{00}
$15.00 for each additional point of diversion + 0
150^{00} **total fee**

FEE PAID	- 150^{00}
STILL OWED	0

Completeness Check by:________ Date: 2-15-2008

S:\groups\wr\WRIG DOCUMENTS\application related\limited-license-checklist.wpd 11/23/2007 jks

STATE OF OREGON
WATER RESOURCES DEPARTMENT

RECEIPT # 91459

725 Summer St. N.E. Ste. A
SALEM, OR 97301-4172
(503) 986-0900 / (503) 986-0904 (fax)

INVOICE # ____________

RECEIVED FROM: WestLand Irrigation
BY: ____________

APPLICATION	LL 1111
PERMIT	
TRANSFER	

CASH: ☐ CHECK:# ☒ 23026 OTHER: (IDENTIFY) ☐ ____________

TOTAL REC'D $ 150.00

1083 TREASURY 4170 WRD MISC CASH ACCT

0407	COPIES	$
______	OTHER: (IDENTIFY) ____________	$

0243 I/S Lease ______ 0244 Muni Water Mgmt. Plan ______ 0245 Cons. Water ______

4270 WRD OPERATING ACCT

RECEIVED
OVER THE COUNTER

MISCELLANEOUS

0407	COPY & TAPE FEES		$
0410	RESEARCH FEES		$
0408	MISC REVENUE: (IDENTIFY)	Limited License	$ 150.00
TC162	DEPOSIT LIAB. (IDENTIFY)	____________	$
0240	EXTENSION OF TIME		$

	WATER RIGHTS:	**EXAM FEE**		**RECORD FEE**
0201	SURFACE WATER	$	0202	$
0203	GROUND WATER	$	0204	$
0205	TRANSFER	$		
	WELL CONSTRUCTION	**EXAM FEE**		**LICENSE FEE**
0218	WELL DRILL CONSTRUCTOR	$	0219	$
	LANDOWNER'S PERMIT		0220	$

______ OTHER (IDENTIFY) ____________

0536 TREASURY 0437 WELL CONST. START FEE

0211	WELL CONST START FEE	$	**CARD #**	
0210	MONITORING WELLS	$	**CARD #**	

______ OTHER (IDENTIFY) ____________

0607 TREASURY 0467 HYDRO ACTIVITY LIC NUMBER

0233	POWER LICENSE FEE (FW/WRD)		$
0231	HYDRO LICENSE FEE (FW/WRD)		$
______	HYDRO APPLICATION		$

______ TREASURY OTHER / RDX

FUND ____________ TITLE ____________
OBJ. CODE ____________ VENDOR # ____________
DESCRIPTION ____________ $

RECEIPT: 91459 DATED: 2/15/08 BY:

Distribution – White Copy - Customer, Yellow Copy - Fiscal, Blue Copy - File, Buff Copy - Fiscal

23076

WESTLAND IRRIGATION DISTRICT (541) 667-2030

Oregon Water Resources Department

2/13/2008

Date	Type	Reference	Original Amt.	Balance Due	Discount	Payment
2/13/2008	Bill	Echo Meadows Lim Lic	150.00	150.00		150.00
					Check Amount	150.00

Cash in checking	553	150.00

IRZ

Said Amali
P.E. Ph. D.
Senior Engineer

541.567.0252 *office*
541.314.3170 *mobile*
541.567.4239 *fax*
irz.com | saida@irz.com

505 East Main Street | Hermiston, Oregon 97838

Serving Agri-Business Since 1984

This page to be completed by the local Watermaster.

WATER AVAILABILITY STATEMENT

Name of Applicant: Westland Irrigation District Limited License Number: L-1111

1. To your knowledge, has the stream or basin that is the source for this application ever been regulated for prior rights?

✓ Yes ☐ No

If yes, please explain:

The Umatilla River is intensively managed and regulated the entire year.

RECEIVED
FEB 15 2008
WATER RESOURCES DEPT
SALEM, OREGON

2. Based on your observations, would there be water available in the quantity and at the times needed to supply the use proposed by this application?

✓ Yes ☐ No

3. Do you observe this stream system during regular fieldwork?

✓ Yes ☐ No

If yes, what are your observations for the stream?

Usually, there are periods of flow in the spring well above the needs of current water rights. The timing of these excess flows varies from year to year dependent upon the weather.

4. If the source is a well and if WRD were to determine that there is the potential for substantial interference with nearby surface water sources, would there still be ground water and surface water available during the time requested and in the amount requested without injury to existing water rights?

☐ Yes ☐ No ✓ N/A

What would you recommend for conditions on a limited license that may be issued approving this application?

I understand the requested amount is 125 cfs, the requested end of season for water application is April 15 for irrigated lands and May 31 for non-irrigated lands, and the requested bypass flow condition is 535 cfs as measured at the Umatilla gaging station. I may want to comment further on these values depending upon comments received from others in the basin.

5. Any other recommendations you would like to make?

Umatilla River flows can change rapidly. The applicant needs to be available to make diversion adjustments on short notice in order to fully utilize available excess flows. There needs to be good records kept daily of amounts delivered to each recharge area and to separate irrigation from recharge, especially after April 15th. Watermaster and staff needs access to daily records and to the Westland Canal system to monitor as needed.

Signature ____________ WM District #: 5 Date: February 15, 2008

State of Oregon
Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1271
(503) 986-0900

Application for
Limited Water Use License

A summary of review criteria and procedures that are generally applicable to these applications is available at www.wrd.state.or.us/publication/reports/index.shtml.

RECEIVED
FEB 15 2008
WATER RESOURCES DEPT
SALEM, OREGON

License No. 1111

Applicant(s): Westland Irrigation District

Contact Person: Mike Wick, Westland Irrigation District

Mailing Address: Westland Irrigation District P.O. Box 944 Hermiston, OR. 97838

Telephone No: 541.667.2030

I (We) make application for a Limited License to use or store the following described surface waters or groundwater-not otherwise exempt, or to use stored water of the State of Oregon for a use of a <u>short-term</u> or <u>fixed duration</u>:

1. SOURCE(S) OF WATER for the proposed use: Umatilla River a tributary of Columbia River .

2. TOTAL AMOUNT OF WATER to be diverted: 125 cubic feet per second, or ______ gallons per minute. If water is to be used from more than one source, give the quantity from each: ______ .

3. INTENDED USE(S) OF WATER: (check all that apply)
   - ☐ Road construction or maintenance;
   - ☐ General construction;
   - ☐ Forestland and rangeland management; or
   - ☑ Other: AQUIFER RECHARGE TESTING
     ~~through OAR 690-350-0120:~~

4. DESCRIPTION OF PROPOSED PROJECT: Include a description of the intended place of use as shown on the accompanying site map, the method of water diversion, the type of equipment to be used (including pump horsepower, if applicable), length and dimensions of supply ditches and pipelines:
   See attached limited license supporting documents

5. PROJECT SCHEDULE: (List day, month, and year)
Date water use will begin 3/1/2008
Date project will be completed 12/31/2008
Date water use will be completed 5/31/2008

PLEASE READ CAREFULLY

NOTE: A completed water availability statement from the local watermaster, fees and a site map meeting the requirements of OAR 690-340-030 must accompany this request. The fee for this request is $150 for the first point of diversion plus $15 for each additional point of diversion. *Failure to provide any of the required information will result in the return of your application.* The license, if granted, will not be issued or replaced by a new license for a period of more than five consecutive years. The license, if granted, will be subordinate to all other authorized uses that rely upon the same source, or water affected by the source, and may be revoked at any time it is determined the use causes injury to any other water right or minimum perennial streamflow.

If water source is a well, well logs or adequate information for the Department to determine aquifer, well depth, well seal and open interval, etc. are required. The licensee shall indicate the intended aquifer. If for multiple wells, each map location shall be clearly tied to a well log.

If a limited license is approved, the licensee shall give notice to the Department (Watermaster) at least 15 days in advance of using the water under the Limited License and shall maintain a record of use. The record of use shall include, but need not be limited to, an estimate of the amount of water used, the period of use and the categories of beneficial use to which the water is applied. During the period of the Limited License, the record of use shall be available for review by the Department upon request.

REMARKS: See attachments for a complete project description including maps, water quality monitoring plan, and all other necessary for a complete limited license for Artificial Groundwater Recharge

SIGNATURE of Applicant: DATE: 2/13/2008
Title: Manager, Westland Irrigation District

Mapping Requirements (OAR 690-340-0030):

(1) A request for a limited license shall be submitted on a form provided by the Water Resources Department, and shall be accompanied by the following:

(c) A site map of reproducible quality, drawn to a standard, even scale of not less than 2 inches = 1 mile, showing:

(A) The locations of all proposed points of diversion referenced by coordinates or by bearing and distance to the nearest established or projected public land survey corner;

(B) The general course of the source for the proposed use, if applicable;

(C) Other topographical features such as roads, streams, railroads, etc., which may be helpful in locating the diversion points in the field.

This page to be completed by the local Watermaster.

WATER AVAILABILITY STATEMENT

Name of Applicant: Westland Irrigation District Application Number: ____________

1. To your knowledge, has the stream or basin that is the source for this application ever been regulated for prior rights?

☐ Yes ☐ No

If yes, please explain:

2. Has the stream or basin that is the source for this application ever been regulated for minimum stream flows?

☐ Yes ☐ No

If yes, please explain:

3. Do you observe this stream system during regular fieldwork?

☐ Yes ☐ No

If yes, what are your observations for the stream?

4. Based on your observations, would there be water available in the quantity and at the times needed to supply the development proposed by this application?

☐ Yes ☐ No

What would you recommend for conditions on a permit that may be issued approving this application?

5. Any other recommendations you would like to make?

Signature ______________________ WM District #: ____ Date: ____________

WESTLAND IRRIGATION DISTRICT

P.O. Box 944
Hermiston, OR 97838

Phone (541) 667-2030
Fax (541) 667-2031

February 14, 2008

Tony Justus
Watermaster
Oregon Water Resources Department
116 SE Dorian Ave.
Pendleton, OR 97801

RE: Westland Irrigation District, Echo Meadows Groundwater Recharge Project
Application for a Limited License to Appropriate Water for the Purposes of Groundwater Recharge

Dear Mr. Justus:

This application for a limited license is submitted by the Westland Irrigation District (WID) in response to our January 22, 2008 conference call meeting. We agree that a limited license is the best way to get our project water diversions started in the time that we request (March, 2008).

Based on our ongoing discussions, including a January 25, 2008 meeting with OWRD staff, we believe that we understand the realities and limitations of getting this license quickly approved. As a result, we have developed our application in accordance with the intent of our discussions. However, we appreciate as much licensing flexibility as possible so that our work can answer as many questions as possible.

Based on our discussions we believe that our limited license should include the following elements:

- Divert up to 125 cfs of water from the Umatilla River at WID's Hunt Canal until May 31 of 2008.
- Apply the water to approved locations in the Echo Meadows area for aquifer recharge.
- Allow water to be diverted to irrigated lands until April 15 and non-irrigated lands until May 31 of 2008.

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FEB 15 2008
WATER RESOURCES DEPT
SALEM, OREGON

The essential elements of our sampling and monitoring program will consist of the following:

- Monitor surface water diversions from the Hunt Canal and at each recharge field,
- Monitor surface water quality for a range of water quality parameters, as well as pesticides and herbicides,
- Monitor groundwater elevations with pressure transducers, neutron probes, and groundwater level indicators,
- Monitor groundwater quality for a range of water quality parameters, as well as pesticides and herbicides,
- Measure surface water return flows to indicate the effectiveness of the project, and
- Develop a report that shows the effectiveness of the project for future years of application and ultimately- a certificated water right.

Our limited license has a broad spectrum of support including the Confederated Tribes of Umatilla Indian Reservation and Umatilla County.

Accompanied with this letter is a $150.00 check for the limited license and a copy of our supporting materials for your reference. We have also sent a copy of this information to Mr. Donn Miller, OWRD-Salem.

Thank you in advance for your time and attention. We seek WRD's prompt review and approval of our limited license application. If we are missing any information, we will be pleased to promptly provide you with what you need.

Sincerely,

WESTLAND IRRIGATION DISTRICT

Mike Wick
District Manager

Enclosures: Limited License Application and Supporting Documents

CC: Donn Miller, OWRD-Salem, w/enclosures
Fred Ziari, IRZ Consulting LLC, w/enclosures

SUPPLEMENTAL INFORMATION

APPLICATION FOR A LIMITED LICENSE TO APPROPRIATE WATER FOR THE PURPOSE OF GROUNDWATER RECHARGE

ECHO MEADOWS, UMATILLA BASIN

13 February 2008

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WATER RESOURCES DEPT
SALEM, OREGON

1.0 INTRODUCTION

This document contains the information and data required by the Oregon Water Resources Department (OWRD) as part of a Limited License application (LL) sponsored by the Westland Irrigation District (WID). The LL is for a study to evaluate the feasibility of surface recharge of an alluvial aquifer in the Echo Meadows area of Umatilla County by water diverted from the Umatilla River during "high flow" months of 2008. The study includes monitoring of changes in subsurface storage and discharge to the Umatilla River during "low flow" months. The findings of this project will be extremely useful to other studies planned at a much larger scale in the basin. The Echo Meadows area is located east of the town of Echo in the Umatilla basin as shown on Figure 1.

This document includes information on study background and objectives, approach, sampling and monitoring, data evaluation, and implementation schedule.

1.1 Background

Irrigated agriculture is the single most important economic driver in the Umatilla Basin. Expansion of irrigated agriculture within the WID service area and elsewhere in the basin is severely limited by availability of additional water during the later portion of the crop growing season. Additionally, the aquatic habitat along the river is also negatively affected from low stream flows during the late summer –early fall months.

Comprehensive information and data on practical approaches to provide more water for both out-of-stream uses and enhancement of river flow for fish habitat improvement are generally lacking for the Umatilla River. Several groundwater recharge studies were conducted in the Echo Meadows area between 1998 and 2003 to begin to gather such information and data. The main purpose of these "pilot-scale" studies was to evaluate opportunities for shallow aquifer recharge using high flows in Umatilla River, similar to the current project. The maximum amount of water that was diverted and recharged was 368 acre-feet (AF) which was diverted in 2003. These projects were conducted under Limited License number 00661.

The findings of these studies provide good initial information regarding the practicality of this approach. The project was able to use the existing WID irrigation system of canals, headgates, and gages to convey and regulate flow of diverted water to fields. The findings also included data and information on hydrogeology and recharge water mounding, water quality, and river flow gains and water temperature. An initial groundwater flow model was developed based on the available information and data. The results of the model appear to provide good simulations of the groundwater flow system under the limited recharge scenarios implemented.

Due to the limited-scale nature of the previous projects, their findings are also limited. The project subject of this LL includes collection and evaluation of additional data to augment previous findings. It is important that the LL is approved by OWRD in a timely manner so that water diversions could begin as soon as possible due to the changing river flow rates. Additionally, as the State of Oregon begins its process to investigate feasibility of aquifer storage in the basin, the findings of this LL project can significantly expedite implementation of the State projects.

1.2 Stakeholders' Involvement

The WID envisions the following participation and cooperation from the area stakeholders:

- The land owners in area of the project whose lands will receive the recharge water are very eager to complete this study and have agreed to provide their fields for this project. Agreements from several area land owners are enclosed with this application.
- WID, as the sponsoring agency, will allow use of its irrigation facilities to physically divert Umatilla River water to individual turnouts on its Hunt Canal. WID will also maintain the required diversion records including data on the location, amount, and timing of diverted water.
- Confederated Tribes of the Umatilla Indian Reservations (CTUIR) are interested in this study for its potential to investigate river flow augmentation and water temperature reduction associated with groundwater discharge during the low flow season. They have been a cooperative and willing participant in project discussions.
- Umatilla County provides assistance on land use and property ownership to the project. The required approval of the land use associated with this project is enclosed with the LL application.
- State agencies such as OWRD, Department of Environmental Quality (DEQ), and the Oregon Department of Fish and Wildlife (ODFW), are participants in project discussions.

2.0 STUDY OBJECTIVES

The main objective of this study is to provide additional "proof of concept" that alluvial aquifer recharge with river water diverted during high flows can increase aquifer storage and increase Umatilla River base flow during low flow periods. Specifically, this project has been designed to provide information and data to answer the following questions:

1. **Can the target volume of water be diverted during the river high flow period?** Based on available stream flow measurement data along the Umatilla River at the Yoakum and Umatilla River gages, recent history of other diversions at the Umatilla gage, and precipitation amounts received in the area in this water year, it appears that a significant volume of water may be available for diversion during this water year. Historical data suggests that excess flow may be available in most water years. In this project, the degree to which our target recharge volume can be attained will be evaluated.

2. **Can the WID system operation and the recharge methods be managed to allow effective infiltration of the diverted water?** The maximum carrying capacity of WID's Hunt Canal is 220 cubic feet per second (cfs). WID also diverts water for the County Line Water Improvement District (CLWID). Management of the canal operation and competing uses for diverted water will be evaluated in this study.

3. **What is the subsurface distribution and migration path/rate of recharged groundwater?** Findings of previous studies indicate that water recharged within one half mile of Umatilla River would show a peak increase in river base flow within approximately two months. Water applied near the southern portion of the Echo Meadow area would result in a peak discharge several months later and would still be discharging to the river even one year later. These findings were based on computer modeling results using area-wide hydrogeologic information and relatively small volumes of recharge water. Additional hydrogeology data and information will be collected in this project to further assess these results.

4. **What is the distribution of discharge water along the river?** The OWRD studies have indicated that groundwater discharge to Umatilla River along this area generally takes place downstream of the Dillon Diversion. Findings of previous studies indicate presence of several large seeps in this reach. Additional data and information will be collected in this project in an attempt to better define whether groundwater discharge occurs at seeps or is diffuse.

5. **Can the existing groundwater flow model be refined for water management purposes?** The groundwater flow model developed in the previous studies will be refined with additional data to be collected in this project. The extent of refinement will depend on the available project budget and schedule. In a previous study, the model was used to simulate the observed groundwater heads to within 5 feet (ft) in most wells in Echo Meadows.

3.0 STUDY APPROACH

A significant amount of data and information is available from previous studies conducted in the study area. However, these studies have been at a rather limited-scale and there are key data gaps that will need to be addressed for large-scale aquifer recharge that will be needed for meaningful water storage and river flow augmentation purposes in the future. This section contains a brief summary of available information, the project approach to recharge, a description of recharge system components, and data gaps. A data collection plan including environmental sampling and monitoring is presented in the next section below.

An important aspect of this study that is different than recent studies conducted in Yakima Valley in Washington, and elsewhere in the western U.S., is that in this project recharge will occur on land which has not been engineered specifically for groundwater recharge. In this study existing fields and other natural areas will be used for this purpose. As a result, the findings of this project will be used to evaluate whether land requirements and overall cost of such a recharge can be significantly reduced.

3.1 Study Area

The Echo Meadows area was selected in the previous studies for aquifer recharge (study area) since it had historically been an important area of groundwater recharge and groundwater base flows (WRD, 1991). This is primarily due to the geology of the alluvial aquifer in the area. Of great importance is that much of this area was flood irrigated in the past and there is an existing series of canals and ditches that may be used to economically convey water to the appropriate locations.

The study area encompasses approximately 9,000 acres north and east of WID's Hunt Canal and south and west of Umatilla River, and portions of land located south and west of the canal. It consists of mostly pivot-irrigated fields, some flood-irrigated fields, and unfarmed areas of low elevation in which groundwater daylights and is seen as natural ponds or "wetlands" on maps. Figure 2 shows the boundaries of the study area, more detail of the present land use, and a general pattern of land ownership.

3.2 Water Application Locations

Within the study area, the river water will be applied to fields within a "target recharge area" of non-pivot irrigated-fields and non-irrigated properties and "wetlands" based on the amount of water diverted, timing of diversions, agricultural chemical application, water distribution system, soil infiltration capacity, and distance to river. To achieve the maximum volume of recharge, a combination of fields with different infiltration capacities and distance to Umatilla River will be considered in this study. The target area for application is shown on Figure 3.

The recharge fields will be flood irrigated without any berming or other engineered ponding structure. As such the field infiltration capacity depends on the soil infiltration rate and any natural degree of ponding that may occur. The management of the recharge activities will require site-specific infiltration rates to determine how much water can be recharged at a given field. Based on previous observations, most fields may allow one AF of water per acre per month of infiltration or more. Better estimates of soil infiltration rates will be obtained through infiltrometer testing, as explained further below.

The "wetlands" may allow significantly more (perhaps up to seven times more) recharge to occur. Recharge fields established in the wetland area will be important application sites in this study. Historically, wetlands occupied a larger portion of the Echo Meadows area than today. Their extent has been significantly reduced due to reduced water leakage from irrigation (change in irrigation systems from flood irrigation to sprinklers) and subsequent groundwater level declines.

Since the wetlands are not irrigated, we propose to have the flexibility to extend the recharge period for these fields, and other non-irrigated fields, through May 31st. This will allow us to extend the diversion season, resulting in an extended time when groundwater flows will return to the Umatilla River.

Recharge fields will be selected partly based on whether they receive agricultural chemicals. To minimize potential for migration of these chemicals to groundwater during recharge, fields of pastureland will be preferentially selected for recharge. These fields do not typically receive pesticides or herbicides, and fertilizer application on them is infrequent and minimal. Groundwater samples will be collected at recharge locations to analyze for presence and concentrations of farming chemicals in groundwater.

3.3 Water Diversion Rate and Quality

Water will be diverted from Umatilla River at the WID diversion point to Hunt Canal (POD Coordinates: North 76 deg 45 min 56 sec East 2913.19 ft from West ¼ corner sec 21, T3N, R29E, W.M. Based on current water rights, 250 cfs of flow is dedicated to instream uses, 75 cfs is granted to CLWID to divert to Hunt Canal, and 220 cfs is allocated to the feed canal. Therefore, the first 545 cfs of river flow are appropriated, as measured at the Umatilla River gage. Historically, the CLWID had diverted an average of 60-65 cfs of water. It appears that, for practical purposes, Umatilla River flow greater than 535 cfs can be diverted for this study.

The maximum rate at which additional flow for this study can be diverted from the Umatilla River is the available capacity in the Hunt Canal less CLWID diversionary needs. The carrying capacity of the canal is rated at 220 cfs. Using historical CLWID average diversion rate of 60-65 cfs, up to approximately 155 cfs of water can be diverted from the river, or higher if the CLWID diversions fall below 65 cfs. The actual daily diversion rates achieved for this project will be dependent on daily river flow and CLWID diversion rates. Therefore, the total volume of water to be diverted (in AF) is not known at this time. The rate and timing of diversions will be recorded for field planning purposes.

The goal of this study is to apply the maximum amount of water which can be diverted. Water will be applied to irrigated and non-irrigated fields in order to increase the recharge water volume as much as possible. Based on historical flow rates measured in the river, the period of high flow is expected to extend to end of May. Therefore, we propose to divert water for recharge of irrigated fields through 15 April 2008 and to non-irrigated fields through 31 May 2008. The ability to divert and apply the maximum volume of water possible is one of the operational challenges of this study. The findings of this project will enhance our knowledge of the possibilities in this regard and the limitations. These findings are important to future planning on how best to achieve recharge of alluvial aquifers in this and other areas.

Data collected during the 2001-2002 recharge study indicates that the Umatilla River's water quality is good during the proposed period of diversion. The coliform counts ranged between 28 and 103 colony counts per 100 ml and with one exception, nitrate-nitrogen concentrations were less than 1 milligram per liter. Samples will be collected during this study and will be analyzed for water quality parameters as presented further below.

3.4 Water Delivery Structures

River water will be diverted into WID's Hunt canal using the existing headworks. The canal is unlined, approximately 20 to 30 ft wide by 4 ft deep, with a trapezoidal cross section. The head works include an automated pressure transducer near the canal inlet to measure water diversion rates. The canal extends to Service Butte where it splits into two segments (the "A" and "B" Line Canals). The B Line Canal conveys water to the CLWID and the A Line Canal diverts water towards Westland Road. The segment of the canal between the headworks and the split (referred to as the Echo Meadows reach) will be used for recharge during this project (Figure 2).

In the Echo Meadows reach, the canal has a series of headgates that allow diversions to fields north of the canal. The flow through the headgates is measured by noting the headgate openings and the duration of flow.

The distribution of the diverted water to recharge fields is mostly through an existing network of unlined irrigation ditches, some of which are remnants from prior periods of flood irrigation. An objective of this project is to evaluate how well the existing distribution system may be used to convey the water to fields without having to construct additional infrastructure.

3.5 Soils and Hydrogeology

The study area is underlain by the Columbia River Basalt Group (CRB). The top of the basalt has been measured to reside at an elevation of 450 ft in the northern portion of the study area near the river to 600 ft near Highway 395 close to the town of Echo. Based on the elevation of top of basalt and ground surface elevations, the thickness of the sediments within the alluvial aquifer range from approximately 30 to 50 ft in the southern portion of the area to deeper than 150 ft toward northwest of the area.

The logs of the wells drilled in the area do not provide very detailed assessment of the lithology of the sediments. The area has been mapped as Holocene Alluvium (Qal) with Pleistocene catastrophic flood deposits (Qgs) underlying a portion of the western study area. Based on limited field data and description of soils by the USDA Natural Resource Conservation Service descriptions, the surficial soils in the study area overlying the sediments result from a mixed origin of lacustrine (lake), eolian (wind blown) and recent Umatilla River alluvial (stream) sediments. The surficial soils in the north and east sides of the study area are mostly silt loam. Soils covering the south and west sides of the area were formed in wind-blown loess and eolian sands and are predominantly fine sand. It appears that interbedded sand lenses may be present in some areas of the study area (e.g., along the western edge). Additional field data is needed to better define the lithology and stratigraphy of the geological units underlying the study area.

The depth to groundwater in the study area changes seasonally from approximately 3 to 4 ft below ground (bgs) during the irrigation season to more than 15 ft bgs during other times. Several pump tests have been done in the study area during previous studies. The pump test results indicate that the hydraulic conductivity of the soils and sediments varies from a low range of 17 to 44 ft per day (ft/day) to as high as 1,000 ft/day, indicating the variable nature of permeability in sediments across the study area. And there is a wide range of pumping capacities in wells that are of approximately the same construction, based on the WRD well data base. As a result, we can expect heterogeneity in hydraulic characteristics across the area.

The extent of subsurface storage in the study area is an important aspect of any aquifer recharge study. The unsaturated zone is generally less than 15 feet at any time of the year. However, the storage coefficient of the soils and sediments (how much water can be stored or released/unit volume) is not well understood. Past modeling and pump test efforts have indicated that the specific yield in between 0.1 to 0.2. Recharge using large amounts of water (as is being proposed in this study) and groundwater monitoring data will be used to better define the storage component for the study area.

3.6 Groundwater Quality

Limited data is available regarding groundwater quality in the study area. Data collected in 2001, 2002, and 2004 from several wells in the area indicates that coliform count ranged mostly up to 14 colonies per 100 ml with occasional spikes in values and nitrate nitrogen ranged up to 3.76 mg/l. The cation/anion analysis of groundwater samples shows that groundwater hardness is relatively mild (bicarbonate concentrations up to 866 mg/l). Groundwater samples will be collected from existing wells during this study to track potential changes in water quality associated with recharge of Umatilla River water. Groundwater sampling protocol is described further below.

3.7 Groundwater Flow Modeling

Studies by the U.S. Geological Survey have shown the importance of irrigation return flows to the recharge of Columbia River. Previous studies in the lower Umatilla River basin (including the Echo Meadows area) indicated the impact of changes in irrigation practices on river return flows. These studies included development of a preliminary groundwater flow model. This model appeared to provide good simulations for a limited number of recharge scenarios. Depending on the timeline and available budget in this study, additional refinements to the model will be attempted. The expected refinements will include use of improved estimates of hydrogeologic parameters such as lithologic descriptions, and hydraulic conductivity and specific yield values. A refined model will provide a management tool to predict appropriate places and times for groundwater recharge, water withdrawal for out-of-stream uses, and extent of discharge to river under varying recharge conditions such as varying available river recharge water, changing land use patterns, and future changes in recharge objectives.

4.0 SAMPLING AND MONITORING PLAN

This sampling and monitoring plan includes water quality sampling, measurements of river water flow diversion rates, recharge rate monitoring, and groundwater level monitoring during and following water application. It also includes river flow monitoring, water temperature measurements, and thermal infrared scans of the Echo Meadows reach of the Umatilla River. Monitoring parameters and analytes are also proposed.

4.1 Source Water Flow and Quality

The Umatilla River water diversion rates (both instantaneous and duty) will be monitored at the Hunt Canal gaging station. The diversions are recorded continuously on chart. The diversion needs of the CLWID are recorded at another gaging station downstream of the Echo Meadows reach. The river water inflow rate will be managed actively to divert based on the approved diversion rate. The higher flows in the river occur usually during the November through May period of each year.

The total inflow rate less CLWID need will be managed on a daily basis for outflow to the recharge fields. This will be conducted through measurements of flow rate and time duration, at each of several headgates in the canal. Measurements of total diversion flow rates and flow through individual headgates over time will be retained and reported in the study report. The approximate locations of the headgates are shown on Figure 3.

Water quality samples will be collected from the diverted water stream at a location near the headworks. One sample will be collected in the beginning of the study and one during the latter stages. The samples will be analyzed for the parameters listed in the table below. Field parameters will be analyzed using sensors in the field. The field parameter values and descriptions of measuring instruments and their accuracy will be recorded. The samples for analyses of conventional and farming-related parameters will be sent to an Oregon-accredited laboratory. The samples will be collected, handled, stored, preserved, and shipped to selected laboratory according to accepted protocols and shipped under chain-of-custody protocol. The farming-related parameters were selected to correspond to the predominantly agricultural land use of the area upstream of the diversion point and the potential constituents that may be used on field in the study area.

PARAMETER	**ANALYSIS**	**UNIT**	**METHOD**
Field Parameters	Temperature Specific Conductance pH Dissolved Oxygen	Degrees F µS/cm pH unit mg/l	Field sensors
Conventional Parameters	Biological Oxygen Demand Coliform Bacteria Major cations including calcium, magnesium, sodium, and potassium Major anions including carbonate, bicarbonate, sulfate, chloride	mg/l Colonies per 100 ml mg/l mg/l	5210B 9223B 200.7 2320B, 2320B, 4500, 4500
Farming-related parameters	Nitrate nitrogen Organochlorine Pesticides Chlorinated Herbicides Organophosphorus Pesticides	mg/l µg/l µg/l µg/l	4500 8081A 8151A 8141A

mg/l – milligrams per liter, µg/l – micrograms per liter, µS/cm – microsiemens per centimeter

4.2 Recharge Rate

The soil infiltration rate will be measured in selected fields prior to recharge events. The infiltration rates will be measured using double ring infiltrometer protocol as described in ASTM Standard D3385-03. Percolation of recharge water through the soil profile will be monitored through use of neutron probes, as used in agricultural fields for soil moisture monitoring and irrigation scheduling. Occurrence of surface runoff during recharge will be monitored to limit the applied water to infiltrate within the bounds of that field. Water application will be throttled to minimize runoff.

Crop evapotranspiration rates will be monitored during and after recharge events based on weather data obtained from the Bureau of Reclamation/Echo site. This allows crop water uptake for a given field to be determined as another component of the soil water balance.

Evapotranspiration estimates are routinely conducted as part of farm soil moisture management activities.

The above data will be used to estimate aquifer recharge rates for the recharge event.

4.3 Hydrogeology and Groundwater Level

Our existing understanding of soils, geology, and stratigraphy in the study area are based on limited information obtained from well logs, a few shallow borings advanced during previous studies, and area-wide descriptions contained in published literature. This information is sufficient for implementation of this project. However, advancing additional borings to top of bedrock for lithologic description and water level measurement will greatly add to our understanding of groundwater flow system. Depending on study schedule and budget availability, additional soil borings may be advanced within the study area to top of basalt. These may be turned to monitoring wells or abandoned according to OAR 690-240 provisions. We will consult with OWRD prior to advancement of any borings. The existing network of wells and piezometers within the study area will be used for water level monitoring and groundwater sample collection. The locations of wells and piezometers are shown on Figure 3.

Since the exact recharge fields are not known at this time, the exact wells and piezometers that will be used for monitoring can't be assigned. Initially, it is envisioned that pressure transducers will be placed in four piezometers and wells that were used in previous studies and to correspond to locations used to develop the groundwater model. The pressure transducers will be used for continuous water level measurements. This plan may change based on field conditions during the recharge events.

In addition to the four wells above, we will measure water levels in other wells and piezometers as selected based on location of the recharge fields. These measurements will be made on a weekly basis during the recharge events and less frequently (likely monthly) afterwards. The water level measurements will further be used to change or curtail water application in a given area.

4.4 Groundwater Quality

Groundwater quality monitoring is important during a recharge project due to the possible introduction of contaminants and potential changes in geochemistry. Past studies have shown that the groundwater quality in the study area remained very good during and following river water recharge. Groundwater samples will be collected from wells generally downgradient of the recharge fields.

Groundwater samples will be collected from wells following purging of three well volumes and stabilization of field parameters to within 10 percent. Water samples will be collected according to the same procedures as for river water sampling. Prior to each sample collection, the depth to water will be monitored in the well. The samples will be analyzed for the same parameters as the surface water samples, as described further below.

A set of groundwater samples will be collected prior to water diversion to provide an understanding of baseline groundwater quality. These samples will be analyzed for the field, conventional, and farming-related parameters. Additional samples will be collected downgradient of the recharge fields and as close to the apparent groundwater flow pathways as possible for analysis of farming-related parameters. Due to budgetary constraints, three baseline and six additional samples (three wells in each of two rounds of sampling) for a total of nine samples will be collected for this purpose.

Field and conventional parameters will be monitored in the above and several other wells throughout the study. The analysis results for these parameters will provide a more spatially comprehensive data set to further understand potential groundwater geochemical changes. Samples for field and conventional parameter analyses will be collected on a monthly basis and will be conducted at the same time that the water level monitoring occurs.

4.5 Groundwater Discharge

To evaluate groundwater return flow to the Umatilla River along the Echo Meadows reach, river flow monitoring, groundwater piezometer monitoring, and thermal imaging techniques will used. As the season progresses into summer and fall, the river flow is expected to diminish to the extent that an increase in river flow rate from groundwater discharge may be measurable.

The river flow in the Echo Meadows reach will be measured on a monthly basis from April to October of 2008. This will be done by measuring the river discharge above and below the Echo Meadows reach, as well as measurable seeps and drains, such as the Stanfield Drain. This data will be used to conduct a mass balance to detect potential increase in river flow over time. The daily flow data measured at the OWRD and the BOR gages at Echo, Umatilla, Butter Creek, Maxwell will be used to assist in the mass balance calculations.

Piezometers and wells located near the river will also be used to measure groundwater elevations relative to river stage. Piezometers will be selected depending on the location of recharge fields and expected time frame for groundwater return to the river.

Finally, an aerial infrared thermal image of the river along the Echo Meadows reach will be obtained later in the monitoring schedule, potentially during an afternoon in July 2008. The temperature profile of the river and synoptic temperature monitoring along this reach will be used to identify locations where groundwater with colder water may enter the Umatilla River at a higher temperature, whether in the form of seeps or more diffuse discharge pattern, or both. This technique has proven to be effective in this regard during past studies. Field temperature readings will be used to verify aerial measurements.

The principal water quality issue along the Umatilla River is the elevated water temperature and associated low dissolved oxygen levels. River water temperature, dissolved oxygen, conductivity, and pH levels will be measured monthly in samples collected from the river. In addition, two river water samples, preferably located downstream of identified seeps, will be collected for analyses of conventional and farming-related parameters, listed previously.

5.0 DATA ANALYSES AND REPORTING

The source water, groundwater, and discharge data will be used to address the objectives of the study. Additionally, a significant amount of information will be collected regarding the approach to, and management of, application of recharge water to agricultural fields. The collected data will be reviewed for reasonableness and accuracy using standard data exploration techniques (e.g., outlier analysis, etc.). The laboratory data, and associated QA/QC information, will be reviewed for data quality assessment. Unacceptable data will be eliminated from further analysis.

The collected data (both retained and discarded data) will be presented in study report of findings. The report will contain tabulated data, analyses results, and conclusions and recommendations. If the State initiative to further study aquifer storage in the Umatilla Basin proceeds as planned, the findings of this report will be presented in a way to complement these efforts.

A draft report of findings will be prepared for the stakeholders review and solicitation of comments. The report will have to target a variety of users and therefore, will contain relatively non-technical summaries supported by technical information, analysis, and data appendices. Following incorporation of review comments, a final report will be prepared. Electronic copies of the draft and final reports will be made available.

6.0 STUDY SCHEDULE

Many elements of the project schedule have been previously discussed. This narrative discusses the main milestones of the project. The operational phase of the project will start following the receipt of the LL with diversions of water from the Umatilla River. The last monitoring events will be conducted in October 2008. We expect that a draft report of findings will be delivered to OWRD in December 2008. A final report will be prepared within four weeks of receipt of comments.

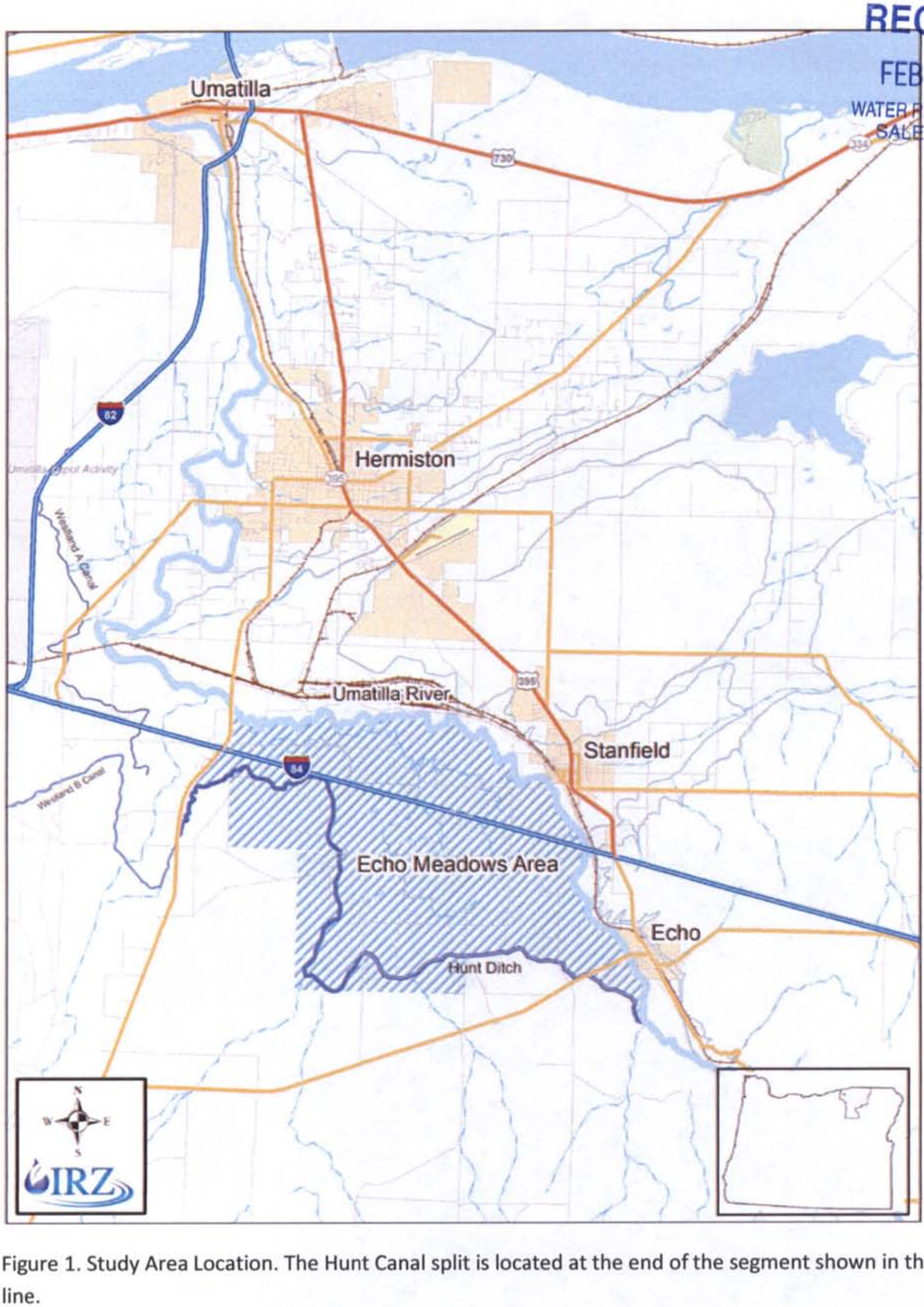


Figure 1. Study Area Location. The Hunt Canal split is located at the end of the segment shown in thick line.

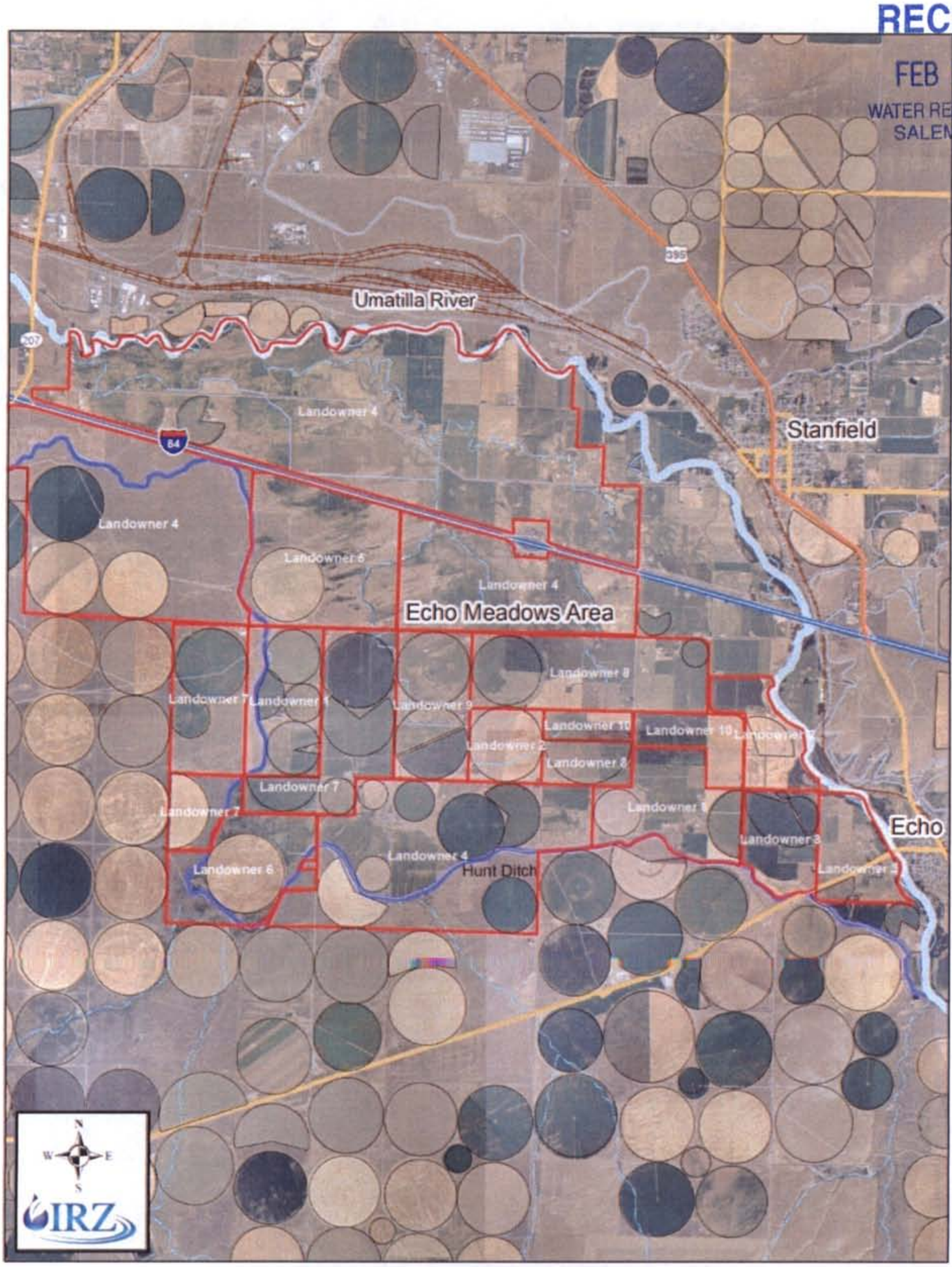
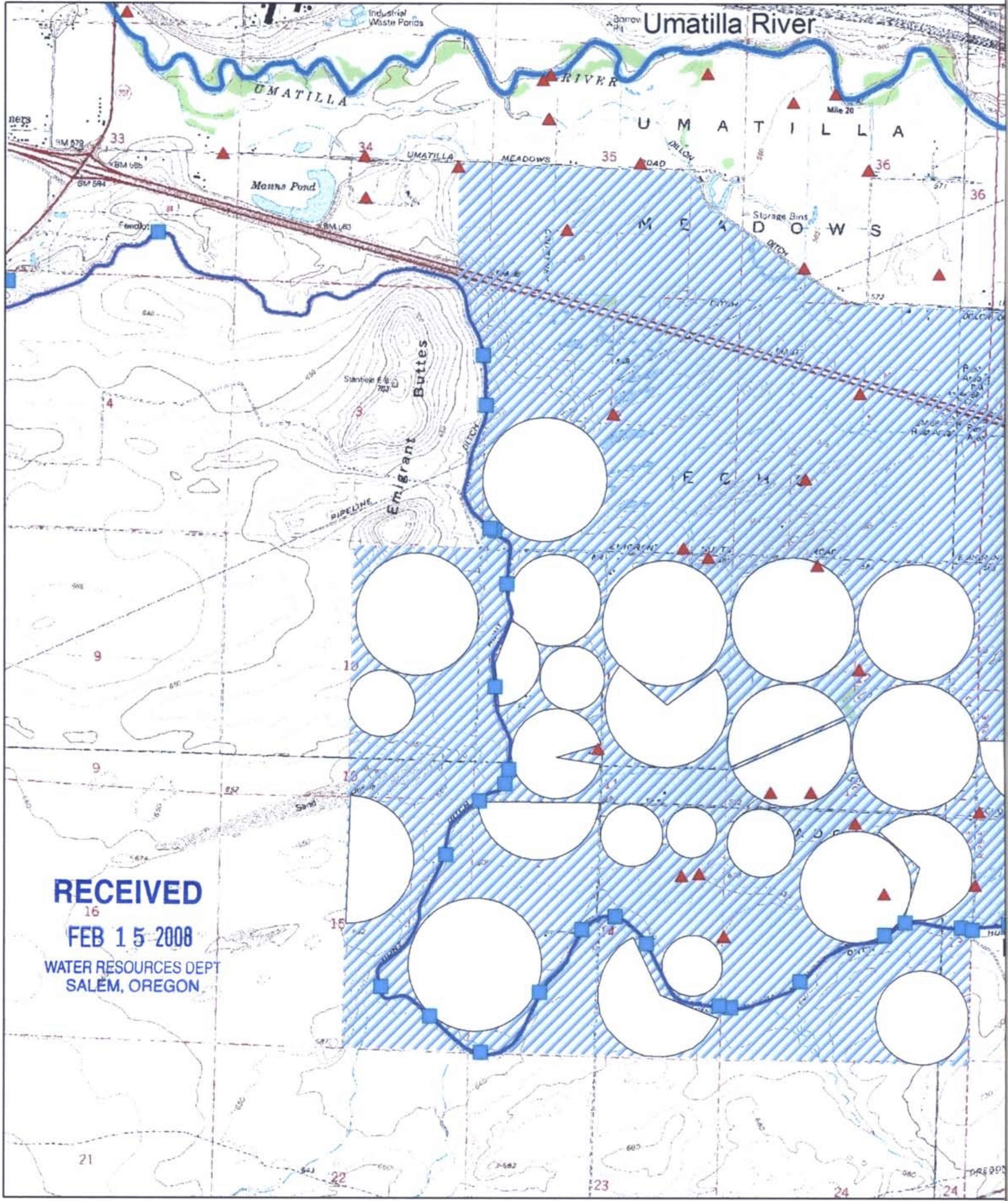
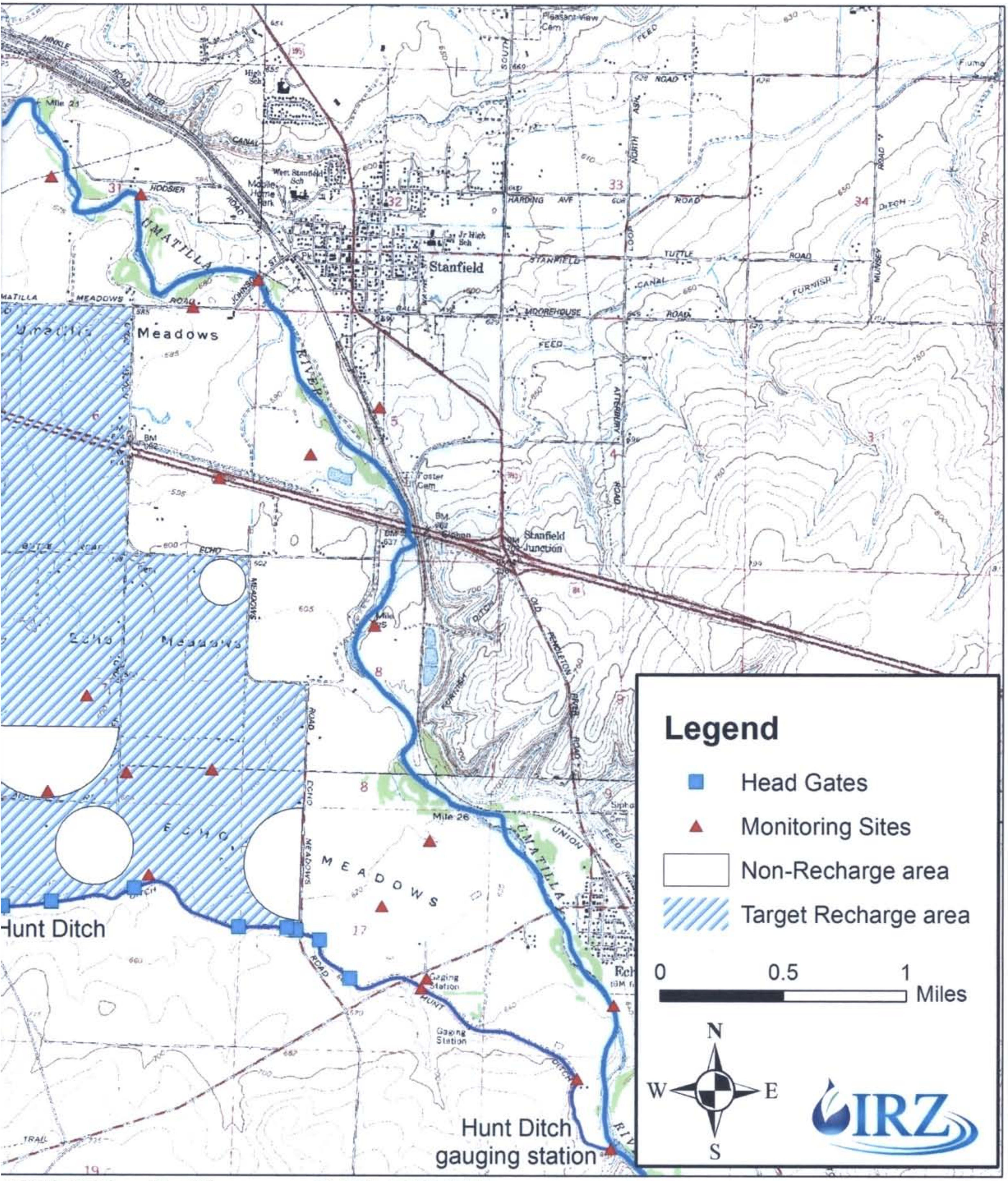


Figure 2. Study Area Land Use



1 Figure 3. Target Recharge Area, Monitoring Points, and Headgates. POD Coordinates: North 76 deg 45 min 56 sec Ea



st 2913.19 ft from West ¼ corner sec 21, T3N, R29E, W.M.

Oregon Water Resources Department

Land Use Information Form

THIS FORM IS NOT REQUIRED IF: 1) water is to be diverted, conveyed, and/or used only on federal lands; or 2) the application is for a water-right transfer, allocation of conserved water, exchange, permit amendment, or ground water registration modification, and all of the following apply: a) only the place of use is proposed for change, b) there are no structural changes, c) the use of water is for irrigation, and d) the use is located in an irrigation district or exclusive farm-use zone.

Applicant Name: Westland irrigation District

Mailing Address: P.O. Box 944

City: Hermiston State: OR Zip: 97838 Day Phone: 541.667.2030

This application is related to a Measure 37 claim. ☐ Yes ☑ No

RECEIVED

FEB 15 2008

WATER RESOURCES DEPT
SALEM, OREGON

A. Land and Location

Please include the following information for all tax lots where water will be diverted (taken from its source), conveyed (transported), or used. Applicants for municipal use, or irrigation uses within irrigation districts may substitute existing and proposed service-area boundaries for the tax-lot information requested below.

Township	Range	Section	¼ ¼	Tax Lot #	Plan Designation (e.g. Rural Residential/RR-5)	Water to be:	Proposed Land Use:
3N	29E	22	SE,SW	see below	at WID headworks	☑ Diverted ☐ Conveyed ☐ Used	divert
3&4N	28&29E	many		see maps		☐ Diverted ☐ Conveyed ☑ Used	recharge
				enclosed		☐ Diverted ☐ Conveyed ☐ Used	groundwater
						☐ Diverted ☐ Conveyed ☐ Used	

List all counties and cities where water is proposed to be diverted, conveyed, or used. Umatilla County will encompass all of the water use. POD is 45.7196 N, 119.17770 E

B. Description of Proposed Use

Type of application to be filed with the Water Resources Department:

☐ Permit to Use or Store Water ☐ Water-Right Transfer ☐ Exchange of Water
☐ Allocation of Conserved Water ☑ Limited Water Use License
☐ Permit Amendment or Ground Water Registration Modification

Source of water: ☐ Reservoir/Pond ☐ Ground Water ☑ Surface Water (name) Umatilla River

Estimated quantity of water needed: 125 ☑ cubic feet per second ☐ gallons per minute ☐ acre-feet

Intended use of water: ☐ Irrigation ☐ Commercial ☐ Industrial ☐ Domestic for ______ household(s)
☐ Municipal ☐ Quasi-municipal ☐ Instream ☐ Other Groundwater recharge

Briefly describe: Limited license will be used to divert water from Umatilla River at high flows and apply that water to fields in Echo Meadows for purposes of groundwater recharge and improvement of base flows along the Umatilla River during low flow conditions.

Note to applicant: *If the Land Use Information Form cannot be completed while you wait, please have a local government representative sign the receipt below and include it with the application filed with the Water Resources Department.*

Receipt for Request for Land Use Information

State of Oregon
Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301-1266

For Local Government Use Only

The following section must be completed by a planning official from each county and city listed unless the project will be located entirely within the city limits. In that case, only the city planning agency must complete this form.

This deals only with the local land-use plan. Do not include approval for activities such as building or grading permits.

RECEIVED
FEB 15 2008
WATER RESOURCES DEPT
SALEM, OREGON

Please check the appropriate box below and provide the requested information

☑ Land uses to be served by proposed water uses (including proposed construction) are allowed outright or are not regulated by your comprehensive plan. Cite applicable ordinance section(s): 152.013.

☐ Land uses to be served by proposed water uses (including proposed construction) involve discretionary land-use approvals as listed in the table below. (Please attach documentation of applicable land-use approvals which have already been obtained. Record of Action/land-use decision and accompanying findings are sufficient.) **If approvals have been obtained but all appeal periods have not ended, check "Being pursued".**

Type of Land-Use Approval Needed (e.g. plan amendments, rezones, conditional-use permits, etc.)	Cite Most Significant, Applicable Plan Policies & Ordinance Section References	Land-Use Approval:	
N/A	N/A	☐ Obtained ☐ Denied	☐ Being pursued ☐ Not being pursued
		☐ Obtained ☐ Denied	☐ Being pursued ☐ Not being pursued
		☐ Obtained ☐ Denied	☐ Being pursued ☐ Not being pursued
		☐ Obtained ☐ Denied	☐ Being pursued ☐ Not being pursued
		☐ Obtained ☐ Denied	☐ Being pursued ☐ Not being pursued

Local governments are invited to express special land-use concerns or make recommendations to the Water Resources Department regarding this proposed use of water below, or on a separate sheet.

Name: J.R. Cook Title: Asst. Planning Dir.
Signature: Phone: 541 278.6251 Date: 2-13-08
Government Entity: Umatilla County

Note to local government representative: *Please complete this form or sign the receipt below and return it to the applicant. If you sign the receipt, you will have 30 days from the Water Resources Department's notice date to return the completed Land Use Information Form or WRD may presume the land use associated with the proposed use of water is compatible with local comprehensive plans.*

Receipt for Request for Land Use Information

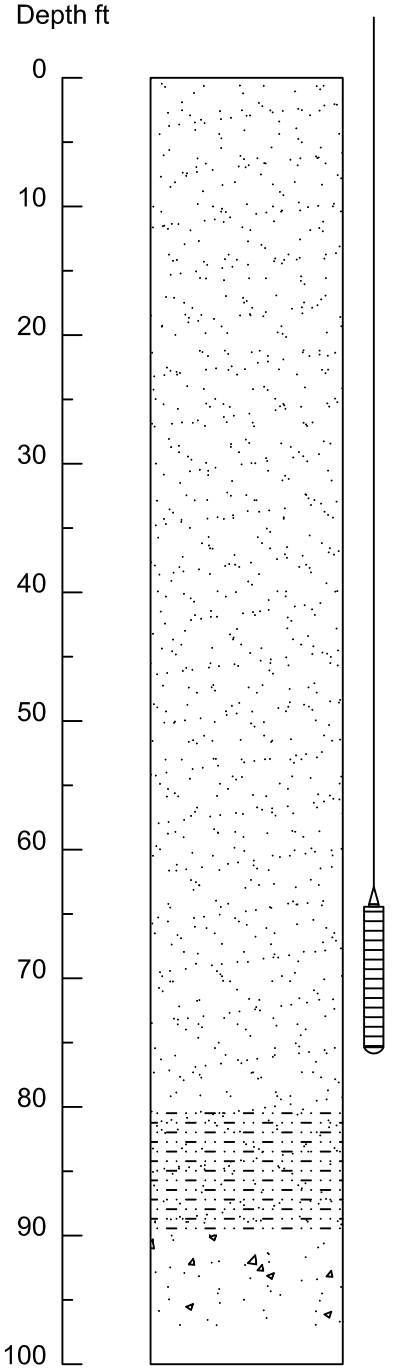
Applicant name:

City or County: Staff contact:
Signature: Phone: Date:

APPENDIX B

Boring Logs

Monitoring well to 76 ft. Screened 66-76 ft



0-80 ft Fine sand with minor silts to some silts. Brown to gray. SP/SM

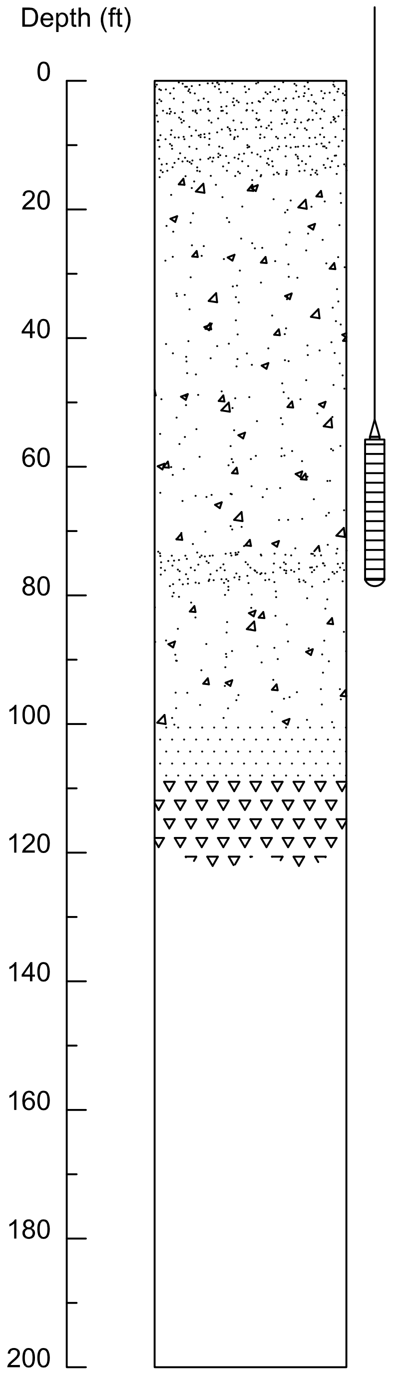
46.5 ft Water Level

80-90 ft Silty clay, clayey silt. Brown. Basaltic (volcanic?) rock fragments, increasingly indurated with depth. MC/CL

90-97 ft Bottom of Borehole. Rock fragments, with brown clays, indurated. Alkali Canyon??

Date:	4/16/2008	Driller:	Environmental West Exploration Inc.	Boring Log for L93716
Total Depth:	97 ft.	Equipment:	Sonic Drill log	Umatilla Basin Recharge Project
Location:	L93716	Type:	Groundwater Monitoring Well	IRZ
Lat/Long:	45.80985N, 119.52839W	Logged By:	James Graham, RG	
		IRZ Project No:	08-016	

Monitoring well to 80 ft. Screened 70-80 ft



0-16 ft Fine to medium sands. Minor to some silt. Gray and brown layers. SW/SM

16-73 ft Medium to extremely coarse sands and gravel mix (Gravel to 1.5 in). Few to no fines. Dark gray and black sands with some white and red grains. Occasional sand grain lenses 1-3 ft thick. SP/GP. Water level at 617 ft

73-78 ft Fine sand with silts. Brown. SP

78-100 ft (as 16-73 ft)

100-108 ft Silty clay, clayey silt with minor sand. Brown, somewhat sticky, plastic. ML

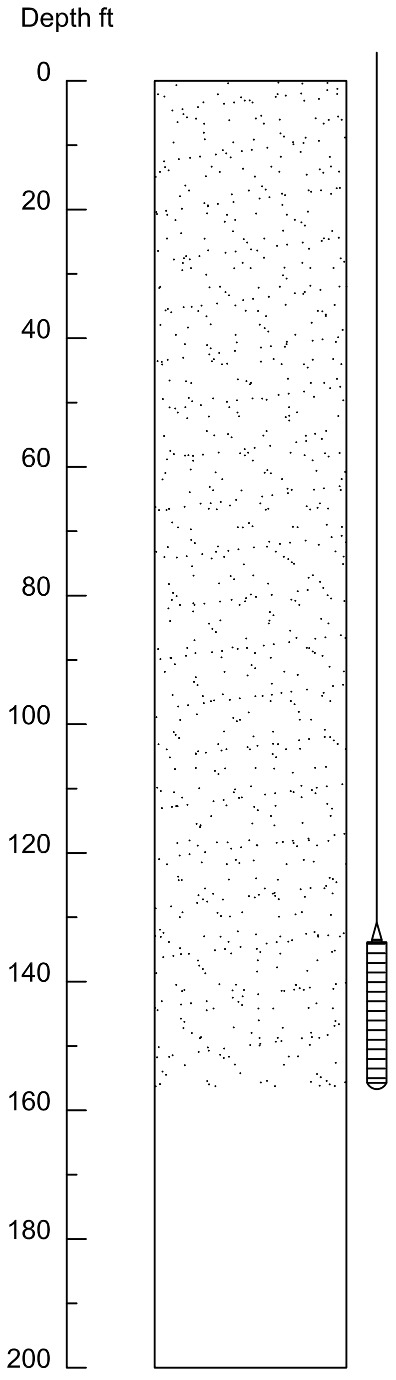
108-108.5 ft Bottom of Borehole. Basalt, black

Date:	10/30/2008	Driller:	Environmental West Exploration Inc.
Total Depth:	108.5 feet	Equipment:	Sonic drill rig
Location:	L93717	Type:	Groundwater Monitoring Well
Lat/Long:	45.79198N, 119.46125W. Near	Logged By:	James Graham, RG
	County Line	IRZ Project No:	08-016

Boring Log for L93717

Umatilla Basin Recharge Project

Monitoring well to 156 ft. Screened 146-156 ft



0-156 ft Fine uniform sand with minor silt. Gray at surface, gray and brown at depth. Rock fragments at 115-116 ft, slightly coarser sand at 136-156 ft SP

156 ft Bottom of Borehole

Date:	11/01/2008	Driller:	Environmental West Exploration Inc.	Boring Log for L93718 Umatilla Basin Recharge Project IRZ
Total Depth:	156 ft.	Equipment:	Sonic Drill Rig	
Location:	L93718	Type:	Groundwater Monitoring Well	
Lat/Long:	45.81749N, 119.51465W	Logged By:	James Graham, RG	
		IRZ Project No:	08-016	

MORR 50985

MORR
50985

Amended

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

WELL I.D. # L 32551
START CARD # ~~130070~~
130170

(1) LAND OWNER Well Number
Name Aylett, Jeddie
Address 76625 Frontage Rd
City Heppner State OR Zip 97838

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☒ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☐ No Depth of Completed Well 110 ft.
Explosives used ☐ Yes ☐ No Type Amount

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds
20"	0	110'	PTD Cem	0	70	3 YDS³

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	16"	110'	104'	.250	☒	☐	☒	☐
	16"	76'	+2	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☒ Screens Type SS PIPESIZE Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
76'	104'	.080		16"		☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
600'		102'	1 hr.

Temperature of water 60 °F Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Morrow Latitude Longitude
Township 4N N or S Range 27E E or W. WM.
Section 19 SE 1/4 SW 1/4
Tax Lot 200 Lot Block Subdivision
Street Address of Well (or nearest address) 76625 Frontage Rd

(10) STATIC WATER LEVEL:
45' ft. below land surface. Date 9-10-01
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 70'

From	To	Estimated Flow Rate	SWL
70'	80'	600'	45'

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
SAND	0	105'	45'
BLK BASALT	105'	110'	

RECEIVED
OCT 3 1 2001
WATER RESOURCES DEPT.
SALEM, OREGON

RECEIVED
FEB 19 2002
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 8-14-01 Completed 9-10-01

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

Signed Rusty R. Otto WWC Number 1702
Date 9-10-01

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

Signed Gary Burd WWC Number 544
Date 9-10-01

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

MORR 51131

(7-A)

PENDLETON
GRAIN GROWERS

RECEIVED
FEB 21 1957
STATE ENGINEER
SALEM, OREGON

RECEIVED

4N/27-28M(1)

Morrow County
Application No. U 819
Permit No. U 725
Well No. 2

REPORT ON COMPLETION OF WELL

(Note: This report should be submitted to the State Engineer, Salem, Oregon, as soon as possible after the well is completed. If more than one well is covered by this permit, a separate report shall be filed for each)

Date of Report 2-20, 1957

1. Location of well: W 1/2 of Section 28 Twp. 4 Rge. 27, W. M. E
2. Name of nearest natural surface stream BUTTER CREEK
3. Distance from well to that stream: ABOUT 6 ~~feet.~~ MILES
4. If the well is less than 1300 feet from a natural surface stream, give the difference in elevation between the ground surface at the well and the lowest point in stream channel: ________ feet.
5. Date of beginning drilling or digging: 7-25-55
6. Date well was completed 2-1-57

7. LOG OF MATERIALS ENCOUNTERED

Character of Material	Depth at which encountered	Thickness of stratum
SANDY TOP SOIL	At surface	18 ft.
SAND + GRAVEL	ft.	89 ft.
	ft.	ft.
	ft.	ft.
	ft.	ft.
	ft.	ft.
	ft.	ft.
	ft.	ft.
	ft.	ft.

Remarks:

WELL INFORMATION

8. Diameter of well 12 inches. Depth of well 107 feet.
9. Depth at which water was first encountered 48 feet.
10. Water level when completed: 48 feet below ground surface.
11. Additional information regarding well; such as soil conditions, quick sand, caves, obstructions, rock, etc.:
CASED TO BOTTOM WITH 12" STD. PIPE

MORR 51131

4N/27-28M(1)

36. Date of test: 2-2-57 37. Temperature of water _____°F. or _____°C.
38. Motor speed during test: 2200 ±
39. Test made by (weir, tank or other means): CALIBRATED ORIFICE

40.

pounds pressure	TOTAL HEAD	*Total lift in feet	Gallons per min.	°Feet to water level	▲Draw-down	+Time
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.
____lbs.	Gauge at pump	Total___ft.___in.	______	______ft.	____ft.	______M.

* Difference in elevation between water level in well and outlet of pump test line.

° Distance from ground level to water surface in well.

▲ Distance water level is lowered during time interval.

\+ Hour and minute at which observation was made.

41. Installation will work efficiently under normal head of __________ft.
42. Water is discharged into: __________
43. Was water lowered to pump intake by test? __________
44. Remarks: __________

4N/27 - 28M(1)
M(1)

RECEIVED

February 14, 1957

Mr. Scott Chapman
Box 150
Ordnance, Oregon

Dear Sir:

The results of the well test we made for you February 2, 1957 are as follows:

Static level 48 ft.-----95 ft. column and bowls installed.

12:00 AM	pump started	660 GPM	pumping level	50 ft.
12:15 PM		815 GPM	" "	50 ft.
12:25 PM		1050 GPM	" "	50 ft.
12:30 PM		1100 GPM	" "	50 ft.
12:35 PM		1320 GPM	" "	51 ft.
12:45 PM		1425 GPM	" "	51 ft.
1:00 PM		1460 GPM	" "	51 ft.
1:10 PM		1475 GPM	" "	51 ft.

RECEIVED
SEP 20 1967
STATE ENGINEER
SALEM, OREGON

MORR 611

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM 10, OREGON
within 30 days from the date
of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 3N/27-4 H

State Permit No.

(1) OWNER:
Name CLARK + BERNICE KEY
Address Route # 1 Box 184 A
HERMISTON - OREGON

(2) LOCATION OF WELL:
County MORROW Driller's well number 8
SE ¼ NW ¼ Section 4 T. 3 R. 27N W.M.
Bearing and distance from section or subdivision corner
FROM NE CORNER of section 4
South 1980 Feet West 780 Feet

(3) TYPE OF WORK (check):
[illegible] Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
[illegible]bandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
12" Diam. from 0 ft. to 60 ft. Gage ¼"
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☒ Yes ☐ No
Type of perforator used TORCH
Size of perforations ¼ in. by 6 in.
perforations from 22 ft. to 55 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☐ No
Manufacturer's Name
[illegible]pe Model No.
[illegible]m. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal BENTONITE
Depth of seal 20 ft. Was a packer used?
Diameter of well bore to bottom of seal 16 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 28 ft. below land surface Date 9/25/67
Artesian pressure lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Clark Key
Yield: 200 gal./min. with 20 ft. drawdown after 10 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well below casing 12"
Depth drilled 180 ft. Depth of completed well 180 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifiers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
top soil	ZERO	5
SAND AN GRAVEL	5	55
CLAY	55	85
BASALT	85	110
CLAY	110	150
~~Brokken~~ BROKEN BASALT	~~[illegible]~~	~~175~~
CLAY INTER BEDDED	150	175
BASALT	175	180

Work started JUNE 1 1967 Completed September 1967
Date well drilling machine moved off of well 19

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Clark Key
(Person, firm or corporation) (Type or print)
Address Hermiston Ore RT 1 # 184A
Drilling Machine Operator's License No. self
[Signed]
(Water Well Contractor)
Contractor's License No. Date , 19

(USE ADDITIONAL SHEETS IF NECESSARY)

MORR 616

ORIGINAL
File Original, and Duplicate with the STATE ENGINEER, SALEM, OREGON

MORR 616

WATER WELL DRILLERS REPORT
STATE OF OREGON

Do Not Fill In State Well No. 3N/27 - 4 R(1)
State Permit No. G48

(1) OWNER:
Name Ernest Royster
Address % Carl Knighten
Irrigon, Oregon

(2) LOCATION OF WELL: App G94
County Morrow Owner's number, if any—
R. F. D. or Street No. Rt.1Bx.77 Hermiston, Oregon
Bearing and distance from section or subdivision corner
700'from the E line 1110" from S line
SE corner of section 4 T 3 R 27
4 miles South of Boardman Ore Morrow County Line

(3) TYPE OF WORK (check):
New well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☑
Dug Well ☐

(6) CASING INSTALLED:
Threaded ☑ Welded ☐

FROM	ft. to	ft.	Diam.	Gage or Wall
0	89		12"	

If gravel packed

Diameter of Bore	from ft.	to ft.

Type and size of shoe or well ring 12" steel Size of gravel:
Describe joint threaded

(7) PERFORATIONS:
Type of perforator used None
SIZE of perforations in., length, by in.

FROM	ft. to	ft.	perf per foot	No. of rows

SCREENS: none
Give Manufacturer's Name, Model No. and Size

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☐ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☐ No
If yes, note depth of strata
FROM ft. to ft.
METHOD OF SEALING

(9) WATER LEVELS: 3350 11-21-58
Depth at which water was first found 111 to 135 ft.
Standing level before perforating ft.
Standing level after perforating ft.

Log Accepted by:
[Signed] Ernest J. Royster Owner Dated Aug 25, 1955

(10) WELL TESTS:
Was a pump test made? ☑ Yes ☐ No ? If yes, by whom? Ben Dreyer
Yield: 360 gal./min. with 110 ft. ~~draw down~~ after 8 hrs.
PL.
Artesian flow g.p.m.
Shut-in pressure lbs. per square inch.
Bailer test g.p.m. with ft. drawdown
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☐ No

(11) WELL LOG:
Diameter of well, 12 inches.
Total depth 185 ft. Depth of completed well 185 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

	ft. to		ft.	
0	ft. to	3	ft.	Sandy soil
3	"	25	"	Sandy & gravel
25	"	30	"	Yellow clay
30	"	34	"	Gravel
34	"	50	"	White clay
50	"	89	"	White sand
89	"	111	"	Red clay
111	"	135	"	Shaley black rock some water
135	"	146	"	Red clay
146	"	185	"	Shaley black rock found more water

Ground elevation at well site Appx560 feet above mean sea level.
Work started Aug.6 1955. Completed Aug.22 1955

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ben Dreyer
(Person, firm, or corporation) (Typed or printed)
Address Box 487 Stanfield, Oregon
Driller's well number
[Signed] Ben Dreyer
(Well Driller)
License No. 12 Dated Aug.25, 1955

[redacted]ICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

RECEIVED
AUG 2 - 1971
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

G-5540

[illegible]

MORR
9416

State Well No. 4N/27-20CC
State Permit No.

[redacted] 52

(1) OWNER:
Name Arnold J. Braat
Address Rt. 1 Box 179
Hermiston, Oregon 97838

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

[redacted] CASING INSTALLED:
Threaded ☐ Welded ☒
16" Diam. from 0.0 ft. to 171.5 ft. Gage .250 wall
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[redacted] PERFORATIONS:
Perforated? ☒ Yes ☐ No.
Type of perforator used Mills Knife
Size of perforations 3 in. by 3/16 in.
808 perforations from 144.5 ft. to 170.0 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
To Be tested Aug. 2, or 3, 1971
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
[redacted] " " "
" " " "
Bailer test 60 gal./min. with Neg. ft. drawdown after 2 hrs.
Artesian flow NONE g.p.m.
[redacted]perature of water 55 Depth artesian flow encountered NONE ft.

(9) CONSTRUCTION:
Well seal—Material used Bentonite mixed
Well sealed from land surface to 19.0 ft.
Diameter of well bore to bottom of seal 20 in.
Diameter of well bore below seal 17 in. Drive shoe
Number of sacks of cement used in well seal — sacks
Number of sacks of bentonite used in well seal 3 1/2 sacks
Brand name of bentonite Baroid
Number of pounds of bentonite per 100 gallons of water water Not metered, well mixed lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs 0 Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Morrow Driller's well number 23
S.W. ¼ SW ¼ Section 20 T. 4N R. 27E W.M.
Bearing and distance from section or subdivision corner
70 ft. E. of West property Line
28 ft. N. of South Property Line

(11) WATER LEVEL: Completed well.
Depth at which water was first found 58 ft.
Static level 44.0 ft. below land surface. Date July 30, 1971
Artesian pressure NONE lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 15"
Depth drilled 173.0 ft. Depth of completed well 173.0 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Loose Blow Sand.	0.0	3.0	
Sandy Silt	3.0	21.0	
Med. fine to med. Course	21.0	58.0	
Lt. Brown Sand.			
Med. course, Sharp	58.0	65.0	44.0
Grey Sand.			
Med. Cours. sharp Grey	65.0	110.0	44.0
Sand w/ 5% 1"-gravel.			
Med. Course sharp Grey	110.0	144.0	44.0
Sand 8% to 10% 1" -			
gravels.			
Med. Course to Course	144.0	171.5	44.0
gray sharp Sand,			
Approx. 18% to 20%			
1" - gravels.			
Hard Dense Black	171.5	173.0	
Basalt Rock.			

Work started July 3 1971 Completed July 31 1971
Date well drilling machine moved off of well Aug. 1 1971

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] John L. Brown (Drilling Machine Operator) Date Aug. 1, 1971
Drilling Machine Operator's License No. 481

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name B & B. Drilling Co. (Person, firm or corporation) (Type or print)
Address 1326 Grape St. Sweet Home, Ore.
[Signed] John L. Brown (Water Well Contractor)
Contractor's License No. 516 Date Aug. 1, 1971

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the

STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

WATER WELL REPORT

STATE OF OREGON G-5590

(Please type or print)

(Do not write above this line)

State Well No. 4N/27E-20CC

State Permit No.

Well No. 1

(1) OWNER:

Name

Address

(2) TYPE OF WORK (check):

New Well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:

Threaded ☐ Welded ☐

" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:

Perforated? ☐ Yes ☐ No.

Type of perforator used

Size of perforations in. by in.

perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:

Well screen installed? ☐ Yes ☐ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water Depth artesian flow encountered ft.

[illegible] CONSTRUCTION:

Well seal—Material used

Well sealed from land surface to ft.

Diameter of well bore to bottom of seal in.

Diameter of well bore below seal in.

Number of sacks of cement used in well seal sacks

Number of sacks of bentonite used in well seal sacks

Brand name of bentonite

Number of pounds of bentonite per 100 gallons of water lbs./100 gals.

Was a drive shoe used? ☐ Yes ☐ No Plugs Size: location ft.

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☐ No Size of gravel:

Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County Driller's well number

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found ft.

Static level ft. below land surface. Date

Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing

Depth drilled ft. Depth of completed well ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL

Work started 19 Completed 19

Date well drilling machine moved off of well 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] (Drilling Machine Operator) Date , 19

Drilling Machine Operator's License No.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name (Person, firm or corporation) (Type or print)

Address

[Signed] (Water Well Contractor)

Contractor's License No. Date , 19

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

FARMORE DISTRIBUTING COMPANY
~~BOX [illegible] ATHENA, OREGON~~

WELL TEST LOG

Test Number

Place Arnold Braat

Well Size 15"

Static Level 40'

Pump Setting 130' Plus Bowls

Air Line 135'

Well Depth 170'

Date August 3, 1971

START TIME	RPM CHECK	GPM READING	AIRLINE READING	ORFICE READING	DROP PIPE	MAKE	SIZE	PUMP INSTALLED		WATER CONDITIONER
								SERIAL	MODEL	
11:45	1100	1266	30# @ 97'	16"						Muddy Sandy
12:05	1350	1585	38#	26"	Increase RPM					Sandy
12:30	1650	1910	35#	38"	Increase RPM - Clearing					Sandy
1:30	1900	2370	32#	54"						Sandy
2:25	2000	2588	33#	60"						Sandy
3:00	2000	2588	32#	61"						Clear
3:30	2000	2588	32#	61"						Clear
4:00	2000	2588	32#	61"	~~Shut Down~~					Clear
4:30	2000	2588	32#	61"	Shut Down					

TESTED BY: KEN HEARN.

FARMORE
DISTRIBUTING CO.
PENDLETON, OREGON

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the

STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

MORR
951

WATER WELL REPORT
STATE OF OREGON

RECEIVED
SEP 25 1973
STATE ENGINEER
SALEM, OREGON

(Please type or print)
(Do not write above this line)

G-5548 Well No. 3

State Well No. 4N/27E-28 6
State Permit No. 54

(1) OWNER:
Name Jedediah Aylett
Address Rt. 1 Box 281 Hermiston Oregon 97838

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:
Threaded ☐ Welded ☑
16" Diam. from ft. to 110 ft. Gage .025 Wall
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☑ Yes ☐ No.
Type of perforator used Knife
Size of perforations 3/16 in. by 2 in.
240 perforations from 85 ft. to 100 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Bentonite
Well sealed from land surface to app. 18 ft.
Diameter of well bore to bottom of seal 16 in.
Diameter of well bore below seal 16 in.
Number of sacks of cement used in well seal — sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite Yellow Stone Western Bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☑ Yes ☐ No Plug Concrete Size: location 100 ft.
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? depth of strata 77 ft
Method of sealing strata off
Was well gravel packed? ☑ Yes ☐ No Size of gravel: 2 1/2 Minus
Gravel placed from 0 ft. to 100 ft.

(10) LOCATION OF WELL:
County Morrow Driller's well number
NW ¼ ¼ Section 28 T. 4 N R. 27 East W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 77 ft.
Static level 77 ft. below land surface. Date Aug 7, 1973
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 16"
Depth drilled 110 ft. Depth of completed well 101 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Top Soil (Sand)	0	3	
Pea gravel	3	10	
Fine gravel to Coarse Rock	10	110	
at 65 feet there was	6"	of	
hard calechee.			

Work started July 21 1973 Completed Sept 8 1973
Date well drilling machine moved off of well Aug. 21 1973

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Self Drilled Date , 19
(Drilling Machine Operator)
Drilling Machine Operator's License No.

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Jedediah Aylett
(Person, firm or corporation) (Type or print)
Address Rt. 1 Box 281 – Hermiston, Oregon 97838
[Signed] Jedediah M. Aylett
(Water Well Contractor)
Contractor's License No. Date Aug 28, 1973

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

STATE ENGINEER
Salem, Oregon

G-55HA (3)

OBSERVATION WELL
Well Record

MORR
9160

STATE WELL NO. 4N/27-28[illegible] F(1)
COUNTY ~~Umatilla~~ Morrow
APPLICATION NO. U819

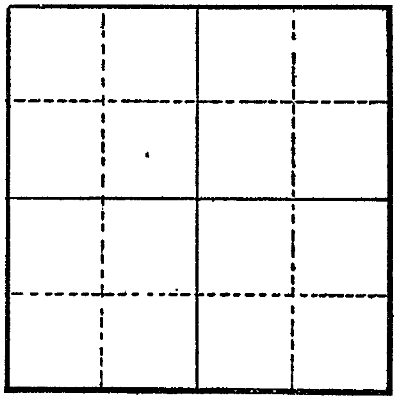
OWNER: J.W. Aylett No 2 ~~Scott~~ Chapman
MAILING ADDRESS: Box 150

LOCATION OF WELL: Owner's No. [illegible] #1
CITY AND STATE: Ordnance Oregon

SW ¼ NW ¼ Sec. 28 T. 4 N. R. 27 E., W.M.

Bearing and distance from section or subdivision corner

Altitude at well 550



Section 28

TYPE OF WELL: Drilled Date Constructed

Depth drilled 119 ft. Depth cased

CASING RECORD: 12 inches.

FINISH:

AQUIFERS: "Pea gravel" from 72 ft. to 80 ft.

WATER LEVEL: 64 feet below land surface. 60.63' (11-10-61)

PUMPING EQUIPMENT: Type Turbine H.P.
Capacity G.P.M.

WELL TESTS:
Drawdown ft. after hours G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Irrigation Temp. °F. , 19
SOURCE OF INFORMATION USGS
DRILLER or DIGGER
ADDITIONAL DATA:
Log x Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:
Reportedly test pumped 820 gpm for 17 hours with no drawdown.

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 4N/27-28[illegible] F(1)
County ~~Umatilla~~ Morrow
Application No.

Well Log

Owner: Scott Chapman Owner's No.

Driller: A.M. Edwards Date Drilled 1954

CHARACTER OF MATERIAL	(Feet below land surface)		Thickness (feet)
	From	To	
Glaciofluviatile deposits:			
Soil, sandy, loose	0	2	2
Gravel, cemented	2	5	3
Boulders, gravel and sand	5	18	13
Hardpan	18	21	3
Boulders	21	31	10
Clay, yellow	31	35	4
Gravel	35	37	2
Clay, blue	37	42	5
Clay, yellow, sandy	42	60	18
Sand, coarse, and "pea Gravel"	60	61	1
Clay, blue, and heavy boulders	61	64	3
Clay, yellow, mixed with gravel	64	72	8
"Pea gravel", sandy, water bearing	72	80	8
Gravel, large and small, mixed	80	87	7
Gravel, cobble-size, and smaller gravel	87	98	11-
Gravel, pebbles	98	101	3
Gravel, cobbles	101	105	4
"Pea gravel" and sand	105	109	4
"Pea gravel" and cobbles	109	119	10

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

RECEIVED
FEB 2 1970
STATE ENGINEER
SALEM, OREGON

13A

MORR
968

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

G1011

State Well No. (2) ± 4N/27-30
State Permit No. G2952

#1 Owners

(1) OWNER:

Name Clarence W. Ruddell
Address 105 E ST.Hermiston Ore.97838

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

[redacted] CASING INSTALLED: Threaded ☐ Welded ☒

16" Diam. from Top ft. to 85 ft. Gage 1/4"
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[redacted] PERFORATIONS: Perforated? ☒ Yes ☐ No.

Type of perforator used Torch & Perforator
Size of perforations 1/4 in. by 4 in.
Torch perforations from 45 ft. to 65 ft.
Perforated perforations from 65 ft. to 80 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.

[redacted] level 55 ft. below land surface Date May 1969
[redacted] pressure lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Columbia Pump
[redacted] 1850 gal./min. with 5 ft. drawdown after 6 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:

Well seal—Material used Bintinnight & cement motor base
Depth of seal 20 ft.
Diameter of well bore to bottom of seal in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 1/4"to3/4 pit run
Gravel placed from 35 ft. to 85 ft.

(11) LOCATION OF WELL:

County ~~Morrow~~ Driller's well number ~~Self~~
E 1/4 1/4 Section 30 T. 4N R. 27E W.M.
Bearing and distance from section or subdivision corner
Center of N. E. 1/4 Sec 30

(12) WELL LOG: Diameter of well below casing ~~16"~~

Depth drilled 85' ft. Depth of completed well 85' ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Soil & Sand	0	6'	
from this pont on the sand			
becamecorser as we went down			
till a corse sand at the			
rock, just under bee gravel			
cased to the bysolt at85'	6'	85"	

RECEIVED
JAN 1 9 1970
STATE ENGINEER
SALEM, OREGON

Work started Feb 1966 Completed Apr 1969
Date well drilling machine moved off of well apr 1969

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] CW Ruddell (Drilling Machine Operator) Date dec, 1969.

Drilling Machine Operator's License No.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME ~~Clarence W. Ruddell~~ (Person, firm or corporation) (Type or print)
Address ~~105 E ST.Hermisten Ore.~~
[Signed] CW Ruddell (Water Well Contractor)
Contractor's License No. Date , 19

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

G-5449

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FEB 24 1970
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

G-4140 30

RECEIVED
FEB 24 1970
STATE ENGINEER
SALEM, OREGON

State Well No. 4N/27-32(bca)
State Permit No. MORR 971

(1) OWNER:
Name Gail Holzapfel
Address Wasco Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☐
16" Diam. from 1 ft. to 111 ft. Gage 5/16
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used Mills Knife
Size of perforations 1/4 in. by 2 1/4 in.
4 perforations from 60 ft. to 105 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 70 ft ft. below land surface Date 4-1968
Artesian pressure lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: 2000 gal./min. with None ft. drawdown after hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Well seal—Material used Clay & Cement 20 ft. 15 yds. Gravel Packed
Depth of seal 111 ft.
Diameter of well bore to bottom of seal 16 in in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 3/4 - 1"
Gravel placed from 20 ft. to 111 ft.

(11) LOCATION OF WELL:
County Morrow Driller's well number #5
NE ¼ NW ¼ Section 32 T. 4N R. 27E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG: Diameter of well below casing 16"
Depth drilled 111 ft. Depth of completed well ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Sand & Gravel	1 ft.	111 ft.	70
Basalt →	Bottom.		70

Work started Feb 1968 Completed April 1968
Date well drilling machine moved off of well April 1968

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Owner. Date , 19
(Drilling Machine Operator)
Drilling Machine Operator's License No.

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Gail Holzapfel
(Person, firm or corporation) (Type or print)
Address Wasco.
[Signed] Gail Holzapfel
(Water Well Contractor)
Contractor's License No. Date 4- , 1968

(USE ADDITIONAL SHEETS IF NECESSARY)

WSB

ORIGINAL
File Original and
Duplicate with the
STATE ENGINEER,
SALEM, OREGON

RECEIV
FEB 25 1957
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

G-3853
~~G534~~ 12

State Well No. 4N/27-32A(1)
State Permit No. MORR 972

(1) OWNER:
Name Roy Gail Holzapfel
Address Wasco
Oregon

(2) LOCATION OF WELL:
County Morrow Owner's number, if any—
NE ¼ NE ¼ Section 32 T. 4N R. 27E W.M.
Bearing and distance from section or subdivision corner
225' S & 1145' W from
NE Corner Sec 32

TYPE OF WORK (check):
Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
andonment, describe material and procedure in Item 11.

4) PROPOSED USE (check):
mestic ☐ Industrial ☐ Municipal ☐
tion ☒ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

CASING INSTALLED:
Threaded ☐ Welded ☒
16" Diam. from 100 ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☒ Yes ☐ No
Type of perforator used Slots
SIZE of perforations ¼ in. by 8 in.
perforations from 46 ft. to 95 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

) SCREENS:
Well screen installed ☐ Yes ☐ No
anufacturer's Name
Model No.
Diam. Slot size Set from ft. to ft.
iam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
s well gravel packed? ☐ Yes ☒ No Size of gravel:
ravel placed from ft. to ft.
Was a surface seal provided? ☒ Yes ■ No To what depth? 4 ft.
Material used in seal— Cement
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Soft Depth of strata 41
Method of sealing strata off

(10) WATER LEVELS:
Static level 65 ft. below land surface Date
Artesian pressure lbs. per square inch Date

Log Accepted by:
[Signed] Roy Gail Holzapfel Date Feb 11, 1957
(Owner)

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller
Yield: 960 gal./min. with no 0 drawdown after 7 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 58 Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well 16 inches.
Depth drilled 106 ft. Depth of completed well 106 ft.

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Sand	1	38
gravel	38	100
Clay	100	106

Work started Nov 9 1956 Completed Dec 10 1956

(13) PUMP:
Manufacturer's Name Worthington
Type: turbon H.P. 50

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Marion Dufo
(Person, firm, or corporation) (Type or print)
Address Roosevelt Wash

Driller's well number

[Signed]
(Well Driller)
License No. 165 Date Feb 11 1957

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

MORR 4N

OBSERVATION WELL

Well Record

STATE WELL NO. 4N/27-32~~I~~J(1)
COUNTY Morrow
APPLICATION NO. U-572, U-573, U-859

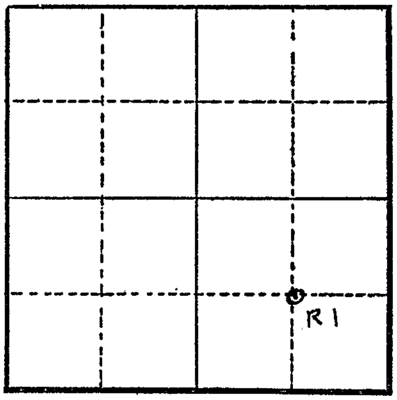
OWNER: Georgia Belle & Roy Gail Holsapfel MAILING ADDRESS: Box 315

LOCATION OF WELL: Owner's No. 2 CITY AND STATE: Wasco, Oregon

SE ¼ SE ¼ Sec. 32 T. 4 N. ~~S~~, R. 27 E. ~~W~~, W.M.

Bearing and distance from section or subdivision corner Well is shown on map as being at the intersection of the qurter -quarter section lines in the SE¼ of Section 32

Altitude at well



Section 32

TYPE OF WELL: drilled Date Constructed Oct. Nov. 53

Depth drilled 310 Depth cased

CASING RECORD: 12 inch

Well abandoned does not exist any longer

FINISH:

AQUIFERS: Basalt, 295 to 310 ft.

WATER LEVEL: 90 ft. below LSD in 1953
75.99' " " 11-10-61

PUMPING EQUIPMENT: Type turbine (Worthington) H.P. 50
Capacity 350 G.P.M.

WELL TESTS:
Drawdown ft. after hours G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Irrigation Temp. °F. , 19
SOURCE OF INFORMATION U-573
DRILLER or DIGGER H. T. Leonard
ADDITIONAL DATA:
Log X Water Level Measurements X Chemical Analysis Aquifer Test

REMARKS: THIS WELL CANCELED FROM CERT.

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 4N/27-32J(1)
County Morrow
Application No. U-572, U-573, U-859

Well Log

Owner: Georgia Belle & Roy Gail Holsapfel Owner's No. 2

Driller: H. T. Leonard Date Drilled Oct. Nov. 1953

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Sandy loam	0	6	6
Sand	6	26	20
Gravel	26	63	37
Gravel and clay	63	90	27
Clay, burnt, and water	90	93	3
Clay	93	110	17
Basalt, black	110	136	36
Basalt, gray	136	157	21
Clay, green, and sand	157	187	30
Basalt, black and water	187	192	5
Basalt, black	192	295	103
Basalt, burnt, water bearing	295	310	15

UMAT
1543

COPY **OBSERVATION WELL**

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM 10, OREGON
within 30 days from the date
of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

dbc
State Well No. 4N/27-22K(1)

State Permit No.

(1) OWNER:
Name U.S. ARMY INSTALLATION
Address ORDNANCE DEPOT

(2) LOCATION OF WELL:
County UMATILLA Driller's well number #2
NW ¼ SE ¼ Section 22 T. 4N R. 27E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
[illegible] Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☑ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
15" Diam. from 0 ft. to 218 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☐ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No
[illegible]facturer's Name
Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal
Depth of seal ft. Was a packer used?
Diameter of well bore to bottom of seal in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth
Was a drive shoe used? ☐ Yes ☐ No
Was well gravel packed? ☐ Yes ☐ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level [illegible] 95 ft. below land surface Date [illegible]3
Artesian pressure lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: 1000 gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG:
Diameter of well below casing 15
Depth drilled 360 ft. Depth of completed well 325 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
DUG PIT (NO RECORD)	0	12
GRAVEL, COARSE, SOME BOULDERS	12	43
SAND & COARSE GRAVEL	43	66
SAND	66	69
SAND & COARSE GRAVEL	69	80
SAND & SMALL GRAVEL	80	95
GRAVEL	95	149
GRAVEL, CEMENTED	149	155
ROCK, HARD, WITH CLAY SEAMS	155	197
CLAY & SHALE	197	204
BASALT, GRAY, HARD	204	207
BASALT, & BLUE CLAY	207	213
BASALT, BLACK	213	215
CLAY, BLUE	215	216
BASALT, BLACK, HARD	216	223
BASALT, BLACK, VERY HARD	223	264
BASALT, GRAY	264	277
BASALT, BLACK, CREVICED	277	282
BASALT, GRAY, HARD	282	288
BASALT, BLACK, HARD	288	296
BASALT, BLACK, HONEYCOMB	296	316
BASALT, BLACK	316	320
BASALT, BLACK, HONEYCOMB	320	330
BASALT, BLACK	330	335

Work started 19 . Completed 1941
OVER
Date well drilling machine moved off of well 19

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME A. A. DURAND & SON
(Person, firm or corporation) (Type or print)
Address
Drilling Machine Operator's License No.
[Signed]
(Water Well Contractor)
Contractor's License No. Date , 19

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

X

1 of 5

State Well No. 4N/27-22 abc K(1

County

Application No.

Water Level Record

OWNER: Umatilla Army Depot

OWNER'S NO. 2

Description of measuring point: S. E. ¼ Sec. 22 T4N R27E Umatilla

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
Mar 50	72		Jan 54	83	
Apr	72		Feb	83	
May	72		Mar	87	
Jun	72		Apr	87	
Jul	72		May	80	
Aug	72		Jun	80	
Sep	76		Jul	80	
Oct	72		Aug	79	
Nov	--		Sep	79	
Dec	--		Oct	78	
Jan 51	--		Nov	78	
Feb	--		Dec	79	
Mar	--		Jan 55	79	
Apr	--		Feb	79	
May	--		Mar	79	
June	--		Apr	79	
			May	80	
			Jun	81	

REMARKS: Records unavailable July 1951 thru December 1953
No static levels recorded before March 1950.

State Printing 39314

STATE ENGINEER
Salem, Oregon

2 of 5

State Well No.
County
Application No.

Water Level Record

OWNER: Umatilla Army Depot OWNER'S NO. 2

Description of measuring point: S. E. ¼ Sec. 22 T4N R27E Umatilla

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
July	80		Jan 57	79	
Aug	80		Feb	77	
Sep	84		Mar		Air Line Broke
Oct	78		Apr	74	
Nov	78		May	72	
Dec	77		Jun	75	
Jan 56	78		Jul		Pump out
Feb	79		Aug		Pump Out
Mar	78		Sep	82	
Apr	78		Oct	82	
May	79		Nov	83	
Jun	79		Dec	87	
Jul	79		Jan 58	85	
Aug	79		Feb	86	
Sep	79		Mar	84.5	
Oct	77		Apr	87	
Nov	77		May	89	
Dec	79		Jun	99	

REMARKS:

State Printing 89314

STATE ENGINEER
Salem, Oregon

3 of 5

State Well No. ....

County ....

Application No. ....

Water Level Record

OWNER: Umatilla Army Depot OWNER'S NO. 2

Description of measuring point: S. E. ¼ Sec. 22 T4N R27E Umatilla

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
Jul 58	89		Jan 60	80	
Aug	89		Feb	79	
Sep	86		Mar	81	
Oct	80		Apr	82	
Nov	81		May	82	
Dec	81		Jun	84	
Jan 59	81		Jul	85	
Feb		Under Repairs	Aug	83	
Mar		" "	Sep	81	
Apr		" "	Oct	80	
May	83		Nov	80	
Jun	89		Dec	80	
Jul	84		Jan 61	80	
Aug	90		Feb	80	
Sep	81		Mar	79	
Oct	80		Apr	81	
Nov	80		May	81	
Dec	80		Jun	81	

REMARKS:

STATE ENGINEER
Salem, Oregon

4 of 5

State Well No.
County
Application No.

Water Level Record

OWNER: Umatilla Army Depot OWNER'S NO. 2

Description of measuring point: S. E. ¼ Sec. 22 T4N R27E Umatilla

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
Jul 61	83		Jan 63	83	
Aug	81		Feb	83	
Sep	82		Mar	83	
Oct	80		Apr	83	
Nov	81		May	83	
Dec	81		Jun	85	
Jan 62	82		Jul	88	
Feb	81		Aug	89	
Mar	--		Sep	87	
Apr	83		Oct	86	
May	83		Nov	85	
Jun	93		Dec	85	
Jul	87		Jan 64	85	
Aug	99		Feb	86	
Sep	85		Mar	88	
Oct	83		Apr	95	
Nov	83		May	98	
Dec	83		Jun	97	

REMARKS:

STATE ENGINEER
Salem, Oregon

5 of 5

State Well No.

County

Application No.

Water Level Record

~~OWNER~~: Umatilla Army Depot OWNER'S NO. 2

Description of measuring point: S. E ½ Sec. 22 T4N R27E Umatilla

Date	Water Level Feet ~~(above)~~ (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
Jul 64	105				
Aug	104				
Sep	102				
Oct	94				
Nov	92				
Dec	92				
Jan 65	92				
Feb	92				
Mar	92				
Apr	89				
May	90				

REMARKS:

89

NC 9 (NEW) Well #7 ac

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

RECEIVED MAR 22 1968 STATE ENGINEER

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED MAY 27 1968 STATE ENGINEER SALEM, OREGON

State Well No. 4N/27-24 B
State Permit No. G-5710

Ronald Baker G-4767 UMAT 1546

(1) OWNER:
Name Chas Jackson
Address Hermiston Ore

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☐
18" Diam. from 0 removed ft. to 20 ft. Gage Thin Wall
16" Diam. from 0 ft. to 151 ft. Gage 250
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☑ Yes ☐ No.
Type of perforator used Mills
Size of perforations 1/4 in. by 4 in.
163 perforations from 75 ft. to 150 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
level 75 ft. below land surface Date 3-15-68
sian pressure lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow NO g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Well seal—Material used Bentonite
Depth of seal 20 ft.
Diameter of well bore to bottom of seal 20 in.
Were any loose strata cemented off? ☐ Yes ☑ No Depth
Was a drive shoe used? ☑ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☐ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Umatilla Driller's well number
NW ¼ NE ¼ Section 24 T. 4 R. 27 W.M.
Bearing and distance from section or subdivision corner
About 15' West of East Side about 115'
North of corner NW of NE 1/4 Section

(12) WELL LOG: Diameter of well below casing 16"
Depth drilled 154 ft. Depth of completed well 151 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Top soil	0	4	0
Cemented Sand & Gravel	4	65	
Sand & Gravel-W.B.	65	91	75
6"- Gravel - W.B.	91	126	
Sand Gravel Aq			
Imbeded Clay seams	126	154	75
Well Cemented back to		151	

Work started Feb 16 1968 Completed 20 Mar 1968
Date well drilling machine moved off of well 3-21 1968

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] W. R. Ille (Drilling Machine Operator) Date 3-21, 1968
Drilling Machine Operator's License No. 499

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME W. R. Ille Drilling Co. (Person, firm or corporation) (Type or print)
Address 2731 NE 132 Ave Portland
[Signed] W. R. Ille (Water Well Contractor)
Contractor's License No. 405 Date 3-21, 1968

(USE ADDITIONAL SHEETS IF NECESSARY)

NC

UMAT 2406

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

RECEIVED
1968
STATE ENGINEER
SALEM, OREGON

RECEIVED
[illegible] 22 1968
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT

STATE OF OREGON

(Please type or print)
(Do not write above this line)

G-5734
G-4246

State Well No. 4N/28-19E
State Permit No.

---

(1) OWNER:

Name MALCOLM SKINNER
Address HERMISTON ORE

(2) TYPE OF WORK (check):

New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:

Threaded ☐ Welded ☐

16" Diam. from 0 ft. to 126 ft. Gage .250
14" Diam. from 65 ft. to 126 ft. Gage 12
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:

Perforated? ☐ Yes ☐ No.

Type of perforator used MILLS
Size of perforations 4 in. by 14 in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from 65 ft. to 125 ft.

(7) SCREENS:

Well screen installed? ☐ Yes ☑ No

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.

Static level 66 ft. below land surface Date 1-26-68
Artesian pressure NO lbs. per square inch Date

(9) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☑ No If yes, by whom? Lane
Yield: 3000 gal./min. with 31 ft. drawdown after 8 hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☑ No

(10) CONSTRUCTION:

Well seal—Material used Bentonite
Depth of seal 18 ft.
Diameter of well bore to bottom of seal 18 in.
Were any loose strata cemented off? ☐ Yes ☑ No Depth
Was a drive shoe used? ☑ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:

County Umatilla Driller's well number
SW ¼ NE ¼ Section 19 T. 4N R. 28E W.M.
Bearing and distance from section or subdivision corner
2000' South 1000' East of N.W. Corner Sec 19

(12) WELL LOG:

Diameter of well below casing 16-14
Depth drilled 126 ft. Depth of completed well 126 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Top Soil	0	3.5	
Cemented Sand & Gravel	3.5	62	
Sand & Gravel	62	97	
6" Minus Gravel Wy	97	110	
Clay deposits water	110	126	
Bearing-Sand & Gravel			

Work started 12-12 1967 Completed 1-25 1968
Date well drilling machine moved off of well 1-26-68 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] W.R. Ille Date 2-25, 1968
(Drilling Machine Operator)

Drilling Machine Operator's License No. 299

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME W. R. Ille
(Person, firm or corporation) (Type or print)

Address 2231 NE 132 ave

[Signed] W.R. Ille
(Water Well Contractor)

Contractor's License No. 405 Date 2-25, 1968

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the

STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT 2420

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
MAR - 7 1977
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 4N/28E-20bb
State Permit No.

(1) OWNER:
Name LeRuen Pollock
Address Highway 30 Hermiston

(2) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
ary ☐ Driven ☐
le ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☒
16" Diam. from -9 ft. to 120 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used Torch
Size of perforations 1/4 in. by 6 in.
110 perforations from 27 ft. to 105 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
iler test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used cement
Well sealed from land surface to -9 to 27 ft.
Diameter of well bore to bottom of seal 30 in.
Diameter of well bore below seal 16 in.
8" ⑥
Number of sacks of cement used in well seal 12½ sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 3" to 6"
Gravel placed from 27 ft. to 30 ft.

(10) LOCATION OF WELL:
County Uma Driller's well number 352
NW ¼ NW ¼ Section 20 T. 4N. R. 28 E W.M.
Bearing and distance from section or subdivision corner
SW corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found ft.
Static level 26 ft. below land surface. Date Feb 24
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing
Depth drilled ft. Depth of completed well ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Gravel 5020 0-6"	30	50	26
Clay Blue	50	75	26
Clay Brown	75	100	26
Clay Brown 7&			
Gravel	100	110	26
Gravelo 4"	110	119	26
Broken Rock			
Basalt	119	130	26

Work started Feb 4 1977 Completed Feb 24 1977
Date well drilling machine moved off of well Feb 24 1977

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] J.R. Frederickson (Drilling Machine Operator) Date Feb 24, 1977
Drilling Machine Operator's License No. B 52

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name J.R. Frederickson (Person, firm or corporation) (Type or print)
Address RT 2 Box 2066
[Signed] J.R. Frederickson (Water Well Contractor)
Contractor's License No. 635 Date Feb 24, 1977

(USE ADDITIONAL SHEETS IF NECESSARY)

UMAT 54971

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

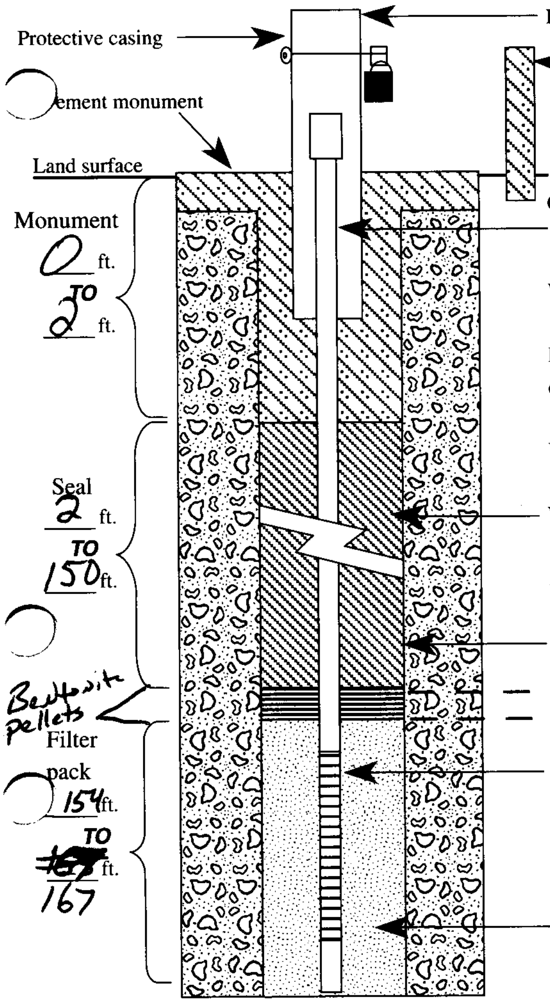
WELL I.D. # L61034
Start Card # 158232

(1) OWNER/PROJECT:
WELL NO. MW 11-8
Name Umatilla Chemical Depot
Address Building 32
City Hermiston State Or. Zip 97838-9544

(2) TYPE OF WORK:
☑ New construction ☐ Alteration (Repair/Recondition)
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD
☑ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Hollow Stem Auger ☐ Other

BORE HOLE CONSTRUCTION
Special Standards Yes ☑ No ☐
Depth of completed well 166 ft.



Monument 0 ft. TO 2 ft.
Seal 2 ft. TO 150 ft.
Filter pack 154 ft. TO 167 ft.

Casing diameter 2 in.
material sch 80 PVC
Welded ☐ Threaded ☑ Glued ☐
Liner diameter ______ in.
material ______
Welded ☐ Threaded ☐ Glued ☐
Well seal:
Material Bentonite grout
Amount 31 bags
Grout weight 10.1
Borehole diameter 6 in.
Bentonite plug at least 3 ft. thick
Screen material sch 80' PVC prepack
interval(s):
From 156 To 166
From ______ To ______
Slot size .010 in. prepack
Filter pack:
Material SAND
Size 10/20 in.

(5) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ______ Yield ______ GPM
Conductivity ______ PH ______
Temperature of water 54 °/C Depth artesian flow found ______ ft.
Was water analysis done? ☐ Yes ☑ No
By whom? ______
Depth of strata to be analyzed. From ______ ft. to ______ ft.
Remarks: ______

Name of supervising Geologist/Engineer Robin Smith

(6) LOCATION OF WELL By legal description
Well Location: County Umatilla
Township 4 ([✓ N] or S) Range 27 ([✓ E] or W) Section 2
1. SE 1/4 of SW 1/4 of above section.
2. **Either** Street address of well location Umatilla Depot Hermiston Or.
or Tax lot number of well location ______
3. **ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.**

(7) STATIC WATER LEVEL:
155.6 Ft. below land surface. Date 10/10/03
Artesian Pressure ______ lb/sq. in. Date ______

(8) WATER BEARING ZONES:
Depth at which water was first found 155.6

From	To	Est. Flow Rate	SWL

(9) WELL LOG:
Ground elevation ______

Material	From	To	SWL
Sand w/gravel	0	4	
Sandy gravel	4	62	
Fine to med. grade sand	62	68	
Sandy gravel	68	75	
gravely sand	75	92	
Coarse to med grade sand	92	118	
Sand w/some silt	118	140	
Silty sand	140	170	155.6
Bentonite Chip 24 bags	2	42	
Bentonite pellets ½ bucket	167	170	

RECEIVED
OCT 22 2003
WATER RESOURCES DEPT
SALEM, OREGON

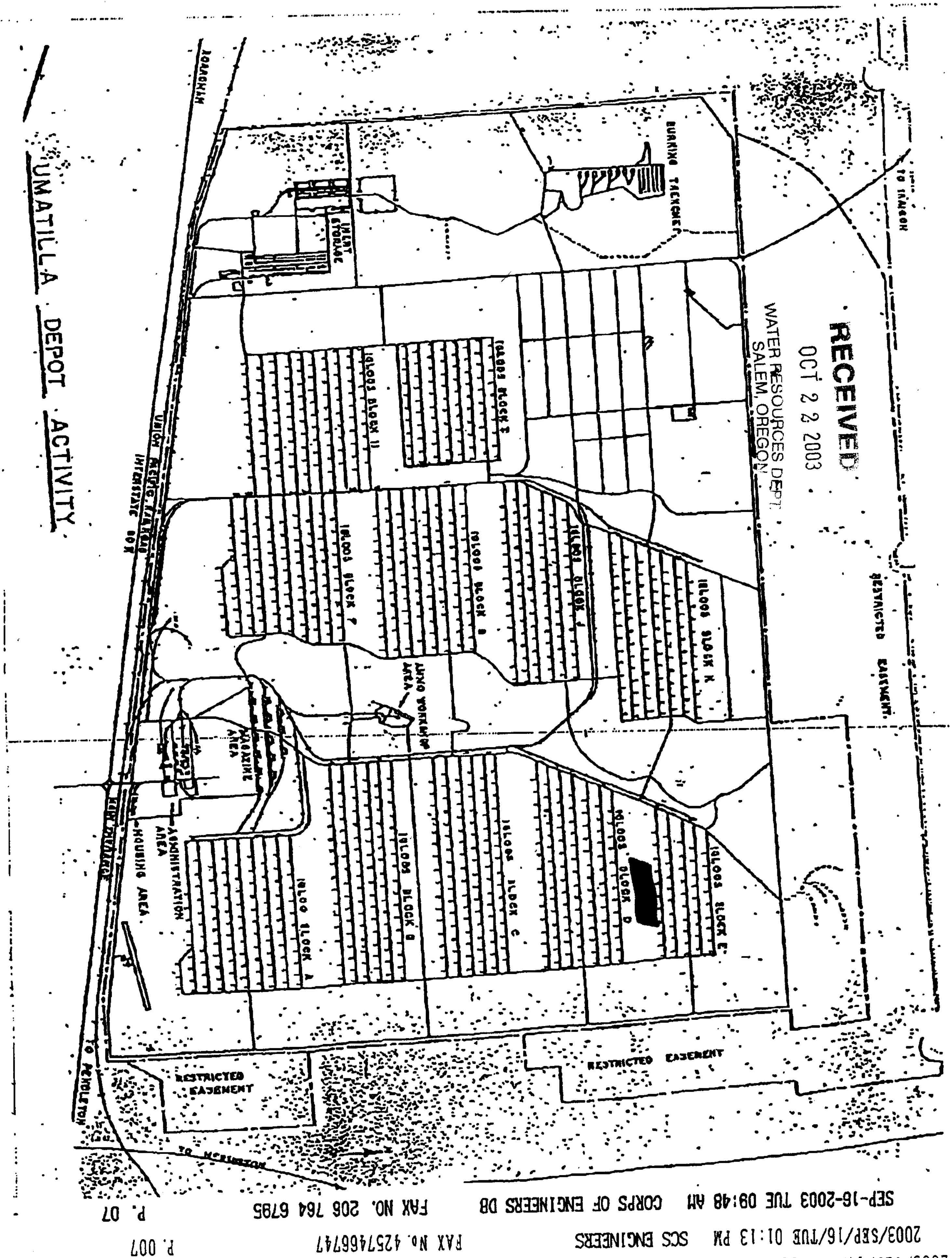
Date started 10/8/03 Completed 10/11/03

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.
MWC Number 10430
Signed ______ Date 10/15/03

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
MWC Number 10054
Signed ______ Date 10/17/03

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

RECEIVED
OCT 22 2003
WATER RESOURCES DEPT
SALEM, OREGON



UMAT 54975

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

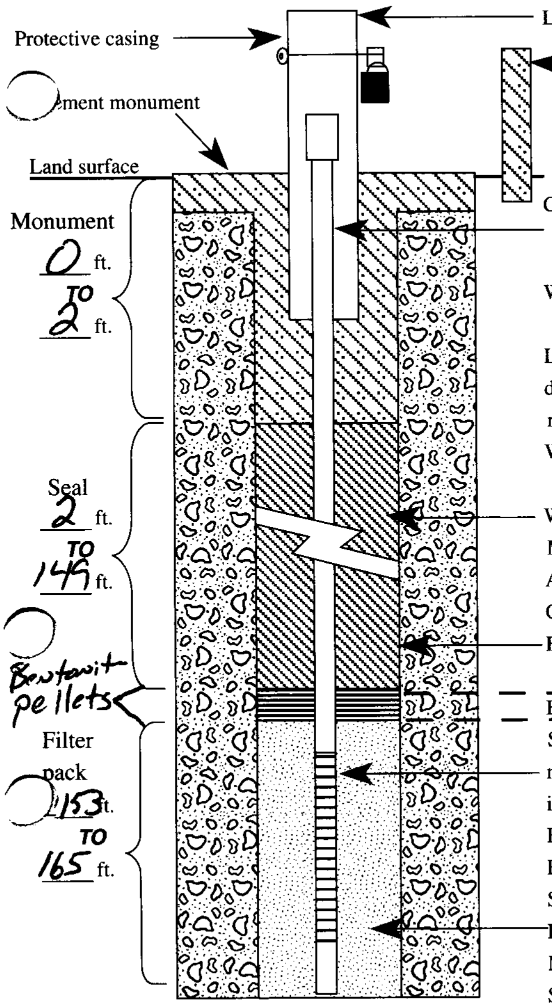
WELL I.D.# L61035
Start Card # 158231

(1) OWNER/PROJECT:
WELL NO. MW 11-7
Name Umatilla Chemical Depot
Address Building 32
City Hermiston State Or. Zip 97838-9544

(2) TYPE OF WORK:
☑ New construction ☐ Alteration (Repair/Recondition)
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD
☑ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Hollow Stem Auger ☐ Other

BORE HOLE CONSTRUCTION
Special Standards Yes ☑ No ☐ Depth of completed well 165 ft.



Monument 0 ft. TO 2 ft.

Seal 2 ft. TO 149 ft.

Bentonite pellets

Filter pack 153 ft. TO 165 ft.

Casing diameter 2 in.
material sch 80 PVC
Welded ☐ Threaded ☑ Glued ☐

Liner
diameter in.
material
Welded ☐ Threaded ☐ Glued ☐

Well seal:
Material Bentonite Grout
Amount 16 bgs
Grout weight 10.1
Borehole diameter 6 in.
Bentonite plug at least 3 ft. thick

Screen
material sch 80 PVC
interval(s):
From 155 To 165
From To
Slot size .010 in. Prepack

Filter pack:
Material Sand
Size 10/20 in.

(5) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability Yield GPM
Conductivity PH
Temperature of water 54 °F/C Depth artesian flow found ft.
Was water analysis done? ☐ Yes ☑ No
By whom?
Depth of strata to be analyzed. From ft. to ft.
Remarks:

Name of supervising Geologist/Engineer Robin Smith

(6) LOCATION OF WELL By legal description
Well Location: County Umatilla
Township 4 ([✓ N] or S) Range 27 ([✓ E] or W) Section 11
1. NE 1/4 of NW 1/4 of above section.
2. **Either** Street address of well location Umatilla Depot Hermiston Or.
or Tax lot number of well location

3. ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:
153 Ft. below land surface. Date 10/13/03
Artesian Pressure lb/sq. in. Date

(8) WATER BEARING ZONES:
Depth at which water was first found 153

From	To	Est. Flow Rate	SWL

(9) WELL LOG:
Ground elevation

Material	From	To	SWL
Gravely Sand	0	2	
Sandy Gravel	2	43	
Sandy Gravel w/trace silt	43	46	
Sandy Gravel	46	65	
Gravely Sand	65	92	
Sandy Gravel	92	110	
Silty Sand	110	114	
Sandy Silt	114	165	153
Bentonite Chips 21 bags	2	42	

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OCT 22 2003
WATER RESOURCES DEPT
SALEM, OREGON

Date started 10/11/03 Completed 10/14/03

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.
MWC Number 10430
Signed Date 10/16/03

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
MWC Number 10054
Signed Date 10/17/03

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

UMAT 54975

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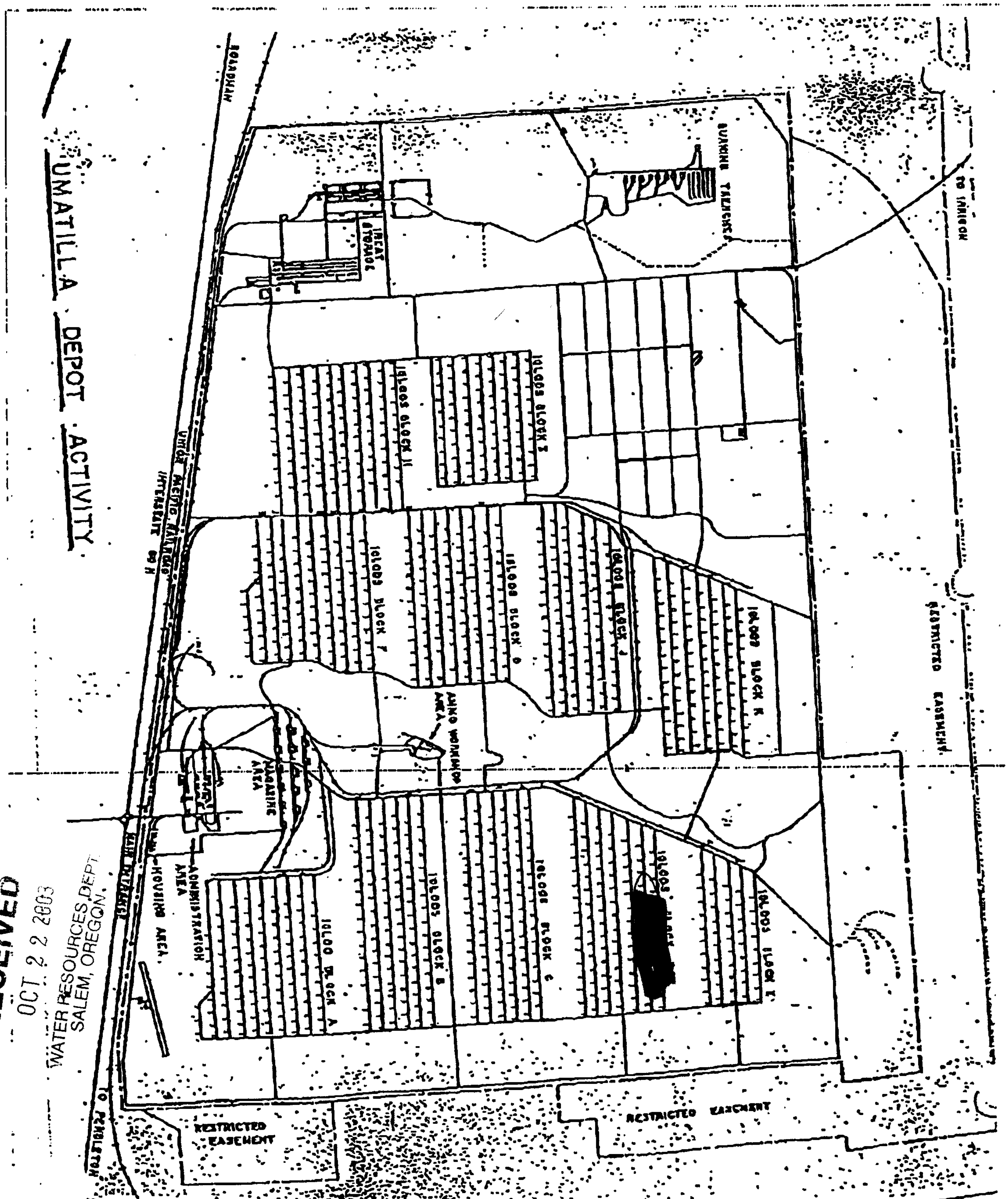
OCT 2 2 2003
WATER RESOURCES DEPT
SALEM, OREGON



SEP-16-2003 TUE 09:48 AM CORPS OF ENGINEERS DB FAX NO. 206 764 6795 P. 05

2003/SEP/16/TUE 01:12 PM SCS ENGINEERS FAX No. 4257466747 P. 005

2003/SEP/17/WED 11:26 AM SCS ENGINEERS FAX No. 4257466747 P. 005

5

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

UMAT 9858

RECEIVED
JUL - 1 1993
WATER RESOURCES DEPT.
SALEM, OREGON

4N/27E/15ca

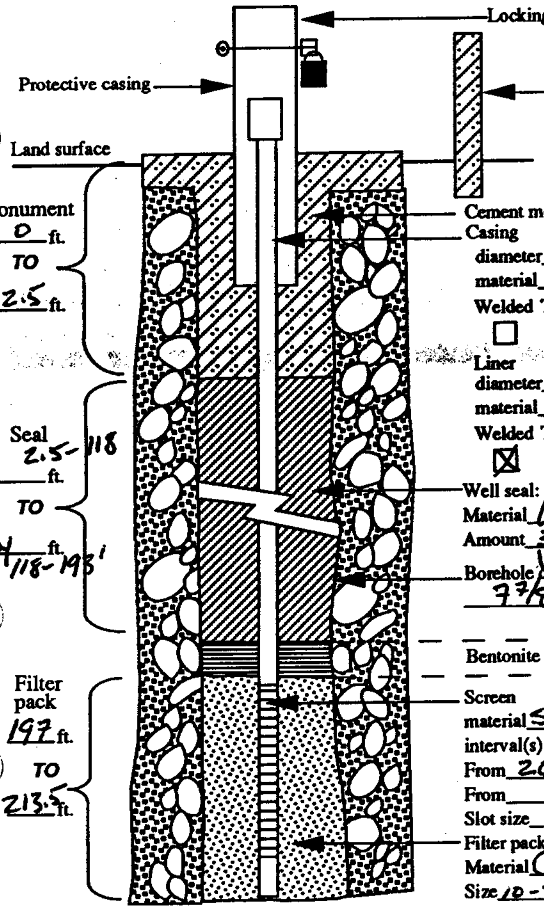
Start Card # 55664

(1) OWNER/PROJECT: 4-21 WELL NO. MW 4-21
Name US. DEPARTMENT OF THE ARMY
Address UMATILLA DEPOT ACTIVITY
City HERMISTON State OR Zip 97837-9544

(2) TYPE OF WORK:
☒ New construction ☐ Repair ☐ Recondition
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Hollow Stem Auger ☐ Other

(4) BORE HOLE CONSTRUCTION
Special Standards Yes ☐ No ☒ Depth of completed well 213.5 ft.



Monument 0 ft. TO 2.5 ft.

Seal Cement 2.5-118 ft. TO Volclay 118-193' ft.

Filter pack 197 ft. TO 213.5 ft.

Casing
diameter 4 in.
material Sch 80 PVC
Welded ☐ Threaded ☒ Glued ☐

Liner set@167'
diameter 8 in.
material steel
Welded ☒ Threaded ☐ Glued ☐

Well seal:
Material Cement/bent
Amount 34sx Volclay 7sx
Borehole diameter 7 7/8 in.

Screen
material S.S wire wrap
interval(s):
From 202 To 212
From To
Slot size 020 in.

Filter pack:
Material Colorado Silica
Size 10-20 in.

(5) WELL TEST:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability Yield GPM
Conductivity PH
Temperature of water 13 °F/[✓ C] Depth artesian flow found ft.
Was water analysis done? ☐ Yes ☐ No
By whom?
Depth of strata to be analyzed. From ft. to ft.
Remarks:

Name of supervising Geologist/Engineer MARK OCHSNER

(6) LOCATION OF WELL By legal description
Well Location: County UMATILLA
Township 4 [✓ N] or S) Range 27 [✓ E] or W) Section 15
1. NE 1/4 of SW 1/4 of above section.
2. Street address of well location Umatilla Army Depot Hermiston, OR
3. Tax lot number of well location N/A
4. ATTACH MAP WITH LOCATION IDENTIFIED.

(7) STATIC WATER LEVEL:
152 Ft. below land surface. Date 11-21-92
Artesian Pressure lb/sq. in. Date

(8) WATER BEARING ZONES:
Depth at which water was first found 123

From	To	Est. Flow Rate	SWL

(9) WELL LOG: Ground elevation 614.6

Material	From	To	SWL
SAND, brown, dry	0	3.5	
sandy GRAVEL, brown	3.5		
to gray, dry		65	
gravelly SAND, gray/	65		
brown, dry		75	
sandy GRAVEL, gray	75		
occasional cobbles, dry			123
to saturated @123'		148	
sandy SILT, grayish/brown	148		
saturated		154.5	
BASALT, gray, slightly	154.5		
weathered, dry to wet		200	
BASALT, green/gray	200	213.5	
highly weathered			

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AUG 25 1993
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 11-15-92 Completed 11-19-92

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

Signed MWC Number 10063
Date 6/21/93

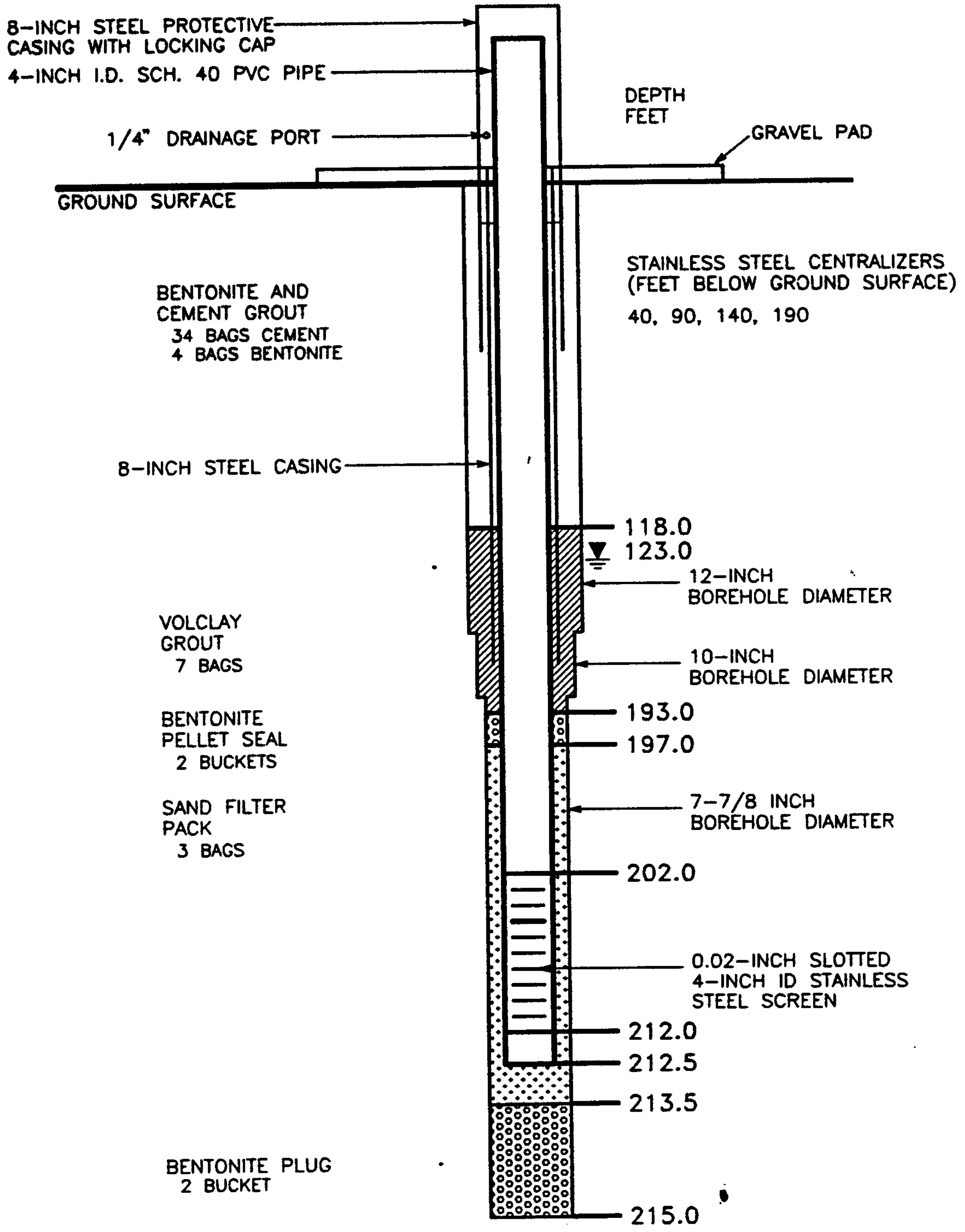
(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed Steve Story MWC Number 10093
Date 6/18/93

UMAT 5858

Well Installation Diagram
Explosive Washout Lagoons
Supplementary Remedial Investigation
UMATILLA, OREGON

Location: 4-21
Installation Date: 11/21/92
Surface Elevation: 614.60 Feet MSL
Top of PVC Elevation: 616.57 Feet MSL



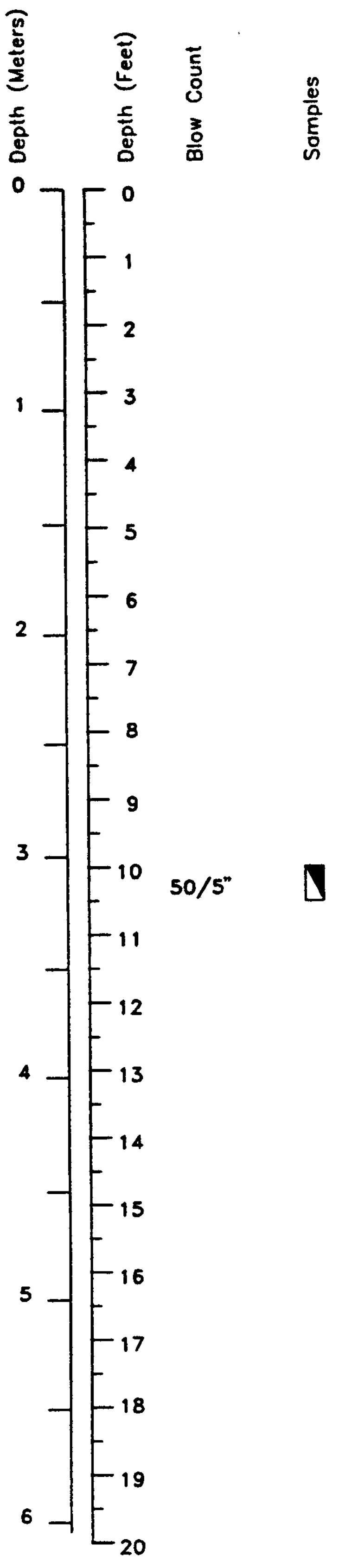
▼ GROUNDWATER ENCOUNTERED DURING DRILLING

NOT TO SCALE

UMAT 5858

BORING 4-21

Surface Elevation: 614.60 Feet
Surface Conditions: Flat Brush and Sand Field (Sage Brush)
Location: Umatilla, OR



Symbols	Description
SP	<u>SAND:</u> BROWN (7.5 YR 5/3), <5-10% FINES, >90-95% FINE TO MEDIUM SAND, ANGULAR QUARTZ AND BASALT, SOME K-FELDSPAR, FELSIC, MICACEOUS, POORLY GRADED, DRY, PLEIST. SAND - CUTTINGS - INCREASE IN ROUNDED, FINE TO MEDIUM GRAVEL, BASALT CLASTS.
GP	<u>GRAVEL:</u> GRAYISH BROWN (10 YR 5/2), <5% FINES, 5-10% FINE TO COARSE SAND (AS ABOVE), PREDOMINANTLY FINE TO COARSE GRAVELS, BASALT, ROUNDED TO SUBROUNDED, POORLY GRADED, DRY, VERY DENSE <u>GRAVEL:</u> AS ABOVE, CUTTINGS, DRY

PLATE
LOG OF BORING

A2-RI
B.1*-22

Dames & Moore

BORING 4-21 (CONTINUED)

Location: Umatilla, OR

Depth (Meters)	Depth (Feet)	Blow Count	Samples	Symbols	Description
	20				SANDY GRAVEL: GRAYISH-BROWN (10 YR 5/2). 30% FINE TO COARSE SAND, 70% MEDIUM TO COARSE GRAVELS, POORLY GRADED, DRY, DENSE, OCCASIONAL COBBLE SIZE BASALT CLASTS. SAND IS ANGULAR, PREDOMINATLY FELSIC, QUARTZ, K – FELDSPAR, MICACEOUS, GRAVELS ARE ANGULAR BASALT FRAGMENTS. –CUTTINGS
	21				
	22				
7	23				
	24				
	25				– CUTTINGS ARE AS ABOVE – VERY DRY.
	26				
8	27				
	28				
	29				SANDY GRAVEL: GRAYISH BROWN (10 YR 5/2), 20% FINE TO COARSE SAND, <5% FINES, 75% COARSE GRAVELS, POORLY GRADED, DRY, DENSE TO VERY DENSE, SAND IS PREDOMINANTLY QUARTZ AND BASALT, FELSIC, MICACEOUS, GRAVELS ARE ANGULAR, BASALT FRAGMENTS, FRESH.
9	30	50/6"	▨	GP	
	31				END OF DAY
	32				
10	33				
	34				
	35				– CUTTINGS AS ABOVE, HARD DRILLING
11	36				
	37				
	38				
	39				
12	40				

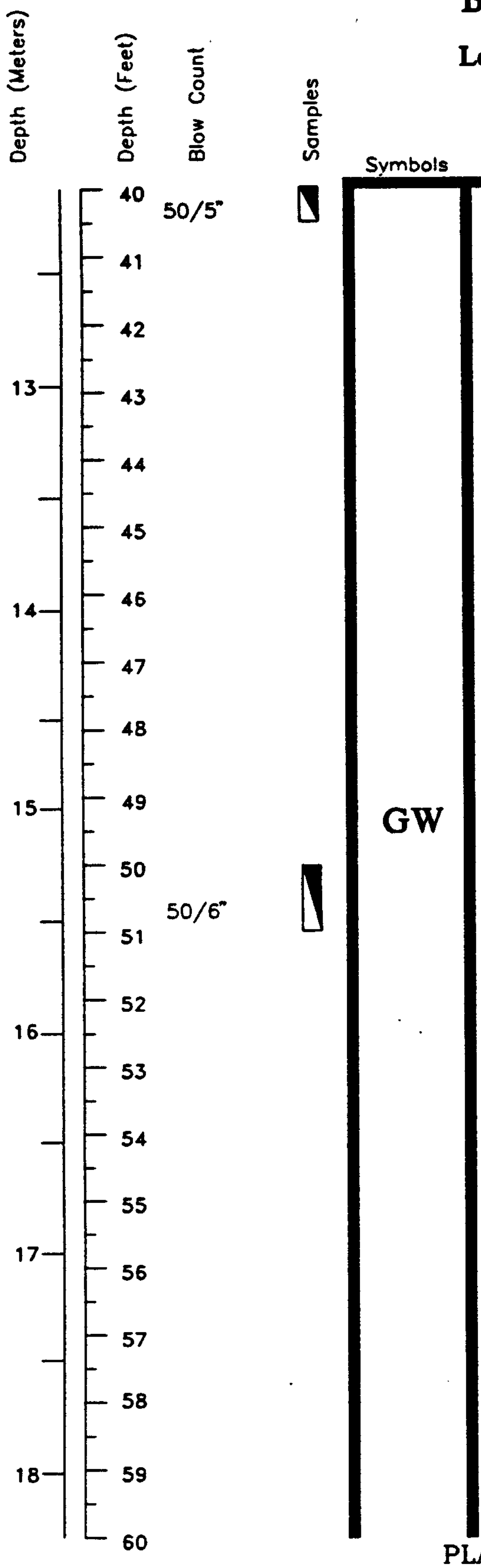
PLATE
LOG OF BORING

A2-RI
B.1*-23

Dames & Moore

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

SANDY GRAVEL: GRAYISH BROWN (10 YR 5/2), <5% FINES, 25% FINE TO COARSE SAND, 75% MEDIUM TO COARSE GRAVELS, WELL GRADED, DRY, DENSE, SAND IS ANGULAR, FELSIC, PREDOMINANTLY QUARTZ AND BASALT, SOME K-FELDSPAR. GRAVELS ARE SUBROUNDED BASALT, OCCASIONAL ANGULAR BASALT FRAGMENTS, ALLUVIUM

- BECOMING MORE MAFIC

SANDY GRAVEL: GRAYISH BROWN (10 YR 5/2), <5-10% FINES, 35% FINE TO COARSE SAND, ANGULAR, PREDOMINANTLY BASALT, MAFIC, >55% FINE TO COARSE GRAVELS, ANGULAR TO SUB-ROUNDED, BASALT CLASTS AND FRAGMENTS, WELL GRADED, DENSE, ALLUVIUM

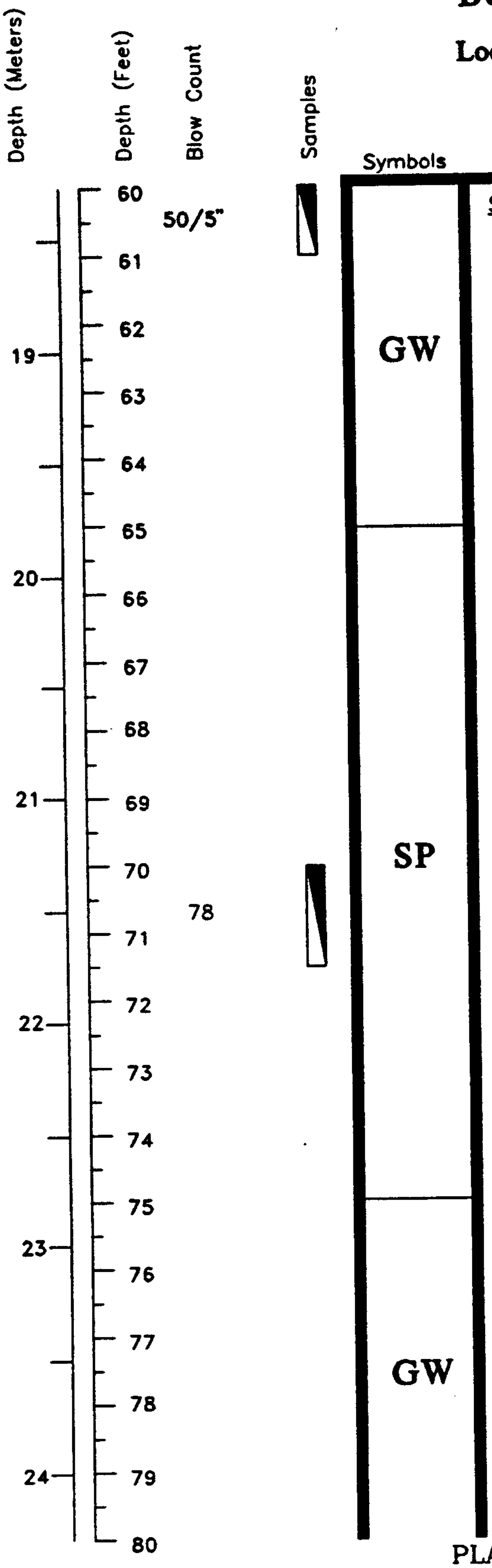
- CUTTINGS ARE PREDOMINANTLY SAND AND GRAVEL HIGHLY MAFIC, PREDOMINANTLY BASALT.

PLATE
LOG OF BORING

A2-RI
B.1*-24

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

SANDY GRAVEL: GRAY (7.5 YR 5/0), 35% FINE TO COARSE SAND, ANGULAR TO SUBROUNDED, MAFIC, PREDOMINANTLY BASALT, 65% FINE TO MEDIUM GRAVELS, SUBROUNDED BASALT, DRY, WELL GRADED.

- SAND INCREASING WITH DEPTH

GRAVELLY SAND: GRAY BROWN (10 YR 5/2), < 5% FINES, 25% ANGULAR TO SUBROUNDED BASALT GRAVELS, 75% FINE TO COARSE SAND, ANGULAR TO SUBROUNDED, POORLY GRADED, DRY, DENSE

- INCREASING GRAVEL WITH DEPTH

- CUTTINGS ARE SANDY GRAVEL, WELL GRADED

PLATE
LOG OF BORING

A2-RI
B.1*-25

Dames & Moore

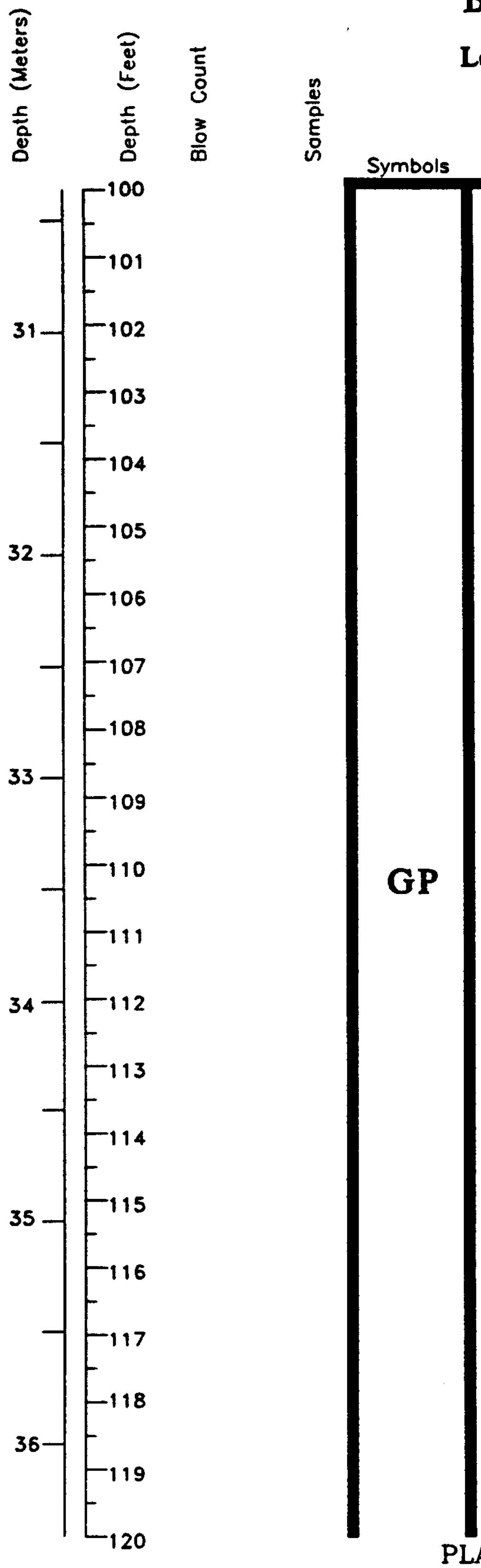
BORING 4-21 (CONTINUED)

Location: Umatilla, OR

Depth (Meters)	Depth (Feet)	Blow Count	Samples	Symbols	Description
	80	50/5"	◪		GRAVEL: GRAY (10 YR 5/0), < 5% FINES, < 10% FINE TO MEDIUM SAND, PREDOMINANTLY ANGULAR TO SUBROUNDED BASALT GRAVELS, POORLY GRADED, DENSE, DRY
	81				
25	82				
	83				
	84				
26	85				– GRAVEL BECOMES ROUNDED TO WELL ROUNDED
	86				
	87				
	88				
27	89				GRAVEL: GRAY (10 YR 5/0), 10% FINE TO COARSE SAND, ANGULAR BASALT, PREDOMINANTLY ROUNDED, FINE TO MEDIUM BASALT GRAVEL, POORLY GRADED, DRY, OCCASIONAL 1–2" PIECES OF HIGHLY VESICULAR BASALT
	90	50/6"	◪	GP	
	91				
28	92				
	93				
	94				
29	95				– DRILLING BECOMES VERY HARD, 4–6" COBBLES IN CUTTINGS
	96				
	97				
	98				
30	99				
	100				

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

SANDY GRAVEL: GRAY (10 YR 5/0), < 5% FINES, 45% FINE TO COARSE ANGULAR SAND, PREDOMINANTLY BASALT, MAFIC, SOME QUARTZ, 55% ANGULAR TO SUBROUNDED BASALT GRAVELS, POORLY GRADED, DRY, DENSE

GRAVEL: GRAY (10 YR 5/0), < 5% FINES, < 10% FINE TO COARSE SAND, PREDOMINANTLY ROUNDED TO ANGULAR BASALT, POORLY GRADED, DRY, VERY DENSE

- CUTTINGS BECOME MOIST AT 115', SANDY GRAVEL

- CUTTINGS BECOME DRY AT 117', HARD DRILLING AT 118'

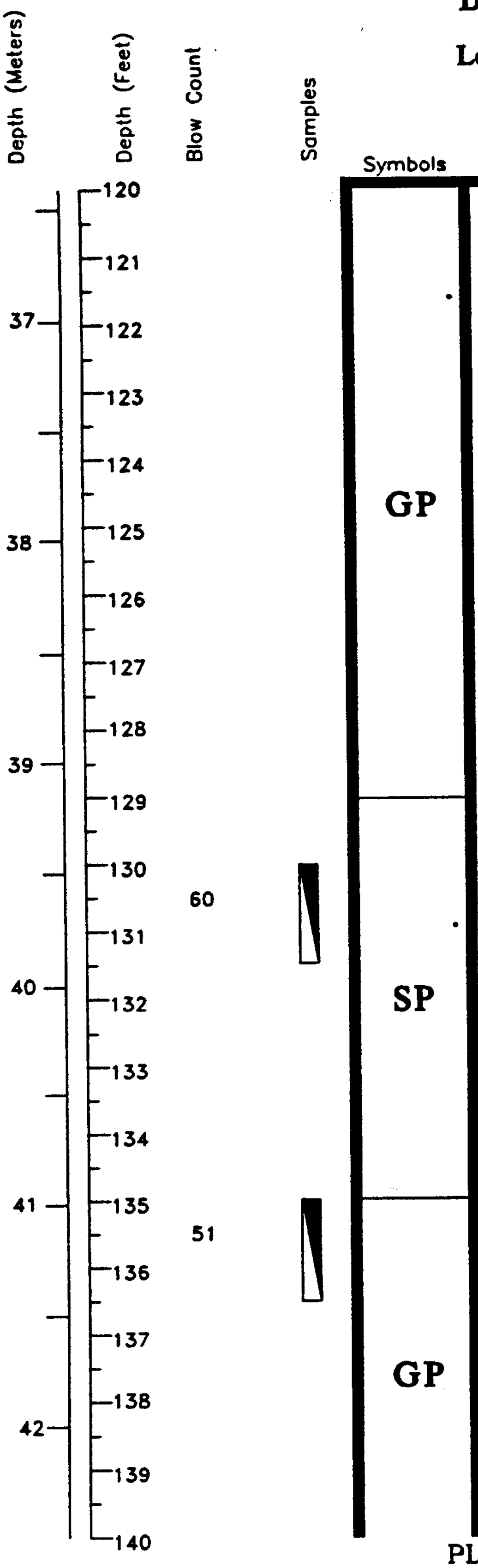
PLATE
LOG OF BORING

A2-RI
B.1*-27

Dames & Moore

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

GRAVEL: GRAY (10 YR 5/0), LITTLE OR NO FINES, PREDOMINANTLY SUBROUNDED TO ROUNDED BASALT GRAVEL, OCCASIONAL ANGULAR FRAGMENTS, DRY, VERY DENSE TO HARD, NO SPOON COLLECTED DUE TO VERY HARD DRILLING, POORLY GRADED

- CUTTINGS BECOME SATURATED AT 123' BGS

- CUTTINGS BECOME FINER WITH DEPTH

- CUTTINGS BECOME COARSE SAND TO FINE GRAVEL

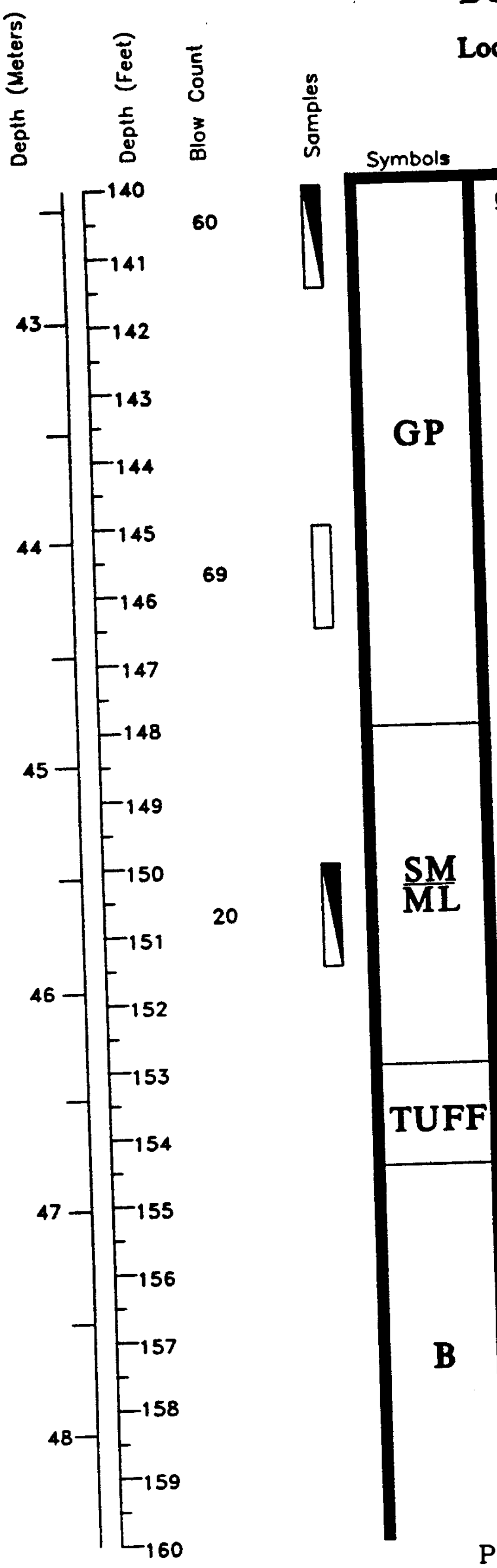
GRAVELLY SAND: GRAYISH-BROWN (10 YR 5/2), < 5% FINES, 20-25% FINE TO MEDIUM ANGULAR BASALT GRAVELS, 75-80% FINE TO COARSE SAND, PREDOMINANTLY COARSE, ANGULAR, BASALTIC, HIGHLY MAFIC, SATURATED, DENSE

- CUTTINGS BECOME FINE GRAVELS, SATURATED.

GRAVEL: GRAY TO DARK GRAY (7.5 YR 4/0), <5% FINES, < 10% MEDIUM TO COARSE SAND, PREDOMINANTLY FINE TO MEDIUM ROUNDED TO SUBROUNDED BASALT, SATURATED, DENSE, HIGHLY MAFIC

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

GRAVEL: GRAY (7.5 YR 4/0), < 5% FINES, 5–10% MEDIUM TO COARSE SAND, SUBROUNDED BASALTIC, > 90% FINE TO MEDIUM GRAVELS, SUBROUNDED BASALT, SLIGHTLY WEATHERED, SATURATED, DENSE

NO RECOVERY

- CUTTINGS INDICATE FINE TO MEDIUM GRAVELS (BASALT)

INCREASING FINES WITH DEPTH

SANDY SILT: DARK GRAYISH BROWN (2.5 Y 4/2), 60% FINES, 40% VERY FINE TO FINE ANGULAR SAND, FELSIC, SATURATED, NON-PLASTIC, SOFT TO MEDIUM STIFF, OCCASIONAL FINE BASALT GRAVELS

FRAGMENTS OF LIGHT TAN CEMENTED ASH (TUFF) AT 163'

- HARDER DRILLING AT 154'
- REFUSAL AT 154.5' BGS WITH BECKER RIG

BASALT: DARK GRAY (7.5 YR 4/0), SLIGHT TO MODERATE WEATHERING, VESICULAR, WEATHERED HORIZONTAL FRACTURING, RECOVERING CHIPS FROM CYCLONE, DRY

PLATE
LOG OF BORING

A2-RI
B.1*-29

Dames & Moore

BORING 4-21 (CONTINUED)

Location: Umatilla, OR

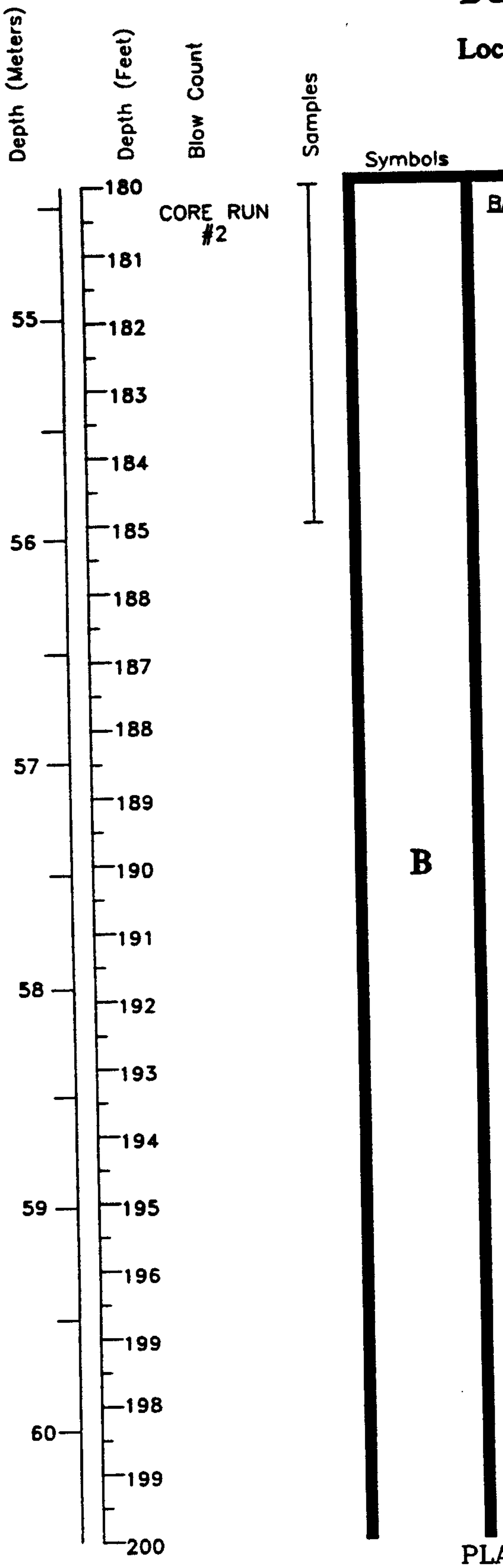
Depth (Meters)	Depth (Feet)	Blow Count	Samples	Symbols	Description
	160				– BASALT CHIPS DISCHARGING FROM CYCLONE
	161				
49	162	CORE RUN #1			BASALT; LIGHT GRAY (2.5 Y 6/0), VESICULAR BASALT, FINE GRAINED, OCCASIONAL (Ca) PLAG. IN MAFIC MATRIX, HORIZONTAL FRACTURING WITH SOME (Fe) STAINING AT 166–167' NO PHENOCRYSTS, NO PYRITE, CHLORITE, CALCITE MINERALS
	163				
	164				– SIMILAR TO TOP FLOW ENCOUNTERED AT 4–19. COMPETENT ROCK RQD = 38% RECOVERY = 100%
50	165				
	166				– SET 8" CASING FROM SURFACE TO 167' – CEMENTED IN PLACE
	167				
51	168				– SOME H_2O RETURN AT 168–169' – CUTTINGS ARE FRESH BASALT CHIPS, SOME WATER
	169				
	170			B	
	171				
52	172				
	173				
	174				
53	175				– CUTTINGS ARE FRESH BASALT CHIPS, LESS WATER
	176				– CONTINUE DRILLING WITH 5 1/2" HAMMER
	177				– BECOMES VERY DRY AT 175–180', BLUE-GRAY BASALT DUST FROM CYCLONE
54	178				
	179				
	180				

PLATE
LOG OF BORING

A2-RI
B.1*-30

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

BASALT: LIGHT GRAY (2.5 Y 6/0), FRACTURED BASALT, APHANITIC, BECOMES FRACTURED AND WEATHERED AT 182–183', OCCASIONAL VERTICAL FRACTURING, SIGNIFICANT CHLORITE FILLING AT 184', BLUE GREEN COLOR, DRY

- BASALT IS FRESH AT 180–181', BECOMES MORE FRACTURED WITH DEPTH
  RQD = 66% RECOVERY = 100%

- VERY HARD DRILLING AT 185', FRESH BASALT CHIPS DISCHARGING

- BASALT DUST: (BLUE GRAY) VERY DRY

- TOOL DROP FROM 189–191', FRACTURE ZONE ?

- DRILLING BECOMES HARD AGAIN AT 191'

- VERY HARD AND DRY, FRESH BASALT CHIPS AS ABOVE

- DRILLING BECOMES SOFTER AT 199' WILL CORE AT 200'

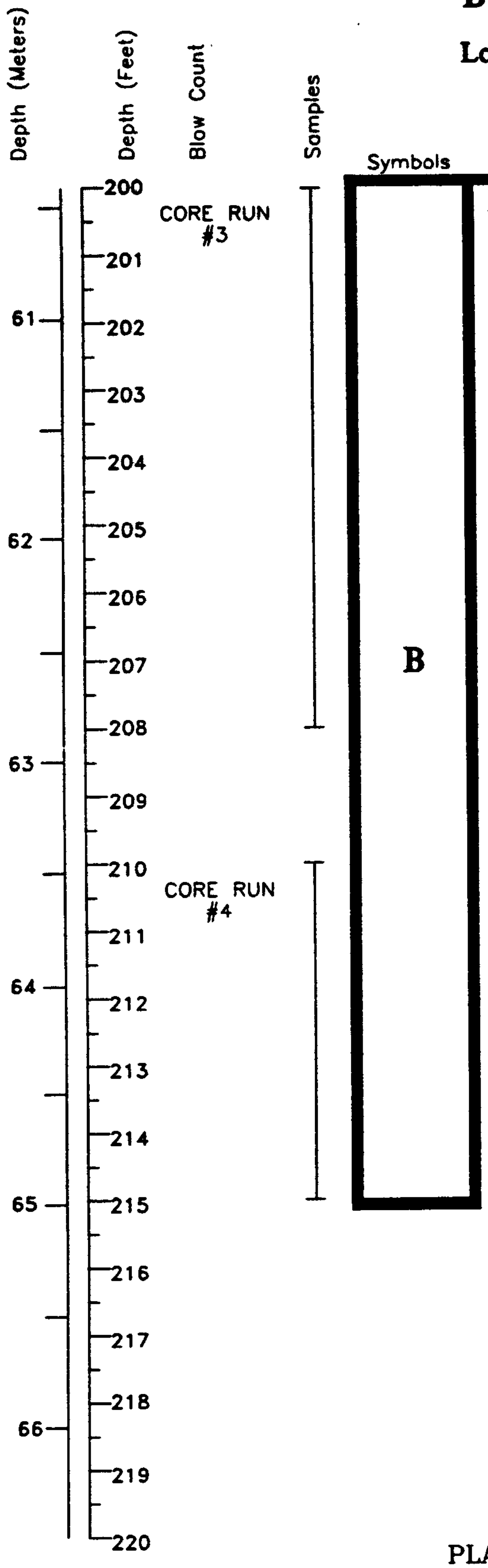
PLATE
LOG OF BORING

A2-RI
B.1*-31

Dames & Moore

BORING 4-21 (CONTINUED)

Location: Umatilla, OR



Description

BASALT: GREEN GRAY, (5 G 6/1), POOR RECOVERY, HIGHLY WEATHERED, CHLORITIZED ZONES, ROCK WAS OBVIOUSLY ROLLED AROUND IN CORE BARREL, BECOMES VESICULAR AT 202'. NO RECOVERY FROM 202–208', DRY, SELAH INTERBED ?
RQD = 8% RECOVERY = 25%

– CLEAN HOLE WITH 5 1/2" HAMMER TO 210'. CUTTINGS ARE GREENISH BASALT (CHLORITE)

BASALT: GREEN GRAY, (5 G 6/1), HIGHLY WEATHERED, VESICULAR BASALT, CHLORITIZED TO 213'.
BECOMES LIGHT GRAY (4.5 Y 6/0), APHANITIC BASALT, FRESH, MINOR VESICLES FILLED WITH SECONDARY CALCITE – COMPETENT ROCK
NO RECOVERY FROM 214–215'
RQD = 33% RECOVERY = 80%

BORING COMPLETED AT A DEPTH OF 215 FEET BGS. REAM HOLE TO 215' ON 11/19/92.

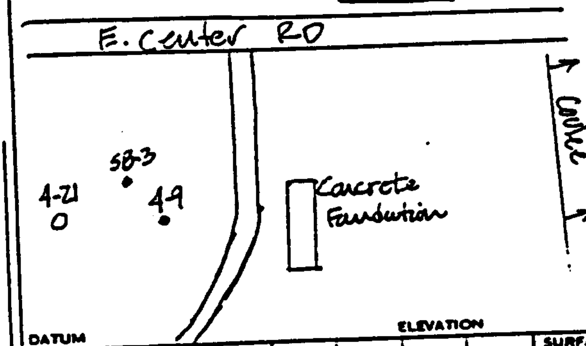
GROUNDWATER ENCOUNTED AT 123' DURING DRILLING, SHALLOW AQUIFER

PLATE
LOG OF BORING

A2-RI
B.1*-32

Dames & Moore

LOCATION OF BORING Surv. Bnld N
E. Center RD



JOB NO. 06762-086-111
CLIENT USATHAMA
LOCATION Umatilla OR
BORING NO. 4-21
SHEET 1 OF 11
DRILLING METHOD: Becker Hammer Triple wall Csg: 12" 9" 6" reverse circ.
SAMPLING METHOD: Calif. Split spoon 3" x 18" 140# ext. hammer 30" drop

WATER LEVEL					
TIME					
DATE					
CASING DEPTH					

DRILLING
START TIME 1600
START DATE 11/15/92
FINISH TIME
FINISH DATE

DATUM
ELEVATION
SURFACE CONDITIONS: Flat, brush: Sand field (Sage Brush)

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	~~DEPTH OF CASING~~ TIME	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF RINGS~~ OVM	DEPTH IN FEET	SOIL GRAPH	
						0		
						1		SAND: Brown (7.5YR 5/3), <5-10% fines, >90-95% f-m Sand - angular quartz: basalt, some ksp. felsic, micaceous, poorly graded, dry, most sand -cuttings-
Grab	– / –	1605	– / –	–	0.0	2	SP	
						3		- increase in rounded f-m gravel, basalt clasts
						4		
						5		
						6		
						7		
						8		
						9		GRAVEL: Grayish Brown (10YR 5/2), <5% fines, 5-10% f-c Sand (As Above), Pred. f-c gravels, basalt, rounded to subrounded, poorly graded, dry, v. dense.
U	5" / 5"	1615	1 / 10.0	50-5	0.0	10	GP	
						1		
						2		
						3		
						4		
						15		
						6		GRAVEL: As Above -cuttings- dry
						7		
						8		
						9		
						20		

DRILLING CONTR. Layne Env.

No.162888

BY Marla Ochsner
DATE 11/15/92 CHK'D BY

620.1 (3) (REV. 11-80)

Dames & Moore

LOCATION OF BORING See page 1	JOB NO. 06702-086-111	CLIENT USATHAMA	LOCATION Umatilla OR
	DRILLING METHOD: See page 1		BORING NO. 4-21
	SAMPLING METHOD:		SHEET 2 of 11
			DRILLING START / FI TIME DATE
DATUM / ELEVATION	WATER LEVEL / TIME / DATE / CASING DEPTH		

DRILLING CONTR Layne Env.

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	~~DEPTH OF CASING~~ TIME	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF JARS~~ OVM	DEPTH IN FEET	SOIL GRAPH	
cuttings	– / –	1625	– / –	—	0.0	20	GP	SANDY GRAVEL : Grayish-Brown (10YR 5/2), 30% f-c Sand, 70% m-c gravels, poorly graded, dr
						1		dense, occassional cobble size basalt clasts. Sand is angular, pred. felsic, quartz, ksp, baslt
						2		gravels are angular basalt fragments -cuttings-
						3		
						4		
						5		-cuttings are as Above - v. dry.
						6		
						7		
						8		
						9		SANDY GRAVEL: Grayish-Brown (10YR 5/2). 20% f-c
						30	GP	Sand, <5% fines, 75% c gravels, Poorly graded dry, dense to v. dense, Sand is pred. quartz,
U	6" / 6"	1645	2 / 30	50/6"	0.0	1		: basalt, felsic, micaceous, gravels are angular basalt fragments - fresh.
						2		End of dr
						3		
						4		
						5		- Cuttings As Above Hard drilling
						6		
						7		
						8		
						9		
						40		

BY Mark Ochsner DATE 11/15/92 CHK'D BY

028.1 (2) (REV. 11-80)

Dames & Moore

CATION OF BORING

See page 1

JOB NO.	CLIENT	LOCATION
06702-086-111	USATHAMA	Umatilla OR

BORING NO. 4-21

SHEET 3 OF 11

DRILLING METHOD: See page 1

SAMPLING METHOD:

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DRILLING

START	FIN
TIME	TI
DATE	DA

TUM

ELEVATION

SURFACE CONDITIONS:

TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH	
						40	GW	SANDY GRAVEL: Grayish Brown (10YR5/2), <5% fine 25% f-C. Sand, 75% M-C gravels, well graded, dry, dense. Sand is angular, felsic, Pred quartz & basalt - Sme kspar. gravels are Subrounded basalt occassional angular basalt fragments. Alluvium
	5" / 4"	1700	3 / 40.0	505"		1		
						2		
						3		Eodrahn
						4		- becoming more mafic.
						45		
						6		
						7		
						8		
						9		SANDY GRAVEL: Grayish Brown (10YR5/2) <5-10% fi 35% F-C. Sand, angular, pred basalt, mafic, 55% F-C gravels, angular to Subrounded, ba clasts and fragments, well graded, dense Alluvium
						50	GW	
1	12 / 10	0800	4 / 50.0	49/5.0"	0.0	1		
						2		
						3		
						4		
						5	GW	- Cuttings are pred. Sand & Gravel highly mafic - Pred basalt.
						6		
						7		
						8		
						9		
						60		

Dames & Moore

LOCATION OF BORING: See page 1	JOB NO. 06702 086-111	CLIENT USATHAMA	LOCATION Umatilla OR
	DRILLING METHOD:		BORING NO. 4-21
	SAMPLING METHOD: See page 1		SHEET 4 OF 11
DATUM	ELEVATION		DRILLING START / FINISH

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

	START	FINISH
TIME		
DATE		

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF RINGS~~ OVA	DEPTH IN FEET	SOIL GRAPH	
						60	GW	SANDY GRAVEL: Gray (7.5YR 6/0), 35% F-c San angular to subrounded, mafic, pred. basalt. 65% F-m gravel, subrounded basalt, dry, wel
4	12/10	0830	5/60.0	50/4.5"	0.0	1		
						2		
						3		Sand increasing w/ depth - ~~Cuttings become~~
						4		
						5		
						6		
						7		
						8		
						9		
						70	SP	GRAVELLY SAND: Gray ~~7.5YR~~ Brown (10YR 5/2), <5% fines, 25% angular to subrounded basalt gravel; 75% F-c Sand, angular to subrounded, Poorly graded, dry, dense
U	18/15	0845	6/70.0	17/20/48	0.0	1		
						2		
						3		
						4		increasing gravel w/ depth
						5		
						6	GW	- Cuttings are Sandy Gravel, well graded
						7		
						8		
						9		
						80		

No. 162892

DRILLING CONTR. Layne West.

BY Mark Ochsner

DATE 11/16/92 CHK'D BY

028 1 (2) (REV 11-80)

No.1b2893

Dames & Moore

LOCATION OF BORING: See page 1

JOB NO.

CLIENT

LOCATION

BORING NO. 4-21

SHEET 5 OF 11

DRILLING METHOD:

SAMPLING METHOD: See page 1

DRILLING START TIME | FINIS TIM

DATE | DAT

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DATUM

ELEVATION

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF OVA	DEPTH IN FEET	SOIL GRAPH	
U	5/5"	0930	7/80.0	50/5"	0.0	80	GP	GRAVEL: Gray (10YR 5/0), <5% fines, <10% f-m Sand, Pred. angular to Subrounded basalt gravels, poorly graded, dense, dry
	/		/			1		
	/		/			2		
	/		/			3		
	/		/			4		
	/		/			5		Gravel becomes rounded to well rounded
	/		/			6		
	/		/			7		
	/		/			8		
	/		/			9		
	/		/			90	GP	GRAVEL: Gray (10YR 5/0), 10% F-c Sand, angu basalt, Pred. rounded F-m basalt gravel; poorly graded, dry, occassional 1-2" pieces of highly vesicular basalt
U	6"/6"	1015	8/90.0	50-6"	0.0	1		
	/		/			2		
	/		/			3		
	/		/			4		
	/		/			5		- Drilling becomes V. HARD 4-6" Cobbles in cuttings
	/		/			6		
	/		/			7		
	/		/			8		
	/		/			9		
	/		/			100		

DRILLING CONTR Layne Envi

BY Mark Ochsner

DATE 11/16/92 CHK'D BY

(REV. 11-80)

Dames & Moore

LOCATION OF BORING See page 1	JOB NO. 06702-086-11	CLIENT USATHAMA		LOCATION Umatilla C
	DRILLING METHOD:			BORING NO. 4-21
	SAMPLING METHOD: See page 1			SHEET 6 OF 11
				DRILLING
	WATER LEVEL			START / FIN
	TIME			TIME
	DATE			DATE
DATUM / ELEVATION	CASING DEPTH			

DRILLING CONTR. Layne NW

No.162894

BY Mark Ochsner

DATE 11/16/92 CHK'D BY

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF FITTINGS~~ OVA	DEPTH IN FEET	SOIL GRAPH	SURFACE CONDITIONS:
Cuttings	/	1045	/	Grab	-	100	GP	SANDY GRAVEL: Gray (10YR 5/0) <5% fines, 45% F-C angular Sand - Pred basalt, mafic, - 55% angular to Subround basalt gravels, Poor graded, dry, dense
	/		/			1		
	/		/			2		
	/		/			3		
	/		/			4		
	/		/			5		
	/		/			6		
	/		/			7		
	/		/			8		
	/		/			9		
Cuttings	/	1110	X	Grab	-	110	GP	GRAVEL: Gray (10YR 5/0) <5% fines, <10% f-c Sand, Pred. rounded to angular basalt, Poorly Graded, dry, V. dense
	/		/			1		
	/		/			2		
	/		/			3		
	/		/			4		
	/		/			5		-Cuttings become moist at 115' - Sandy Grav
	/		/			6		
	/		/			7		-cuttings become dry at 117' HARD drilling at 118'
	/		/			8		
	/		/			9		
	/		/			120		

020 1 (2) (REV. 11-00)

Dames & Moore

LOCATION OF BORING	See page 1
JOB NO.	06702-026-111
CLIENT	USATHAMA
LOCATION	Umatilla OR
BORING NO.	4-21
SHEET	7 OF 11
DRILLING METHOD:	
SAMPLING METHOD:	See page 1
DRILLING	START TIME / FINISH TIME; DATE / DATE
WATER LEVEL	
TIME	
DATE	
CASING DEPTH	
DATUM	
ELEVATION	
SURFACE CONDITIONS:	

DRILLING CONTR. Layne Env.

62895

BY Mark Ochsner

DATE 11/16/92 CHK'D BY

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF RINGS~~	DEPTH IN FEET	SOIL GRAPH
cuttings		1140	X	Grab	0.0	120	GP
						1	
						2	
						▼3	
						4	
						5	
						6	
						7	
						8	
						9	
						130	SP
U	18/15	1200	9/130	16/27/33	0.0	1	
						2	
						3	
						4	
						135	
U		1220	10/135	17/22/29		6	GP
						7	
						8	
						9	
						140	

GRAVEL: Gray (10YR 5/1) little or no fines, Pred subrounded to rounded basalt gravel, occassional angular fragments, dry, V. dense to hard, no spoon collected due to v. hard drilling, poorly graded.

- cuttings become Saturated at 123 bgs

- cuttings became finer w/depth.

- cuttings become coarse sand to fine gravel

GRAVELLY SAND: Grayish Brown (10YR 5/2), <5% fines 20-25% F-M angular basalt gravels, 75-80% F-C Sand, Pred coarse, angular, basaltic, highly mafic, Saturated, dense.

cuttings become fine gravels. saturated

GRAVEL: Gray to Dk Gray (7.5YR 4/0), <5% fines, <10% mc Sand, Pred F-m rounded to subrounded basalt, saturated, dense, highly mafic

GEB 1 (3) (REV 11-80)

Dames & Moore

LOCATION OF BORING See page 1	JOB NO. 06702-086-161	CLIENT USATHAMA	LOCATION Umatilla				
	DRILLING METHOD: See Page 1		BORING NO. 4-21				
	SAMPLING METHOD:		SHEET 8 OF 11				
			DRILLING				
			START	FIN			
	WATER LEVEL				TIME	TIM	
	TIME						
	DATE				DATE	DA	
DATUM / ELEVATION	CASING DEPTH						

DRILLING CONTR. Layne Env.

No.162897

BY Mark Adams

DATE 11/16/92 CHK'D BY

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	~~NUMBER OF RINGS~~ OVA	DEPTH IN FEET	SOIL GRAPH	SURFACE CONDITIONS:
						140	GP	GRAVEL: Gray (7.5YR 4/0), <5% fines, 5-10% m-c Sand, Subrounded basaltic, >90% f-m gravels, subrounded basalt, slightly weathered Saturated, dense
U	18/15	1295	10/140	18/27/37	0.0	1		
						2		
						3		
						4		
U	18/0	1310	X	17/39/36	0.0	145	GP	no recovery -cuttings indicate f-m gravels (basalt)
						6		
						7		increasing fines w/depth
						8		
						9		
						150	SM/ML	SANDY SILT: Dk grayish Brown (2.5Y 4/2), 60% fines 40% v.fine to fine angular Sand, felsic, Saturated, ~~sl~~ nonplastic, soft - med stiff, occassional fine basalt gravels.
U	18/12	1320	11/150	16/10/10	0.0	1		
						2		Fragments of Lt Tan Cemented ash (tuff) at !
						3	TUFF	-Harder drilling at 154'
						4		- Refusal at 154.5' bgs w/ Becker rig
						155	B	Basalt: Dk Gray (7.5YR 4/0), slight to moderate weathering, vesicular, weathered horizontal fracturing, recovering chips from cyclone, dry.
						6		
						7		
						8		
						9		
						160		

020.1 (3) (REV 11-80)

Dames & Moore

LOCATION OF BORING: See Page 1

JOB NO.: 06702-086-111
CLIENT: USATHAMA
LOCATION: Umatilla CK
BORING NO.: 4-21
SHEET 9 OF 11
DRILLING METHOD:
SAMPLING METHOD: See Page 1

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DRILLING
START | FIN
TIME | TIM
DATE | DA

DATUM
ELEVATION
SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH	
						160		-Basalt chips discharging from cyclone.
						1		
						2	B	BASALT: Lt Gray (2.5Y 6/0), vesicular basalt, fine grained, occassional co plag in mafic matrix, horizontal fracturing with some Fe staining at ... No phenocrysts, no pyrite, chlorite, calcite minera...
						3		
				Core run #1	162 - 167'	4		-Similar to top flow encountered at 4-19. Competent Rock. Recovery = 100% RQD = 38%
						5		
						6		-Set 8" Casing from Surface to 167' - Cemented in Place.
						7		
						8		-Some H2O return at 168-169'
						9	B	-Cuttings are fresh basalt chips - some wat...
						170		
						1		
						2		
						3		
						4		
						5		-Cuttings are fresh basalt chips less water Continue drilling w/ 5½" hammer
						6		
						7		
						8		-becomes v. dry at 175-180' - blue gray basalt dust from cyclone
						9		
						180		

DRILLING CONTR. Layne env.

No. 198198

BY Mark A. Ochsner

DATE 11/18/92 CHK'D BY

628 1 (3) (REV 11-80)

Dames & Moore

LOCATION OF BORING	JOB NO.	CLIENT	LOCATION
See Page 1	06702-086-11	USATHAMA	Umatilla c

DRILLING METHOD: See Page 1

SAMPLING METHOD:

BORING NO. 4-21

SHEET 10 OF 11

DRILLING

START	FI
TIME	
DATE	

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DATUM

ELEVATION

SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH	
				Core run #2	180-185'	180	B	BASALT: Lt. Gray (2.5Y 6/0), fractured basalt, Aphanitic, becomes fractured: weathered at 182-183', occassional vertical fracturing, Significant Chlorite filling @ 184', bluegray color. Dry
						1		
						2		
						3		Basalt is fresh at 180-181. Becomes more fractured with depth. Recovery: 100% RQD=66%
						4		
						5		-V. hard drilling at 185' -Fresh basalt Chips discharging -basalt dust-(bluegray) V. dry
						6		
						7		
						8		
						9		-Tool drop from 189-191' - Fracture zone?
						190		
						1		-Drilling Becomes hard again at 191'
						2		
						3		
						4		
						5	B	-V. hard: dry -Fresh basalt Chips as Abo
						6		
						7		
						8		
						9		-Drilling becomes Softer at 199' will Core at 200'
						200		

DRILLING CONTR. Layne Env.

No 198199

BY Mark Ochsner

DATE 11/19/92 CHK D BY

620 1 (3) (REV 11-80)

Dames & Moore

LOCATION OF BORING
See Page 1

JOB NO. 06702-086-11
CLIENT USATHAMA
LOCATION Umatilla C
BORING NO. 4-21
DRILLING METHOD:
SAMPLING METHOD: See Page 1
SHEET 11 OF 11

DRILLING	START	FINI
TIME		123
DATE		11/19

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

DATUM
ELEVATION
SURFACE CONDITIONS:

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH	
				Core run #3	200-208'	200	B	BASALT: Green Gray (5G 6/1). Poor Recovery. highly weathered, Chloritized seams. Rock
						1		was 'obviously' Rolled around in Core Barrel. Becomes Vesicular at 202'. No Recovery from
						2		202-208'. dry. Swab Interbed? Recovery : 25%
						3		RQD : 8%
						4		
						5		
						6		
						7		-Clean hole w/5½" hammer to 210'. cuttings are greenish basalt (Chlorite)
						208		
						9		
				Core run #4	210-215'	210	B	BASALT: Green Gray (5G 6/1). highly weathered vesicular basalt. Chloritized to 213'.
						1		Becomes Lt Gray (2.5Y 6/0) aphanitic basalt fresh, minor vesicles filled with Secondary
						2		Calcite - competent Rock no Recovery from 214-215'
						3		Recovery = 80%
						4		RQD = 33%
						5		Coring terminated at 215'. Ream hole to 215'. 11/19/92
						6		G.W. encountered at 123 during drilling. Shallow Aquifer
						7		
						8		
						9		
						0		

DATE 11/19/92 CHK'D BY

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
6099

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
APR 10 1975
STATE ENGINEER
SALEM, OREGON

State Well No. 4N/27E-20
State Permit No.

(1) OWNER:
Name Tom Mann
Address R. I Box 208 Hermiston, Ore. 97838

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to I52 ft. Gage 250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
air
Bailer test 75 gal./min. with 70 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
[illegible]perature of water Depth artesian flow encountered ft.

[illegible] CONSTRUCTION:
Well seal—Material used cement
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal I0 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 3 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Umatilla Driller's well number
¼ ¼ Section 20 T. 4N R. 27 E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 75 ft.
Static level 54 ft. below land surface. Date 4-4-75
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 0
Depth drilled I52 ft. Depth of completed well I52 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Surface sand	0	5	
Sand brown	5	65	
Sand black coarse	65	I47	
Gravel	I47	I52	54

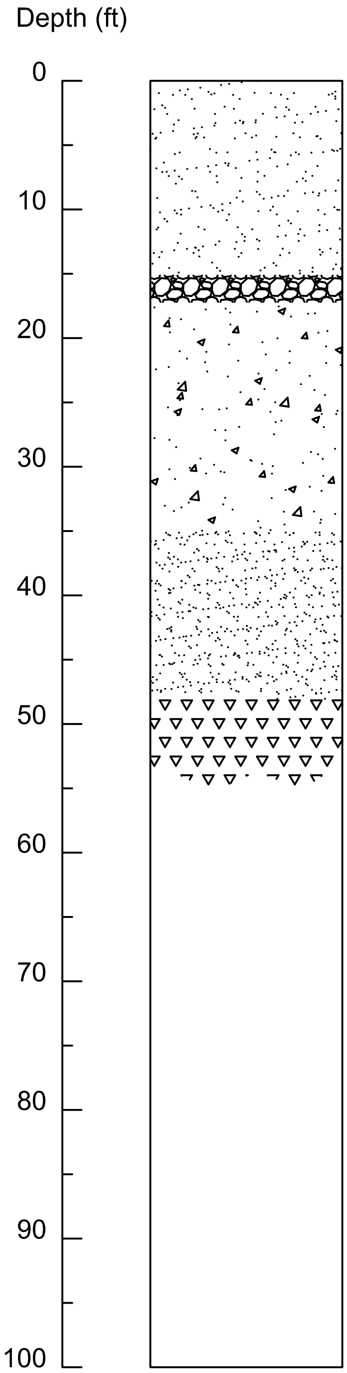
Work started 4-4-75 19 75 Completed 4-4-75 1975
Date well drilling machine moved off of well 4-4 1975

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] R. C. Allison Date 4-7, 1975
(Drilling Machine Operator)
Drilling Machine Operator's License No. 300

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Allison Drilling Co.
(Person, firm or corporation) (Type or print)
Address R. 2 Box 309-C Hermiston, Ore. 97838
[Signed] R. C. Allison
(Water Well Contractor)
Contractor's License No. 419 Date 4-7, 1975

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119



0-15 ft Fine uniform sand. Windblown. Minor silt. Light brown. SW/SM

15-17 ft Caliche. Hard, indurated.

17-35 ft Fine to medium sand. occasional gravel. More gravel in 1-2 ft lenses at 19 ft and 30 ft Light brown to gray layers SP/GP

35-48 ft Coarser sand than above, gravel to 30%, few fines. brown to dark gray. SP/GP.

48 ft Bottom of Borehole. Below 48 ft basalt.

Date:	04/16/2008	Driller:	Water Well Drilling, Umatilla, OR
Total Depth:	48 feet	Equipment:	Air rotary, casing hammer
Location:	Echo Meadows	Type:	Geologic borehole
South of Hunt Canal, East of White House Rd.		Logged By:	James Graham, RG
		IRZ Project No:	08-016

Boring Log

Umatilla Basin Recharge Project

IRZ

NC

RECEIVED
JUN 29 1966
STATE ENGINEER
SALEM, OREGON

UMAT
1173

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 3N/28-1 H(1)
State Permit No.

(1) OWNER:
Name State Highway Commission
Address Hermiston, Oregon

(2) LOCATION OF WELL:
County Umatilla Driller's well number
¼ ¼ Section T. R. W.M.
Bearing and distance from section or subdivision corner
Stanfield Rest Area
Eastbound lane Mile Post 185.5

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
[illegible]ndonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☒
10" Diam. from 0 ft. to 64 ft. Gage .250
6" Diam. from 0 ft. to 76 ft. Gage .250
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
[illegible] Model No.
[illegible]n. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal Cement
Depth of seal 76 ft. Was a packer used? no
Diameter of well bore to bottom of seal in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 12 ft. below land surface Date 6-27-66
Artesian pressure lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller
Yield: 50 gal./min. with 46 ft. drawdown after 4 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled 135 ft. Depth of completed well 135 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sandy Soil	0	6
Sand and gravel	6	46
Clay Gravel	46	50
Brown Shale Rock	50	52
Brown Sandy clay	52	60
White Sand	60	64
Black Basalt Rock	64	78
Brown Sandstone	78	80
Black Rock Medium	80	84
Gray Rock Hard	84	128
Brown Sand Rock	128	131
Brown Rock Medium	131	133
Brown Slay Stone	133	135

Work started 6-7 1966 Completed 6-27 1966
Date well drilling machine moved off of well 6-28 1966

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ben Dreyer Drilling Contractor
(Person, firm or corporation) (Type or print)
Address Rt. 1, Box 225 Hermiston, Oregon

Drilling Machine Operator's License No. 7

[Signed] Ben Dreyer
(Water Well Contractor)

Contractor's License No. 12 Date June 27, 1966

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
1191

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
JUL 29 1974
STATE ENGINEER
SALEM, OREGON

State Well No. 3N/28E-11cd
State Permit No.

(1) OWNER:
Name Emert Ranches
Address Echo, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:
~~Threaded ☐~~ Welded ☒
16 " Diam. from 0 ft. to 87 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☒ Yes ☐ No.
Type of perforator used Saw Slots
Size of perforations 3/16 in. by 3 in.
1368 perforations from 65 ft. to 84 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Lane + Boller Louverd
Type Machine Louverd Model No.
Diam. 16 Slot size 1/8 Set from 23 ft. to 28 ft.
Diam. 16 Slot size 1/8 Set from 60 ft. to 65 ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Maddox
Yield: 333 gal./min. with 27 ft. drawdown after 24 hrs.
426 " 52 " 28 "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
[illegible]rature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement Grout
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 26 in.
Diameter of well bore below seal 26 in.
Number of sacks of cement used in well seal 48 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☒ Yes ☐ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 1/8 to 1/2
Gravel placed from 18 ft. to 87 ft.

(10) LOCATION OF WELL:
County Umatilla Driller's well number
SE ¼ SW ¼ Section 11 T. 3N R. 28 W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 4 ft.
Static level 4 ft. below land surface. Date 7-18-74
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing
Depth drilled 87 ft. Depth of completed well 87 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Topsoil-sandy	0	9	
Sand & sandy clay	9	17	
Sand-gravel-small cobbles	17	26	
Clay w/gravel-hard-yellow	26	45	
Sandstone-med hard- brown	45	48	
Clay-hard-brown	48	55	
Clay w/gravel-hard brown	55	61	
Sand-gravel-small cobbles	61	69	
Sandstone-hard-brown	69	73	
Sand cemented	73	74	
Clay-hard-grey	74	76	
Sandstone-soft-grey	76	85	
Basalt-hard-black	85	87	

Work started 6/7 1974 Completed 6/11 1974
Date well drilling machine moved off of well 6/12 1974

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Norman L. Hill (Drilling Machine Operator) Date 7-22, 1974
Drilling Machine Operator's License No. 754

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name MADDOX DRILLING (Person, firm or corporation) (Type or print)
Address 145 N. SHORE MOSES LAKE WA
[Signed] Glen Maddox (Water Well Contractor)
Contractor's License No. 555 Date 7-22, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
1195

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
JUL 29 1974
STATE ENGINEER
SALEM, OREGON

State Well No. 3N/28E-12aa
State Permit No.

Umatilla

(1) OWNER:
Name H. C. Akins
Address 1225 SW Goodwin, Pendleton, Ore.

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☒ Welded ☐
16" Diam. from 0 ft. to 59 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☒ Yes ☐ No.
Type of perforator used Machine
Size of perforations 3/16 in. by 3 in.
perforations from 55 ft. to 59 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Johnson
Type Model No.
Diam. 16 Slot size 60 Set from 33 ft. to 43 ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Maddox
Yield: 650 gal./min. with 30 ft. drawdown after 24 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement Grout
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 26 in.
Diameter of well bore below seal 26 in.
Number of sacks of cement used in well seal 49 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☐ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 3/4 RR
Gravel placed from 18 ft. to 59 ft.

(10) LOCATION OF WELL:
County Driller's well number
NE ¼ NE ¼ Section 12 T. 3N R. 28E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 2 ft.
Static level 2 ft. below land surface. Date 7-18-74
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing
Depth drilled ft. Depth of completed well ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Fill	0	7	
Top soil sandy	7	15	
Sand-gravel-small cobbles	15	39	
Cobbles-large	39	43	
Clay - gravel	43	45	
Clay-hard-D.grey	45	52	
Clay & gravel	52	56	
Gravel - cemented	56	60	
Basalt - hard - black	60		

Work started 6/14 1974 Completed 6/19 1974
Date well drilling machine moved off of well 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Norman L. Hill Date 7-22, 1974
(Drilling Machine Operator)
Drilling Machine Operator's License No. 754

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name MADDOX DRILLING
(Person, firm or corporation) (Type or print)
Address 145 N SHORE MOSES LAKE WA
[Signed] Glen Maddox
(Water Well Contractor)
Contractor's License No. 555 Date 7-22, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
1198

RECEIVED
NOV 13 1972
STATE ENGINEER
SALEM. OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No. 3N/28E-14 ca
State Permit No.

(1) OWNER:
Name Clarence Watson
Address R I Box 24 Echo ore.

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:
Threaded ☐ Welded ☒
[illegible]" Diam. from 0 ft. to 61 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☐ Yes ☒ No.
[illegible] of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 5 ft. below land surface Date 11-7-72
[illegible]sian pressure lbs. per square inch Date

(9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
[illegible]ld: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 8 gal./min. with 73 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:
Well seal—Material used Cement
Depth of seal 18 ft.
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Umatilla Driller's well number
NE ¼ SW ¼ Section 14 T. 3N R. 28 E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing 6
Depth drilled 73 ft. Depth of completed well 73 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Surface ashy soil	0	5	
cement gravel	5	48	
sand dark	48	51	
clay yellow	51	55	
" + gravel	55	71	5
rock dark	71	73	5

Work started 11-2 1972 Completed 11-7 1972
Date well drilling machine moved off of well 11-8 1972

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] R. C. Allison (Drilling Machine Operator) Date 11-10, 1972
Drilling Machine Operator's License No. 300

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Allisons Drlg. Co. (Person, firm or corporation) (Type or print)
Address R2 Box 309-C Hermiston ore
[Signed] R. C. Allison (Water Well Contractor)
Contractor's License No. 419 Date 11-10, 1972

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
1211

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
APR 8 1974
STATE ENGINEER
SALEM, OREGON

State Well No. 3N/28E-22
State Permit No. aca

(1) OWNER:
Name Chester Pryor
Address R. I Box 307 Warden, Wash. 98857

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☒ Other ☐

[illegible] CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 96 ft. Gage 250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 40 gal./min. with 70 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
[illegible]mperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used bentonite
Well sealed from land surface to I8 ft.
Diameter of well bore to bottom of seal I0 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite big horn
Number of pounds of bentonite per 100 gallons of water I00 lbs./100 gals.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
Driller's well number #6
County Umatilla
¼ ¼ Section 22 T. 3N R. 28E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 33 ft.
Static level 20 ft. below land surface. Date 4-2-74
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6
Depth drilled I02 ft. Depth of completed well I02 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
surface sand	0	3	
gravel	3	I3	
clay yellow	I3	I6	
gravel coarse	I6	33	
gravel fine	33	43	20
clay brown	43	80	20
cement gravel	80	97	20
rock grey hard	97	I02	20

Work started 3-27 1974 Completed 4-2 1974
Date well drilling machine moved off of well 4-3 1974

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Kenneth Mack (Drilling Machine Operator) Date 4-4, 1974
Drilling Machine Operator's License No. I26

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Allison Drlg. Co. (Person, firm or corporation) (Type or print)
Address R. 2 Box 309-C Hermiston, Ore. 97838
[Signed] (Water Well Contractor)
Contractor's License No. 4I9 Date 4-4, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
1256

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
AUG 4 1967
STATE ENGINEER

State Well No. 3N/29-5
State Permit No.

(1) OWNER:
Name ROGERS CONSTRUCTION CO. INC
Address 11760 NE. Gilson St. Portland, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

[illegible] CASING INSTALLED:
Threaded ☐ Welded ☐
" Diam. from ft. to ft. Gage
16" Diam. from 0 ft. to 60 ft. Gage Standard
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 16 ft. below land surface Date 8/24/67
Artesian pressure lbs. per square inch Date

(9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Farmore, Athena, Ore.
Yield: 400 gal./min. with 28 ft. drawdown after 4 hrs.
" 361 " 23 " "
" 310 " 17 " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 54 Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:
Well seal—Material used Cement Grout
Depth of seal 0-23 ft.
Diameter of well bore to bottom of seal 20 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Umatilla Driller's well number
¼ ¼ Section 5 T. 3N R. 29E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing [illegible]" 16"
Depth drilled 81 ft. Depth of completed well 81 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Top soil	0	8	
Gravel	8	27	
Brown clay & sand	27	37	
Gravel & grey clay	37	45	
Gravel	45	50	
Red broken basalt with chunks of yellow soapstone	54	81	16

Work started 7/17/67 19 Completed 7/31/67 19
Date well drilling machine moved off of well 8/2/67 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Wayne Cross (Drilling Machine Operator) Date 8/2/67, 19
Drilling Machine Operator's License No. 526

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME D.K."DON" SMITH (Person, firm or corporation) (Type or print)
Address P.O. BOX 179 Walla Walla, Washington
[Signed] D K Smith (Water Well Contractor)
Contractor's License No. 204 Date 8/2/67, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

RECEIVED
MAY 22 1975
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
MAY 5 1975
STATE ENGINEER
SALEM, OREGON

State Well No. 3N/29E-7 bc
State Permit No.

G-7031

UMAT
1270

(1) OWNER:
Name Chester Prior
Address Hermiston, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐
& Drainage

[illegible] CASING INSTALLED: Threaded ☐ Welded ☒
16" Diam. from 0 ft. to 62 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

[illegible] PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used Saw slot
Size of perforations 3/16 in. by 3 in.
288 perforations from 35 ft. to 39 ft.
792 perforations from 51 ft. to 62 ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Johnson
Type Irrigators round wire Model No.
Diam. 16" Slot size 100 Set from 25 ft. to 35 ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Prior
Yield: 350 gal./min. with 37 ft. drawdown after 12 hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered None ft.

(9) CONSTRUCTION:
Well seal—Material used Neat cement
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 26 in.
Diameter of well bore below seal 26 in.
Number of sacks of cement used in well seal 50 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 3/8
Gravel placed from 18 ft. to 62 ft.

(10) LOCATION OF WELL:
County Umatilla Driller's well number #1
SW ¼ NW ¼ Section 7 T. 3N R. 29E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 3 ft.
Static level 3 ft. below land surface. Date 3/15/75
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 0
Depth drilled 62 ft. Depth of completed well 62 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Top soil	0	3	
Top soil & sand	3	13	
Sand & silt	13	17	
Clay,	17	18	
Sand, gravel, sm. cobbles	18	35	
Clay & gravel cemented	35	48	
Clay, grey	48	54	
Basalt, broken	54	62	

Work started 3/3 1975 Completed 3/7 1975
Date well drilling machine moved off of well 3/12 1975

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Norman L. Hill (Drilling Machine Operator) Date 4/22, 1975
Drilling Machine Operator's License No. 754

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Glen Maddox (Person, firm or corporation) (Type or print)
Address 145 Northshore Dr., Moses Lake, Wa. 98837
[Signed] Glen Maddox (Water Well Contractor)
Contractor's License No. 555 Date 4/22, 1975

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

NC

UMAT 1317

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

RECEIVED
JAN 21 1965
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 3N/29-17

State Permit No.

(1) OWNER:
Name Robert Spike
Address R I Echo oregon

(2) LOCATION OF WELL:
County Umatilla Driller's well number
¼ ¼ Section 17 T. 3N, R. 29 W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☒
8" Diam. from 0 ft. to 25 ft. Gage 322
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal Cement
Depth of seal 18 ft. Was a packer used? NO
Diameter of well bore to bottom of seal 12 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 15 ft. below land surface Date 12-29-64
Artesian pressure lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 25 gal./min. with 10 ft. drawdown after 16 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well below casing 8 ins
Depth drilled 30 ft. Depth of completed well 30 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifiers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Soil sandy	0	4
Gravel	4	10
Sand	10	25
Rock	25	29
Gravel	29	30

Work started 12-14 1964 Completed 12-29 1964
Date well drilling machine moved off of well 12-30 1964

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Allison Drlg. Co.
(Person, firm or corporation) (Type or print)
Address R 2 Box 309-C Hermiston Ore
Drilling Machine Operator's License No. 300
[Signed] R. C. Allison
(Water Well Contractor)
Contractor's License No. 419 Date 1-13, 1965

(USE ADDITIONAL SHEETS IF NECESSARY)

WATER WELL REPORT
STATE OF OREGON

#12- 75' to 108' is soft sandstone -per WWC 1/20/83 JCB

RECEIVED
OCT 15 1982
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 4N/28E-33db
State Permit No. UMAT 2615

(1) OWNER:
Name MIKE HOPPER
Address RT 2 BOX 5
City STANFIELD State ORE

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary Air ☑ Driven ☐
Rotary Mud ☐ Dug ☐
Ca[illegible] ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED:
Steel ☐ Plastic ☐
Threaded ☐ Welded ☑
10 " Diam. from +2 ft. to 112'4" Gauge .250
" Diam. from ft. to ft. Gauge

[illegible]LINER INSTALLED:
" Diam. from ft. to ft. Gauge

(6) PERFORATIONS:
Perforated? ☑ Yes ☐ No
Type of perforator used FACTORY
Size of perforations 7/16 in. by 3 in.
190 perforations from 92 ft. to 112 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot Size Set from ft. to ft.
Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
[illegible] gal./min. with ft. drawdown after hrs.
" " " "
Air test 150 gal./min. with drill stem at 100 ft. 1 hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
T[illegible]erature of water 60° Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Special standards: Yes ☐ No ☑
Well seal—Material used ~~24~~' PORTLAND CEMENT
Well sealed from land surface to 24 ft.
Diameter of well bore to bottom of seal 16+ in.
Diameter of well bore below seal 9 7/8 in.
Number of sacks of cement used in well seal 22 sacks
How was cement grout placed? TREMIE

Was pump installed? NO Type HP Depth ft.
Was a drive shoe used? ☑ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☑ No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County UMATILLA Driller's well number NORTH
NW ¼ SE ¼ Section 33 T. 4N R. 28E W.M.
Tax Lot # Lot Blk Subdivision
Address at well location:

(11) WATER LEVEL: Completed well.
Depth at which water was first found 8' ft.
Static level 36 ft. below land surface. Date
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 9 7/8
Depth drilled 157 ft. Depth of completed well 137 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
SAND	0	18	
CLAY	18	42	
GRAVEL	42	75	
SOFT SANDSTONE	85	108	
GRAVEL	108	127	
BASALT BLACK w/SS	127	137	

Work started 10-7 1982 Completed 10-12 1982
Date well drilling machine moved off of well 10-12 1982

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Tony Burd (Drilling Machine Operator) Date 10-12, 1982
Drilling Machine Operator's License No. 933

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Tony Burd Well Drilling Inc (Person, firm or corporation) (Type or print)
Address 5543 SW Douglas Pendleton OR
[Signed] Tony Burd (Water Well Contractor)
Contractor's License No. 544 Date 10-12, 1982

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*12658-690

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

RECEIVED

MAR 18 1987

WATER RESOURCES DEPT.
SALEM, OREGON

UMAT
2638

4N/28E-35b

(1) OWNER: Well Number

Name Double M Ranch

Address Rt. 2, Box 5

City Stanfield State OR Zip 97825

(2) TYPE OF WORK:

☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☑ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Other

(4) PROPOSED USE:

☑ Domestic ☐ Community ☐ Industrial ☐ Irrigation

[illegible]hermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☑ Depth of Completed Well 140 ft.

Explosives used Yes ☐ No ☐ Type Amount

HOLE			SEAL			
Diameter	From	To	Material	From	To	Amount sacks or pounds
10"	0	25	Cement	0	25	14
6"	25	140				

How was seal placed: Method ☐ A ☐ B ☑ C ☐ D ☐ E

☐ Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	59	.250	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4½"	60	140		☐	☑	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 59'

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
30		140	1 hr.

Temperature of water Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Umatilla Latitude ' " Longitude ' "

Township 4N N or S, Range 28E E or W, WM.

Section 35 SE ¼ NW ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

Rt. 2, Stanfield, OR 97825

(10) STATIC WATER LEVEL:

8 ft. below land surface. Date 3-4-87

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 6

From	To	Estimated Flow Rate	SWL
6	16	4	
49	127	25	

(12) WELL LOG: Ground elevation

Material	From	To	SWL
Sandy clay soil	0	6	
Sand with some clay	6	16	WB
Cemented gravel	16	49	
Green clay	49	127	WB
Gray basalt	127	140	

Date started 3-4-87 Completed 3-4-87

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1218

Signed Patrick C Wallace Date 3-6-87

WHITE COPIES - WATER RESOURCES DEPARTMENT YELLOW COPY - CONSTRUCTOR PINK COPY - CUSTOMER 9809C 10/86

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

RECEIVED
JUL 2 5 1985
WATER RESOURCES DEPT
SALEM, OREGON

PLEASE TYPE or PRINT IN INK

UMAT
2956

4N/29E-32
dc
(for official use only)

(1) OWNER:
Name James Whelan
Address Rt 1 Box 4
City Stanfield State ORE

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary Air ☒ Driven ☐
Rotary Mud ☐ Dug ☐
Cable ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Thermal: Withdrawal ☐ Reinjection ☐
Other: Piezometric ☐ Grounding ☐ Test ☐

(5) CASING INSTALLED:
Steel ☒ Plastic ☐
Threaded ☐ Welded ☐
6" Diam. from +1 ft. to 52 ft. Gauge .250
" Diam. from ft. to ft. Gauge

LINER INSTALLED:
Steel ☐ Plastic ☐
Threaded ☐ Welded ☐
" Diam. from ft. to ft. Gauge

(6) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot Size Set from ft. to ft.
Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
[illegible]d: gal./min. with ft. drawdown after hrs.
" " "
Air test 35 gal./min. with drill stem at 400 ft. 2 hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
[illegible]perature of water 58° Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Special standards: Yes ☐ No ☒
Well seal—Material used cement
Well sealed from land surface to 53 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Amount of sealing material 13 sacks ☐ pounds ☐
How was cement grout placed? pumped

Was pump installed? Type HP Depth ft.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL by legal description:
County Umatilla SW ¼ SE ¼ of Section 32 of
Township 4N (Township is North or South), Range 29E (Range is East or West), WM.
Tax Lot Lot Block Subdivision
MAILING ADDRESS OF WELL (or nearest address)

(11) WATER LEVEL of COMPLETED WELL:
Depth at which water was first found 31 ft.
Static level 49 ft. below land surface. Date 7-17-85
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled 403 ft. Depth of completed well 403 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Silt	0	8	
Sandy Clay TAN	8	31	
Clay & gravels	31	32	
White Clay	32	47	
Black Basalt	47	143	
Grey Basalt	143	173	
Red Cinders	173	178	49
Black Basalt	178	195	
Red Cinders	195	220	
Black Basalt	220	246	
Visicular Basalt	246	257	
Black Basalt	257	345	
Grey Basalt	345	362	
Visicular Basalt	362	394	
Black Basalt	394	403	

Date work started 7-15-85 /completed 7-17-85
Date well drilling machine moved off of well 7-17 19 85

(unbonded) Water Well Constructor Certification (if applicable):
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] E F Brown Date , 19

(bonded) Water Well Constructor Certification:
Bond (number) Issued by: (Surety Company Name)
On behalf of Brown & Brown Drilling Inc. (type or print name of Water Well Constructor)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
(Signed) E F Brown (Water Well Constructor)
(Dated) 7-17-85

NOTICE TO WATER WELL CONSTRUCTOR
The original and first copy of this report are to be filed with the WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.

SP*46866-690

~~STATE~~ STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

UMAT
50141

RECEIVED
MAY 17 1996
WATER RESOURCES DEPT
SALEM, OREGON

(START CARD) # 76292

(1) OWNER: Well Number
Name Jim or Shawna Ramos
Address P.O. Box 301
City Echo State OR Zip 97826

(2) TYPE OF WORK:
☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD:
☑ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☑ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Well 293 ft.
Explosives used ☐ Yes ☑ No Type Amount

HOLE			SEAL			Amount
Diameter	From	To	Material	From	To	sacks or pounds
10"	0	107	Cement	0	107	31 sacks
6"	107	293				

How was seal placed: Method ☐ A ☐ B ☑ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	107	.250	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 107

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
60+		293	1 hr.

Temperature of Water 60° Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Umatilla Latitude Longitude
Township 3N N or S. Range 29E E or W. WM.
Section 22 NE ¼ SW ¼
Tax Lot 7701 Lot Block Subdivision
Street Address of Well (or nearest address) Old Reith Hwy.
Echo, OR 97826

(10) STATIC WATER LEVEL:
83 ft. below land surface. Date 4-5-96
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 208

From	To	Estimated Flow Rate	SWL
208	234	18	83
284	291	50	83

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Clay soil	0	1	
Brown clay	1	38	
Brown clay with gravel	38	49	
Brown basalt, broken	49	53	
Gray basalt	53	57	
Black basalt with green soapstone	57	98	
Gray basalt	98	208	
Gray basalt with green soapstone	208	234	WB
Gray basalt	234	284	
Black basalt with green soapstone	284	291	WB
Gray basalt	291	293	

Date started 4-5-96 Completed 4-5-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 121
Signed Patrick Wallace Date 4-30-9

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 10/91

NOV 0 6 1989
WATER RESOURCES DEPT.
SALEM, OREGON

UMAT
5324

4N/28E/28dd

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

(START CARD) # 4003

(1) OWNER:
Well Number:
Name J R Simplot
Address Buttercreek Highway
City Hermiston State ORE Zip

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☒ Depth of Completed Well 200 ft.
Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	HOLE From	HOLE To	SEAL Material	SEAL From	SEAL To	Amount sacks or pounds
16	0	156	cement	0	146	137 sks
12	156	200				

How was seal placed: Method ☒ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material 100 sacks
Silica sand packed
Gravel placed from ft. to ft. Size of gravel 8 to 12 slot

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+1	146	375	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	8	+5	175		☒	☐	☒	☐
		190	20		☒	☐	☒	☐

Final location of shoe(s) 146

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☒ Screens Type Cook Material Stainless

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
175	190	.060		8"	pip	☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
Pump	DATA	included	1 hr.

Temperature of water 56° Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☒ Other Nitrates
Depth of strata: 126 - 131

(9) LOCATION OF WELL by legal description:
County Umatillia Latitude ' " Longitude ' "
Township 4N N or S, Range 28E E or W, WM.
Section 28 SE ¼ SE ¼
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
116 ft. below land surface. Date 10-16-89
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 92

From	To	Estimated Flow Rate	SWL
126	131	25 +	92
170	190	110	116

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
silt	0	6	
sand & yellow clay	6	72	
silt gravels & Boulders	72	126	
sand & gravels	126	131	92
Reddish Brown silt	131	152	
fine sand & gravels	152	170	116
silt & gravels	170	185	|
pea gravels	185	190	|
Blue Clay	190	198	
Black Basalt	198	200	

Date started 9-30-88 Completed 10-13-89

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number
Signed E T Brown Date 10-15-89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER

9809C 3/88

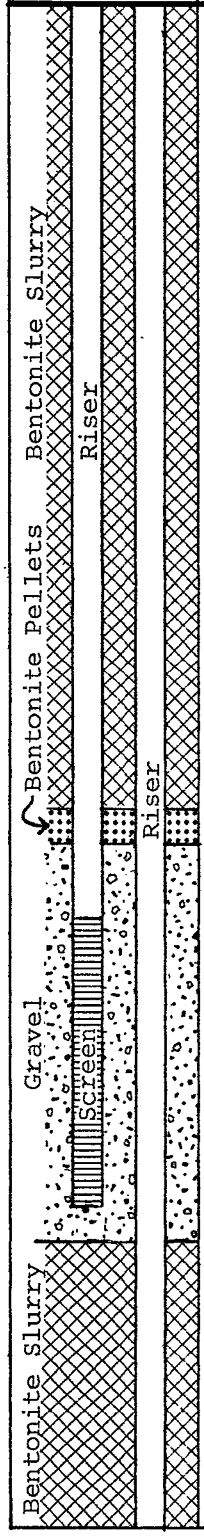
Sweet, Edwards & Associates, Inc.

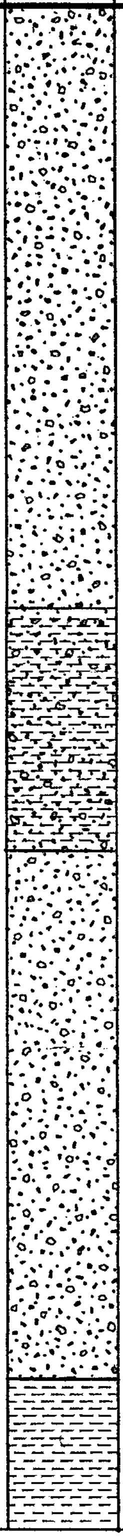
BORING LOG

PROJECT J.R. Simplot - Hermiston

Page 2 **of** 3

Boring No. M-11





WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
	Drilled cased hole 0'-147'		15	Bag				
		80	16	"				
			17	"				
		90	18	"				
			19	"				
		100	20	"				
			21	"			102'-115' Sandy Gravel, Silty Sandy Gravel, Gravelly Silty Sand- Grey or brown, moderately well to well graded, slightly to moderately cohesive, moist. (SW/GW)	
		110	22	"				
			23	"			115'-143' Gravelly Sand, Sandy Gravel, Gravel- Grey or brown, loose to slightly cohesive, occasional silty zones, well graded, water bearing. (SW/GW)	
		120	24	"				
			25	"				
		130	26	"				
			27	"				
		140	28	"				
			29	"			143'-162' Sandstone, Siltstone- Brown, moderately hard.	

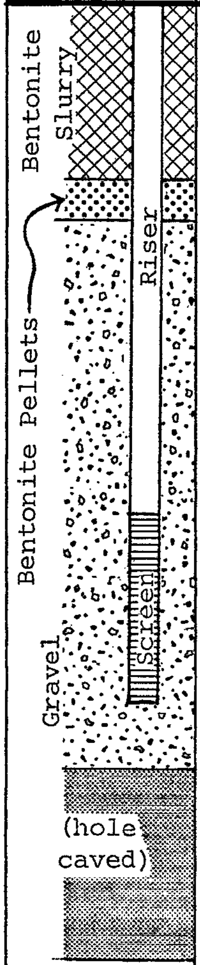
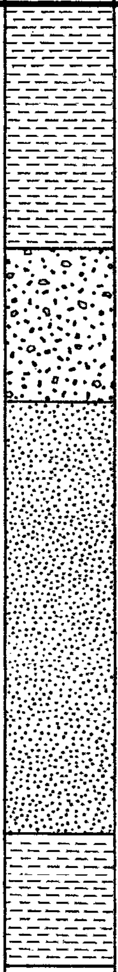
Sweet, Edwards & Associates, Inc.

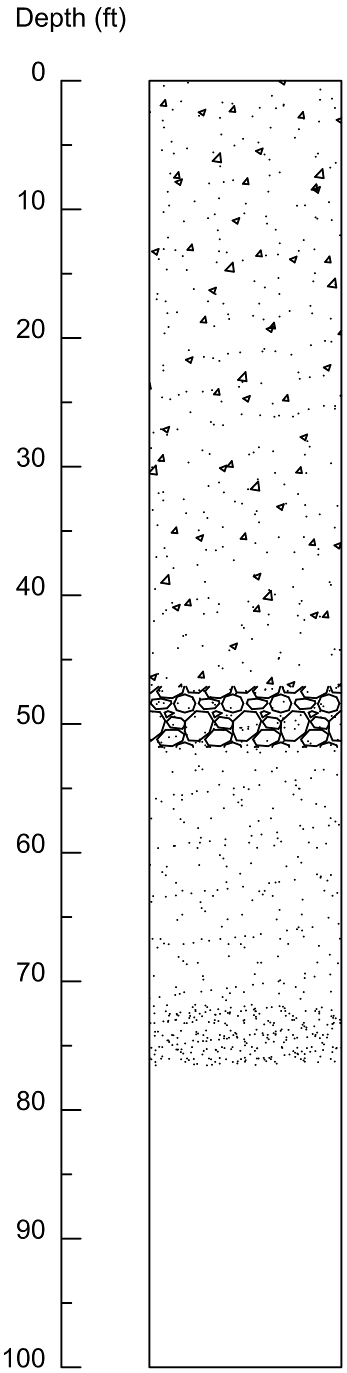
BORING LOG

PROJECT J.R. Simplot - Hermiston

Page 3 **of** 3

Boring No. M-11

WELL DETAILS	PENETRATION TIME/RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
	Drilled open hole (uncased) 147'-200'	150	30	Bag				
			31	"				
		160	32	"				
			33	"			162'-170' Gravel, Sandy Gravel- Slightly cemented, water bearing. (GW)	
		170	34	"			170'-193' Sand- Tan, medium grained, poorly graded, slightly to moderately cohesive. (SP)	
			35	"				
		180	36	"				
			37	"				
		190	38	"			193'-200' Siltstone- Yellow to dark grey, moderately hard (significant amount of tan sand in samples probably washing in from overlying material.	
			39	"				
		200	40	"				
		210						
		220						



0-47 ft Silty sand, sandy silt with occasional basalt gravel. Gray to brown. Slightly to poorly indurated with caliche from 7-37 ft. Layers of varying composition 3-10 ft in thickness. Silt layers are non-plastic and non-sticky to semi-plastic and semi-sticky. SM/ML

47-52 ft Abundant gravel to 1-2 inch with sand, minor silt. Gray. GW/SW

52-72 ft Silt with minor clay, occasional gravel. Brown. ML

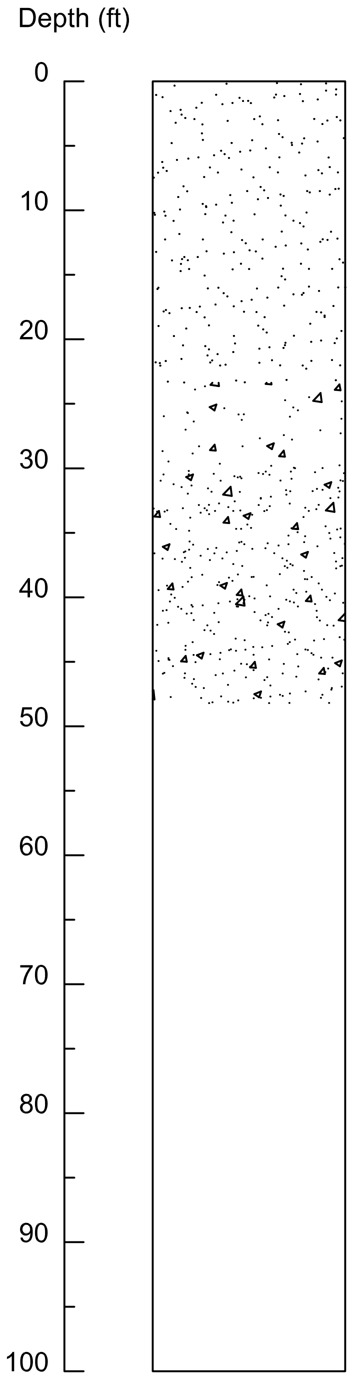
72-77 ft Bottom of Borehole. Silts with minor sands, occasional gravel. Brown with calcite? inclusions. Semi indurated. Material can form a core. Gravel sized material and rock chunks, basaltic. ML (Alkali Canyon?)

Date:	10/28/2008	Driller:	Environmental West Exploration Inc.
Total Depth:	77 feet	Equipment:	Sonic drill rig
Location:	SG-BH1	Type:	Geologic borehole
Lat/Long:	45.83389N, 119.16680W	Logged By:	James Graham, RG
		IRZ Project No:	08-016

Boring Log

Umatilla Basin Recharge Project

IRZ



0-23 ft Silty sands to sandy silts with occasional gravel to 1 inch. Silt are somewhat plastic and sticky. Upper 7 ft partially cemented. Light brown to gray layering. SM/ML

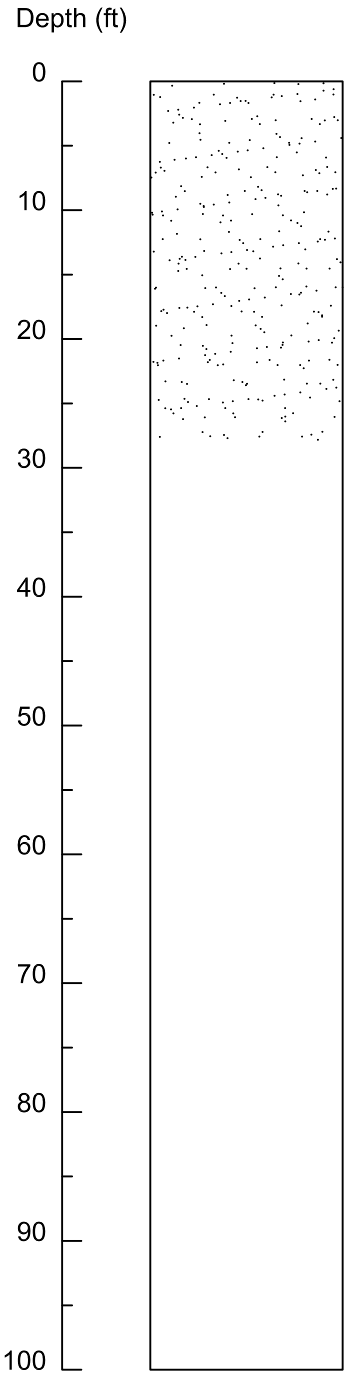
23-30ft Gravelly sands, minor silt. Gravels are 1.5 inch, basaltic. Light brown in color. SW

30-47 ft Bottom of Borehole. Silty sands are silty sands with minor gravel. Light gray. SM/SP

Date:	10/28/2008	Driller:	Environmental West Exploration Inc.
Total Depth:	47 feet	Equipment:	Sonic Drill Rig
Location:	SG-BH2	Type:	Echo Meadows Borehole
Lat/Long:	45.82982N, 119.18273W	Logged By:	James Graham, RG
		IRZ Project No:	08-016

Boring Log

Umatilla Basin Recharge Project



0-28 ft Silty sands to sandy silts, few sites 0-5 ft. Gray to brown subtle layering 0-8 ft in thickness. SM

28 ft Bottom of Borehole.

Date:	4/16/2008	Driller:	Environmental West Exploration Inc.	Boring Log
Total Depth:	28 feet	Equipment:	Sonic Drill Rig	Umatilla Basin Recharge Project
Location:	SG-BH3	Type:	Echo Meadows Borehole	IRZ
Lat/Long:	45.82211N, 119.17327W	Logged By:	James Graham, RG	
		IRZ Project No:	08-016	

APPENDIX C

Echo Meadows Aquifer Test Report

PEG Principals Environmental and Water Resources Group

October 15, 2008

Said Amali
IRZ Consulting, LLC
505 E. Main Street
Hermiston, OR 97838

This letter is written in regards to the aquifer test performed by the staff of Principals Environmental Group and IRZ Consulting LLC on October 7 and 8, 2008 at well UMAT1995 located in Echo Meadows. In addition, I am enclosing the results of evaluation of water level data for well UMAT 1271 which was recorded by IRZ's pressure transducer installed previously in this well. The data resembled an aquifer pump test and were from a regular irrigation pumping event by the property owner. In my opinion, the data are of sufficiently long duration to allow their use to obtain aquifer hydraulic properties. This data was obtained during July 2008.

The pump test equipment included a submersible pump, generator, and a water line to discharge the pumped water to a nearby ditch. The groundwater level in the pumping well was monitored by both a manual water level indicator and a pressure transducer. Additionally, two shallow temporary piezometers were installed as observation wells at distances of 50 and 250 feet west of the pumping well. Pressure transducers and automatic data loggers were installed in the observation wells.

The pump test began on October 7 at 16:53. The discharge of the pump was approximately 450 gallons per minute (gpm). The wells were monitored for approximately 1,230 minutes during pumping and 1,440 minutes (one day) during recovery. Data for the aquifer test is enclosed electronically as EXCEL spreadsheet files "2008-10-09-U1195 well test", "one_minute_50 ft ", and "one_minute_test_200" for the pumping well, 50-foot piezometer, and the 200-foot piezometer, respectively. These files include the original transducer data (which measure the height of the water column above the transducer, modifications to produce elapsed time and drawdown data, and plots of the elapsed time/drawdown data.

It was noticed on October 8 that the discharge water was leaving the vicinity of the pumping well slowly and had backed up near the pumping well. The effect of this water cycling was observed in the continuous water level data record from the three wells.

Figure 1 shows the data collected at the 50 foot observation well during the pump test. The drawdown is plotted versus time on a log-log scale. Superimposed on the observed data is the Theis curve. As can be seen on this figure, there is a significant deviation from the Theis curve at about 50 minutes. Following that time, drawdown is less than expected due to the recirculation of the well water back into the shallow aquifer. Similarly, the recovery phase of the aquifer test was not deemed useful due to discharge problems.

Use of the Theis method allows for the calculation of transmissivity and storativity during unsteady state conditions. The match point of 1/u and W(u) (values of 1,1) were selected at at a time of 17 minutes and drawdown of 0.6 feet (Figure 1). As such, transmissivity (T), hydraulic conductivity (K) and storativity (s) are calculated as:

$T = 15.3\ Q*W(u)/\Delta h = 15.3(450)\ (1)/0.6 =$ **11,475 ft^2/day**

$K = T/b = 11,475/50 =$ **230 ft/day**
where b, the thickness of the aquifer, is estimated at 50 feet based on well log

$s = Tu/360*t/r^2 =$ **0.22**
where t is time match and r is distance of the observation from the pumping well.

Using the same Theis curve matching technique, values of T, K, and s for the 250-foot observation well were estimated at **38,250 ft^2/day, 765 ft/day, and 0.29,** respectively, with a significant deviation at 80 minutes due to cycling.

During review of pressure transducer data from well UMAT 1271, it was observed that this well was pumped continuously from July 17 to August 6, 2008. At the same time, well UMAT1269 acted as an observation well for this pump test, located approximately 1,625 feet due west. The continuous level data for this well is enclosed as EXCEL spreadsheet file “UMAT 1271 Pump test Data”.

Figure 2 shows the water level drawdown of these two wells plotted as log values of time and drawdown. Superimposed on the observation well is the Theis curve. As can be seen in Figure 2, the drawdown data closely follows the idealized Theis curve for this 20 day period. The pumping well also follows the Theis curve when it is translated to the data. Using the same calculations as discussed before, the values of T, K, and s based on observation well UMAT 1269 data are **11,769 ft^2/day, 356 ft/day (aquifer thickness 33 feet) and 0.091** respectively. These values are in the range of values estimated for well UMAT 1195.

Thank you in advance for your time and attention.

Sincerely,
Principals Group

James D. Graham

James D. Graham, RPG

Enclosures: (4) Excel spreadsheets (sent electronically), 2 figures

APPENDIX D

Laboratory Analytical Reports

Anatek Labs, Inc.

Chain of Custody Record

☒ 1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246 ○
○ 504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433 ○

080724 047 **IRZC** Last Due 8/5/2008
1st SAMP 7/22/2008 1st RCVD 7/24/2008
UMATILLA RECHARGE

Company Name: IRZ Consulting	Project Manager: Said Amali
Address: 505 E Main	Project Name & #: Umatilla Recharge
City: Hermiston State: OR Zip: 97838	Email Address: Saida@irz.com
Phone: 541-567-0252	Purchase Order #:
Fax:	Sampler Name & phone: Jim Graham

Please refer to our normal turn around times at:
http://www.anateklabs.com/services/guidelines/reporting.asp

[✓ Normal]
__Next Day*
__2nd Day*
__Other*______

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
__Email

Provide Sample Description / List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Ca/Mg/K/Na	SO4/Cl/HCO3/CO3	NO3/NO2-N	TDS
1	U1269	7/22/08 13:30	W	1		X	X	X	X
2	DMPW2	10:30		2					
3	JSPW1	11:15		2					
4	U1317	13:00		2					
5	TCDW1	1355		1					
6	Wetland	15:30		2					
7	HCSW1	11:00		2					
	DMPP2								

Preservative:

Note Special Instructions/Comments

MWBS

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by	Kari Miller	Kari Miller	Anatek	7-24-08	1600
Relinquished by					
Received by					
Relinquished by					
Received by					

Inspection Checklist

Received Intact? [✓ Y] N
Labels & Chains Agree? [✓ Y] N
Containers Sealed? [✓ Y] N
VOC Head Space? Y N

WPS

Temperature (°C): 12.5
Preservative: NA
Date & Time:
Inspected By:

Anatek Labs, Inc.
1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Login Report

Customer Name: IRZ CONSULTING LLC
Order ID: 080724047
Purchase Order:
Order Date: 7/24/2008
Project ID:
Project Name: UMATILLA RECHARGE
Comment:

Sample #: 080724047-001 **Customer Sample #:** U1269 **Site:**

Recv'd: ☑ **Collector:** JIM GRAHAM **Date Collected:** 7/22/2008
Quantity: 1 **Matrix:** Drinking Water **Date Received:** 7/24/2008 11:00:00 A
Comment:

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Sample #: 080724047-002 **Customer Sample #:** DMPW2 **Site:**

Recv'd: ☑ **Collector:** JIM GRAHAM **Date Collected:** 7/22/2008
Quantity: 2 **Matrix:** Drinking Water **Date Received:** 7/24/2008 11:00:00 A
Comment:

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Customer Name:	IRZ CONSULTING LLC	**Order ID:**	080724047
Purchase Order:		**Order Date:**	7/24/2008
Project ID:		**Project Name:**	UMATILLA RECHARGE
Comment:			

Sample #:	080724047-003	**Customer Sample #:**	JSPW1	**Site:**	
Recv'd:	☑	**Collector:**	JIM GRAHAM	**Date Collected:**	7/22/2008
Quantity:	2	**Matrix:**	Drinking Water	**Date Received:**	7/24/2008 11:00:00 A
Comment:					

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Sample #:	080724047-004	**Customer Sample #:**	U1317	**Site:**	
Recv'd:	☑	**Collector:**	JIM GRAHAM	**Date Collected:**	7/22/2008
Quantity:	2	**Matrix:**	Drinking Water	**Date Received:**	7/24/2008 11:00:00 A
Comment:					

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Sample #:	080724047-005	**Customer Sample #:**	TCDW1	**Site:**	
Recv'd:	☑	**Collector:**	JIM GRAHAM	**Date Collected:**	7/22/2008
Quantity:	1	**Matrix:**	Drinking Water	**Date Received:**	7/24/2008 11:00:00 A
Comment:					

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***

Customer Name: IRZ CONSULTING LLC **Order ID:** 080724047

Purchase Order: **Order Date:** 7/24/2008

Project ID: **Project Name:** UMATILLA RECHARGE

Comment:

SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Sample #: 080724047-006 **Customer Sample #:** WETLAND **Site:**

Recv'd: ☑ **Collector:** JIM GRAHAM **Date Collected:** 7/22/2008

Quantity: 2 **Matrix:** Drinking Water **Date Received:** 7/24/2008 11:00:00 A

Comment:

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Sample #: 080724047-007 **Customer Sample #:** HCSW1 **Site:**

Recv'd: ☑ **Collector:** JIM GRAHAM **Date Collected:** 7/22/2008

Quantity: 2 **Matrix:** Drinking Water **Date Received:** 7/24/2008 11:00:00 A

Comment:

Test	Test Group	Method	Due Date	Priority
BICARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CALCIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
CARBONATE		SM2320B	8/5/2008	***Normal (6-10 Days)***
CHLORIDE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
MAGNESIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
NITRATE+ NITRITE AS N		EPA 300.0	8/5/2008	***Normal (6-10 Days)***
POTASSIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SODIUM		EPA 200.8	8/5/2008	***Normal (6-10 Days)***
SOLIDS - TDS		EPA 160.1	8/5/2008	***Normal (6-10 Days)***
SULFATE		EPA 300.0	8/5/2008	***Normal (6-10 Days)***

Customer Name: IRZ CONSULTING LLC

Order ID: 080724047

Purchase Order:

Order Date: 7/24/2008

Project ID:

Project Name: UMATILLA RECHARGE

Comment:

SAMPLE CONDITION RECORD

Samples received in a cooler?	Yes
Samples received intact?	Yes
What is the temperature inside the cooler?	12.5
Samples received with a COC?	Yes
Samples received within holding time?	Yes
Are all sample bottles properly preserved?	Yes
Are VOC samples free of headspace?	N/A
Is there a trip blank to accompany VOC samples?	N/A
Labels and chain agree?	Yes

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Tuesday, May 13, 2008

James Graham
Principals Environmental Group
7220 SE 27th Ave.
Portland, OR 97202 97202

RE: Echo / [none]

Enclosed are the results of analyses for samples received by the laboratory on 3/7/2008 at11:08:00AM.

Thank you for using Apex Labs. We appreciate your business and strive to provide the highest quality services to the environmental industry.

If you have any questions concerning this report or the services we offer, please feel free to contact me by email at: dthomas@apex-labs.com, or by phone at 503-718-2323.

DRAFT REPORT

The results provided in this report are PRELIMINARY and are subject to change based on subsequent analysis, QC validation or final data review. Please use these results with the understanding that they may have not been finalized by the laboratory

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:40

ANALYTICAL REPORT FOR SAMPLES

SAMPLE INFORMATION

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
U1269	A803069-01	Water	03/05/08 17:10	03/07/08 11:08
HW	A803069-02	Water	03/06/08 11:00	03/07/08 11:08
JSPW	A803069-03	Water	03/06/08 15:30	03/07/08 11:08

ANALYTICAL SAMPLE RESULTS

Anions by EPA 300.0 (Ion Chromatography)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
U1269 (A803069-01)			**Matrix: Water**					
Nitrate-Nitrogen	**8.34**	---	0.0250	mg/L	1	03/07/08 16:16	EPA 300.0	
Nitrite-Nitrogen	**0.0460**	---	0.0250	"	"	"	"	
U1269 (A803069-01RE1)			**Matrix: Water**					
Chloride	**64.6**	---	0.500	mg/L	5	03/13/08 17:32	EPA 300.0	
Sulfate	**83.3**	---	0.500	"	"	"	"	
HW (A803069-02)			**Matrix: Water**					
Chloride	**2.04**	---	0.100	mg/L	1	03/07/08 16:32	EPA 300.0	
Nitrate-Nitrogen	**0.214**	---	0.0250	"	"	"	"	
Nitrite-Nitrogen	ND	---	0.0250	"	"	"	"	
Sulfate	**2.09**	---	0.100	"	"	"	"	
JSPW (A803069-03)			**Matrix: Water**					
Chloride	**12.1**	---	0.100	mg/L	1	03/07/08 15:44	EPA 300.0	
Nitrate-Nitrogen	**3.62**	---	0.0250	"	"	"	"	
Nitrite-Nitrogen	ND	---	0.0250	"	"	"	"	
Sulfate	**20.3**	---	0.100	"	"	"	"	

Principals Environmental Group
7220 SE 27th Ave.
Portland, OR 97202 97202

Project: **Echo**
Project Number: [none]
Project Manager: James Graham

Reported:
05/13/08 15:40

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
U1269 (A803069-01)			**Matrix: Water**					
Calcium	**72800**	---	2500	ug/L	25	03/12/08 18:30	EPA 6020	
Magnesium	**35000**	---	2500	"	"	"	"	
Potassium	**11200**	---	2500	"	"	"	"	
Sodium	**55000**	---	2500	"	"	"	"	
Hardness (Calc)	**326**	---	16.5	mg CaCO3/L	"	"	Calc	
HW (A803069-02)			**Matrix: Water**					
Calcium	**6990**	---	100	ug/L	1	03/12/08 17:42	EPA 6020	
Magnesium	**2760**	---	100	"	"	"	"	
Potassium	**1640**	---	100	"	"	"	"	
Sodium	**5010**	---	100	"	"	"	"	
Hardness (Calc)	**28.8**	---	0.662	mg CaCO3/L	"	"	Calc	
JSPW (A803069-03)			**Matrix: Water**					
Calcium	**33700**	---	500	ug/L	5	03/12/08 18:33	EPA 6020	
Magnesium	**14100**	---	500	"	"	"	"	
Potassium	**7970**	---	100	"	1	03/12/08 17:36	"	
Sodium	**13600**	---	500	"	5	03/12/08 18:33	"	
Hardness (Calc)	**142**	---	3.31	mg CaCO3/L	"	"	Calc	

Principals Environmental Group
7220 SE 27th Ave.
Portland, OR 97202 97202

Project: **Echo**
Project Number: [none]
Project Manager: James Graham

Reported:
05/13/08 15:40

ANALYTICAL SAMPLE RESULTS

Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
U1269 (A803069-01)			**Matrix: Water**					
Total Alkalinity	**253**	---	20.0	mg CaCO3/L	1	03/10/08 16:24	EPA 310.1	
Bicarbonate Alkalinity	**253**	---	20.0	"	"	"	"	
Carbonate Alkalinity	ND	---	20.0	"	"	"	"	
Hydroxide Alkalinity	ND	---	20.0	"	"	"	"	
Total Dissolved Solids	**590**	---	10.0	mg/L	"	03/12/08 11:52	EPA 160.1	B, B-01
HW (A803069-02)			**Matrix: Water**					
Total Alkalinity	**34.0**	---	20.0	mg CaCO3/L	1	03/10/08 16:24	EPA 310.1	
Bicarbonate Alkalinity	**34.0**	---	20.0	"	"	"	"	
Carbonate Alkalinity	ND	---	20.0	"	"	"	"	
Hydroxide Alkalinity	ND	---	20.0	"	"	"	"	
HW (A803069-02RE1)			**Matrix: Water**					
Total Dissolved Solids	**89.0**	---	10.0	mg/L	1	03/14/08 14:58	EPA 160.1	
JSPW (A803069-03)			**Matrix: Water**					
Total Alkalinity	**117**	---	20.0	mg CaCO3/L	1	03/10/08 16:24	EPA 310.1	
Bicarbonate Alkalinity	**117**	---	20.0	"	"	"	"	
Carbonate Alkalinity	ND	---	20.0	"	"	"	"	
Hydroxide Alkalinity	ND	---	20.0	"	"	"	"	
JSPW (A803069-03RE1)			**Matrix: Water**					
Total Dissolved Solids	**231**	---	10.0	mg/L	1	03/14/08 18:35	EPA 160.1	

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Anions by EPA 300.0 (Ion Chromatography)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030060 - Method Prep: Aq							**Water**					
Blank (8030060-BLK1)						**Analyzed: 03/07/08 08:30**						
EPA 300.0												
Chloride	ND	---	0.100	mg/L	1	---	---	---	---	---	---	
Nitrate-Nitrogen	ND	---	0.0250	"	"	---	---	---	---	---	---	
Nitrite-Nitrogen	ND	---	0.0250	"	"	---	---	---	---	---	---	
Sulfate	ND	---	0.100	"	"	---	---	---	---	---	---	
LCS (8030060-BS1)						**Analyzed: 03/07/08 08:45**						
EPA 300.0												
Chloride	20.5	---	0.100	mg/L	1	20.0	---	102	85-115%	---	---	
Nitrate-Nitrogen	5.16	---	0.0250	"	"	5.00	---	103	"	---	---	
Nitrite-Nitrogen	5.00	---	0.0250	"	"	"	---	100	"	---	---	
Sulfate	19.2	---	0.100	"	"	20.0	---	96	"	---	---	

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Anions by EPA 300.0 (Ion Chromatography)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030129 - Method Prep: Aq							**Water**					
Blank (8030129-BLK1)							**Analyzed: 03/13/08 15:48**					
EPA 300.0												
Chloride	ND	---	0.100	mg/L	1	---	---	---	---	---	---	
Sulfate	ND	---	0.100	"	"	---	---	---	---	---	---	
LCS (8030129-BS1)							**Analyzed: 03/13/08 16:04**					
EPA 300.0												
Chloride	20.3	---	0.100	mg/L	1	20.0	---	101	85-115%	---	---	
Sulfate	19.1	---	0.100	"	"	"	---	95	"	---	---	

The results provided in this report are PRELIMINARY and are subject to change based on subsequent analysis, QC validation or final data review. Please use these results with the understanding that they may have not been finalized by the laboratory

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:40

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030097 - EPA 3015							**Water**					
Blank (8030097-BLK1)						**Analyzed: 03/12/08 16:30**						
EPA 6020												
Calcium	ND	---	100	ug/L	1	---	---	---	---	---	---	
Magnesium	ND	---	100	"	"	---	---	---	---	---	---	
Potassium	ND	---	100	"	"	---	---	---	---	---	---	
Sodium	ND	---	100	"	"	---	---	---	---	---	---	
LCS (8030097-BS1)						**Analyzed: 03/12/08 16:32**						
EPA 6020												
Calcium	2290	---	100	ug/L	1	2220	---	103	80-120%	---	---	
Magnesium	2360	---	100	"	"	"	---	106	"	---	---	
Potassium	2270	---	100	"	"	"	---	102	"	---	---	
Sodium	2320	---	100	"	"	"	---	105	"	---	---	

Principals Environmental Group
7220 SE 27th Ave.
Portland, OR 97202 97202

Project: **Echo**
Project Number: [none]
Project Manager: James Graham

Reported:
05/13/08 15:40

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030088 - Method Prep: Aq							**Water**					
Blank (8030088-BLK1)						**Analyzed: 03/10/08 16:24**						
EPA 310.1												
Total Alkalinity	ND	---	20.0	mg CaCO3/L	1	---	---	---	---	---	---	
Bicarbonate Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
Carbonate Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
Hydroxide Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
LCS (8030088-BS1)						**Analyzed: 03/10/08 16:24**						
EPA 310.1												
Total Alkalinity	239	---	20.0	mg CaCO3/L	1	240	---	99.6	85-115%	---	---	
Duplicate (8030088-DUP1)			**Source: A803069-01**			**Analyzed: 03/10/08 16:24**						
EPA 310.1												
Total Alkalinity	**248**	---	20.0	mg CaCO3/L	1	---	253	---	---	2.00	20%	
Bicarbonate Alkalinity	**248**	---	20.0	"	"	---	253	---	---	2.00	20%	
Carbonate Alkalinity	ND	---	20.0	"	"	---	ND	---	---	---	20%	
Hydroxide Alkalinity	ND	---	20.0	"	"	---	ND	---	---	---	20%	

Principals Environmental Group	Project:	**Echo**	
7220 SE 27th Ave.	Project Number:	[none]	**Reported:**
Portland, OR 97202 97202	Project Manager:	James Graham	05/13/08 15:40

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030098 - Total Dissolved Solids							**Water**					
Blank (8030098-BLK1)						**Analyzed: 03/12/08 11:52**						
EPA 160.1												
Total Dissolved Solids	**28.0**	---	10.0	mg/L	1	---	---	---	---	---	---	B
Duplicate (8030098-DUP1)			**Source: A803069-02**			**Analyzed: 03/12/08 11:52**						
EPA 160.1												
Total Dissolved Solids	**93.0**	---	10.0	mg/L	1	---	92.0	---	---	1	20%	B
Reference (8030098-SRM1)						**Analyzed: 03/12/08 11:52**						
EPA 160.1												
Total Dissolved Solids	664	---		mg/L	1	600		111	85-115%		---	B

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030139 - Total Dissolved Solids							**Water**					
Blank (8030139-BLK1)						**Analyzed: 03/14/08 14:58**						
EPA 160.1												
Total Dissolved Solids	ND	---	10.0	mg/L	1	---	---	---	---	---	---	
Duplicate (8030139-DUP1)			**Source: A803069-02RE1**			**Analyzed: 03/14/08 14:58**						
EPA 160.1												
Total Dissolved Solids	**87.0**	---	10.0	mg/L	1	---	89.0	---	---	2	20%	
Reference (8030139-SRM1)						**Analyzed: 03/14/08 14:58**						
EPA 160.1												
Total Dissolved Solids	616	---		mg/L	1	600		103	85-115%		---	

SAMPLE PREPARATION INFORMATION

Apex Laboratories

Anions by EPA 300.0 (Ion Chromatography)

Method Prep: Aq

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 8030060							
A803069-01	Water	EPA 300.0	03/05/08 17:10	03/07/08 07:20	10mL/10mL	10mL/10mL	1.00
A803069-02	Water	EPA 300.0	03/06/08 11:00	03/07/08 07:20	10mL/10mL	10mL/10mL	1.00
A803069-03	Water	EPA 300.0	03/06/08 15:30	03/07/08 07:20	10mL/10mL	10mL/10mL	1.00
Batch: 8030129							
A803069-01RE1	Water	EPA 300.0	03/05/08 17:10	03/07/08 07:20	10mL/10mL	10mL/10mL	1.00

Total Metals by EPA 6020 (ICPMS)

[CALC]

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: [CALC]							
A803069-01	Water	Calc	03/05/08 17:10	03/11/08 11:22			NA
A803069-02	Water	Calc	03/06/08 11:00	03/11/08 11:22			NA
A803069-03	Water	Calc	03/06/08 15:30	03/11/08 11:22			NA

EPA 3015

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 8030097							
A803069-01	Water	EPA 6020	03/05/08 17:10	03/11/08 11:22	45mL/50mL	45mL/50mL	1.00
A803069-02	Water	EPA 6020	03/06/08 11:00	03/11/08 11:22	45mL/50mL	45mL/50mL	1.00
A803069-03	Water	EPA 6020	03/06/08 15:30	03/11/08 11:22	45mL/50mL	45mL/50mL	1.00

Conventional Chemistry Parameters

Method Prep: Aq

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 8030088							
A803069-01	Water	EPA 310.1	03/05/08 17:10	03/10/08 14:34	50mL/50mL	50mL/50mL	NA
A803069-02	Water	EPA 310.1	03/06/08 11:00	03/10/08 14:34	50mL/50mL	50mL/50mL	NA
A803069-03	Water	EPA 310.1	03/06/08 15:30	03/10/08 14:34	50mL/50mL	50mL/50mL	NA

DRAFT REPORT

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Apex Laboratories

Conventional Chemistry Parameters

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Total Dissolved Solids							
Batch: 8030098							
A803069-01	Water	EPA 160.1	03/05/08 17:10	03/11/08 11:35	100mL/1N/A	100mL/1mL	NA
Batch: 8030139							
A803069-02RE1	Water	EPA 160.1	03/06/08 11:00	03/13/08 11:10	100mL/1N/A	100mL/1mL	NA
A803069-03RE1	Water	EPA 160.1	03/06/08 15:30	03/13/08 11:10	100mL/1N/A	100mL/1mL	NA

Principals Environmental Group	Project:	**Echo**	
7220 SE 27th Ave.	Project Number:	[none]	**Reported:**
Portland, OR 97202 97202	Project Manager:	James Graham	05/13/08 15:40

Notes and Definitions

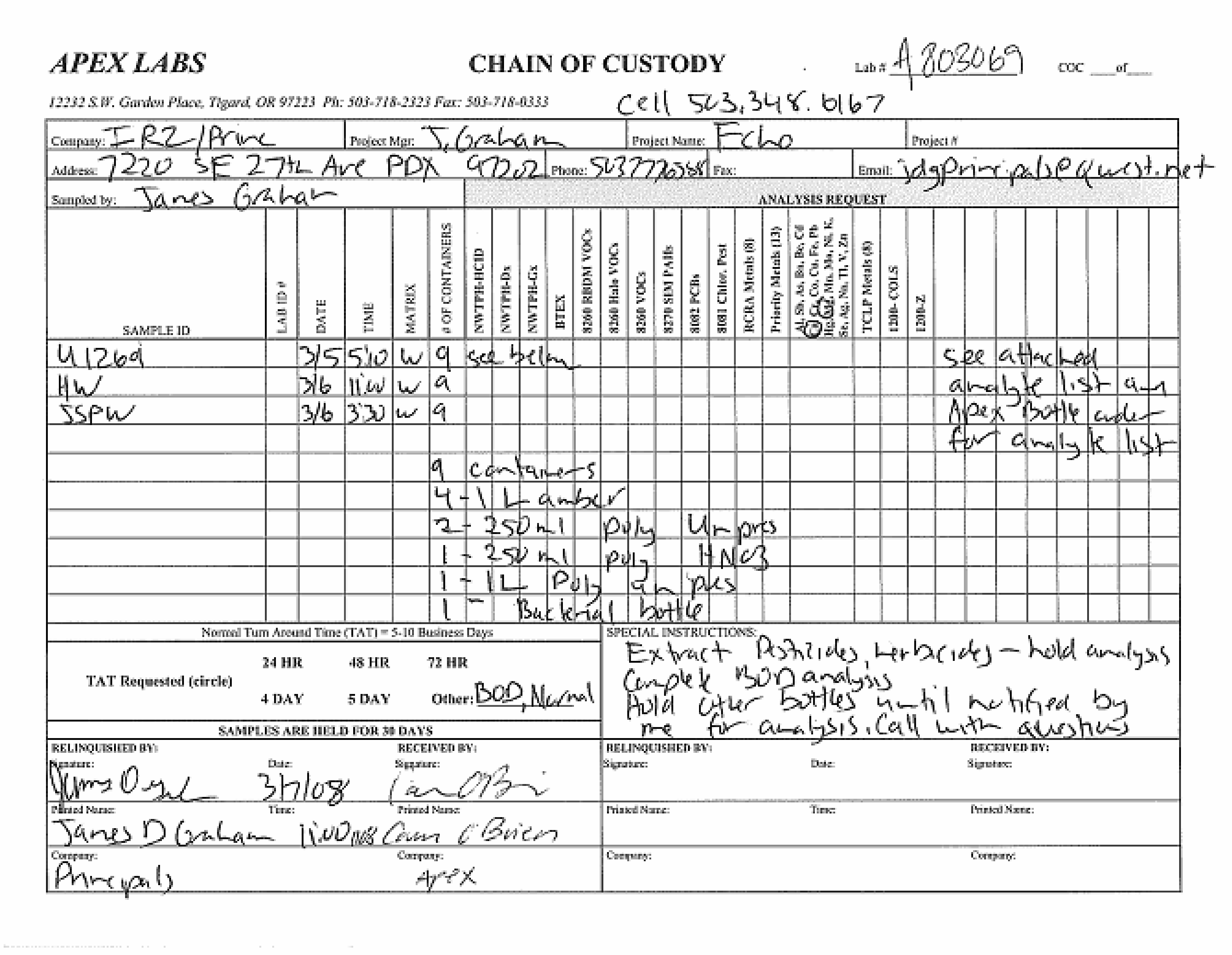
Qualifiers:

B	Analyte detected in the associated extraction blank.
B-01	The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.

Notes and Conventions:

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	If MDL is not listed, data has been evaluated to the Method Reporting Limit only.
Batch QC	Unless specifically stated, all analyses include full Batch QC, including Sample Duplicates, Matrix Spikes and/or Matrix Spike Duplicates, in order to meet or exceed method and regulatory requirements. This report contains only results for Batch QC derived from samples included in this report. Complete Batch QC results are available upon request. In cases where there is insufficient sample provided for Sample Duplicates and/or Matrix Spikes, a Lab Control Sample Duplicate (LCS Dup) is analyzed to demonstrate accuracy and precision of the extraction and analysis.

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:40



APEX LABS **CHAIN OF CUSTODY** Lab # A803069 COC ___ of ___

12232 S.W. Garden Place, Tigard, OR 97223 Ph: 503-718-2323 Fax: 503-718-0333

Cell 503.348.6167

Company: IRZ/Princ
Project Mgr: J. Graham
Project Name: Echo
Project #:
Address: 7220 SE 27th Ave PDX 97202
Phone: 5037726588
Fax:
Email: jdgprincipals@qwest.net
Sampled by: James Graham

ANALYSIS REQUEST

SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	BTEX	8260 RBDM VOCs	8260 Halo VOCs	8260 VOCs	8270 SIM PAHs	8082 PCBs	8081 Chlor. Pest	RCRA Metals (8)	Priority Metals (13)	Al, Sb, As, Ba, Be, Cd, Ca, Co, Cu, Fe, Pb, Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn	TCLP Metals (8)	1200-COLS	1200-Z								
U126a		3/5	5:10	W	9	see below																see attached							
HW		3/6	11:00	W	9																	analyte list and							
SSPW		3/6	3:30	W	9																	Apex Bottle order							
																						for analyte list							
					9 containers																								
					4 - 1L amber																								
					2 - 250ml poly Unpres																								
					1 - 250ml poly HNO3																								
					1 - 1L Poly unpres																								
					1 - Bacterial bottle																								

Normal Turn Around Time (TAT) = 5-10 Business Days

TAT Requested (circle) 24 HR 48 HR 72 HR 4 DAY 5 DAY Other: BOD, Normal

SAMPLES ARE HELD FOR 30 DAYS

SPECIAL INSTRUCTIONS:
Extract Pesticides, Herbicides – hold analysis
Complete BOD analysis
Hold other bottles until notified by me for analysis. Call with questions

RELINQUISHED BY:		RECEIVED BY:	RELINQUISHED BY:		RECEIVED BY:
Signature:	Date: 3/7/08	Signature:	Signature:	Date:	Signature:
Printed Name: James D Graham	Time: 1100	Printed Name: Cam O'Brien	Printed Name:	Time:	Printed Name:
Company: Principals		Company: Apex	Company:		Company:

The results provided in this report are PRELIMINARY and are subject to change based on subsequent analysis, QC validation or final data review. Please use these results with the understanding that they may have not been finalized by the laboratory

BioLogic Resources, LLC
10260 SW Nimbus Ave., Suite M11
Portland, OR 97223
Phone 503.670.1312
Fax 503.670.7262

For: Apex Laboratories
12232 SW Garden Place
Tigard, OR 97223
Attn: Darwin Thomas

Received: 03.07.08
Tested: 03.07.08
Completed: 03.12.08

Lab #	Sample	BOD_5 mg/L	Fecal Coliforms MPN/100mL
	Project: Apex080307-A803069		
AP066	A803069-01 U1269 03.05.08 17:10	< 2.0	< 2
AP067	A803069-02 HW 03.06.08 11:00	< 2.0	9
AP068	A803069-03 SSPW 03.06.08 15:30	< 2.0	< 2

Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998:
BOD_5: Method 5210B; Method 405.1, EPA
Fecal Coliforms: Method 9221E

Kim W. Hutchinson
Microbiologist/Principal

Apex Labs

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Tuesday, May 13, 2008

James Graham
Principals Environmental Group
7220 SE 27th Ave.
Portland, OR 97202 97202

RE: Echo / [none]

Enclosed are the results of analyses for samples received by the laboratory on 3/12/2008 at 1:21:00PM.

Thank you for using Apex Labs. We appreciate your business and strive to provide the highest quality services to the environmental industry.

If you have any questions concerning this report or the services we offer, please feel free to contact me by email at: dthomas@apex-labs.com, or by phone at 503-718-2323.

DRAFT REPORT

The results provided in this report are PRELIMINARY and are subject to change based on subsequent analysis, QC validation or final data review. Please use these results with the understanding that they may have not been finalized by the laboratory

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

ANALYTICAL REPORT FOR SAMPLES

SAMPLE INFORMATION

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Mills	A803112-01	Water	03/10/08 11:30	03/12/08 13:21
DMPW-2	A803112-02	Water	03/11/08 15:00	03/12/08 13:21

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

ANALYTICAL SAMPLE RESULTS

Anions by EPA 300.0 (Ion Chromatography)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
Mills (A803112-01)			**Matrix: Water**					
Chloride	**5.39**	---	0.100	mg/L	1	03/13/08 18:20	EPA 300.0	
Nitrate-Nitrogen	**2.03**	---	0.0250	"	"	"	"	H-06
Nitrite-Nitrogen	ND	---	0.0250	"	"	"	"	H-06
Sulfate	**6.59**	---	0.100	"	"	"	"	
DMPW-2 (A803112-02)			**Matrix: Water**					
Nitrite-Nitrogen	ND	---	0.0250	mg/L	1	03/13/08 14:14	EPA 300.0	
DMPW-2 (A803112-02RE1)			**Matrix: Water**					
Chloride	**59.0**	---	0.500	mg/L	5	03/13/08 15:01	EPA 300.0	
Nitrate-Nitrogen	**13.2**	---	0.125	"	"	"	"	A-01
Sulfate	**64.1**	---	0.500	"	"	"	"	

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
DMPW-2 (A803112-02)			**Matrix: Water**					
Calcium	**57300**	---	1000	ug/L	10	03/18/08 12:08	EPA 6020	
Magnesium	**23600**	---	1000	"	"	"	"	
Potassium	**4420**	---	100	"	1	03/17/08 16:49	"	
Sodium	**46200**	---	1000	"	10	03/18/08 12:08	"	
Hardness (Calc)	**240**	---	6.62	mg CaCO3/L	"	"	Calc	

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

ANALYTICAL SAMPLE RESULTS

Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
DMPW-2 (A803112-02)			**Matrix: Water**					
Total Dissolved Solids	**118**	---	10.0	mg/L	1	03/19/08 18:04	EPA 160.1	
DMPW-2 (A803112-02RE1)			**Matrix: Water**					
Total Alkalinity	**132**	---	20.0	mg CaCO3/L	1	03/18/08 12:52	EPA 310.1	
Bicarbonate Alkalinity	**132**	---	20.0	"	"	"	"	
Carbonate Alkalinity	ND	---	20.0	"	"	"	"	
Hydroxide Alkalinity	ND	---	20.0	"	"	"	"	

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Anions by EPA 300.0 (Ion Chromatography)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030129 - Method Prep: Aq						**Water**						
Blank (8030129-BLK1)						**Analyzed: 03/13/08 15:48**						
EPA 300.0												
Chloride	ND	---	0.100	mg/L	1	---	---	---	---	---	---	
Nitrate-Nitrogen	ND	---	0.0250	"	"	---	---	---	---	---	---	
Nitrite-Nitrogen	ND	---	0.0250	"	"	---	---	---	---	---	---	
Sulfate	ND	---	0.100	"	"	---	---	---	---	---	---	
LCS (8030129-BS1)						**Analyzed: 03/13/08 16:04**						
EPA 300.0												
Chloride	20.3	---	0.100	mg/L	1	20.0	---	101	85-115%	---	---	
Nitrate-Nitrogen	5.06	---	0.0250	"	"	5.00	---	101	"	---	---	
Nitrite-Nitrogen	4.95	---	0.0250	"	"	"	---	99	"	---	---	
Sulfate	19.1	---	0.100	"	"	20.0	---	95	"	---	---	
Duplicate (8030129-DUP1)			**Source: A803112-02**			**Analyzed: 03/13/08 14:29**						
EPA 300.0												
Nitrite-Nitrogen	ND	---	0.0250	mg/L	1	---	ND	---	---	---	20%	
Duplicate (8030129-DUP2)			**Source: A803112-02RE1**			**Analyzed: 03/13/08 15:32**						
EPA 300.0												
Chloride	**59.5**	---	0.500	mg/L	5	---	59.0	---	---	0.9	20%	
Nitrate-Nitrogen	**13.4**	---	0.125	"	"	---	13.2	---	---	2	20%	
Sulfate	**76.0**	---	0.500	"	"	---	64.1	---	---	17	20%	
Matrix Spike (8030129-MS1)			**Source: A803112-02RE1**			**Analyzed: 03/13/08 15:17**						
EPA 300.0												
Chloride	79.2	---	0.200	mg/L	1	20.0	59.0	101	75-125%	---	---	
Nitrate-Nitrogen	18.5	---	0.0500	"	"	5.00	13.2	106	"	---	---	
Nitrite-Nitrogen	4.83	---	0.0500	"	"	"	ND	97	"	---	---	
Matrix Spike (8030129-MS2)			**Source: A803112-02RE1**			**Analyzed: 03/13/08 17:00**						
EPA 300.0												
Sulfate	84.9	---	0.400	mg/L	2	20.0	64.1	104	75-125%	---	---	

DRAFT REPORT

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030150 - EPA 3015							**Water**					
Blank (8030150-BLK1)						**Analyzed: 03/17/08 13:25**						
EPA 6020												
Calcium	ND	---	100	ug/L	1	---	---	---	---	---	---	
Magnesium	ND	---	100	"	"	---	---	---	---	---	---	
Potassium	ND	---	100	"	"	---	---	---	---	---	---	
Sodium	ND	---	100	"	"	---	---	---	---	---	---	
LCS (8030150-BS1)						**Analyzed: 03/17/08 13:28**						
EPA 6020												
Calcium	2300	---	100	ug/L	1	2220	---	103	80-120%	---	---	
Magnesium	2350	---	100	"	"	"	---	106	"	---	---	
Potassium	2280	---	100	"	"	"	---	102	"	---	---	
Sodium	2200	---	100	"	"	"	---	99	"	---	---	
Duplicate (8030150-DUP1)			**Source: A803112-02**			**Analyzed: 03/17/08 16:52**						
EPA 6020												
Potassium	**4380**	---	100	ug/L	1	---	4420	---	---	1	20%	
						Analyzed: 03/18/08 12:11						
EPA 6020												
Calcium	**57600**	---	1000	"	10	---	57300	---	---	0.4	20%	
Magnesium	**23500**	---	1000	"	"	---	23600	---	---	0.05	20%	
Sodium	**46600**	---	1000	"	"	---	46200	---	---	0.8	20%	

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030176 - Method Prep: Aq							**Water**					
Blank (8030176-BLK1)						**Analyzed: 03/18/08 12:52**						
EPA 310.1												
Total Alkalinity	ND	---	20.0	mg CaCO3/L	1	---	---	---	---	---	---	
Bicarbonate Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
Carbonate Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
Hydroxide Alkalinity	ND	---	20.0	"	"	---	---	---	---	---	---	
LCS (8030176-BS1)						**Analyzed: 03/18/08 12:52**						
EPA 310.1												
Total Alkalinity	237	---		mg CaCO3/L	1	240	---	98.8	85-115%	---	---	A-01a

QUALITY CONTROL (QC) SAMPLE RESULTS

DRAFT: Conventional Chemistry Parameters

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 8030178 - Total Dissolved Solids							**Water**					
Blank (8030178-BLK1)						**Analyzed: 03/19/08 15:45**						
EPA 160.1												
Total Dissolved Solids	ND	---	10.0	mg/L	1	---	---	---	---	---	---	
Duplicate (8030178-DUP1)			**Source: A803112-02**			**Analyzed: 03/19/08 15:45**						
EPA 160.1												
Total Dissolved Solids	**134**	---	10.0	mg/L	1	---	118	---	---	13	20%	
Reference (8030178-SRM1)						**Analyzed: 03/19/08 18:04**						
EPA 160.1												
Total Dissolved Solids	588	---		mg/L	1	600		98	85-115%		---	

DRAFT REPORT

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Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44

SAMPLE PREPARATION INFORMATION

Apex Laboratories

Anions by EPA 300.0 (Ion Chromatography)

Method Prep: Aq

Batch: 8030129

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A803112-01	Water	EPA 300.0	03/10/08 11:30	03/13/08 12:58	10mL/10mL	10mL/10mL	1.00
A803112-02	Water	EPA 300.0	03/11/08 15:00	03/13/08 12:58	10mL/10mL	10mL/10mL	1.00
A803112-02RE1	Water	EPA 300.0	03/11/08 15:00	03/13/08 12:58	10mL/10mL	10mL/10mL	1.00

Total Metals by EPA 6020 (ICPMS)

[CALC]

Batch: [CALC]

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A803112-02	Water	Calc	03/11/08 15:00	03/14/08 14:45			NA

EPA 3015

Batch: 8030150

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A803112-02	Water	EPA 6020	03/11/08 15:00	03/14/08 14:45	45mL/50mL	45mL/50mL	1.00

Conventional Chemistry Parameters

Method Prep: Aq

Batch: 8030176

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A803112-02RE1	Water	EPA 310.1	03/11/08 15:00	03/18/08 11:30	50mL/50mL	50mL/50mL	NA

Total Dissolved Solids

Batch: 8030178

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A803112-02	Water	EPA 160.1	03/11/08 15:00	03/18/08 11:38	100mL/1N/A	100mL/1mL	NA

Notes and Definitions

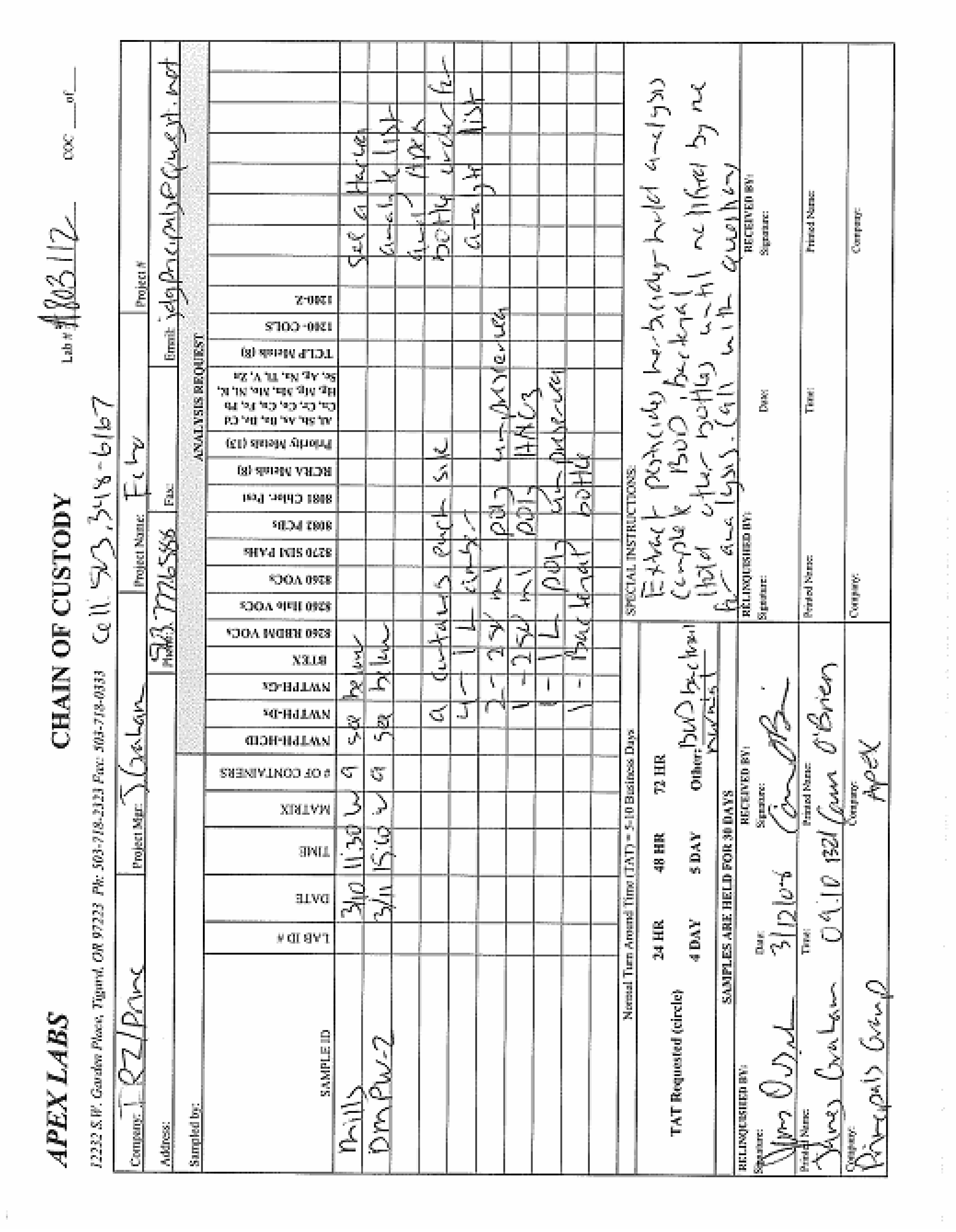
Qualifiers:

A-01	Rerun of sample prepared and originally run prior to hold-time expiration.
A-01a	Used for JP DOCs, BSD2 and 3 not calculating RPD correctly.
H-06	This sample was received outside the EPA recommended holding time.

Notes and Conventions:

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	If MDL is not listed, data has been evaluated to the Method Reporting Limit only.
Batch QC	Unless specifically stated, all analyses include full Batch QC, including Sample Duplicates, Matrix Spikes and/or Matrix Spike Duplicates, in order to meet or exceed method and regulatory requirements. This report contains only results for Batch QC derived from samples included in this report. Complete Batch QC results are available upon request. In cases where there is insufficient sample provided for Sample Duplicates and/or Matrix Spikes, a Lab Control Sample Duplicate (LCS Dup) is analyzed to demonstrate accuracy and precision of the extraction and analysis.

Principals Environmental Group	Project: **Echo**	
7220 SE 27th Ave.	Project Number: [none]	**Reported:**
Portland, OR 97202 97202	Project Manager: James Graham	05/13/08 15:44



APEX LABS

CHAIN OF COUSTODY

Lab # A803112

COC ___of___

12232 S.W. Garden Place, Tigard, OR 97223 Ph: 503-718-2323 Fax: 503-718-0333 Cell 503.348-6167

Company: I RZ/Princ
Project Mgr: J Graham
Project Name: Echo
Project #:
Address:
Phone: 503.7726586
Fax:
Email: jdgprincipals@quest.net
Sampled by:

ANALYSIS REQUEST

SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	BTEX	8260 RBDM VOCs	8260 Halo VOCs	8260 VOCs	8270 SIM PAHs	8082 PCBs	8081 Chlor. Pest	RCRA Metals (8)	Priority Metals (13)	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn	TCLP Metals (8)	1200-COLS	1200-Z
Mills		3/10	11:30	w	9	see below															
DMPW-2		3/11	15:00	w	9	see below															

see attached analyte list and Apex bottle order for analyte list

9 containers each site
4 - 1L amber
2 - 250 ml poly unpreserved
1 - 250 ml poly HNO3
1 - 1L poly unpreserved
1 - Bacterial bottle

Normal Turn Around Time (TAT) = 5-10 Business Days

TAT Requested (circle): 24 HR 48 HR 72 HR 4 DAY 5 DAY Other: BOD bacterial nitrate

SAMPLES ARE HELD FOR 30 DAYS

SPECIAL INSTRUCTIONS:
Extract pesticides, herbicides - hold analysis
complete BOD, bacterial
Hold other bottles until notified by me for analysis. Call with questions

RELINQUISHED BY:		RECEIVED BY:
Signature:	Date: 3/12/08	Signature:
Printed Name: James Graham	Time: 09:10 1321	Printed Name: Conn O'Brien
Company: Principals Group		Company: Apex

RELINQUISHED BY:		RECEIVED BY:
Signature:	Date:	Signature:
Printed Name:	Time:	Printed Name:
Company:		Company:

DRAFT REPORT

The results provided in this report are PRELIMINARY and are subject to change based on subsequent analysis, QC validation or final data review. Please use these results with the understanding that they may have not been finalized by the laboratory

PAL
Pacific Agricultural Laboratory
12505 N.W. Cornell Rd. • Portland, OR 97229-5651 • Ph 503.626.7943 • Fx 503.641.0644

May 8, 2008
IRZ Consulting
505 E Main Street
Hermiston, OR 97838

Report Number: P080207
Client Project ID: none given
Sample Matrix: water
Number of Samples: 5

Analytical Report

Client Sample ID: JSPW **PAL Sample ID:** P08020701

Ext. Date	Analysis Date	Analyte	Amount Detected	Method Reporting Limit
4/22/08	5/2/08	Dicamba	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	MCPA	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	2,4-D	Not detected	0.080 ug/liter (ppb)
4/23/08	5/1/08	Thifensulfuron	Not detected	0.0080 ug/liter (ppb)
4/23/08	5/1/08	Metsulfuron	Not detected	0.0080 ug/liter (ppb)

Client Sample ID: DMPW2 **PAL Sample ID:** P08020702

Ext. Date	Analysis Date	Analyte	Amount Detected	Method Reporting Limit
4/22/08	5/2/08	Dicamba	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	MCPA	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	2,4-D	Not detected	0.080 ug/liter (ppb)
4/23/08	5/1/08	Thifensulfuron	Not detected	0.0080 ug/liter (ppb)
4/23/08	5/1/08	Metsulfuron	Not detected	0.0080 ug/liter (ppb)

Client Sample ID: Mills **PAL Sample ID:** P08020703

Ext. Date	Analysis Date	Analyte	Amount Detected	Method Reporting Limit
4/22/08	5/2/08	Dicamba	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	MCPA	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	2,4-D	Not detected	0.080 ug/liter (ppb)
4/23/08	5/1/08	Thifensulfuron	Not detected	0.0080 ug/liter (ppb)
4/23/08	5/1/08	Metsulfuron	Not detected	0.0080 ug/liter (ppb)

Client Sample ID: Hunt Canal **PAL Sample ID:** P08020704

Ext. Date	Analysis Date	Analyte	Amount Detected	Method Reporting Limit
4/22/08	5/2/08	Dicamba	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	MCPA	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	2,4-D	Not detected	0.080 ug/liter (ppb)
4/23/08	5/1/08	Thifensulfuron	Not detected	0.0080 ug/liter (ppb)
4/23/08	5/1/08	Metsulfuron	Not detected	0.0080 ug/liter (ppb)

Client Sample ID: U-1269 **PAL Sample ID:** P08020705

Ext. Date	Analysis Date	Analyte	Amount Detected	Method Reporting Limit
4/22/08	5/2/08	Dicamba	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	MCPA	Not detected	0.080 ug/liter (ppb)
4/22/08	5/2/08	2,4-D	Not detected	0.080 ug/liter (ppb)
4/23/08	5/1/08	Thifensulfuron	Not detected	0.0080 ug/liter (ppb)
4/23/08	5/1/08	Metsulfuron	Not detected	0.0080 ug/liter (ppb)

Stephen Thun
Laboratory Director

Quality Assurance Report

Extr. Date	Analysis Date	Batch QC Sample #	Analyte	% Recovery Recovery	Expected %
Method Blank Data					
4/22/08	5/2/08	P080200 MB	Dicamba	Not detected	<0.080 ug/liter (ppb)
4/22/08	5/2/08	P080200 MB	MCPA	Not detected	<0.080 ug/liter (ppb)
4/22/08	5/2/08	P080200 MB	2,4-D	Not detected	<0.080 ug/liter (ppb)
4/23/08	5/1/08	P080207 MB	Thifensulfuron	Not detected	<0.0080 ug/liter (ppb)
4/23/08	5/1/08	P080207 MB	Metsulfuron	Not detected	<0.0080 ug/liter (ppb)
Matrix Spike Data					
4/22/08	5/2/08	P080200 LCS	Dicamba	59	0-169
4/22/08	5/2/08	P080200 LCS	MCPA	43	0-161
4/22/08	5/2/08	P080200 LCS	2,4-D	70	54-111
4/23/08	5/1/08	P080207 LCS	Thifensulfuron	100	40-120
4/23/08	5/1/08	P080207 LCS	Metsulfuron	108	40-120
4/22/08	5/2/08	P080200 LCSD	Dicamba	79	0-169
4/22/08	5/2/08	P080200 LCSD	MCPA	73	0-161
4/22/08	5/2/08	P080200 LCSD	2,4-D	91	54-111
4/23/08	5/1/08	P080207 LCSD	Thifensulfuron	106	40-120
4/23/08	5/1/08	P080207 LCSD	Metsulfuron	110	40-120

Additional Project Information

Methodology Employed

Dicamba, MCPA and 2,4-D in Water	EPA 8321A (HPLC-MS)
Thifensulfuron and Metsulfuron in Water	DuPont Method (HPLC-MS)

Additional Project Notes

1. The chlorinated acids were converted to their free acid forms. These residues were then quantitated as free acids.

Pacific Agricultural Laboratory

Analytical Request/Chain of Custody

Pacific Agricultural Laboratory
12505 N.W. Cornell Rd. • Portland, OR 97229
Tel 503.626.7943 • Fax 503.641.0644 • www.pacaglab.com

Page ____ of ____
PAL Project # P080207

CLIENT INFO

Name James Graham (for)
Contact IRZ Consulting
Address 505 E Main Street
City Hermiston State OR Zip 97838
Telephone 541-567-0252 Fax ____
Email Saida@irz.com
Project # Echo Purchase Order # ____
Method of Shipment Brought to Lab

Requested Turnaround Time
☒ Standard (10 working days)
☐ Rush ____ please specify

PAL ID	Client Sample ID	Sample Date	Sample Time	Sample Type	Container Type	No. of Containers	Requested Analysis: 8321A	DuPont	547 No (SLT)	see attached	sheet for	Herbicide list	Comments
P080207 01	JSPW	4/17	1330	w	Amber, 1L	2	X	X	?				Call Said
02	DM PW2	"	1400	w	"	"	X	X	?				@ 541-314-3170
03	Mills	"	14:37	"	"	"	X	X	?				for confirmation
04	Hunt Canal	"	14:55	"	"	"	X	X	?				regarding
05	U-1269	"	15:15	"	"	"	X	X	?				EPA 547

Relinquished by: SIGNATURE James O Graham DATE 4/18/08 TIME 11:15
Received by SIGNATURE Dan DATE 4-18-08 TIME 11:15

Relinquished by: SIGNATURE ____ DATE ____ TIME ____
Received by SIGNATURE ____ DATE ____ TIME ____

Lab Comments: ____

BioLogic Resources, LLC
10260 SW Nimbus Ave., Suite M11
Portland, OR 97223
Phone 503.670.1312
Fax 503.670.7262

For: Apex Laboratories
12232 SW Garden Place
Tigard, OR 97223
Attn: Darwin Thomas

Received: 03.12.08
Tested: 03.12.08
Completed: 03.18.08

Lab #	**Sample**	**BOD_5 mg/L**	**Fecal Coliforms MPN/100mL**
	Project: Apex080312-A803112		
AP070	A803112-01 Mills 03.10.08 11:30	< 2.0	< 2
AP071	A803112-02 DMPW-2 03.11.08 15:00	< 2.0	17

Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998:
BOD_5: Method 5210B; Method 405.1, EPA
Fecal Coliforms: Method 9221E

Kim W. Hutchinson
Microbiologist/Principal

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-001	**Sampling Date**	6/3/2008	**Date/Time Received**	6/5/2008 10:15 AM
Client Sample ID	U1317	**Sampling Time**	6:00 PM		
Matrix:	Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	33.4	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	8.23	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	4.84	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Color (true)	10	Color Units	5	6/10/2008	DMB	EPA 110.2	
Hardness	ND	mg/L	1	6/16/2008	DMB	EPA 200.8	
Iron	0.157	mg/L	0.01	6/11/2008	DMB	EPA 200.8	
Magnesium	3.31	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Manganese	0.00176	mg/L	0.001	6/11/2008	DMB	EPA 200.8	
NO3/N	1.60	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	1.60	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	2.06	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	5.72	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
TDS	60	mg/L	10	6/16/2008	DMB	EPA 160.1	
Sulfate	8.96	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Turbidity	ND	NTU	0.1	6/16/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.046	cm-1	0.009	6/10/2008	SUB	SM 5910	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C1320
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C1287

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-002	**Sampling Date**	6/3/2008	**Date/Time Received**	6/5/2008 10:15 AM
Client Sample ID	HCSW1	**Sampling Time**	5:30 PM		
Matrix:	Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	60	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	30.1	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	4.09	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	1.03	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Color (true)	ND	Color Units	5	6/10/2008	DMB	EPA 110.2	
Magnesium	1.64	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
NO3/N	0.075	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	0.101	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	0.026	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	1.37	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	2.63	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sulfate	1.19	mg/L	0.1	6/5/2008	JTT	EPA 300.0	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-003	**Sampling Date**	6/3/2008	**Date/Time Received**	6/5/2008	10:15 AM
Client Sample ID	U1269	**Sampling Time**	5:00 PM			
Matrix:	Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	215	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	51.8	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	52.7	mg/L	0.5	6/11/2008	JTT	EPA 300.0	
Color (true)	5	Color Units	5	6/10/2008	DMB	EPA 110.2	
Hardness	ND	mg/L	1	6/16/2008	DMB	EPA 200.8	
Iron	2.14	mg/L	0.01	6/11/2008	DMB	EPA 200.8	
Magnesium	23.1	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Manganese	0.0704	mg/L	0.001	6/11/2008	DMB	EPA 200.8	
NO3/N	7.32	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	7.42	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	0.104	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	8.65	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	40.1	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
TDS	500	mg/L	10	6/16/2008	DMB	EPA 160.1	
Sulfate	75.4	mg/L	0.5	6/11/2008	JTT	EPA 300.0	
Turbidity	ND	NTU	0.1	6/16/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.046	cm-1	0.009	6/10/2008	SUB	SM 5910	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-004	**Sampling Date**	6/3/2008	**Date/Time Received**	6/5/2008	10:15 AM
Client Sample ID	DMPW2	**Sampling Time**	4:30 PM			
Matrix:	Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	136	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	49.2	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	65.1	mg/L	0.5	6/11/2008	JTT	EPA 300.0	
Color (true)	ND	Color Units	5	6/10/2008	DMB	EPA 110.2	
Magnesium	19.8	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
NO3/N	15.4	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	15.4	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	3.47	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	37.4	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sulfate	77.8	mg/L	0.5	6/11/2008	JTT	EPA 300.0	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-005	**Sampling Date**	6/4/2008	**Date/Time Received**	6/5/2008 10:15 AM
Client Sample ID	U1198	**Sampling Time**	12:00 PM		
Matrix:	Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	236	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	57.6	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	34.3	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Color (true)	10	Color Units	5	6/10/2008	DMB	EPA 110.2	
Hardness	ND	mg/L	1	6/16/2008	DMB	EPA 200.8	
Iron	ND	mg/L	0.01	6/11/2008	DMB	EPA 200.8	
Magnesium	18.6	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Manganese	0.00543	mg/L	0.001	6/11/2008	DMB	EPA 200.8	
NO3/N	0.354	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	0.354	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	2.61	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	27.4	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
TDS	347	mg/L	10	6/16/2008	DMB	EPA 160.1	
Sulfate	30.6	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Turbidity	ND	NTU	0.1	6/16/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.11	cm-1	0.009	6/10/2008	SUB	SM 5910	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-006	**Sampling Date**	6/3/2008	**Date/Time Received**	6/5/2008 10:15 AM
Client Sample ID	U1269 DUP	**Sampling Time**	5:15 PM		
Matrix:	Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Iron	1.96	mg/L	0.01	6/11/2008	DMB	EPA 200.8	
Manganese	0.0701	mg/L	0.001	6/11/2008	DMB	EPA 200.8	
NO3/N	7.29	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	7.39	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	0.104	mg/L	0.01	6/5/2008	JTT	EPA 300.0	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Client:	IRZ CONSULTING LLC	**Batch #:**	080605020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMAT. RECHARGE 08-016
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080605020-007	**Sampling Date**	6/4/2008	**Date/Time Received**	6/5/2008	10:15 AM
Client Sample ID	U1193	**Sampling Time**	10:00 AM			
Matrix:	Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	<2	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	189	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	57.0	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	14.1	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Color (true)	5	Color Units	5	6/10/2008	DMB	EPA 110.2	
Hardness	ND	mg/L	1	6/16/2008	DMB	EPA 200.8	
Iron	ND	mg/L	0.01			EPA 200.8	
Magnesium	15.8	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Manganese	ND	mg/L	0.001	6/16/2008	DMB	EPA 200.8	
NO3/N	8.77	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	8.77	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	3.53	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	10.3	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
TDS	358	mg/L	10	6/16/2008	DMB	EPA 160.1	
Sulfate	22.5	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Turbidity	ND	NTU	0.1	6/16/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.025	cm-1	0.009	6/10/2008	SUB	SM 5910	

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080605020
Project Name: UMAT. RECHARGE 08-016

Analytical Results Report

Sample Number 080605020-008
Client Sample ID U1177
Matrix: Water

Sampling Date 6/4/2008
Sampling Time 12:30 PM

Date/Time Received 6/5/2008 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Fecal Coliform	23	MPN/100mL	2	6/6/2008	KAS	SM9221E	
Bicarbonate	154	mg/L	10	6/10/2008	DMB	SM2320B	
BOD	<2	mg/L	2	6/10/2008	EMB	SM5210B	
Calcium	61.9	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	10	6/10/2008	DMB	SM2320B	
Chloride	48.8	mg/L	0.1	6/5/2008	JTT	EPA 300.0	
Color (true)	ND	Color Units	5	6/10/2008	DMB	EPA 110.2	
Magnesium	14.5	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
NO3/N	14.3	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO3/N+NO2/N	14.4	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
NO2/N	0.055	mg/L	0.01	6/5/2008	JTT	EPA 300.0	
Potassium	4.04	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sodium	27.4	mg/L	0.1	6/16/2008	DMB	EPA 200.8	
Sulfate	52.1	mg/L	0.5	6/11/2008	JTT	EPA 300.0	

Authorized Signature

MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

Comments: UV 254 ANALYSIS PERFORMED BY MWH LABS , MONROVIA CALIFORNIA

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-001	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008 11:00 AM
Client Sample ID	U1269	**Sampling Time**	1:30 PM		
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	194	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	50.5	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	50.7	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	23.4	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	7.48	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	8.89	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	43.5	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	517	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	70.7	mg/L	0.5	7/28/2008	JTT	EPA 300.0	

Comments:

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-002	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008 11:00 AM
Client Sample ID	DMPW2	**Sampling Time**	10:30 AM		
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	140	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	82.4	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	56.8	mg/L	0.5	7/28/2008	JTT	EPA 300.0	
Magnesium	34.1	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	13.7	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	6.10	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	68.1	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	506	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	72.5	mg/L	0.5	7/28/2008	JTT	EPA 300.0	

Comments:

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-003	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008 11:00 AM
Client Sample ID	JSPW1	**Sampling Time**	11:15 AM		
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	114	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	24.5	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	8.37	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	10.7	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	2.10	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	6.92	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	11.7	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	230	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	14.5	mg/L	0.1	7/24/2008	JTT	EPA 300.0	

Comments:

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080724047
Project Name: UMATILLA RECHARGE

Analytical Results Report

Sample Number 080724047-004
Client Sample ID U1317
Matrix: Drinking Water

Sampling Date 7/22/2008
Sampling Time 1:00 PM

Date/Time Received 7/24/2008 11:00 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	40.0	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	6.86	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	3.17	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	2.81	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	0.603	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	2.08	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	6.15	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	115	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	3.77	mg/L	0.1	7/24/2008	JTT	EPA 300.0	

Comments:

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-005	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008	11:00 AM
Client Sample ID	TCDW1	**Sampling Time**	1:55 PM			
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	251	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	56.4	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	22.3	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	19.6	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	3.38	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	3.06	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	20.4	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	416	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	34.0	mg/L	0.1	7/24/2008	JTT	EPA 300.0	

Comments:

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-006	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008 11:00 AM
Client Sample ID	WETLAND	**Sampling Time**	3:30 PM		
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	43.4	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	6.81	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	2.69	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	2.77	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	ND	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	1.82	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	5.23	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	84	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	2.31	mg/L	0.1	7/24/2008	JTT	EPA 300.0	

Comments:

Client:	IRZ CONSULTING LLC	**Batch #:**	080724047
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080724047-007	**Sampling Date**	7/22/2008	**Date/Time Received**	7/24/2008 11:00 AM
Client Sample ID	HCSW1	**Sampling Time**	11:00 AM		
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	45.5	mg/L	5	7/25/2008	DMB	SM2320B	
Calcium	7.47	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	7/25/2008	DMB	SM2320B	
Chloride	2.95	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Magnesium	3.08	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
NO3/N+NO2/N	0.219	mg/L	0.1	7/24/2008	JTT	EPA 300.0	
Potassium	1.98	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
Sodium	5.40	mg/L	0.1	7/31/2008	DMB	EPA 200.8	
TDS	71	mg/L	10	7/30/2008	DMB	EPA 160.1	
Sulfate	2.72	mg/L	0.1	7/24/2008	JTT	EPA 300.0	

Authorized Signature

MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

Comments:

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C1320
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C1287

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080400

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information

Federal Express; 5/23/2008; 1110 Hrs; 7.2°C; Wound
Results submitted by:
President Secretary 6/5/08

Sample Identification: Echo Meadows, HC, Raw water

Sample Information: SOURCE: Irrigation Canal; Unchlorinated; pH 5.65; 10.31°C

Sample Date & Time: 5/21/2008 03:18 PM —» 5/21/2008 03:56 PM **Sampler:** Said Amali

Amount: 115.4425 L (30.5 gal) **Filter Color:** Brown **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:33 PM **Centrifugate:** 0.303 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.1924 L

Amorphous Debris	silt (2-50 µm), clay (1-2 µm), sand (50-2000 µm), inorganic precipitate, aggregates
Algae	100,000/100 L, predominantly Chlorophytes, Chlamydomonas, Scenedesmus, Zygnematales
Diatoms	500,000/100 L, predominantly Pennales, Synedra, Navicula, Nitzschia, Cymbella, Diatoma, Cocconeis, Achnanthes, Fragilaria, Gomphonema, Rhoicosphenia, some Centrales, Melosira
Plant debris	ND
Rotifers	ND
Nematodes	500/100 L
Pollen (pine)	2,000/100 L
Ameba	1,000/100 L, test
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber; Section 11.1.1 omitted. All limitations stated in the method apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, then particulate extraction was modified.

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080400

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information

Federal Express; 5/23/2008; 1110 Hrs; 8.2°C; Wound
Results submitted by
President/Secretary 6/5/08

Sample Identification: Morrow County, Dr., CLWID-B Line, Raw water

Sample Information: SOURCE: Lake or Reservoir; Unchlorinated

Sample Date & Time: 5/21/2008 11:21 AM —» 5/21/2008 12:10 PM **Sampler:** Said Amali

Amount: 193.035 L (51 gal) **Filter Color:** Light brown **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:33 PM **Centrifugate:** 0.259 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.09652 L

Amorphous Debris	clay (1-2 µm), silt (2-50 µm), inorganic precipitate, aggregates
Algae	5,000,000/100 L, predominantly Chlorophytes, Chlamydomonas, Scenedesmus, Spirogyra, Ulothrix, Oedogonium, Pediastrum, Closterium, some Cyanophytes, Merismopedia, Oscillatoria, some Cryptomonads, Chroomonas
Diatoms	9,000,000/100 L, predominantly Pennales, Synedra, Fragilaria, Gomphonema, Navicula, Nitzschia, Cymbella, some Centrales, Cyclotella
Plant debris	ND
Rotifers	ND
Nematodes	3,000/100 L
Pollen (pine)	1,000/100 L
Ameba	2,000/100 L, test
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber; Section 11.1.1 omitted. All limitations stated in the method apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, then particulate extraction was modified.

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080400

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Laboratory Information

Federal Express; 5/23/2008; 1110 Hrs; 7.6°C; Wound
Results submitted by:
President/Secretary 6/5/08

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Sample Identification: Morrow County, Dr., CLWID-Well

Sample Information: SOURCE: Drilled Well; Unchlorinated

Sample Date & Time: 5/21/2008 01:37 PM —» 5/22/2008 08:40 AM **Sampler:** Said Amali

Amount: 2937.16 L (776 gal) **Filter Color:** Off white **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:07 PM **Centrifugate:** <0.001 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 590 L

Amorphous Debris	clay (1-2 µm), silt (2-50 µm), inorganic precipitate, aggregates
Algae	6/100 Gal, some Chlorophytes, Cosmarium, Didymocystis
Diatoms	2/100 Gal, some Centrales, Stephanodiscus
Plant debris	ND
Rotifers	ND
Nematodes	54/100 Gal
Pollen (pine)	1/100 Gal
Ameba	34/100 Gal, test
Ciliates	ND
Colorless Flagellates	4/100 Gal
Crustaceans	ND
Other Arthropods	ND
Other	ND

Giardia and Coccidia are none detected (ND) by MPA unless reported under "Other".

This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). 1992. USEPA, Port Orchard, WA, EPA 910/9-92-029. All limitations stated in the methods apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, particulate extraction was modified.

COMMENTS: Score: 10-Moderate Risk per EPA Consensus Method referenced above.

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080514

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information
UPS; 6/19/2008; 0940 Hrs; 17.6°C; Wound
Results submitted by:
TJC

Sample Identification: Echo Meadows, U1269

Sample Information: SOURCE: Drilled Well; Unchlorinated

Sample Date & Time: 6/16/2008 06:00 PM —» 6/17/2008 12:14 PM **Sampler:** Said Amali

Amount: 1981.448 L (523.5 gal) **Filter Color:** Rust **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 6/19/2008 01:41 PM **Centrifugate:** 0.265 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 9 L

Amorphous Debris	silt (2-50 µm), clay (1-2 µm)
Algae	ND
Diatoms	ND
Plant debris	ND
Rotifers	ND
Nematodes	ND
Pollen (pine)	ND
Ameba	ND
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

Giardia and Coccidia are none detected (ND) by MPA unless reported under "Other".

This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). 1992. USEPA, Port Orchard, WA, EPA 910/9-92-029. All limitations stated in the methods apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, particulate extraction was modified.

COMMENTS: Score: 0-Low Risk per EPA Consensus Method referenced above.

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To: Mr. Said Amali
IRZ Consulting, Inc.
505 E. Main
Hermiston, Oregon 97838

Date: 8/6/08

Lab No.: 08-223

Project: Laboratory Testing – Umatilla Recharge Project

Project No.: 2065.1.1

Report of: Sieve analysis

Sample Identification

As requested, NTI provided sieve analysis on samples delivered to our laboratory on July 28, 2008 by an IRZ Consulting, Inc. representative. All testing was performed in general accordance with the methods indicated. Our laboratory's test results are summarized on the following table and attached page.

Laboratory Test Results

Sieve Analysis of Aggregate (ASTM C136/ C117)				
Sieve Size	**CL SS 1 @ 6" – 3.0' Percent Passing**	**CL SS 2 @ 6" – 3.0' Percent Passing**	**CL SS 3 @ 6" – 3.0' Percent Passing**	**FD 1-1 @ 6" – 3.0' Percent Passing**
⅜"	100	100	100	100
¼"	99	100	100	100
#4	99	100	99	100
#8	98	100	99	100
#10	98	99	98	100
#16	95	98	97	100
#30	73	80	80	99
#40	49	60	55	97
#50	27	36	32	91
#100	16	14	17	53
#200	12.7	9.8	10.8	31.5

Copies: Addressee
Bryan Black, HDR, Inc.

REVIEWED BY: Bridgett Adams

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To: Mr. Said Amali
IRZ Consulting, Inc.
505 E. Main
Hermiston, Oregon 97838

Date: 8/6/08

Lab No.: 08-223

Project: Laboratory Testing – Umatilla Recharge Project

Project No.: 2065.1.1

Laboratory Test Results

Sieve Analysis of Aggregate (ASTM C136/ C117)

Sieve Size	FD 1-2 @ 6" – 2.5' Percent Passing	FD 1-2 @ 2.5' – 3.0' Percent Passing	FD 1-3 @ 6" – 3.0' Percent Passing
½"	100	100	100
⅜"	100	99	100
¼"	99	98	100
#4	99	98	100
#8	99	98	100
#10	99	98	99
#16	98	97	99
#30	97	95	96
#40	94	92	93
#50	89	86	86
#100	61	66	67
#200	40.4	50.7	44.3

REVIEWED BY: Bridgett Adame

Anatek Labs, Inc.

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504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-001	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008	11:00 AM
Client Sample ID	HUNT DITCH					
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	18.4	mg/L	1	5/23/2008	DMB	SM2320B	
Aluminum	0.450	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	80	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	80	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	80	MPN/100mL	2	5/24/2008	WOZ	SM9221B	
Barium	0.0197	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bicarbonate	18.4	mg/L	5	5/23/2008	DMB	SM2320B	
BOD	2.24	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	4.15	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	6/2/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	6/2/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	0.720	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	10	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	0.00124	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	-2.61			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.111	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/28/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/28/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.116	mg/L	0.1	5/22/2008	JTT	EPA 300.0	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-001 **Sampling Date** 5/20/2008 **Date/Time Received** 5/21/2008 11:00 AM
Client Sample ID HUNT DITCH
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	
Dibromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Dichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/23/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Hardness	16.6	mg/L	1	5/23/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	0.751	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	1.50	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	0.0198	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	5/27/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	5/27/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	5/27/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	5/27/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	5/27/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	5/27/2008	SAT	EPA 505	
Potassium	1.44	mg/L	0.1	5/23/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-001	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	HUNT DITCH				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Selenium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
Dicamba	ND	ug/L	2	6/4/2008	TGT	EPA 8321A	
MCPA	ND	ug/L	0.1	6/4/2008	TGT	EPA 8321A	
Metsulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Thifensulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Tribenuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
silica (as SiO2)	13.2	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	2.72	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	57	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	100	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	0.967	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
TOC	2.37	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	42.6	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.091	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-001 **Sampling Date** 5/20/2008 **Date/Time Received** 5/21/2008 11:00 AM
Client Sample ID HUNT DITCH
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	0.00142	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-002	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	DMPW2				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	188	mg/L	1	5/23/2008	DMB	SM2320B	
Aluminum	ND	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	0.00409	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	2	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	2	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	11	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Barium	0.0382	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bicarbonate	188	mg/L	5	5/23/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	60.7	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	6/2/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	6/2/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	66.3	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	0.00115	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	ND	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	0.00128	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	0.306			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.310	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/28/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/28/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.487	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	
Dibromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-002	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008	11:00 AM
Client Sample ID	DMPW2					
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Dichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/23/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Hardness	251	mg/L	1	5/23/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	0.352	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	24.0	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	16.3	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	6/4/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	6/4/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	6/4/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	6/4/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	6/4/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	6/4/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	6/4/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	6/4/2008	SAT	EPA 505	
Potassium	3.98	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Selenium	0.00699	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-002	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008	11:00 AM	
Client Sample ID	DMPW2						
Matrix:	Drinking Water						

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
Dicamba	ND	ug/L	2	6/4/2008	TGT	EPA 8321A	
MCPA	ND	ug/L	0.1	6/4/2008	TGT	EPA 8321A	
Metsulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Thifensulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Tribenuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
silica (as SiO2)	24.7	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	45.3	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	464	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	ND	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	78.9	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
TOC	1.42	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	0.44	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.024	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-002	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	DMPW2				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	0.0710	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-003	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008	11:00 AM
Client Sample ID	DMPW2-DUP					
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	175	mg/L	1	5/23/2008	DMB	SM2320B	
Aluminum	ND	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	0.00417	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	8	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Barium	0.0384	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bicarbonate	175	mg/L	5	5/23/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	70.1	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	6/2/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	6/2/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	68.4	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	0.00114	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	ND	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	0.232			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.329	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/28/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/28/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.475	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	
Dibromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-003	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008	11:00 AM
Client Sample ID	DMPW2-DUP					
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Dichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/23/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Hardness	289	mg/L	1	5/23/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	0.343	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	27.6	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	16.4	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	6/4/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	6/4/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	6/4/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	6/4/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	6/4/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	6/4/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	6/4/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	6/4/2008	SAT	EPA 505	
Potassium	4.36	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Selenium	0.00706	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Anatek Labs, Inc.

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Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-003	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	DMPW2-DUP				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
Dicamba	ND	ug/L	2	6/4/2008	TGT	EPA 8321A	
MCPA	ND	ug/L	0.1	6/4/2008	TGT	EPA 8321A	
Metsulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Thifensulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Tribenuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
silica (as SiO2)	23.4	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	50.6	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	484	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	ND	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	81.5	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
TOC	1.39	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	ND	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.024	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-003	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	DMPW2-DUP				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	0.0563	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-004	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	U1269				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	229	mg/L	1	5/23/2008	DMB	SM2320B	
Aluminum	ND	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	<2	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Barium	0.0769	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bicarbonate	229	mg/L	5	5/23/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	67.8	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	6/2/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	6/2/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	53.8	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	0.00143	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	10	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	-0.00539			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.0997	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	0.00185	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/28/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/28/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.188	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	
Dibromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-004 **Sampling Date** 5/20/2008 **Date/Time Received** 5/21/2008 11:00 AM
Client Sample ID U1269
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Dichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/23/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/23/2008	SAT	SM6251B	
Hardness	295	mg/L	1	5/23/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	2.02	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	30.4	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	0.0887	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	7.57	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	6/2/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	6/2/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	6/2/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	6/2/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	6/2/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	6/2/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	6/2/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	6/2/2008	SAT	EPA 505	
Potassium	10.4	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Selenium	0.00448	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-004	**Sampling Date**	5/20/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	U1269				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
Dicamba	ND	ug/L	2	6/4/2008	TGT	EPA 8321A	
MCPA	ND	ug/L	0.1	6/4/2008	TGT	EPA 8321A	
Metsulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Thifensulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Tribenuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
silica (as SiO2)	19.9	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	52.5	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	496	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	6.54	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	76.5	mg/L	0.1	6/3/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/22/2008	TGT	EPA 524.2	
TOC	2.43	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	32.1	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.050	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-004
Sampling Date 5/20/2008
Date/Time Received 5/21/2008 11:00 AM
Client Sample ID U1269
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	0.00193	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-005
Sampling Date 5/19/2008
Date/Time Received 5/21/2008 11:00 AM
Client Sample ID McNARY POOL
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	41.9	mg/L	1	5/28/2008	DMB	SM2320B	
Aluminum	0.351	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	0.00150	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	2	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	2	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	2	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Barium	0.0165	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beta particles/photon emmiters	ND	pCi/L	100	6/6/2008	SUB	EPA 901.1	
Bicarbonate	41.9	mg/L	5	5/28/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	9.35	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	5/30/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	5/30/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/28/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	2.83	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	ND	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	0.00187	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	-1.38			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.0850	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/28/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/28/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.179	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-005	**Sampling Date**	5/19/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	McNARY POOL				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Gross Alpha	ND	pCi/L	2.16	5/29/2008	SUB	EPA 900.0	
Gross Beta	ND	pCi/L	3.74	5/29/2008	SUB	EPA 900.0	
Dibromoacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Dichloroacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/29/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Hardness	35.4	mg/L	1	5/29/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	0.420	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	2.93	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
Manganese	0.0168	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N+NO2/N	0.314	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	5/27/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	5/27/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	5/27/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	5/27/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	5/27/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	5/27/2008	SAT	EPA 505	
Potassium	1.21	mg/L	0.1	5/29/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-005	**Sampling Date**	5/19/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	McNARY POOL				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Radium 226	ND	pCi/L	0.88	5/31/2008	SUB	EPA 903.0	
Radium 228	ND	pCi/L	0.1	5/31/2008	SUB	EPA 904.0	
Selenium	0.00128	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
silica (as SiO2)	7.01	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	5.56	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
TDS	80	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	8.61	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	8.17	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
TOC	2.55	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	7.31	NTU	0.1	5/28/2008	DMB	EPA 180.1	
Uranium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
UV Absorbance at 254 nm	0.023	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

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Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-005	**Sampling Date**	5/19/2008	**Date/Time Received**	5/21/2008 11:00 AM
Client Sample ID	McNARY POOL				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	0.00427	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-006	**Sampling Date**	5/21/2008	**Date/Time Received**	5/22/2008 11:00 AM
Client Sample ID	CLWID WELL 1				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	70.4	mg/L	1	5/23/2008	DMB	SM2320B	
Aluminum	ND	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Antimony	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Arsenic	0.00352	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
E. Coli	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221F	
Fecal Coliform	<2	MPN/100mL	2	5/24/2008	WOZ	SM9221E	
Total Coliform	<2	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Barium	0.0111	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Beryllium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bicarbonate	70.4	mg/L	5	5/23/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Cadmium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Calcium	18.6	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbofuran	ND	ug/L	2	5/30/2008	JWC	EPA 531.1	
Oxamyl	ND	ug/L	4	5/30/2008	JWC	EPA 531.1	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloramine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chloride	1.95	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Chlorine	ND	mg/L	0.05	5/27/2008	ETL	SM4500CLG	
Chromium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Color	5	color units	5	5/23/2008	DMB	EPA 110.2	
Copper	0.00106	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Corrosivity	-0.279			5/30/2008	ETL	Calculation	
Cyanide	ND	mg/L	0.01	5/29/2008	ETL	EPA 335.4	
Diquat	ND	ug/L	0.8	5/27/2008	JWC	EPA 549.2	
Dissolved Iron	0.0704	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Dissolved Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
1,2-Dibromo-3-chloropropane(DBCP)	ND	ug/L	0.04	5/29/2008	SAT	EPA 504.1	
1,2-Dibromoethane (EDB)	ND	ug/L	0.02	5/29/2008	SAT	EPA 504.1	
Endothall	ND	ug/L	10	5/28/2008	EMP	EPA 548.1	
Fluoride	0.220	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Glyphosate	ND	ug/L	9	5/28/2008	JWC	EPA 547	
Dibromoacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-006	**Sampling Date**	5/21/2008	**Date/Time Received**	5/22/2008	11:00 AM
Client Sample ID	CLWID WELL 1					
Matrix:	Drinking Water					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Dichloroacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Monobromoacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Monochloroacetic acid	ND	ug/L	2	5/29/2008	SAT	SM6251B	
Total HAA5	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Trichloroacetic acid	ND	ug/L	1	5/29/2008	SAT	SM6251B	
Hardness	68.6	mg/L	1	5/23/2008	DMB	EPA 200.8	
2,4,5-TP (Silvex)	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dalapon	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dicamba	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Dinoseb	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Pentachlorophenol	ND	ug/L	0.08	5/27/2008	SAT	EPA 515.3	
Picloram	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Iron	0.0907	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Lead	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Magnesium	5.36	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Mercury-Icpms	ND	mg/L	0.0001	5/28/2008	DMB	EPA 200.8	
Nickel	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	0.314	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
NO2/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Odor	ND	TON	1	5/21/2008	ETL	EPA 140.1	
Chlordane	ND	ug/L	0.4	5/27/2008	SAT	EPA 505	
Endrin	ND	ug/L	0.02	5/27/2008	SAT	EPA 505	
gamma-BHC (Lindane)	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Heptachlor	ND	ug/L	0.08	5/27/2008	SAT	EPA 505	
Heptachlor epoxide	ND	ug/L	0.04	5/27/2008	SAT	EPA 505	
Methoxychlor	ND	ug/L	0.2	5/27/2008	SAT	EPA 505	
PCBs	ND	µg/L	0.5	5/27/2008	SAT	EPA 505	
Toxaphene	ND	ug/L	2	5/27/2008	SAT	EPA 505	
Potassium	2.00	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Selenium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Alachlor	ND	ug/L	0.4	5/29/2008	EMP	EPA 525.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-006	**Sampling Date**	5/21/2008	**Date/Time Received**	5/22/2008 11:00 AM
Client Sample ID	CLWID WELL 1				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Atrazine	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Benzo[a]pyrene	ND	ug/L	0.02	5/29/2008	EMP	EPA 525.2	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.6	5/29/2008	EMP	EPA 525.2	
bis-2(ethylhexyl)adipate	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorobenzene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Hexachlorocyclopentadiene	ND	ug/L	0.2	5/29/2008	EMP	EPA 525.2	
Simazine	ND	ug/L	0.15	5/29/2008	EMP	EPA 525.2	
silica (as SiO2)	16.0	mg/L	1	5/29/2008	DMB	EPA 200.8	
Silver	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Sodium	6.64	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	98.0	mg/L	10	5/28/2008	DMB	EPA 160.1	
TSS	ND	mg/L	5	5/28/2008	DMB	EPA 160.2	
Sulfate	2.56	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
MBAS	ND	mg/L	0.05	6/3/2008	JTT	SM5540C	
Thallium	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
Bromodichloromethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Bromoform	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Chloroform	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Dibromochloromethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Total Trihalomethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
TOC	1.82	mg/L	0.1	6/5/2008	SUB	SM5310C	
Turbidity	0.33	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.028	cm-1	0.009	5/29/2008	SUB	SM 5910	
1,1,1-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1,2-Trichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,1-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2,4-Trichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloroethane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,2-Dichloropropane	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
1,4-Dichlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Benzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Carbon Tetrachloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-006	**Sampling Date**	5/21/2008	**Date/Time Received**	5/22/2008 11:00 AM
Client Sample ID	CLWID WELL 1				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
chlorobenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
cis-1,2-dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Ethylbenzene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Methylene chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Styrene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Tetrachloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Toluene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
trans-1,2-Dichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Trichloroethene	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Vinyl Chloride	ND	ug/L	0.5	5/28/2008	TGT	EPA 524.2	
Epichlorohydrin	ND	ug/L	1	5/28/2008	TGT	EPA 8260B	
Zinc	ND	mg/L	0.001	5/28/2008	DMB	EPA 200.8	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client: IRZ CONSULTING LLC
Address: 505 MAIN STREET
HERMISTON, OR 97383
Attn: SAID AMALI

Batch #: 080521020
Project Name: UMATILLA RECHARGE PROJECT

Analytical Results Report

Sample Number 080521020-007
Sampling Date 5/20/2008
Date/Time Received 5/23/2008 11:00 AM
Client Sample ID WELL JSPW1
Matrix: Drinking Water

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Total Coliform	30	MPN/100mL	2	5/25/2008	WOZ	SM9221B	
Bicarbonate	112	mg/L	5	5/28/2008	DMB	SM2320B	
BOD	<2	mg/L	2	5/27/2008	EMB	SM5210B	
Calcium	33.8	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	5/28/2008	DMB	SM2320B	
Chloride	13.5	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
2,4-D	ND	ug/L	0.1	5/27/2008	SAT	EPA 515.3	
Magnesium	14.1	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
NO3/N+NO2/N	4.14	mg/L	0.1	5/23/2008	JTT	EPA 300.0	
Potassium	8.34	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
Dicamba	ND	ug/L	2	6/4/2008	TGT	EPA 8321A	
MCPA	ND	ug/L	0.1	6/4/2008	TGT	EPA 8321A	
Metsulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Thifensulfuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Tribenuron methyl	ND	ug/L	0.08	6/4/2008	TGT	EPA 8321A	
Sodium	13.7	mg/L	0.1	5/29/2008	DMB	EPA 200.8	
Sulfate	18.1	mg/L	0.1	5/23/2008	JTT	EPA 300.0	

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

Client:	IRZ CONSULTING LLC	**Batch #:**	080521020
Address:	505 MAIN STREET HERMISTON, OR 97383	**Project Name:**	UMATILLA RECHARGE PROJECT
Attn:	SAID AMALI		

Analytical Results Report

Sample Number	080521020-008	**Sampling Date**	5/21/2008	**Date/Time Received**	5/22/2008 11:00 AM
Client Sample ID	CLWID-B LINE				
Matrix:	Drinking Water				

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Bicarbonate	7.34	mg/L	5	5/23/2008	DMB	SM2320B	
Calcium	4.22	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Carbonate	ND	mg/L	5	5/23/2008	DMB	SM2320B	
Chloride	0.670	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Color	15	color units	5	5/23/2008	DMB	EPA 110.2	
Dissolved Iron	0.120	mg/L	0.01	5/30/2008	DMB	EPA 200.8	
Dissolved Manganese	0.00131	mg/L	0.001	5/30/2008	DMB	EPA 200.8	
Hardness	16.9	mg/L	1	5/23/2008	DMB	EPA 200.8	
Iron	0.593	mg/L	0.01	5/28/2008	DMB	EPA 200.8	
Magnesium	1.53	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Manganese	0.00705	mg/L	0.001	5/28/2008	DMB	EPA 200.8	
NO3/N	ND	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Potassium	1.44	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
Sodium	2.86	mg/L	0.1	5/23/2008	DMB	EPA 200.8	
TDS	45	mg/L	10	5/28/2008	DMB	EPA 160.1	
Sulfate	0.874	mg/L	0.1	5/22/2008	JTT	EPA 300.0	
Turbidity	20.1	NTU	0.1	5/23/2008	DMB	EPA 180.1	
UV Absorbance at 254 nm	0.032	cm-1	0.009	5/29/2008	SUB	SM 5910	

Authorized Signature

MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

Comments: UV 254 PERFORMED BY MWH, MONROVIA CA. TOC PERFORMED BY NEILSON RESEARCH, MEDFORD OR. RAD ANALYSIS PERFORMED BY BENCHMARK ANALYTIC, SAUCON PA

APPENDIX E

County Line Aquifer Hydraulic Properties from Wozniak (1995)

Table 2.1 Summary of hydraulic parameters for the alluvial aquifer

Unit	Discharge	K gpd/ft*ft	K ft/day	S	Location	Method	Well	Source
Pscfc			2000-5000		Umatilla Ordnance Depot	Aquifer tests		Nick Easterly, Army Corp., personal comm.
Pscfc	>500 gpm	14960	2000	0.2	4N/27E-30	Aquifer test	MORR 683	This report, Appendix C
Pscfc	>500 gpm	9312	1245	0.24	4N/25E-02	Aquifer test	MORR 684	CH2M Hill, 1975
Pscfc	>500 gpm	9267	1239	0.37	5N/26E-27	Aquifer test	MORR 1250	CH2M Hill, 1975
Pscfc	>500 gpm	5131	686	0.21	5N/26E-31	Aquifer test	MORR 1252	CH2M Hill, 1975
Pscfc	<100 gpm	3067 - 13,389	410 - 1790		4N/27E-15bcd	Aquifer test	LUB 124	Dames and Moore, 1994b
Pscfc	<100 gpm	30,765 - 50,490	4113 - 6750		4N/27E-15bcd	Aquifer test	LUB 132	Dames and Moore, 1994b
Pscfc	<100 gpm	7802 - 29,351	1043 - 3924		4N/27E-15cab	Aquifer test	LUB 127	Dames and Moore, 1994b
Pscfc		4376	585		Umatilla Ordnance Depot	Average of multiple slug tests		Dames and Moore, 1994b
Pscff	>500 gpm	667	89 - 178	2.5 E-04	4N/29E-17	Aquifer tests	UMAT 2866	WRD files
Pscff		202	27		Umatilla Ordnance Depot	Average of multiple slug tests		Dames and Moore, 1994b

Pscfc: Coarse-grained catastrophic flood deposits
Pscff: Fine-grained catastrophic flood deposits

APPENDIX F

2003 ODEQ Synoptic Sampling Event Results and Well Location Map

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
M&P DAIRY MW-1	3404204	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Bromide**		**1.22**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Calcium**		**92,900**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Chloride**		**170**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Fluoride**		**0.31**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Iron**		**320**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Magnesium**		**27,100**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Manganese**		**9.4**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Nitrate+Nitrite as N**		**22.7**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Perchlorate**		**24.7**	ug/L		Duplicate	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Perchlorate**		**24.9**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Phosphorus, total**		**0.0341**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Potassium**		**8,370**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Sodium**		**39,400**	ug/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
M&P DAIRY MW-1	3404204	**Sulfate**		**37.5**	mg/L	9/30/2003	Regular Sample	M&P DAIRY MW-1
UMA002	3394090	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Bromide**		**0.215**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Calcium**		**84,300**	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Chloride**		**72.2**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Fluoride**		**0.344**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	Iron	U	10	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Magnesium**		**47,000**	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	Manganese	U	1	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Nitrate+Nitrite as N**		**26.4**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Perchlorate**		**3.71**	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Phosphorus, total**		**0.0204**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Potassium**		**5,440**	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Sodium**		**51,200**	ug/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA002	3394090	**Sulfate**		**79.2**	mg/L	9/25/2003	Regular Sample	71202 WILSON RD UMA 002
UMA003	3384351	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	Bromide	U	0.2	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Calcium**		**90,000**	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Chloride**		**86**	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Fluoride**		**0.523**	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	Iron	U	10	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Magnesium**		**51,600**	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	Manganese	U	1	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Nitrate+Nitrite as N**		**38.6**	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Perchlorate**		**4.22**	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Phosphorus, total**		**0.0161**	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Potassium**		**5,720**	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Sodium**		**49,000**	ug/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA003	3384351	**Sulfate**		**115**	mg/L	9/15/2003	Regular Sample	78648 EASTGARD RD UMA003
UMA026	3394089	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Calcium**		**71,200**	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Calcium**		**73,200**	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	**Chloride**		**29.5**	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Fluoride**		**0.268**	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Iron**		**33.9**	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Iron**		**34.4**	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	**Magnesium**		**18,800**	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Magnesium**		**19,100**	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	Manganese	U	1	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	Manganese	U	1	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Nitrate+Nitrite as N**		**8.66**	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Phosphorus, total**		**0.111**	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Potassium**		**8,580**	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	**Potassium**		**8,660**	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Sodium**		**40,400**	ug/L		Duplicate	430 NS 7TH UMA 026
UMA026	3394089	**Sodium**		**40,900**	ug/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA026	3394089	**Sulfate**		**58.8**	mg/L	9/25/2003	Regular Sample	430 NS 7TH UMA 026
UMA028	3384302	**Ammonia (NH3+NH4) as N**		**0.209**	mg/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Calcium**		**68,500**	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	Iron	U	10	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Magnesium**		**43,800**	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	Manganese	U	1	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Nitrate+Nitrite as N**		**5.88**	mg/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Phosphorus, total**		**0.024**	mg/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Potassium**		**6,720**	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3384302	**Sodium**		**30,000**	ug/L	9/15/2003	Regular Sample	UMA 028 70696 QUAIL LN
UMA028	3394052	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	70696 QUAIL UMA 028
UMA028	3394052	**Chloride**		**22.8**	mg/L	9/22/2003	Regular Sample	70696 QUAIL UMA 028
UMA028	3394052	**Fluoride**		**0.193**	mg/L	9/22/2003	Regular Sample	70696 QUAIL UMA 028
UMA028	3394052	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	70696 QUAIL UMA 028
UMA028	3394052	**Sulfate**		**29.9**	mg/L	9/22/2003	Regular Sample	70696 QUAIL UMA 028
UMA029	3384301	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	**Calcium**		**125,000**	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	Iron	U	10	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	**Magnesium**		**84,900**	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	Manganese	U	1.4	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	**Nitrate+Nitrite as N**		**45.9**	mg/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	Phosphorus, total	U	0.01	mg/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	**Potassium**		**14,200**	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3384301	**Sodium**		**101,000**	ug/L	9/15/2003	Regular Sample	UMA 029 #3 MTN VIEW DR
UMA029	3394051	**Bromide**		**0.671**	mg/L	9/22/2003	Regular Sample	#3 MTN VIEW UMA 029
UMA029	3394051	**Chloride**		**143**	mg/L	9/22/2003	Regular Sample	#3 MTN VIEW UMA 029
UMA029	3394051	**Fluoride**		**0.506**	mg/L	9/22/2003	Regular Sample	#3 MTN VIEW UMA 029
UMA029	3394051	**Perchlorate**		**6.65**	ug/L	9/22/2003	Regular Sample	#3 MTN VIEW UMA 029
UMA029	3394051	**Sulfate**		**240**	mg/L	9/22/2003	Regular Sample	#3 MTN VIEW UMA 029

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA032	3384353	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	81329 W 8TH UMA032
UMA032	3384353	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Calcium**		**71,400**	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Chloride**		**21.3**	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Fluoride**		**0.343**	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Iron**		**21.8**	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Magnesium**		**19,700**	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	Manganese	U	1	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Nitrate+Nitrite as N**		**8.15**	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	Perchlorate	U	1	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Phosphorus, total**		**0.0451**	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Phosphorus, total**		**0.0471**	mg/L		Duplicate	81329 W 8TH UMA032
UMA032	3384353	**Potassium**		**8,780**	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Sodium**		**33,800**	ug/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA032	3384353	**Sulfate**		**43.3**	mg/L	9/16/2003	Regular Sample	81329 W 8TH UMA032
UMA033	3384305	**Ammonia (NH3+NH4) as N**		**0.105**	mg/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Calcium**		**67,100**	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Iron**		**25.2**	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Magnesium**		**16,600**	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Nitrate+Nitrite as N**		**7.09**	mg/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Phosphorus, total**		**0.0271**	mg/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Potassium**		**7,510**	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3384305	**Sodium**		**26,700**	ug/L	9/16/2003	Regular Sample	UMA 033 81481 W SEVENTH
UMA033	3394055	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	81481 W SEVENTH UMA 033
UMA033	3394055	**Chloride**		**16.4**	mg/L	9/22/2003	Regular Sample	81481 W SEVENTH UMA 033
UMA033	3394055	**Fluoride**		**0.178**	mg/L	9/22/2003	Regular Sample	81481 W SEVENTH UMA 033
UMA033	3394055	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	81481 W SEVENTH UMA 033
UMA033	3394055	**Sulfate**		**23.9**	mg/L	9/22/2003	Regular Sample	81481 W SEVENTH UMA 033
UMA034	3384306	**Ammonia (NH3+NH4) as N**		**0.116**	mg/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Calcium**		**43,300**	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Magnesium**		**9,710**	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Nitrate+Nitrite as N**		**2**	mg/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Phosphorus, total**		**0.0956**	mg/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Potassium**		**4,720**	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3384306	**Sodium**		**10,700**	ug/L	9/16/2003	Regular Sample	UMA 034 74503 FROBERG
UMA034	3394056	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	74503 FROBERG UMA 034
UMA034	3394056	**Chloride**		**4.93**	mg/L	9/22/2003	Regular Sample	74503 FROBERG UMA 034
UMA034	3394056	**Fluoride**		**0.321**	mg/L	9/22/2003	Regular Sample	74503 FROBERG UMA 034
UMA034	3394056	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	74503 FROBERG UMA 034
UMA034	3394056	**Sulfate**		**12.3**	mg/L	9/22/2003	Regular Sample	74503 FROBERG UMA 034
UMA036	3394088	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Calcium**		**59,900**	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Chloride**		**18.2**	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Fluoride**		**0.235**	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	Iron	U	10	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Magnesium**		**15,300**	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	Manganese	U	1	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Nitrate+Nitrite as N**		**5.23**	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Phosphorus, total**		**0.059**	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Potassium**		**7,380**	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Sodium**		**30,800**	ug/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA036	3394088	**Sulfate**		**30.9**	mg/L	9/25/2003	Regular Sample	RT. 2 BOX 435 UMA 036
UMA038	3384313	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Calcium**		**72,000**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Iron**		**104**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Magnesium**		**23,300**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Manganese**		**8.6**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Nitrate+Nitrite as N**		**2.4**	mg/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Phosphorus, total**		**0.0471**	mg/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Potassium**		**8,400**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3384313	**Sodium**		**34,200**	ug/L	9/16/2003	Regular Sample	UMA 038 1800 CHERRY ST
UMA038	3394062	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	1800 CHERRY UMA 038
UMA038	3394062	**Chloride**		**20.4**	mg/L	9/22/2003	Regular Sample	1800 CHERRY UMA 038
UMA038	3394062	**Fluoride**		**0.312**	mg/L	9/22/2003	Regular Sample	1800 CHERRY UMA 038
UMA038	3394062	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	1800 CHERRY UMA 038
UMA038	3394062	**Sulfate**		**35.9**	mg/L	9/22/2003	Regular Sample	1800 CHERRY UMA 038
UMA040	3384356	**Ammonia (NH3+NH4) as N**		**1.23**	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Calcium**		**50,800**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Chloride**		**21.3**	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Fluoride**		**0.402**	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Iron**		**766**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Magnesium**		**15,900**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Manganese**		**340**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	Nitrate+Nitrite as N	U	0.02	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	Perchlorate	U	1	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Phosphorus, total**		**0.313**	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Potassium**		**9,900**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Sodium**		**25,600**	ug/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA040	3384356	**Sulfate**		**36.8**	mg/L	9/16/2003	Regular Sample	80576 N OTTRD UMA040
UMA041	3384355	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Calcium**		**47,700**	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Chloride**		**18.9**	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Fluoride**		**0.229**	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA041	3384355	Iron	U	10	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Magnesium**		**11,300**	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	Manganese	U	1	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Nitrate+Nitrite as N**		**2.58**	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	Perchlorate	U	1	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Phosphorus, total**		**0.101**	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Potassium**		**6,490**	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Sodium**		**23,200**	ug/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA041	3384355	**Sulfate**		**19.2**	mg/L	9/16/2003	Regular Sample	32154 DIAGONAL RD UMA041
UMA042	3384354	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Calcium**		**114,000**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Chloride**		**16.4**	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Fluoride**		**0.345**	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Iron**		**38.2**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Magnesium**		**32,700**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	Manganese	U	1	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Nitrate+Nitrite as N**		**13.2**	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Perchlorate**		**4.34**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Perchlorate**		**4.46**	ug/L		Duplicate	32292 E LOOP RD UMA042
UMA042	3384354	**Phosphorus, total**		**0.0522**	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Potassium**		**7,040**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Sodium**		**49,900**	ug/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA042	3384354	**Sulfate**		**52.2**	mg/L	9/16/2003	Regular Sample	32292 E LOOP RD UMA042
UMA045	3384357	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Calcium**		**45,700**	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Chloride**		**6.57**	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Fluoride**		**0.782**	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	Iron	U	10	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Magnesium**		**30,000**	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	Manganese	U	1	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Nitrate+Nitrite as N**		**3.14**	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	Perchlorate	U	1	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	Phosphorus, total	U	0.01	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Potassium**		**4,950**	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Sodium**		**21,100**	ug/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA045	3384357	**Sulfate**		**13**	mg/L	9/16/2003	Regular Sample	34070 E LOOP RD UMA045
UMA046	3384325	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Calcium**		**24,900**	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Iron**		**27**	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Magnesium**		**16,900**	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Nitrate+Nitrite as N**		**1.96**	mg/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	Phosphorus, total	U	0.01	mg/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Potassium**		**3,270**	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3384325	**Sodium**		**13,500**	ug/L	9/17/2003	Regular Sample	UMA 046 32654 E HIGHLAND EXT
UMA046	3394074	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	32654 E HIGHLAND UMA 046
UMA046	3394074	**Chloride**		**5.96**	mg/L	9/23/2003	Regular Sample	32654 E HIGHLAND UMA 046
UMA046	3394074	**Fluoride**		**0.257**	mg/L	9/23/2003	Regular Sample	32654 E HIGHLAND UMA 046
UMA046	3394074	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	32654 E HIGHLAND UMA 046
UMA046	3394074	**Sulfate**		**11**	mg/L	9/23/2003	Regular Sample	32654 E HIGHLAND UMA 046
UMA047	3384333	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Calcium**		**43,300**	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	Iron	U	10	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Magnesium**		**10,600**	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	Manganese	U	1	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Nitrate+Nitrite as N**		**3.5**	mg/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Phosphorus, total**		**0.0309**	mg/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Potassium**		**4,830**	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3384333	**Sodium**		**35,500**	ug/L	9/18/2003	Regular Sample	UMA 047 555 OLD HINKLE RD
UMA047	3394082	**Bromide**		**0.237**	mg/L	9/24/2003	Regular Sample	550 OLD HINKLE UMA 047
UMA047	3394082	**Chloride**		**28.9**	mg/L	9/24/2003	Regular Sample	550 OLD HINKLE UMA 047
UMA047	3394082	**Fluoride**		**0.279**	mg/L	9/24/2003	Regular Sample	550 OLD HINKLE UMA 047
UMA047	3394082	Perchlorate	J	1.83	ug/L	9/24/2003	Regular Sample	550 OLD HINKLE UMA 047
UMA047	3394082	**Sulfate**		**30.4**	mg/L	9/24/2003	Regular Sample	550 OLD HINKLE UMA 047
UMA048	3384332	Ammonia (NH3+NH4) as N	NA			9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	**Calcium**		**26,600**	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	Iron	U	10	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	**Magnesium**		**7,320**	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	Manganese	U	1	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	Nitrate+Nitrite as N	NA			9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	Phosphorus, total	NA			9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	**Potassium**		**3,440**	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3384332	**Sodium**		**40,800**	ug/L	9/18/2003	Regular Sample	UMA 048 OTZENBERGER
UMA048	3394081	Bromide	U	0.2	mg/L		Duplicate	OTZENBERGER UMA 048
UMA048	3394081	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	OTZENBERGER UMA 048
UMA048	3394081	**Chloride**		**5.78**	mg/L		Duplicate	OTZENBERGER UMA 048
UMA048	3394081	**Chloride**		**5.84**	mg/L	9/24/2003	Regular Sample	OTZENBERGER UMA 048
UMA048	3394081	**Fluoride**		**0.57**	mg/L	9/24/2003	Regular Sample	OTZENBERGER UMA 048
UMA048	3394081	**Fluoride**		**0.594**	mg/L		Duplicate	OTZENBERGER UMA 048
UMA048	3394081	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	OTZENBERGER UMA 048
UMA048	3394081	**Sulfate**		**10.3**	mg/L	9/24/2003	Regular Sample	OTZENBERGER UMA 048
UMA048	3394081	**Sulfate**		**10.7**	mg/L		Duplicate	OTZENBERGER UMA 048
UMA056	3384326	**Ammonia (NH3+NH4) as N**		**0.17**	mg/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	**Calcium**		**44,600**	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	**Magnesium**		**18,700**	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	**Nitrate+Nitrite as N**		**6.46**	mg/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	Phosphorus, total	U	0.01	mg/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA056	3384326	**Potassium**		**7,680**	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3384326	**Sodium**		**76,300**	ug/L	9/17/2003	Regular Sample	UMA 056 78904 N LOOP RD
UMA056	3394075	**Bromide**		**0.55**	mg/L	9/23/2003	Regular Sample	78904 N LOOP UMA 056
UMA056	3394075	**Chloride**		**86.6**	mg/L	9/23/2003	Regular Sample	78904 N LOOP UMA 056
UMA056	3394075	**Fluoride**		**0.269**	mg/L	9/23/2003	Regular Sample	78904 N LOOP UMA 056
UMA056	3394075	**Perchlorate**		**6.53**	ug/L	9/23/2003	Regular Sample	78904 N LOOP UMA 056
UMA056	3394075	**Perchlorate**		**6.55**	ug/L		Duplicate	78904 N LOOP UMA 056
UMA056	3394075	**Sulfate**		**65.7**	mg/L	9/23/2003	Regular Sample	78904 N LOOP UMA 056
UMA057	3424303	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	Bromide	U	0.2	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Calcium**		**87,300**	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Chloride**		**38.7**	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Fluoride**		**0.336**	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	Iron	U	10	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Magnesium**		**24,200**	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	Manganese	U	1	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Nitrate+Nitrite as N**		**12.2**	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Perchlorate**		**2.04**	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Phosphorus, total**		**0.0501**	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Potassium**		**9,210**	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Sodium**		**32,800**	ug/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA057	3424303	**Sulfate**		**68.4**	mg/L	10/16/2003	Regular Sample	UMA 057 81166 N OH RD HERMISTON
UMA058	3384318	**Ammonia (NH3+NH4) as N**		**0.158**	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Calcium**		**69,000**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Magnesium**		**23,300**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Nitrate+Nitrite as N**		**9.22**	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Phosphorus, total**		**0.116**	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Potassium**		**7,110**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384318	**Sodium**		**72,200**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3
UMA058	3384319	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Calcium**		**70,200**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Magnesium**		**23,500**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Nitrate+Nitrite as N**		**9.19**	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Phosphorus, total**		**0.118**	mg/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Potassium**		**7,110**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA058	3384319	**Sodium**		**72,800**	ug/L	9/17/2003	Regular Sample	UMA 058 SIMPLOT WELL #3 (QA)
UMA063	3384358	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Calcium**		**53,900**	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Chloride**		**12.5**	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Fluoride**		**0.284**	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	Iron	U	10	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Magnesium**		**33,700**	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	Manganese	U	1	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Nitrate+Nitrite as N**		**7.56**	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	Perchlorate	J	1.7	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Phosphorus, total**		**0.019**	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Potassium**		**3,270**	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Sodium**		**24,900**	ug/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA063	3384358	**Sulfate**		**22.9**	mg/L	9/17/2003	Regular Sample	28920 BRIDGE RD UMA 063
UMA065	3394087	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Bromide**		**0.205**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Calcium**		**95,100**	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Chloride**		**91.8**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Fluoride**		**0.197**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	Iron	U	10	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Magnesium**		**35,500**	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	Manganese	U	1	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Nitrate+Nitrite as N**		**9.09**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Perchlorate**		**2.88**	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Phosphorus, total**		**0.0176**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Potassium**		**14,600**	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Sodium**		**85,300**	ug/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA065	3394087	**Sulfate**		**93.2**	mg/L	9/24/2003	Regular Sample	34099 BEACH SHORE DR. UMA 065
UMA073	3384362	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Calcium**		**54,600**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Chloride**		**28.7**	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Fluoride**		**0.234**	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Iron**		**139**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Magnesium**		**19,200**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Manganese**		**1.8**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Nitrate+Nitrite as N**		**8.48**	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	Perchlorate	J	1.06	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Phosphorus, total**		**0.0974**	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Potassium**		**6,570**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Sodium**		**43,100**	ug/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA073	3384362	**Sulfate**		**38.5**	mg/L	9/18/2003	Regular Sample	78554 ECHOLS RD UMA 073
UMA078	3384359	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Calcium**		**70,100**	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Chloride**		**22.7**	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Fluoride**		**0.155**	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	Iron	U	10	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Magnesium**		**20,200**	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	Manganese	U	1	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Nitrate+Nitrite as N**		**9.6**	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA078	3384359	Perchlorate	J	1.14	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Phosphorus, total**		**0.071**	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Potassium**		**6,460**	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Sodium**		**24,700**	ug/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA078	3384359	**Sulfate**		**26.6**	mg/L	9/17/2003	Regular Sample	78853 AGNEW RD UMA 078
UMA079	3384360	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	Bromide	U	0.2	mg/L		Duplicate	29206 NOBLE RD UMA 079
UMA079	3384360	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Calcium**		**31,300**	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Chloride**		**8.34**	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Chloride**		**8.59**	mg/L		Duplicate	29206 NOBLE RD UMA 079
UMA079	3384360	**Fluoride**		**0.223**	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Fluoride**		**0.228**	mg/L		Duplicate	29206 NOBLE RD UMA 079
UMA079	3384360	Iron	U	10	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Magnesium**		**10,400**	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Manganese**		**10.9**	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Nitrate+Nitrite as N**		**0.835**	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	Perchlorate	U	1	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	Phosphorus, total	U	0.01	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Potassium**		**4,090**	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Sodium**		**15,900**	ug/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA079	3384360	**Sulfate**		**10.2**	mg/L		Duplicate	29206 NOBLE RD UMA 079
UMA079	3384360	**Sulfate**		**10.5**	mg/L	9/18/2003	Regular Sample	29206 NOBLE RD UMA 079
UMA080	3384365	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Bromide**		**0.266**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Calcium**		**48,100**	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Chloride**		**36.1**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Fluoride**		**0.19**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Iron**		**10**	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Magnesium**		**17,300**	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	Manganese	U	1	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Nitrate+Nitrite as N**		**5.05**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	Perchlorate	J	1.6	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Phosphorus, total**		**0.0578**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Potassium**		**5,520**	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Sodium**		**22,800**	ug/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA080	3384365	**Sulfate**		**29.7**	mg/L	9/18/2003	Regular Sample	29893 BUFFALO LAN UMA 080
UMA082	3384363	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Calcium**		**23,500**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Chloride**		**26.1**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Fluoride**		**0.472**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Iron**		**25.2**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Magnesium**		**8,860**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Manganese**		**12.5**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	Nitrate+Nitrite as N	U	0.02	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	Perchlorate	U	1	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Phosphorus, total**		**0.0101**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Potassium**		**9,190**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Sodium**		**57,300**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384363	**Sulfate**		**46.2**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082
UMA082	3384364	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Calcium**		**23,400**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Chloride**		**24.8**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Fluoride**		**0.483**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Iron**		**28.4**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Magnesium**		**8,820**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Manganese**		**13.1**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	Nitrate+Nitrite as N	U	0.02	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	Perchlorate	U	1	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	Phosphorus, total	U	0.01	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Potassium**		**8,960**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Sodium**		**57,000**	ug/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA082	3384364	**Sulfate**		**46.3**	mg/L	9/18/2003	Regular Sample	260 W GETTMAN RD UMA 082 (DUPLICATE)
UMA084	3384320	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Calcium**		**84,500**	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Calcium**		**85,600**	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	Iron	U	10	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Magnesium**		**29,600**	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Magnesium**		**29,900**	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	Manganese	U	1	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Nitrate+Nitrite as N**		**11.4**	mg/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Phosphorus, total**		**0.0797**	mg/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Phosphorus, total**		**0.081**	mg/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Potassium**		**7,560**	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Potassium**		**7,830**	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Sodium**		**42,800**	ug/L	9/17/2003	Regular Sample	UMA 084, 78485 LLOYD RD
UMA084	3384320	**Sodium**		**44,200**	ug/L		Duplicate	UMA 084, 78485 LLOYD RD
UMA084	3394069	**Bromide**		**0.4**	mg/L	9/23/2003	Regular Sample	78485 LLOYD RD UMA 084
UMA084	3394069	**Chloride**		**63**	mg/L	9/23/2003	Regular Sample	78485 LLOYD RD UMA 084
UMA084	3394069	**Fluoride**		**0.136**	mg/L	9/23/2003	Regular Sample	78485 LLOYD RD UMA 084
UMA084	3394069	**Perchlorate**		**2.67**	ug/L	9/23/2003	Regular Sample	78485 LLOYD RD UMA 084
UMA084	3394069	**Sulfate**		**50.5**	mg/L	9/23/2003	Regular Sample	78485 LLOYD RD UMA 084
UMA085	3384303	**Ammonia (NH3+NH4) as N**		**0.104**	mg/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Calcium**		**88,000**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Iron**		**42.6**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Magnesium**		**32,600**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA085	3384303	**Manganese**		**2**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Nitrate+Nitrite as N**		**35.6**	mg/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Phosphorus, total**		**0.0408**	mg/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Potassium**		**9,620**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3384303	**Sodium**		**58,800**	ug/L	9/16/2003	Regular Sample	UMA 085 78953 ROOT RD
UMA085	3394053	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	78953 ROOT LN UMA 085
UMA085	3394053	**Chloride**		**74.8**	mg/L	9/22/2003	Regular Sample	78953 ROOT LN UMA 085
UMA085	3394053	**Fluoride**		**0.374**	mg/L	9/22/2003	Regular Sample	78953 ROOT LN UMA 085
UMA085	3394053	**Perchlorate**		**3.19**	ug/L	9/22/2003	Regular Sample	78953 ROOT LN UMA 085
UMA085	3394053	**Sulfate**		**83.1**	mg/L	9/22/2003	Regular Sample	78953 ROOT LN UMA 085
UMA086	3384352	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Calcium**		**61,800**	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	**Calcium**		**62,700**	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Chloride**		**21.4**	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Fluoride**		**0.457**	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Iron**		**35.9**	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	**Iron**		**36**	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Magnesium**		**26,200**	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	**Magnesium**		**26,300**	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	Manganese	U	1	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	Manganese	U	1	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Nitrate+Nitrite as N**		**6.73**	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	Perchlorate	J	1.22	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Phosphorus, total**		**0.029**	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Potassium**		**7,540**	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Potassium**		**7,560**	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	**Sodium**		**35,300**	ug/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA086	3384352	**Sodium**		**35,700**	ug/L		Duplicate	491 COLUMBIA UMA086
UMA086	3384352	**Sulfate**		**35.2**	mg/L	9/16/2003	Regular Sample	491 COLUMBIA UMA086
UMA089	3404206	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	Bromide	U	0.2	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Calcium**		**123,000**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Chloride**		**25.9**	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Fluoride**		**0.107**	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Iron**		**198**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Magnesium**		**28,900**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Manganese**		**1.8**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Nitrate+Nitrite as N**		**9.72**	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	Perchlorate	U	1	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Phosphorus, total**		**0.0573**	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Potassium**		**7,880**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Sodium**		**22,400**	ug/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA089	3404206	**Sulfate**		**23.4**	mg/L	9/30/2003	Regular Sample	UMA 089 78671 RUDDER LN
UMA094	3384322	**Ammonia (NH3+NH4) as N**		**0.101**	mg/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Calcium**		**71,700**	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Magnesium**		**22,200**	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Nitrate+Nitrite as N**		**7.5**	mg/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Phosphorus, total**		**0.0827**	mg/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Potassium**		**5,250**	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3384322	**Sodium**		**17,700**	ug/L	9/17/2003	Regular Sample	UMA 094 79028 AGNEW RD
UMA094	3394071	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	79028 AGNEW UMA 094
UMA094	3394071	**Chloride**		**12.4**	mg/L	9/23/2003	Regular Sample	79028 AGNEW UMA 094
UMA094	3394071	**Fluoride**		**0.153**	mg/L	9/23/2003	Regular Sample	79028 AGNEW UMA 094
UMA094	3394071	Perchlorate	J	1.17	ug/L	9/23/2003	Regular Sample	79028 AGNEW UMA 094
UMA094	3394071	**Sulfate**		**15.1**	mg/L	9/23/2003	Regular Sample	79028 AGNEW UMA 094
UMA096	3384312	**Ammonia (NH3+NH4) as N**		**0.135**	mg/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Calcium**		**65,000**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Iron**		**49.6**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Magnesium**		**25,300**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Manganese**		**1.6**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Nitrate+Nitrite as N**		**19.6**	mg/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Phosphorus, total**		**0.0368**	mg/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Potassium**		**6,930**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3384312	**Sodium**		**36,800**	ug/L	9/16/2003	Regular Sample	UMA 096 28435 SOUTHSHORE DR
UMA096	3394061	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	28435 SOUTHSHORE DR
UMA096	3394061	**Chloride**		**18.9**	mg/L	9/22/2003	Regular Sample	28435 SOUTHSHORE DR
UMA096	3394061	**Fluoride**		**0.257**	mg/L	9/22/2003	Regular Sample	28435 SOUTHSHORE DR
UMA096	3394061	Perchlorate	J	1.43	ug/L	9/22/2003	Regular Sample	28435 SOUTHSHORE DR
UMA096	3394061	**Sulfate**		**26.2**	mg/L	9/22/2003	Regular Sample	28435 SOUTHSHORE DR
UMA101	3394135	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Bromide**		**0.226**	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Calcium**		**21,200**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Chloride**		**35.8**	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Fluoride**		**0.307**	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Iron**		**14**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Magnesium**		**8,460**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	Manganese	U	1	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Nitrate+Nitrite as N**		**3.7**	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Perchlorate**		**3.47**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Perchlorate**		**3.54**	ug/L		Duplicate	2280 SE 19TH (UMA 101)
UMA101	3394135	Phosphorus, total	U	0.01	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Potassium**		**5,220**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Sodium**		**56,000**	ug/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA101	3394135	**Sulfate**		**21.3**	mg/L	9/24/2003	Regular Sample	2280 SE 19TH (UMA 101)
UMA103	3384311	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Calcium**		**67,200**	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Magnesium**		**43,000**	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA103	3384311	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Nitrate+Nitrite as N**		**22.9**	mg/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Phosphorus, total**		**0.011**	mg/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Potassium**		**6,520**	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3384311	**Sodium**		**37,500**	ug/L	9/16/2003	Regular Sample	UMA 103 81855 RAND RD
UMA103	3394060	Bromide	U	0.2	mg/L		Duplicate	81855 RAND RD UMA 103
UMA103	3394060	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	81855 RAND RD UMA 103
UMA103	3394060	**Chloride**		**33.2**	mg/L	9/22/2003	Regular Sample	81855 RAND RD UMA 103
UMA103	3394060	**Chloride**		**35.9**	mg/L		Duplicate	81855 RAND RD UMA 103
UMA103	3394060	**Fluoride**		**0.412**	mg/L	9/22/2003	Regular Sample	81855 RAND RD UMA 103
UMA103	3394060	**Fluoride**		**0.436**	mg/L		Duplicate	81855 RAND RD UMA 103
UMA103	3394060	**Perchlorate**		**2.17**	ug/L	9/22/2003	Regular Sample	81855 RAND RD UMA 103
UMA103	3394060	**Sulfate**		**69.5**	mg/L	9/22/2003	Regular Sample	81855 RAND RD UMA 103
UMA103	3394060	**Sulfate**		**72.5**	mg/L		Duplicate	81855 RAND RD UMA 103
UMA106	3384328	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Calcium**		**32,200**	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Magnesium**		**18,700**	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Nitrate+Nitrite as N**		**0.929**	mg/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Phosphorus, total**		**0.0475**	mg/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Potassium**		**5,590**	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3384328	**Sodium**		**44,500**	ug/L	9/17/2003	Regular Sample	UMA 106 33352 E PUNKIN CTR
UMA106	3394077	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	33352 E PUNKIN CTR UMA 106
UMA106	3394077	**Chloride**		**18.6**	mg/L	9/23/2003	Regular Sample	33352 E PUNKIN CTR UMA 106
UMA106	3394077	**Fluoride**		**0.375**	mg/L	9/23/2003	Regular Sample	33352 E PUNKIN CTR UMA 106
UMA106	3394077	Perchlorate	U	1	ug/L		Duplicate	33352 E PUNKIN CTR UMA 106
UMA106	3394077	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	33352 E PUNKIN CTR UMA 106
UMA106	3394077	**Sulfate**		**15.3**	mg/L	9/23/2003	Regular Sample	33352 E PUNKIN CTR UMA 106
UMA109	3384331	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Calcium**		**56,900**	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Magnesium**		**16,000**	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Nitrate+Nitrite as N**		**3.19**	mg/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Phosphorus, total**		**0.0792**	mg/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Potassium**		**6,370**	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3384331	**Sodium**		**24,500**	ug/L	9/17/2003	Regular Sample	UMA 109 81232 VETTER
UMA109	3394080	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	81232 VETTER UMA 109
UMA109	3394080	**Chloride**		**17**	mg/L	9/23/2003	Regular Sample	81232 VETTER UMA 109
UMA109	3394080	**Fluoride**		**0.174**	mg/L	9/23/2003	Regular Sample	81232 VETTER UMA 109
UMA109	3394080	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	81232 VETTER UMA 109
UMA109	3394080	**Sulfate**		**21.4**	mg/L	9/23/2003	Regular Sample	81232 VETTER UMA 109
UMA110	3384327	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	**Calcium**		**56,000**	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	**Magnesium**		**36,600**	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	**Nitrate+Nitrite as N**		**5.28**	mg/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	Phosphorus, total	U	0.01	mg/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	**Potassium**		**4,610**	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3384327	**Sodium**		**23,500**	ug/L	9/17/2003	Regular Sample	UMA 110 34139 E LOOP RD
UMA110	3394076	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	34139 E LOOP RD UMA 110
UMA110	3394076	**Chloride**		**10.9**	mg/L	9/23/2003	Regular Sample	34139 E LOOP RD UMA 110
UMA110	3394076	**Fluoride**		**0.494**	mg/L	9/23/2003	Regular Sample	34139 E LOOP RD UMA 110
UMA110	3394076	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	34139 E LOOP RD UMA 110
UMA110	3394076	**Sulfate**		**15.5**	mg/L	9/23/2003	Regular Sample	34139 E LOOP RD UMA 110
UMA112	3384316	**Ammonia (NH3+NH4) as N**		**0.105**	mg/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Calcium**		**45,700**	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Iron**		**22.9**	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Magnesium**		**16,000**	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Nitrate+Nitrite as N**		**3.84**	mg/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Phosphorus, total**		**0.0169**	mg/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Potassium**		**4,340**	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3384316	**Sodium**		**30,800**	ug/L	9/16/2003	Regular Sample	UMA 112 76676 COL JORDAN RD
UMA112	3394065	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	76676 COL JORDAN RD UMA 112
UMA112	3394065	**Chloride**		**10.1**	mg/L	9/23/2003	Regular Sample	76676 COL JORDAN RD UMA 112
UMA112	3394065	**Fluoride**		**0.238**	mg/L	9/23/2003	Regular Sample	76676 COL JORDAN RD UMA 112
UMA112	3394065	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	76676 COL JORDAN RD UMA 112
UMA112	3394065	**Sulfate**		**10.8**	mg/L	9/23/2003	Regular Sample	76676 COL JORDAN RD UMA 112
UMA116	3384329	**Ammonia (NH3+NH4) as N**		**0.107**	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Calcium**		**57,500**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Magnesium**		**21,000**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Nitrate+Nitrite as N**		**3.15**	mg/L		Duplicate	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Nitrate+Nitrite as N**		**3.29**	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Phosphorus, total**		**0.0733**	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Potassium**		**6,960**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384329	**Sodium**		**30,200**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR
UMA116	3384330	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Calcium**		**55,900**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Magnesium**		**20,600**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Nitrate+Nitrite as N**		**3.33**	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Phosphorus, total**		**0.0684**	mg/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Potassium**		**6,930**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE)
UMA116	3384330	**Sodium**		**30,200**	ug/L	9/17/2003	Regular Sample	UMA 116 32915 E PUNKIN CTR (DUPLICATE
UMA116	3394078	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA116	3394078	**Chloride**		**19.7**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116
UMA116	3394078	**Fluoride**		**0.29**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116
UMA116	3394078	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116
UMA116	3394078	**Sulfate**		**18**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116
UMA116	3394079	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116 (DUPLICATE)
UMA116	3394079	**Chloride**		**18.9**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116 (DUPLICATE)
UMA116	3394079	**Fluoride**		**0.352**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116 (DUPLICATE)
UMA116	3394079	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116 (DUPLICATE)
UMA116	3394079	**Sulfate**		**23.8**	mg/L	9/23/2003	Regular Sample	32915 E PUNKIN CTR UMA 116 (DUPLICATE)
UMA119	3384321	**Ammonia (NH3+NH4) as N**		**0.141**	mg/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Calcium**		**96,900**	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Magnesium**		**28,300**	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Nitrate+Nitrite as N**		**8.24**	mg/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Phosphorus, total**		**0.107**	mg/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Potassium**		**7,530**	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3384321	**Sodium**		**28,300**	ug/L	9/17/2003	Regular Sample	UMA 119 1335 LEMMON LN
UMA119	3394070	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	1335 LEMMON LN UMA 119
UMA119	3394070	**Chloride**		**21.5**	mg/L	9/23/2003	Regular Sample	1335 LEMMON LN UMA 119
UMA119	3394070	**Fluoride**		**0.164**	mg/L	9/23/2003	Regular Sample	1335 LEMMON LN UMA 119
UMA119	3394070	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	1335 LEMMON LN UMA 119
UMA119	3394070	**Sulfate**		**22.1**	mg/L	9/23/2003	Regular Sample	1335 LEMMON LN UMA 119
UMA122	3384317	**Ammonia (NH3+NH4) as N**		**0.132**	mg/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Calcium**		**149,000**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Iron**		**223**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Magnesium**		**41,000**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Manganese**		**8.1**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Nitrate+Nitrite as N**		**28.4**	mg/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Phosphorus, total**		**0.0965**	mg/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Potassium**		**7,780**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3384317	**Sodium**		**40,800**	ug/L	9/16/2003	Regular Sample	UMA 122 29752 STARFIELD MEADOWS
UMA122	3394066	**Bromide**		**0.924**	mg/L	9/23/2003	Regular Sample	29752 STANFIELD MEADOWS UMA 122
UMA122	3394066	**Chloride**		**135**	mg/L	9/23/2003	Regular Sample	29752 STANFIELD MEADOWS UMA 122
UMA122	3394066	**Fluoride**		**0.279**	mg/L	9/23/2003	Regular Sample	29752 STANFIELD MEADOWS UMA 122
UMA122	3394066	**Perchlorate**		**6.12**	ug/L	9/23/2003	Regular Sample	29752 STANFIELD MEADOWS UMA 122
UMA122	3394066	**Sulfate**		**105**	mg/L	9/23/2003	Regular Sample	29752 STANFIELD MEADOWS UMA 122
UMA123	3384361	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Bromide**		**1.05**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Calcium**		**132,000**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Chloride**		**128**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Fluoride**		**0.234**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Iron**		**16**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Magnesium**		**40,000**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	Manganese	U	1	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Nitrate+Nitrite as N**		**20.3**	mg/L		Duplicate	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Nitrate+Nitrite as N**		**21.3**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Perchlorate**		**6.8**	ug/L		Duplicate	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Perchlorate**		**7.04**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Phosphorus, total**		**0.071**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Potassium**		**7,750**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Sodium**		**36,400**	ug/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA123	3384361	**Sulfate**		**98.3**	mg/L	9/18/2003	Regular Sample	29976 STANFIELD MEADOWS RD UMA 123
UMA124	3404207	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	Bromide	U	0.2	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Calcium**		**53,600**	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Chloride**		**19.8**	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Fluoride**		**0.218**	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	Iron	U	10	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Magnesium**		**24,500**	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	Manganese	U	1	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Nitrate+Nitrite as N**		**15.5**	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	Perchlorate	J	1.31	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	Phosphorus, total	U	0.01	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Potassium**		**5,890**	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Sodium**		**49,200**	ug/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA124	3404207	**Sulfate**		**35**	mg/L	9/30/2003	Regular Sample	UMA 124 1200 E AIRPORT RD
UMA132	3394137	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Calcium**		**87,000**	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Chloride**		**33.1**	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Fluoride**		**0.191**	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Iron**		**11**	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Magnesium**		**27,700**	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	Manganese	U	1	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Nitrate+Nitrite as N**		**18.7**	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	Perchlorate	J	1.71	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Phosphorus, total**		**0.112**	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Potassium**		**6,000**	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Sodium**		**29,900**	ug/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA132	3394137	**Sulfate**		**25.5**	mg/L	9/24/2003	Regular Sample	79554 AGNEW RD
UMA133	3384315	**Ammonia (NH3+NH4) as N**		**0.102**	mg/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Calcium**		**103,000**	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Magnesium**		**31,400**	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Nitrate+Nitrite as N**		**13.3**	mg/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Phosphorus, total**		**0.0224**	mg/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Potassium**		**6,780**	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3384315	**Sodium**		**58,900**	ug/L	9/16/2003	Regular Sample	UMA 133 76992 COUNTY LINE RD
UMA133	3394064	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	76992 COUNTY LINE RD UMA 133

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA133	3394064	**Chloride**		**27.8**	mg/L	9/23/2003	Regular Sample	76992 COUNTY LINE RD UMA 133
UMA133	3394064	**Fluoride**		**0.0941**	mg/L	9/23/2003	Regular Sample	76992 COUNTY LINE RD UMA 133
UMA133	3394064	Perchlorate	J	1.21	ug/L	9/23/2003	Regular Sample	76992 COUNTY LINE RD UMA 133
UMA133	3394064	**Sulfate**		**40.3**	mg/L	9/23/2003	Regular Sample	76992 COUNTY LINE RD UMA 133
UMA136	3404205	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	Bromide	U	0.2	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Calcium**		**71,900**	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Chloride**		**19.3**	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Fluoride**		**0.191**	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	Iron	U	10	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Magnesium**		**19,700**	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	Manganese	U	1	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Nitrate+Nitrite as N**		**8.53**	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	Perchlorate	J	1.11	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Phosphorus, total**		**0.0754**	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Phosphorus, total**		**0.0759**	mg/L		Duplicate	UMA 136 78638 WALKER RD
UMA136	3404205	**Potassium**		**5,730**	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Sodium**		**22,800**	ug/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA136	3404205	**Sulfate**		**23.2**	mg/L	9/30/2003	Regular Sample	UMA 136 78638 WALKER RD
UMA138	3394138	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Calcium**		**29,600**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Chloride**		**22.4**	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Fluoride**		**0.401**	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Iron**		**60.5**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Magnesium**		**14,700**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Manganese**		**70.9**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Nitrate+Nitrite as N**		**0.156**	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Phosphorus, total**		**0.0182**	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Potassium**		**4,900**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Sodium**		**50,300**	ug/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA138	3394138	**Sulfate**		**34.2**	mg/L	9/24/2003	Regular Sample	79786 AGNEW RD (UMA 138)
UMA144	3384308	**Ammonia (NH3+NH4) as N**		**0.259**	mg/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Calcium**		**86,500**	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Iron**		**17**	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Magnesium**		**23,700**	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Nitrate+Nitrite as N**		**9.36**	mg/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Phosphorus, total**		**0.103**	mg/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Potassium**		**8,680**	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3384308	**Sodium**		**47,600**	ug/L	9/16/2003	Regular Sample	UMA 144 215 W WYOMING
UMA144	3394058	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	215 W WYOMING UMA 144
UMA144	3394058	**Chloride**		**50.4**	mg/L	9/22/2003	Regular Sample	215 W WYOMING UMA 144
UMA144	3394058	**Fluoride**		**0.257**	mg/L	9/22/2003	Regular Sample	215 W WYOMING UMA 144
UMA144	3394058	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	215 W WYOMING UMA 144
UMA144	3394058	**Sulfate**		**58.8**	mg/L	9/22/2003	Regular Sample	215 W WYOMING UMA 144
UMA156	3384324	**Ammonia (NH3+NH4) as N**		**0.139**	mg/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Calcium**		**137,000**	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	Iron	U	10	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Magnesium**		**42,500**	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	Manganese	U	1	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Nitrate+Nitrite as N**		**10.8**	mg/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Phosphorus, total**		**0.0334**	mg/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Potassium**		**6,810**	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3384324	**Sodium**		**28,200**	ug/L	9/17/2003	Regular Sample	UMA 156 32201 E HIGHLAND EXT
UMA156	3394073	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	32201 E HIGHLAND EXT UMA 156
UMA156	3394073	**Chloride**		**16.3**	mg/L	9/23/2003	Regular Sample	32201 E HIGHLAND EXT UMA 156
UMA156	3394073	**Fluoride**		**0.119**	mg/L	9/23/2003	Regular Sample	32201 E HIGHLAND EXT UMA 156
UMA156	3394073	**Perchlorate**		**4.07**	ug/L	9/23/2003	Regular Sample	32201 E HIGHLAND EXT UMA 156
UMA156	3394073	**Sulfate**		**37.3**	mg/L	9/23/2003	Regular Sample	32201 E HIGHLAND EXT UMA 156
UMA160	3384304	**Ammonia (NH3+NH4) as N**		**0.164**	mg/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Calcium**		**63,100**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Iron**		**57.5**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Magnesium**		**24,900**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Manganese**		**13.3**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Nitrate+Nitrite as N**		**18.6**	mg/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Phosphorus, total**		**0.0104**	mg/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Potassium**		**10,800**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3384304	**Sodium**		**61,000**	ug/L	9/16/2003	Regular Sample	UMA 160 WESTERN EMPIRE @ SCALES
UMA160	3394054	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	WESTERN EMPIRE UMA 160
UMA160	3394054	**Chloride**		**32.2**	mg/L	9/22/2003	Regular Sample	WESTERN EMPIRE UMA 160
UMA160	3394054	**Fluoride**		**0.711**	mg/L	9/22/2003	Regular Sample	WESTERN EMPIRE UMA 160
UMA160	3394054	**Perchlorate**		**2.26**	ug/L	9/22/2003	Regular Sample	WESTERN EMPIRE UMA 160
UMA160	3394054	**Sulfate**		**66.1**	mg/L	9/22/2003	Regular Sample	WESTERN EMPIRE UMA 160
UMA161	3414250	Ammonia (NH3+NH4) as N	U	0.1	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	Bromide	U	0.2	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Calcium**		**227,000**	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Chloride**		**140**	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Fluoride**		**0.222**	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	Iron	U	10	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Magnesium**		**55,600**	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	Manganese	U	1	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Nitrate+Nitrite as N**		**51**	mg/L		Duplicate	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Nitrate+Nitrite as N**		**51.1**	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Perchlorate**		**4.23**	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Phosphorus, total**		**0.0212**	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Potassium**		**13,700**	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Sodium**		**59,100**	ug/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA161	3414250	**Sulfate**		**253**	mg/L	10/8/2003	Regular Sample	UMA 161 WESTERN EMPIRE CIRCLE #8 WELL
UMA163	3424304	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA163	3424304	Bromide	U	0.2	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Calcium**		**26,800**	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Chloride**		**3.68**	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Fluoride**		**0.132**	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Iron**		**24.1**	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Magnesium**		**5,550**	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	Manganese	U	1	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Nitrate+Nitrite as N**		**0.461**	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	Perchlorate	U	1	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Phosphorus, total**		**0.0146**	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Potassium**		**3,340**	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Sodium**		**6,530**	ug/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA163	3424304	**Sulfate**		**13.2**	mg/L	10/16/2003	Regular Sample	UMA 163 USF&W SHOP IRIGON
UMA164	3384307	**Ammonia (NH3+NH4) as N**		**0.141**	mg/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Calcium**		**66,100**	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Magnesium**		**16,500**	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Nitrate+Nitrite as N**		**3.96**	mg/L		Duplicate	UMA 164 235 W WASHINGTON
UMA164	3384307	**Nitrate+Nitrite as N**		**4.08**	mg/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Phosphorus, total**		**0.0395**	mg/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Potassium**		**7,650**	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3384307	**Sodium**		**21,500**	ug/L	9/16/2003	Regular Sample	UMA 164 235 W WASHINGTON
UMA164	3394057	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	235 W WASHINGTON UMA 164
UMA164	3394057	**Chloride**		**11.6**	mg/L	9/22/2003	Regular Sample	235 W WASHINGTON UMA 164
UMA164	3394057	**Fluoride**		**0.179**	mg/L	9/22/2003	Regular Sample	235 W WASHINGTON UMA 164
UMA164	3394057	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	235 W WASHINGTON UMA 164
UMA164	3394057	**Sulfate**		**21.5**	mg/L	9/22/2003	Regular Sample	235 W WASHINGTON UMA 164
UMA166	3424306	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	Bromide	U	0.2	mg/L		Duplicate	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	Bromide	U	0.2	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Calcium**		**37,400**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Chloride**		**17.6**	mg/L		Duplicate	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Chloride**		**17.6**	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Fluoride**		**0.341**	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Fluoride**		**0.358**	mg/L		Duplicate	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Iron**		**751**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Magnesium**		**14,600**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Manganese**		**19.8**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Nitrate+Nitrite as N**		**0.817**	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	Perchlorate	U	1	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	Phosphorus, total	U	0.01	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Potassium**		**11,200**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Sodium**		**66,000**	ug/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Sulfate**		**127**	mg/L	10/16/2003	Regular Sample	UMA 166 FORMERLY BIG RIVER FARMS
UMA166	3424306	**Sulfate**		**129**	mg/L		Duplicate	UMA 166 FORMERLY BIG RIVER FARMS
UMA168	3384314	**Ammonia (NH3+NH4) as N**		**0.164**	mg/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Calcium**		**44,400**	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Iron**		**17**	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Magnesium**		**15,100**	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	Manganese	U	1	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Nitrate+Nitrite as N**		**3.28**	mg/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Phosphorus, total**		**0.0385**	mg/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Potassium**		**4,510**	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3384314	**Sodium**		**22,900**	ug/L	9/16/2003	Regular Sample	UMA 168 76016 FRONTAGE RD
UMA168	3394063	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	76016 FRONTAGE RD UMA 168
UMA168	3394063	**Chloride**		**12.2**	mg/L	9/23/2003	Regular Sample	76016 FRONTAGE RD UMA 168
UMA168	3394063	**Fluoride**		**0.172**	mg/L	9/23/2003	Regular Sample	76016 FRONTAGE RD UMA 168
UMA168	3394063	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	76016 FRONTAGE RD UMA 168
UMA168	3394063	**Sulfate**		**9.37**	mg/L	9/23/2003	Regular Sample	76016 FRONTAGE RD UMA 168
UMA180	3384309	**Ammonia (NH3+NH4) as N**		**0.184**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Calcium**		**90,400**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Magnesium**		**49,900**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Manganese**		**122**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Nitrate+Nitrite as N**		**3.98**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Phosphorus, total**		**0.0383**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Potassium**		**8,830**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384309	**Sodium**		**99,500**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LOOP
UMA180	3384310	**Ammonia (NH3+NH4) as N**		**0.172**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Calcium**		**88,200**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	Iron	U	10	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Magnesium**		**49,700**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Manganese**		**121**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Nitrate+Nitrite as N**		**3.98**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Phosphorus, total**		**0.0344**	mg/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Potassium**		**9,090**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3384310	**Sodium**		**101,000**	ug/L	9/16/2003	Regular Sample	UMA 180 80691 WAGON WHEEL LP (QA)
UMA180	3394059	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	WAGON WHEEL LP UMA 180
UMA180	3394059	**Chloride**		**83.4**	mg/L	9/22/2003	Regular Sample	WAGON WHEEL LP UMA 180
UMA180	3394059	**Fluoride**		**0.749**	mg/L	9/22/2003	Regular Sample	WAGON WHEEL LP UMA 180
UMA180	3394059	Perchlorate	U	1	ug/L	9/22/2003	Regular Sample	WAGON WHEEL LP UMA 180
UMA180	3394059	**Sulfate**		**116**	mg/L	9/22/2003	Regular Sample	WAGON WHEEL LP UMA 180
UMA183	3424302	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	Bromide	U	0.2	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Calcium**		**140,000**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Chloride**		**71**	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Fluoride**		**0.537**	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Iron**		**16**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Magnesium**		**55,200**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	Manganese	U	1	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA183	3424302	**Nitrate+Nitrite as N**		**47.5**	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Perchlorate**		**2.04**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Phosphorus, total**		**0.22**	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Potassium**		**6,100**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Sodium**		**48,900**	ug/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA183	3424302	**Sulfate**		**68.7**	mg/L	10/14/2003	Regular Sample	UMA 183 HANSELL BROTHERS
UMA185	3384337	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Calcium**		**24,400**	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	Iron	U	10	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Magnesium**		**8,930**	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	Manganese	U	1	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Nitrate+Nitrite as N**		**0.156**	mg/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Phosphorus, total**		**0.0289**	mg/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Potassium**		**4,120**	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3384337	**Sodium**		**15,500**	ug/L	9/18/2003	Regular Sample	UMA 185 75794 HWY 207
UMA185	3394086	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	75794 HWY 207 UMA 185
UMA185	3394086	**Chloride**		**4.54**	mg/L	9/24/2003	Regular Sample	75794 HWY 207 UMA 185
UMA185	3394086	**Fluoride**		**0.219**	mg/L	9/24/2003	Regular Sample	75794 HWY 207 UMA 185
UMA185	3394086	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	75794 HWY 207 UMA 185
UMA185	3394086	**Sulfate**		**5.67**	mg/L	9/24/2003	Regular Sample	75794 HWY 207 UMA 185
UMA186	3424305	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	Bromide	U	0.2	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Calcium**		**39,100**	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Chloride**		**24.5**	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Fluoride**		**0.255**	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	Iron	U	10	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Magnesium**		**13,700**	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Manganese**		**1.4**	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Nitrate+Nitrite as N**		**4.19**	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	Perchlorate	U	1	ug/L		Duplicate	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	Perchlorate	U	1	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Phosphorus, total**		**0.0588**	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Potassium**		**5,260**	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Sodium**		**24,500**	ug/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA186	3424305	**Sulfate**		**15.6**	mg/L	10/16/2003	Regular Sample	UMA 186 JOHN & NELLIE MADISON
UMA187	3384336	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Calcium**		**20,000**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Iron**		**58.1**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Magnesium**		**6,530**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Manganese**		**67.2**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	Nitrate+Nitrite as N	U	0.02	mg/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Phosphorus, total**		**0.0101**	mg/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Potassium**		**3,200**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3384336	**Sodium**		**31,500**	ug/L	9/18/2003	Regular Sample	UMA 187 MADISON RANCH
UMA187	3394085	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	74246 SAYLOR RD UMA 187
UMA187	3394085	**Chloride**		**20.1**	mg/L	9/24/2003	Regular Sample	74246 SAYLOR RD UMA 187
UMA187	3394085	**Fluoride**		**0.515**	mg/L	9/24/2003	Regular Sample	74246 SAYLOR RD UMA 187
UMA187	3394085	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	74246 SAYLOR RD UMA 187
UMA187	3394085	**Sulfate**		**0.666**	mg/L	9/24/2003	Regular Sample	74246 SAYLOR RD UMA 187
UMA190	3384335	**Ammonia (NH3+NH4) as N**		**0.104**	mg/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Calcium**		**19,100**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Iron**		**118**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Magnesium**		**6,940**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Manganese**		**21.4**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Nitrate+Nitrite as N**		**1.45**	mg/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Phosphorus, total**		**0.0664**	mg/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Potassium**		**4,490**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3384335	**Sodium**		**17,000**	ug/L	9/18/2003	Regular Sample	UMA 190 ROBERT SPIKE @ DITCH
UMA190	3394084	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	ROBERT SPIKE @ DITCH UMA 190
UMA190	3394084	**Chloride**		**10.6**	mg/L	9/24/2003	Regular Sample	ROBERT SPIKE @ DITCH UMA 190
UMA190	3394084	**Fluoride**		**0.165**	mg/L	9/24/2003	Regular Sample	ROBERT SPIKE @ DITCH UMA 190
UMA190	3394084	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	ROBERT SPIKE @ DITCH UMA 190
UMA190	3394084	**Sulfate**		**15.7**	mg/L	9/24/2003	Regular Sample	ROBERT SPIKE @ DITCH UMA 190
UMA191	3384334	**Ammonia (NH3+NH4) as N**		**0.13**	mg/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Calcium**		**44,500**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Iron**		**15**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Magnesium**		**14,800**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Manganese**		**6.2**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Nitrate+Nitrite as N**		**0.247**	mg/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Phosphorus, total**		**0.157**	mg/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Potassium**		**5,820**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3384334	**Sodium**		**71,400**	ug/L	9/18/2003	Regular Sample	UMA 191 ECHO SEWAGE LAGOON
UMA191	3394083	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	CITY OF ECHO SEWAGE LAGOON UMA 191
UMA191	3394083	**Chloride**		**27**	mg/L	9/24/2003	Regular Sample	CITY OF ECHO SEWAGE LAGOON UMA 191
UMA191	3394083	**Fluoride**		**0.261**	mg/L	9/24/2003	Regular Sample	CITY OF ECHO SEWAGE LAGOON UMA 191
UMA191	3394083	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	CITY OF ECHO SEWAGE LAGOON UMA 191
UMA191	3394083	**Sulfate**		**15.3**	mg/L	9/24/2003	Regular Sample	CITY OF ECHO SEWAGE LAGOON UMA 191
UMA192	3424300	**Ammonia (NH3+NH4) as N**		**0.236**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	Bromide	U	0.2	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Calcium**		**32,200**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Chloride**		**13.6**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Fluoride**		**0.211**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	Iron	U	10	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Magnesium**		**14,700**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	Manganese	U	1	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Nitrate+Nitrite as N**		**3.13**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	Perchlorate	U	1	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Phosphorus, total**		**0.123**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Potassium**		**9,320**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Sodium**		**16,400**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10
UMA192	3424300	**Sulfate**		**21.9**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA192	3424301	Ammonia (NH3+NH4) as N	U	0.05	mg/L		Duplicate	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	Ammonia (NH3+NH4) as N	U	0.05	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	Bromide	U	0.2	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Calcium**		**33,000**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Chloride**		**14.3**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Fluoride**		**0.209**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	Iron	U	10	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Magnesium**		**14,900**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	Manganese	U	1	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Nitrate+Nitrite as N**		**2.73**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	Perchlorate	U	1	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Phosphorus, total**		**0.128**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Potassium**		**9,260**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Sodium**		**16,300**	ug/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA192	3424301	**Sulfate**		**21.9**	mg/L	10/14/2003	Regular Sample	UMA 192 PRIOR WELL #10 (DUPLICATE)
UMA201	3384300	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Calcium**		**77,700**	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Calcium**		**78,000**	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	Iron	U	10	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	Iron	U	10	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Magnesium**		**27,000**	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Magnesium**		**27,300**	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	Manganese	U	1	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	Manganese	U	1	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Nitrate+Nitrite as N**		**15.8**	mg/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Nitrate+Nitrite as N**		**16.2**	mg/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Phosphorus, total**		**0.041**	mg/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Phosphorus, total**		**0.0459**	mg/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Potassium**		**8,980**	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Potassium**		**9,180**	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Sodium**		**58,100**	ug/L	9/15/2003	Regular Sample	UMA 201 PORT OF MORROW OR HAY
UMA201	3384300	**Sodium**		**58,600**	ug/L		Duplicate	UMA 201 PORT OF MORROW OR HAY
UMA201	3394050	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	OR HAY PROD UMA 201
UMA201	3394050	**Chloride**		**44.9**	mg/L	9/22/2003	Regular Sample	OR HAY PROD UMA 201
UMA201	3394050	**Fluoride**		**0.223**	mg/L	9/22/2003	Regular Sample	OR HAY PROD UMA 201
UMA201	3394050	Perchlorate	J	1.18	ug/L	9/22/2003	Regular Sample	OR HAY PROD UMA 201
UMA201	3394050	**Sulfate**		**69.2**	mg/L	9/22/2003	Regular Sample	OR HAY PROD UMA 201
UMA244	3394167	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Calcium**		**18,000**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Chloride**		**6.91**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Fluoride**		**0.182**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	Iron	U	10	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Magnesium**		**7,780**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	Manganese	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Nitrate+Nitrite as N**		**1.07**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Phosphorus, total**		**0.0796**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Potassium**		**4,240**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Sodium**		**13,300**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394167	**Sulfate**		**5.59**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S
UMA244	3394168	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Calcium**		**17,400**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Chloride**		**6.94**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Fluoride**		**0.174**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	Iron	U	10	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Magnesium**		**7,590**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	Manganese	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Nitrate+Nitrite as N**		**1.02**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Phosphorus, total**		**0.0785**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Potassium**		**4,200**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Sodium**		**13,300**	ug/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA244	3394168	**Sulfate**		**5.6**	mg/L	9/24/2003	Regular Sample	STALEY MW-3S (DUPLICATE)
UMA259	3394166	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Calcium**		**21,800**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Chloride**		**11.4**	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Fluoride**		**0.24**	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Iron**		**26.8**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Magnesium**		**8,790**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Manganese**		**1.5**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Nitrate+Nitrite as N**		**1.08**	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Phosphorus, total**		**0.062**	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Potassium**		**4,940**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Sodium**		**21,600**	ug/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA259	3394166	**Sulfate**		**15.3**	mg/L	9/24/2003	Regular Sample	STALEY MW-3D
UMA260	3394165	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Calcium**		**66,700**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Chloride**		**21.9**	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Fluoride**		**0.413**	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Iron**		**5,190**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Magnesium**		**15,700**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Manganese**		**459**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Nitrate+Nitrite as N**		**8.87**	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Phosphorus, total**		**1.57**	mg/L	9/24/2003	Regular Sample	STALEY MW-1S

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA260	3394165	**Potassium**		**5,940**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Sodium**		**147,000**	ug/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA260	3394165	**Sulfate**		**49.2**	mg/L	9/24/2003	Regular Sample	STALEY MW-1S
UMA262	3394164	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Calcium**		**65,000**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Chloride**		**17.7**	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Fluoride**		**0.0802**	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Iron**		**248**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Magnesium**		**23,000**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Manganese**		**34.8**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Nitrate+Nitrite as N**		**4.21**	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Phosphorus, total**		**0.112**	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Phosphorus, total**		**0.119**	mg/L		Duplicate	STALEY MW-1D
UMA262	3394164	**Potassium**		**6,900**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Sodium**		**21,900**	ug/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA262	3394164	**Sulfate**		**21.1**	mg/L	9/24/2003	Regular Sample	STALEY MW-1D
UMA279	3394136	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	Bromide	U	0.2	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Calcium**		**62,600**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Chloride**		**20.5**	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Fluoride**		**0.209**	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Iron**		**85.6**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Magnesium**		**16,100**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Manganese**		**1.2**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Nitrate+Nitrite as N**		**4.74**	mg/L		Duplicate	81336 VETTER LN (UMA 279)
UMA279	3394136	**Nitrate+Nitrite as N**		**4.8**	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Phosphorus, total**		**0.0908**	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Potassium**		**6,770**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Sodium**		**28,600**	ug/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA279	3394136	**Sulfate**		**26**	mg/L	9/24/2003	Regular Sample	81336 VETTER LN (UMA 279)
UMA174	3384402	**Ammonia (NH3+NH4) as N**		**0.147**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Calcium**		**122,000**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Chloride**		**56.3**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Fluoride**		**0.212**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	Iron	U	10	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Magnesium**		**32,500**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	Manganese	U	1	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Nitrate+Nitrite as N**		**31.3**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Perchlorate**		**2.13**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Phosphorus, total**		**0.0231**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Potassium**		**11,400**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Sodium**		**40,800**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
UMA174	3384402	**Sulfate**		**99.9**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #1
POM Booster Well #2	3384403	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Calcium**		**125,000**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Chloride**		**51.8**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Fluoride**		**0.153**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	Iron	U	10	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Magnesium**		**34,000**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	Manganese	U	1	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Nitrate+Nitrite as N**		**33.8**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	Perchlorate	J	1.51	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Phosphorus, total**		**0.0331**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Potassium**		**10,900**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Sodium**		**36,600**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Booster Well #2	3384403	**Sulfate**		**79.9**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW BOOSTER WELL #2
POM Circle 12 well	3384404	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Calcium**		**149,000**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Chloride**		**71.9**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Fluoride**		**0.158**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	Iron	U	10	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Magnesium**		**42,100**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	Manganese	U	1	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Nitrate+Nitrite as N**		**44.3**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Perchlorate**		**3.93**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Phosphorus, total**		**0.0288**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Potassium**		**11,200**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Sodium**		**52,000**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
POM Circle 12 well	3384404	**Sulfate**		**118**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW CIRCLE 12 WELL
UMA177	3384400	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	PORT OF MORROW FARM WELL #2
UMA177	3384400	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	Bromide	U	0.2	mg/L		Duplicate	PORT OF MORROW FARM WELL #2
UMA177	3384400	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Calcium**		**79,600**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Chloride**		**40.9**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Chloride**		**42.2**	mg/L		Duplicate	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Fluoride**		**0.268**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Fluoride**		**0.317**	mg/L		Duplicate	PORT OF MORROW FARM WELL #2
UMA177	3384400	Iron	U	10	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Magnesium**		**24,600**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	Manganese	U	1	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Nitrate+Nitrite as N**		**18.6**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	Perchlorate	J	1.01	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Phosphorus, total**		**0.0703**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Potassium**		**8,030**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA177	3384400	**Sodium**		**44,700**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Sulfate**		**57.4**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #2
UMA177	3384400	**Sulfate**		**62.1**	mg/L		Duplicate	PORT OF MORROW FARM WELL #2
UMA178	3384401	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Calcium**		**95,100**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Iron**		**51.2**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Magnesium**		**30,200**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Manganese**		**1.2**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Nitrate+Nitrite as N**		**32.3**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Phosphorus, total**		**0.0518**	mg/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Potassium**		**9,950**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA178	3384401	**Sodium**		**53,300**	ug/L	9/17/2003	Regular Sample	PORT OF MORROW FARM WELL #3
UMA233	3384387	**Sulfate**		**83.5**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Sodium**		**50,100**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Potassium**		**7,930**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Phosphorus, total**		**0.0189**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Perchlorate**		**4.12**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Nitrate+Nitrite as N**		**49.8**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	Manganese	U	1	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Magnesium**		**49,500**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Iron**		**12**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Fluoride**		**0.528**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Chloride**		**66.7**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	**Calcium**		**81,800**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	Bromide	U	0.2	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA233	3384387	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-15
UMA231	3384385	**Sulfate**		**30.2**	mg/L		Duplicate	PORT OF MORROW MW-2
UMA231	3384385	**Sulfate**		**30.5**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Sodium**		**22,400**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Potassium**		**8,600**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Phosphorus, total**		**0.0303**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	Perchlorate	U	1	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Nitrate+Nitrite as N**		**6.98**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	Manganese	U	1	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Magnesium**		**19,700**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	Iron	U	10	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Fluoride**		**0.254**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Chloride**		**15**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	**Calcium**		**67,900**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	Bromide	U	0.2	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA231	3384385	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-2
UMA232	3384386	**Sulfate**		**66.1**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Sodium**		**37,600**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Potassium**		**10,700**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Phosphorus, total**		**0.0427**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Perchlorate**		**2.29**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Nitrate+Nitrite as N**		**33**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	Manganese	U	1	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Magnesium**		**26,800**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Iron**		**47.3**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Fluoride**		**0.288**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Chloride**		**35.2**	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	**Calcium**		**92,200**	ug/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	Bromide	U	0.2	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA232	3384386	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/15/2003	Regular Sample	PORT OF MORROW MW-7
UMA202	3384426	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Calcium**		**31,700**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Chloride**		**18.7**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Fluoride**		**0.66**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Iron**		**19**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Magnesium**		**25,200**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Manganese**		**2.7**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Nitrate+Nitrite as N**		**0.0936**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Phosphorus, total**		**0.128**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Potassium**		**6,770**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Sodium**		**74,200**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA202	3384426	**Sulfate**		**53.9**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 18-2 UMA 202
UMA203	3384428	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Bromide**		**0.293**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Bromide**		**0.316**	mg/L		Duplicate	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Calcium**		**77,000**	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Chloride**		**75.8**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Chloride**		**78.2**	mg/L		Duplicate	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Fluoride**		**0.302**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Fluoride**		**0.355**	mg/L		Duplicate	DEPOT WELL 38-2 UMA 203
UMA203	3384428	Iron	U	10	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Magnesium**		**35,200**	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	Manganese	U	1	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Nitrate+Nitrite as N**		**28.7**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Perchlorate**		**6.53**	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Phosphorus, total**		**0.0883**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Potassium**		**9,480**	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Sodium**		**35,100**	ug/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Sulfate**		**62.8**	mg/L	9/18/2003	Regular Sample	DEPOT WELL 38-2 UMA 203
UMA203	3384428	**Sulfate**		**65.7**	mg/L		Duplicate	DEPOT WELL 38-2 UMA 203
UMA204	3394129	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Bromide**		**0.254**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Calcium**		**60,300**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Chloride**		**44.9**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA204	3394129	**Fluoride**		**0.298**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Magnesium**		**24,000**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	Manganese	U	1	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Nitrate+Nitrite as N**		**16.5**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	Perchlorate	J	1.67	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Phosphorus, total**		**0.0459**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Potassium**		**10,600**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Sodium**		**74,500**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA204	3394129	**Sulfate**		**68**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 46 (UMA 204)
UMA205	3394131	**Ammonia (NH3+NH4) as N**		**0.332**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Calcium**		**34,100**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Chloride**		**16.8**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Fluoride**		**0.878**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Iron**		**71.7**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Magnesium**		**21,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Manganese**		**149**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	Nitrate+Nitrite as N	U	0.02	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Phosphorus, total**		**0.0843**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Potassium**		**6,040**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Sodium**		**86,600**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA205	3394131	**Sulfate**		**70.2**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-5 (UMA 205)
UMA206	3384425	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Calcium**		**55,500**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Chloride**		**15.8**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Fluoride**		**0.203**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Iron**		**20.8**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Magnesium**		**18,500**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Manganese**		**1.2**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Nitrate+Nitrite as N**		**6.2**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Phosphorus, total**		**0.0976**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Potassium**		**10,400**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Sodium**		**21,700**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA206	3384425	**Sulfate**		**34.5**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 57-4 UMA 206
UMA213	3384423	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Bromide**		**0.214**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Calcium**		**44,500**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Chloride**		**29.1**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Fluoride**		**0.949**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Iron**		**17**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Magnesium**		**35,800**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	Manganese	U	1	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Nitrate+Nitrite as N**		**3.61**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Perchlorate**		**5.06**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Phosphorus, total**		**0.0793**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Potassium**		**5,860**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Sodium**		**87,200**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA213	3384423	**Sulfate**		**117**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 19-2 UMA 213
UMA214	3384424	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Calcium**		**64,600**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Chloride**		**14.6**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Fluoride**		**0.197**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	Iron	U	10	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Magnesium**		**21,200**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	Manganese	U	1	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Nitrate+Nitrite as N**		**7.39**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Phosphorus, total**		**0.0658**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Potassium**		**10,900**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Sodium**		**27,500**	ug/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA214	3384424	**Sulfate**		**34.9**	mg/L	9/17/2003	Regular Sample	DEPOT WELL 38-3 UMA 214
UMA215	3394130	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Bromide**		**0.354**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Calcium**		**76,100**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Chloride**		**59.7**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Fluoride**		**0.3**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Magnesium**		**24,200**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	Manganese	U	1	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Nitrate+Nitrite as N**		**17.2**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Perchlorate**		**5.02**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Perchlorate**		**5.04**	ug/L		Duplicate	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Phosphorus, total**		**0.046**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Potassium**		**10,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Sodium**		**38,900**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA215	3394130	**Sulfate**		**77.3**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 38-4 (UMA 215)
UMA217	3394133	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Calcium**		**28,500**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Chloride**		**19.2**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Fluoride**		**0.435**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Iron**		**464**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Magnesium**		**29,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Manganese**		**16.2**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Nitrate+Nitrite as N**		**6.91**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	Perchlorate	J	1.54	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	***EPA Sample ID***	***Analyte Name***	***Qualifier***	***Result***	***Unit***	***Date Collected***	***Sample Type Description***	***Sample Description***
UMA217	3394133	**Phosphorus, total**		**0.0585**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Potassium**		**4,610**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Sodium**		**41,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA217	3394133	**Sulfate**		**34.8**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 16-2 (UMA 217)
UMA218	3384427	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Calcium**		**26,500**	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Chloride**		**17.9**	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Fluoride**		**0.386**	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	Iron	U	10	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Magnesium**		**21,300**	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	Manganese	U	1	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Nitrate+Nitrite as N**		**7.4**	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Perchlorate**		**2.82**	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Phosphorus, total**		**0.0127**	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Potassium**		**2,590**	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Sodium**		**24,300**	ug/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA218	3384427	**Sulfate**		**24.2**	mg/L	9/18/2003	Regular Sample	DEPOT WELL MW-4 UMA 218
UMA224	3394127	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Calcium**		**43,600**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Chloride**		**22.8**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Fluoride**		**0.344**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Magnesium**		**20,600**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Manganese**		**15.5**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Nitrate+Nitrite as N**		**7.35**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Perchlorate**		**2.17**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Phosphorus, total**		**0.074**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Potassium**		**3,960**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Sodium**		**26,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224	3394127	**Sulfate**		**25.5**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Calcium**		**43,100**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Chloride**		**24.2**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Fluoride**		**0.373**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Magnesium**		**20,400**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Manganese**		**14.1**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Nitrate+Nitrite as N**		**7.31**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Perchlorate**		**2.4**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Phosphorus, total**		**0.0724**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Potassium**		**3,930**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Sodium**		**26,600**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA224 (duplicate)	3394128	**Sulfate**		**28**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4- (UMA 224)
UMA225	3394126	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Calcium**		**42,200**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Chloride**		**18.6**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Fluoride**		**0.268**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Magnesium**		**19,800**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	Manganese	U	1	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Nitrate+Nitrite as N**		**8.59**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	Perchlorate	J	1.4	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Phosphorus, total**		**0.0443**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Potassium**		**4,490**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Sodium**		**24,400**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA225	3394126	**Sulfate**		**21.4**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 4-18 (UMA225)
UMA228	3394125	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	Bromide	U	0.2	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Calcium**		**28,800**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Chloride**		**19.9**	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Fluoride**		**0.347**	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Iron**		**12**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Magnesium**		**24,900**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	Manganese	U	1	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Nitrate+Nitrite as N**		**7.66**	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Perchlorate**		**2.56**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Perchlorate**		**2.68**	ug/L		Duplicate	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	Phosphorus, total	U	0.01	mg/L		Duplicate	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	Phosphorus, total	U	0.01	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Potassium**		**2,680**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Sodium**		**19,600**	ug/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA228	3394125	**Sulfate**		**27.5**	mg/L	9/22/2003	Regular Sample	DEPOT WELL 4-16 (UMA228)
UMA276	3394132	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Calcium**		**51,000**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Chloride**		**20.4**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Fluoride**		**0.372**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	Iron	U	10	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Magnesium**		**18,400**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	Manganese	U	1	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Nitrate+Nitrite as N**		**6.02**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	Perchlorate	J	1.34	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Phosphorus, total**		**0.0295**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Potassium**		**8,740**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Sodium**		**32,000**	ug/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)
UMA276	3394132	**Sulfate**		**36.5**	mg/L	9/23/2003	Regular Sample	DEPOT WELL 57-3 (UMA 276)

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA263	3384419	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Bromide**		**0.686**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Calcium**		**91,000**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Chloride**		**187**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Fluoride**		**0.407**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Iron**		**17**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Magnesium**		**50,800**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	Manganese	U	1	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Nitrate+Nitrite as N**		**10.6**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Perchlorate**		**7.79**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Perchlorate**		**7.89**	ug/L		Duplicate	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Phosphorus, total**		**0.0107**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Potassium**		**4,510**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Sodium**		**49,800**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA263	3384419	**Sulfate**		**86.8**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-1 UMA 263
UMA264	3384421	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Calcium**		**19,200**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Chloride**		**31.1**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Fluoride**		**0.474**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Iron**		**23.3**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Magnesium**		**8,950**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	Manganese	U	1	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Nitrate+Nitrite as N**		**7.79**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Perchlorate**		**2.64**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Phosphorus, total**		**0.0302**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Potassium**		**3,960**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Sodium**		**86,000**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384421	**Sulfate**		**39.6**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264
UMA264	3384422	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Calcium**		**19,200**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Chloride**		**30.9**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Fluoride**		**0.454**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Iron**		**22.6**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Magnesium**		**9,000**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	Manganese	U	1	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Nitrate+Nitrite as N**		**7.96**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Perchlorate**		**2.72**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Phosphorus, total**		**0.0321**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Potassium**		**4,060**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Sodium**		**86,300**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA264	3384422	**Sulfate**		**38.7**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-2 UMA 264 DUP
UMA265	3384420	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Bromide**		**0.256**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Calcium**		**27,700**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Chloride**		**31.5**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Fluoride**		**0.306**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Iron**		**36.7**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Magnesium**		**11,800**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Manganese**		**1.3**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Nitrate+Nitrite as N**		**6.98**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Perchlorate**		**2.06**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Phosphorus, total**		**0.0152**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Potassium**		**4,620**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Sodium**		**60,700**	ug/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA265	3384420	**Sulfate**		**27.9**	mg/L	9/16/2003	Regular Sample	HERMISTON FOODS MW-5 UMA 265
UMA059	3394139	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Calcium**		**82,600**	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Chloride**		**32.8**	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Fluoride**		**0.24**	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	Iron	U	10	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Magnesium**		**21,700**	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	Manganese	U	1	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Nitrate+Nitrite as N**		**8.1**	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	Perchlorate	J	1.14	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Phosphorus, total**		**0.106**	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Potassium**		**9,070**	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Sodium**		**37,500**	ug/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA059	3394139	**Sulfate**		**66.9**	mg/L	9/25/2003	Regular Sample	IRRIGON SUPPLY WELL (UMA 059)
UMA266	3394143	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Calcium**		**128,000**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Calcium**		**130,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Chloride**		**44.6**	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Fluoride**		**0.2**	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Iron**		**917**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Iron**		**928**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Magnesium**		**32,100**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Magnesium**		**32,200**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Manganese**		**32.3**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Manganese**		**33**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Nitrate+Nitrite as N**		**41.4**	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Perchlorate**		**2.46**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Phosphorus, total**		**0.0776**	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Potassium**		**10,800**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Potassium**		**11,000**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Sodium**		**47,700**	ug/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA266	3394143	**Sodium**		**48,300**	ug/L		Duplicate	IRRIGON MW UB (UMA 266)

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	***EPA Sample ID***	***Analyte Name***	***Qualifier***	***Result***	***Unit***	***Date Collected***	***Sample Type Description***	***Sample Description***
UMA266	3394143	**Sulfate**		**101**	mg/L	9/25/2003	Regular Sample	IRRIGON MW UB (UMA 266)
UMA267	3394140	**Ammonia (NH3+NH4) as N**		**0.513**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	Bromide	U	0.2	mg/L		Duplicate	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Calcium**		**122,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Chloride**		**77.9**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Chloride**		**78.5**	mg/L		Duplicate	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Fluoride**		**0.231**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Fluoride**		**0.237**	mg/L		Duplicate	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Iron**		**11**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Magnesium**		**31,200**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Manganese**		**375**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Nitrate+Nitrite as N**		**30**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	Perchlorate	J	1.06	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Phosphorus, total**		**0.527**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Potassium**		**13,900**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Sodium**		**82,700**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Sulfate**		**79.6**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 (UMA 267)
UMA267	3394140	**Sulfate**		**81.2**	mg/L		Duplicate	IRRIGON MW DB-4 (UMA 267)
UMA267	3394141	**Ammonia (NH3+NH4) as N**		**0.463**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Calcium**		**120,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Chloride**		**77.4**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Fluoride**		**0.242**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Iron**		**18**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Magnesium**		**31,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Manganese**		**591**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Nitrate+Nitrite as N**		**29.9**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	Perchlorate	J	1.14	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Phosphorus, total**		**0.535**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Potassium**		**14,200**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Sodium**		**81,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA267	3394141	**Sulfate**		**79.8**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DB-4 QA (UMA 267)
UMA268	3394142	**Ammonia (NH3+NH4) as N**		**0.178**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Calcium**		**119,000**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Chloride**		**63.4**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Fluoride**		**0.197**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Iron**		**123**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Magnesium**		**32,800**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Manganese**		**136**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Nitrate+Nitrite as N**		**30.4**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Phosphorus, total**		**0.148**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Potassium**		**12,900**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Sodium**		**66,400**	ug/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA268	3394142	**Sulfate**		**78**	mg/L	9/25/2003	Regular Sample	IRRIGON MW DC (UMA 268)
UMA198	3384323	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Calcium**		**75,700**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Iron**		**55**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Magnesium**		**42,200**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Manganese**		**6.6**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Nitrate+Nitrite as N**		**31.2**	mg/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Phosphorus, total**		**0.0143**	mg/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Potassium**		**4,260**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3384323	**Sodium**		**54,500**	ug/L	9/17/2003	Regular Sample	UMA 198 LAMB WESTON WELL #1
UMA198	3394072	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	LAMB WESTON WELL #1 UMA 198
UMA198	3394072	**Chloride**		**63.1**	mg/L	9/23/2003	Regular Sample	LAMB WESTON WELL #1 UMA 198
UMA198	3394072	**Fluoride**		**0.154**	mg/L	9/23/2003	Regular Sample	LAMB WESTON WELL #1 UMA 198
UMA198	3394072	**Perchlorate**		**3.34**	ug/L		Duplicate	LAMB WESTON WELL #1 UMA 198
UMA198	3394072	**Perchlorate**		**3.36**	ug/L	9/23/2003	Regular Sample	LAMB WESTON WELL #1 UMA 198
UMA198	3394072	**Sulfate**		**26**	mg/L	9/23/2003	Regular Sample	LAMB WESTON WELL #1 UMA 198
UMA234	3384389	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Calcium**		**20,600**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Chloride**		**21.1**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Fluoride**		**0.413**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Iron**		**37.1**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Magnesium**		**11,500**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Manganese**		**1.6**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Nitrate+Nitrite as N**		**7.98**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Perchlorate**		**5.18**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Perchlorate**		**5.35**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	Phosphorus, total	U	0.01	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Potassium**		**3,920**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Sodium**		**45,300**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA234	3384389	**Sulfate**		**14.8**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-3
UMA235	3384390	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Calcium**		**36,000**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Calcium**		**36,100**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Chloride**		**42.9**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Fluoride**		**0.394**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Iron**		**53.7**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Iron**		**55**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Magnesium**		**18,700**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Magnesium**		**18,700**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Manganese**		**1.4**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Manganese**		**1.4**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Nitrate+Nitrite as N**		**25.9**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Perchlorate**		**4.96**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA235	3384390	Phosphorus, total	U	0.01	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Potassium**		**4,460**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Potassium**		**4,490**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Sodium**		**41,300**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Sodium**		**41,500**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-4
UMA235	3384390	**Sulfate**		**9.59**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-4
UMA236	3384393	**Ammonia (NH3+NH4) as N**		**0.55**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Calcium**		**22,500**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Chloride**		**24.9**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Fluoride**		**0.326**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Iron**		**1,330**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Magnesium**		**11,000**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Manganese**		**45.7**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Nitrate+Nitrite as N**		**8.11**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Perchlorate**		**2.96**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Phosphorus, total**		**0.186**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Potassium**		**6,410**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Sodium**		**59,900**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384393	**Sulfate**		**11.4**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6
UMA236	3384394	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Calcium**		**21,800**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Chloride**		**25.3**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Fluoride**		**0.338**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Iron**		**1,210**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Magnesium**		**10,600**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Manganese**		**33.8**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Nitrate+Nitrite as N**		**8.21**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Perchlorate**		**2.82**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Phosphorus, total**		**0.165**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Potassium**		**6,110**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Sodium**		**60,300**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA236	3384394	**Sulfate**		**11.6**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-6 QA
UMA237	3384392	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Bromide**		**0.204**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Calcium**		**139,000**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Chloride**		**84.5**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Fluoride**		**0.308**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Iron**		**35.9**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Magnesium**		**64,600**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Manganese**		**5.8**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Nitrate+Nitrite as N**		**44.3**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Perchlorate**		**5.07**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Perchlorate**		**5.19**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Phosphorus, total**		**0.0754**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Potassium**		**13,700**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Sodium**		**77,200**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA237	3384392	**Sulfate**		**85.7**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-8
UMA238	3384388	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Calcium**		**128,000**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Chloride**		**77.3**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Fluoride**		**0.0853**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Iron**		**716**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Magnesium**		**82,900**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Manganese**		**39.2**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Nitrate+Nitrite as N**		**46.3**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	Perchlorate	J	1.87	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Phosphorus, total**		**0.214**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Potassium**		**5,240**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Sodium**		**25,100**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA238	3384388	**Sulfate**		**39.6**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-10
UMA239	3384405	**Ammonia (NH3+NH4) as N**		**0.252**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Calcium**		**36,300**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Chloride**		**11.5**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Fluoride**		**0.231**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Iron**		**207**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Magnesium**		**13,400**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Manganese**		**8.5**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Nitrate+Nitrite as N**		**0.816**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	Perchlorate	U	1	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Phosphorus, total**		**0.0602**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Potassium**		**3,330**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Sodium**		**15,900**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA239	3384405	**Sulfate**		**24**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-4A
UMA240	3384406	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Bromide**		**1.35**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Calcium**		**125,000**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Chloride**		**131**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Fluoride**		**0.654**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Iron**		**201**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Magnesium**		**28,400**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Manganese**		**11.7**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Nitrate+Nitrite as N**		**4.23**	mg/L		Duplicate	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Nitrate+Nitrite as N**		**4.39**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Perchlorate**		**6.98**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Phosphorus, total**		**0.0241**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Potassium**		**3,100**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA240	3384406	**Sodium**		**65,900**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA240	3384406	**Sulfate**		**159**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-3
UMA241	3394163	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Bromide**		**0.316**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Calcium**		**23,900**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Chloride**		**5.42**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Fluoride**		**0.223**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Iron**		**611**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Magnesium**		**7,410**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Manganese**		**46.4**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Nitrate+Nitrite as N**		**0.181**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	Perchlorate	U	1	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Phosphorus, total**		**0.204**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Potassium**		**5,360**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Sodium**		**21,200**	ug/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA241	3394163	**Sulfate**		**6.79**	mg/L	9/24/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-2
UMA242	3384407	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	Bromide	U	0.2	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Calcium**		**61,800**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Chloride**		**22.1**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Fluoride**		**0.272**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Iron**		**22.8**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Magnesium**		**22,000**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Manganese**		**1.2**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Nitrate+Nitrite as N**		**5.79**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	Perchlorate	U	1	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Phosphorus, total**		**0.108**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Potassium**		**6,740**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Sodium**		**73,800**	ug/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA242	3384407	**Sulfate**		**49.6**	mg/L	9/18/2003	Regular Sample	LAMB-WESTON MADISON RANCH MW-5
UMA243	3384391	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	Bromide	U	0.2	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Calcium**		**54,400**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Chloride**		**32.6**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Fluoride**		**0.284**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Iron**		**1,670**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Magnesium**		**41,700**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Manganese**		**9.2**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Nitrate+Nitrite as N**		**29.1**	mg/L		Duplicate	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Nitrate+Nitrite as N**		**29.7**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Perchlorate**		**2.11**	ug/L		Duplicate	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Perchlorate**		**2.21**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Phosphorus, total**		**0.0109**	mg/L		Duplicate	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Phosphorus, total**		**0.011**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Potassium**		**4,160**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Sodium**		**23,600**	ug/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA243	3384391	**Sulfate**		**35.5**	mg/L	9/16/2003	Regular Sample	LAMB-WESTON NORTH FARM MW-5
UMA271	3404201	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Bromide**		**0.708**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Calcium**		**146,000**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Chloride**		**136**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Fluoride**		**0.353**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Iron**		**24.1**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Magnesium**		**78,000**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	Manganese	U	1	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Nitrate+Nitrite as N**		**36.4**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Perchlorate**		**6.4**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Phosphorus, total**		**0.0187**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Potassium**		**5,740**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Sodium**		**71,000**	ug/L	9/29/2003	Regular Sample	PGE WELL #107
UMA271	3404201	**Sulfate**		**166**	mg/L	9/29/2003	Regular Sample	PGE WELL #107
UMA272	3404200	Ammonia (NH3+NH4) as N	U	0.1	mg/L		Duplicate	PGE WELL #1
UMA272	3404200	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Bromide**		**0.275**	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Bromide**		**0.277**	mg/L		Duplicate	PGE WELL #1
UMA272	3404200	**Calcium**		**11,100**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Chloride**		**35**	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Chloride**		**36.6**	mg/L		Duplicate	PGE WELL #1
UMA272	3404200	**Fluoride**		**1.44**	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Fluoride**		**1.51**	mg/L		Duplicate	PGE WELL #1
UMA272	3404200	**Iron**		**273**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Magnesium**		**5,740**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Manganese**		**60.5**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	Nitrate+Nitrite as N	U	0.05	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	Perchlorate	U	1	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Phosphorus, total**		**0.012**	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Potassium**		**12,400**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Sodium**		**83,000**	ug/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Sulfate**		**4.6**	mg/L	9/29/2003	Regular Sample	PGE WELL #1
UMA272	3404200	**Sulfate**		**4.76**	mg/L		Duplicate	PGE WELL #1
UMA273	3404202	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	Bromide	U	0.2	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Calcium**		**74,500**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Chloride**		**68.6**	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Fluoride**		**0.353**	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Iron**		**26.9**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Magnesium**		**61,100**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	Manganese	U	1	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Nitrate+Nitrite as N**		**32.5**	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Perchlorate**		**2.28**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Phosphorus, total**		**0.645**	mg/L	9/29/2003	Regular Sample	PGE WELL #104

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	*EPA Sample ID*	*Analyte Name*	*Qualifier*	*Result*	*Unit*	*Date Collected*	*Sample Type Description*	*Sample Description*
UMA273	3404202	**Potassium**		**6,920**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Sodium**		**67,800**	ug/L	9/29/2003	Regular Sample	PGE WELL #104
UMA273	3404202	**Sulfate**		**98.9**	mg/L	9/29/2003	Regular Sample	PGE WELL #104
UMA274	3404203	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Bromide**		**1.06**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Calcium**		**23,400**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Calcium**		**23,600**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Chloride**		**163**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Fluoride**		**0.484**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Iron**		**2,180**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Iron**		**2,180**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Magnesium**		**22,300**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Magnesium**		**22,400**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Manganese**		**209**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Manganese**		**210**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Nitrate+Nitrite as N**		**0.0504**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	Perchlorate	U	1	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	Perchlorate	U	1	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Phosphorus, total**		**0.0151**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Potassium**		**9,570**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Potassium**		**9,600**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Sodium**		**238,000**	ug/L		Duplicate	PGE WELL #101
UMA274	3404203	**Sodium**		**240,000**	ug/L	9/29/2003	Regular Sample	PGE WELL #101
UMA274	3404203	**Sulfate**		**222**	mg/L	9/29/2003	Regular Sample	PGE WELL #101
Simplot HL-3	3394175	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Bromide**		**0.548**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Calcium**		**94,600**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Chloride**		**67.7**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Fluoride**		**0.141**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Iron**		**129**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Magnesium**		**29,500**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Manganese**		**3.1**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Nitrate+Nitrite as N**		**11**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	Perchlorate	J	1.66	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Phosphorus, total**		**0.0742**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Potassium**		**5,370**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Sodium**		**43,400**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-3	3394175	**Sulfate**		**93**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-3
Simplot HL-4	3394177	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Calcium**		**87,200**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Iron**		**386**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Magnesium**		**48,200**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Manganese**		**6.4**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Nitrate+Nitrite as N**		**4.71**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Phosphorus, total**		**0.0828**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Potassium**		**3,510**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-4	3394177	**Sodium**		**220,000**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-4
Simplot HL-5	3394176	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Bromide**		**0.509**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Calcium**		**112,000**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Chloride**		**93**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Fluoride**		**0.312**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Iron**		**113**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Magnesium**		**34,300**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Manganese**		**4.1**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Nitrate+Nitrite as N**		**32.3**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Perchlorate**		**4.44**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Phosphorus, total**		**0.0401**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Potassium**		**4,550**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Sodium**		**160,000**	ug/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot HL-5	3394176	**Sulfate**		**172**	mg/L	9/26/2003	Regular Sample	SIMPLOT HL-5
Simplot L-11	3394178	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Bromide**		**1.48**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Calcium**		**114,000**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Chloride**		**200**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Fluoride**		**0.775**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Iron**		**2,330**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Magnesium**		**47,100**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Manganese**		**98.3**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Nitrate+Nitrite as N**		**12.8**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Perchlorate**		**13.4**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Phosphorus, total**		**0.573**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Potassium**		**6,570**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Sodium**		**84,500**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-11	3394178	**Sulfate**		**148**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-11
Simplot L-6	3394174	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Bromide**		**1.02**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Calcium**		**66,800**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Chloride**		**114**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Fluoride**		**0.694**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Iron**		**140**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Magnesium**		**29,800**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Manganese**		**6.2**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Nitrate+Nitrite as N**		**1.33**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	Perchlorate	U	1	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Phosphorus, total**		**0.0366**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Potassium**		**8,880**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Sodium**		**102,000**	ug/L	9/26/2003	Regular Sample	SIMPLOT L-6
Simplot L-6	3394174	**Sulfate**		**188**	mg/L	9/26/2003	Regular Sample	SIMPLOT L-6
UMA058	3394067	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058
UMA058	3394067	**Chloride**		**28.2**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	***EPA Sample ID***	***Analyte Name***	***Qualifier***	***Result***	***Unit***	***Date Collected***	***Sample Type Description***	***Sample Description***
UMA058	3394067	**Fluoride**		**0.232**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058
UMA058	3394067	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058
UMA058	3394067	**Sulfate**		**27.5**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058
UMA058	3394068	Bromide	U	0.2	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058 QA
UMA058	3394068	**Chloride**		**27.5**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058 QA
UMA058	3394068	**Fluoride**		**0.236**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058 QA
UMA058	3394068	Perchlorate	U	1	ug/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058 QA
UMA058	3394068	**Sulfate**		**27.8**	mg/L	9/23/2003	Regular Sample	SIMPLOT# 3 UMA 058 QA
UMA245	3384396	**Ammonia (NH3+NH4) as N**		**0.111**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Calcium**		**29,600**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Chloride**		**6.11**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Fluoride**		**0.266**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	Iron	U	10	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Magnesium**		**10,400**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	Manganese	U	1	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Nitrate+Nitrite as N**		**1.04**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Phosphorus, total**		**0.0536**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Potassium**		**4,160**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Sodium**		**17,100**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA245	3384396	**Sulfate**		**7.32**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11D
UMA246	3384408	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Bromide**		**0.68**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Calcium**		**95,100**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Chloride**		**87.6**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Fluoride**		**0.233**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	Iron	U	10	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Magnesium**		**30,200**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	Manganese	U	1	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Nitrate+Nitrite as N**		**15.9**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Perchlorate**		**4.58**	ug/L		Duplicate	SIMPLOT MW-13S
UMA246	3384408	**Perchlorate**		**4.76**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Phosphorus, total**		**0.104**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Potassium**		**6,680**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Sodium**		**30,700**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA246	3384408	**Sulfate**		**67.6**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13S
UMA247	3384409	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	Bromide	U	0.2	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Calcium**		**41,300**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Chloride**		**15.5**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Fluoride**		**0.207**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	Iron	U	10	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Magnesium**		**14,800**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	Manganese	U	1	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Nitrate+Nitrite as N**		**1.73**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	Perchlorate	U	1	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Phosphorus, total**		**0.0528**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Potassium**		**5,780**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Sodium**		**23,400**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA247	3384409	**Sulfate**		**13.4**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-13D
UMA248	3384399	**Ammonia (NH3+NH4) as N**		**0.479**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Calcium**		**26,400**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Chloride**		**17.7**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Fluoride**		**0.242**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Iron**		**6,330**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Magnesium**		**11,000**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Manganese**		**874**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	Nitrate+Nitrite as N	U	0.02	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Phosphorus, total**		**0.312**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Potassium**		**6,170**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Sodium**		**26,200**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA248	3384399	**Sulfate**		**9.83**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-17
UMA249	3394172	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Bromide**		**0.245**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Calcium**		**45,800**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Chloride**		**37.5**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Fluoride**		**0.377**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Iron**		**66.9**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Magnesium**		**16,500**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Manganese**		**2.3**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Nitrate+Nitrite as N**		**6.91**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	Perchlorate	J	1.24	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Phosphorus, total**		**0.206**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Potassium**		**6,840**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Sodium**		**36,700**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA249	3394172	**Sulfate**		**38.8**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-31
UMA250	3384397	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Bromide**		**0.207**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Calcium**		**94,100**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Chloride**		**102**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Fluoride**		**0.228**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Iron**		**23.1**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Magnesium**		**35,000**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Manganese**		**12.8**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Nitrate+Nitrite as N**		**20.4**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Phosphorus, total**		**0.303**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Potassium**		**9,910**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12

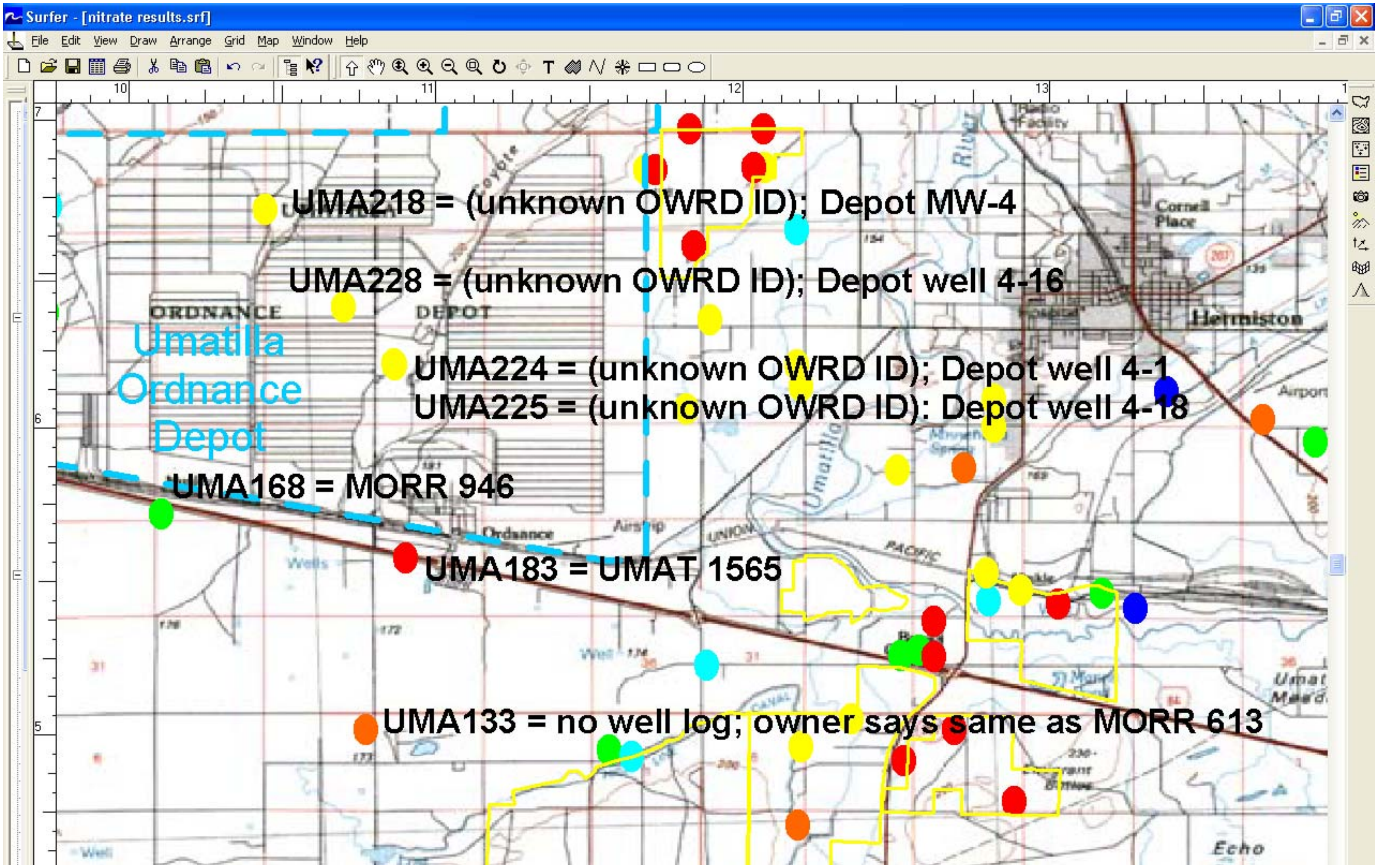
Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA250	3384397	**Sodium**		**131,000**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA250	3384397	**Sulfate**		**42.7**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-12
UMA251	3384410	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Bromide**		**2.11**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Calcium**		**192,000**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Calcium**		**199,000**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Chloride**		**225**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Fluoride**		**0.162**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Iron**		**402**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Iron**		**413**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Magnesium**		**56,200**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Magnesium**		**57,400**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Manganese**		**14.6**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Manganese**		**15.2**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Nitrate+Nitrite as N**		**32.3**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Perchlorate**		**13.9**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Phosphorus, total**		**0.113**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Potassium**		**8,980**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Potassium**		**9,180**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Sodium**		**58,500**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384410	**Sodium**		**58,600**	ug/L		Duplicate	SIMPLOT MW-22
UMA251	3384410	**Sulfate**		**176**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22
UMA251	3384411	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Bromide**		**2.07**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Calcium**		**194,000**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Chloride**		**233**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Fluoride**		**0.152**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Iron**		**413**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Magnesium**		**56,500**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Manganese**		**15.4**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Nitrate+Nitrite as N**		**30.6**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Perchlorate**		**14.5**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Phosphorus, total**		**0.113**	mg/L		Duplicate	SIMPLOT MW-22 QA
UMA251	3384411	**Phosphorus, total**		**0.114**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Potassium**		**9,110**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Sodium**		**58,400**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA251	3384411	**Sulfate**		**198**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-22 QA
UMA252	3384412	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Bromide**		**1.98**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Calcium**		**174,000**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Chloride**		**220**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Fluoride**		**0.169**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Iron**		**1,120**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Magnesium**		**52,000**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Manganese**		**62.9**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Nitrate+Nitrite as N**		**34.5**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Perchlorate**		**15.8**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Phosphorus, total**		**0.16**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Potassium**		**8,790**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Sodium**		**52,900**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA252	3384412	**Sulfate**		**187**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-14
UMA253	3384413	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Bromide**		**1.17**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Calcium**		**160,000**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Chloride**		**105**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Fluoride**		**0.18**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Iron**		**6,520**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Magnesium**		**37,500**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Manganese**		**950**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Nitrate+Nitrite as N**		**26.7**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Perchlorate**		**6.89**	ug/L		Duplicate	SIMPLOT MW-40
UMA253	3384413	**Perchlorate**		**6.97**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Phosphorus, total**		**2.98**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Potassium**		**9,630**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Sodium**		**50,400**	ug/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA253	3384413	**Sulfate**		**71.9**	mg/L	9/19/2003	Regular Sample	SIMPLOT MW-40
UMA254	3394169	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Calcium**		**55,900**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Chloride**		**25.9**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Fluoride**		**0.273**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Iron**		**498**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Magnesium**		**19,800**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Manganese**		**35.3**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Nitrate+Nitrite as N**		**7.06**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Phosphorus, total**		**0.202**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Potassium**		**6,700**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Sodium**		**51,800**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA254	3394169	**Sulfate**		**42.6**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-44
UMA255	3394170	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Calcium**		**61,400**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Chloride**		**50.9**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Fluoride**		**0.289**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Iron**		**294**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Magnesium**		**22,200**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Manganese**		**11.2**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Nitrate+Nitrite as N**		**10.7**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Phosphorus, total**		**0.14**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30

Appendix 1
Sample Results
2003 LUB GWMA Synoptic Sampling Event Report

Well ID	EPA Sample ID	Analyte Name	Qualifier	Result	Unit	Date Collected	Sample Type Description	Sample Description
UMA255	3394170	**Potassium**		**6,210**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Sodium**		**58,200**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA255	3394170	**Sulfate**		**34.3**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-30
UMA256	3394173	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Calcium**		**54,000**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Chloride**		**22**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Fluoride**		**0.353**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	Iron	U	10	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Magnesium**		**18,900**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	Manganese	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Nitrate+Nitrite as N**		**7.59**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Phosphorus, total**		**0.137**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Potassium**		**5,240**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Sodium**		**63,000**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA256	3394173	**Sulfate**		**40.4**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-25
UMA257	3394171	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	Bromide	U	0.2	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Calcium**		**48,600**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Chloride**		**18.4**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Fluoride**		**0.323**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	Iron	U	10	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Magnesium**		**17,400**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	Manganese	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Nitrate+Nitrite as N**		**7.53**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	Perchlorate	U	1	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Phosphorus, total**		**0.155**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Potassium**		**5,790**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Sodium**		**59,600**	ug/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA257	3394171	**Sulfate**		**28.9**	mg/L	9/25/2003	Regular Sample	SIMPLOT MW-24
UMA258	3384398	Ammonia (NH3+NH4) as N	U	0.1	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	Bromide	U	0.2	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Calcium**		**70,400**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Chloride**		**101**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Fluoride**		**0.203**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	Iron	U	10	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Magnesium**		**31,700**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Manganese**		**554**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Nitrate+Nitrite as N**		**5.74**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	Perchlorate	U	1	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Phosphorus, total**		**0.097**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Potassium**		**8,930**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Sodium**		**137,000**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA258	3384398	**Sulfate**		**52.3**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-20
UMA261	3384395	**Ammonia (NH3+NH4) as N**		**0.128**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Bromide**		**0.339**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Calcium**		**54,300**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Chloride**		**47**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Fluoride**		**0.174**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Iron**		**77.4**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Magnesium**		**17,900**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Manganese**		**4.1**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Nitrate+Nitrite as N**		**8.04**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Perchlorate**		**2.5**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Phosphorus, total**		**0.0986**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Potassium**		**5,580**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Sodium**		**23,400**	ug/L	9/17/2003	Regular Sample	SIMPLOT MW-11S
UMA261	3384395	**Sulfate**		**37.9**	mg/L	9/17/2003	Regular Sample	SIMPLOT MW-11S

Notes:
U = not detected at the concentration indicated
J = estimated concentration
NA = not analyzed



UMA218 = (unknown OWRD ID); Depot MW-4

UMA228 = (unknown OWRD ID); Depot well 4-16

UMA224 = (unknown OWRD ID); Depot well 4-1

UMA225 = (unknown OWRD ID): Depot well 4-18

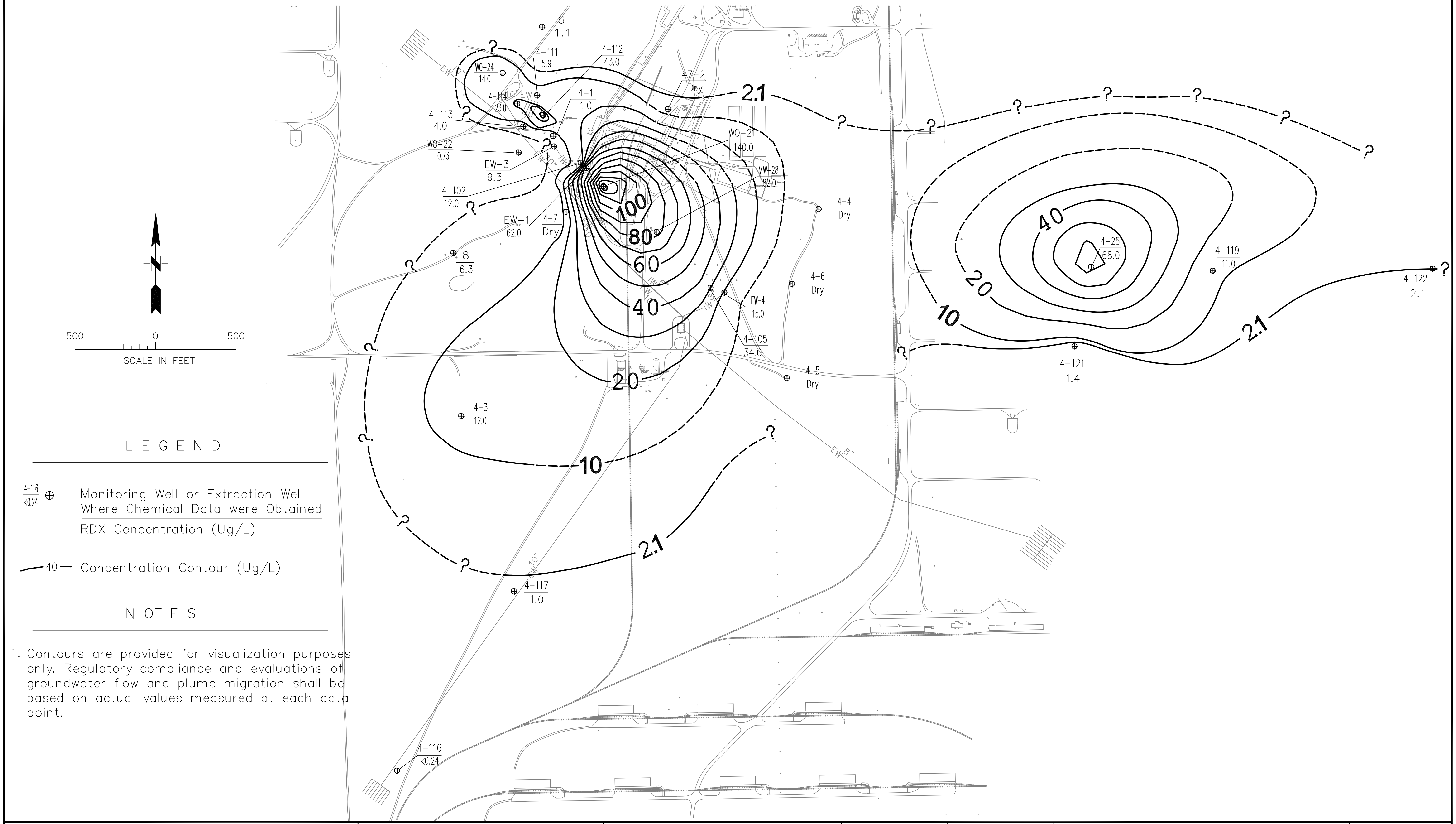
UMA168 = MORR 946

UMA183 = UMAT 1565

UMA133 = no well log; owner says same as MORR 613

APPENDIX G

Groundwater Distribution of RDX and TNT at Depot



L E G E N D

4-116 <0.24 ⊕ Monitoring Well or Extraction Well Where Chemical Data were Obtained
RDX Concentration (Ug/L)

—40— Concentration Contour (Ug/L)

N OT E S

1. Contours are provided for visualization purposes only. Regulatory compliance and evaluations of groundwater flow and plume migration shall be based on actual values measured at each data point.

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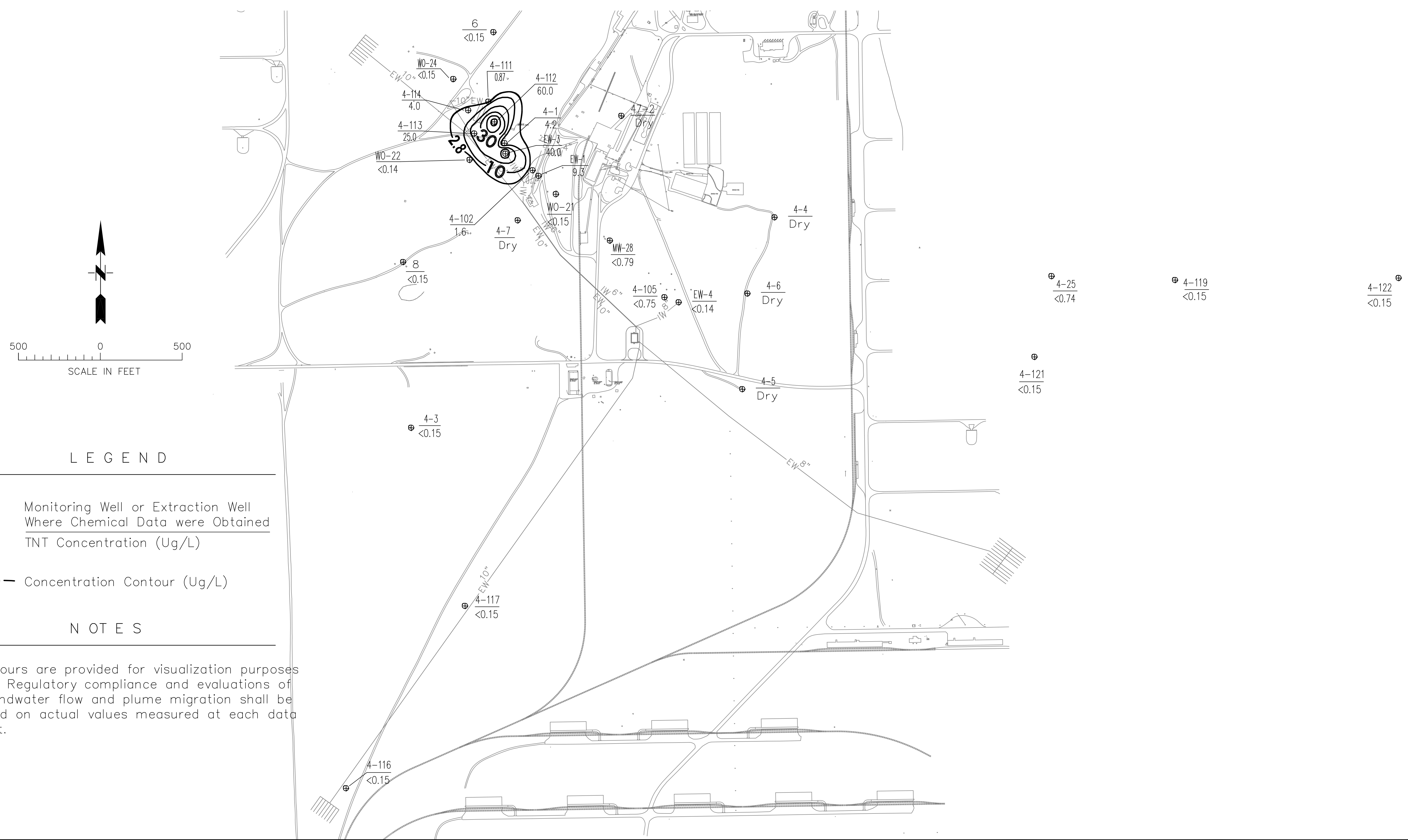
PROJECT NO. 04201030.07	DES BY S.J.	RDX CONCENTRATION CONTOUR MAP OCTOBER 2007	DATE JAN 2008
SCALE AS SHOWN	CHK BY S.J.	UMATILLA CHEMICAL DEPOT WASHOUT AREA	FIGURE 3-9
CAD FILE FIGURE3-9	APP BY M.V.		



LEGEND

4-116 / <0.15 ⊕ Monitoring Well or Extraction Well Where Chemical Data were Obtained / TNT Concentration (Ug/L)

—10— Concentration Contour (Ug/L)

NOTES

1. Contours are provided for visualization purposes only. Regulatory compliance and evaluations of groundwater flow and plume migration shall be based on actual values measured at each data point.

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PROJECT NO. 04201030.07	DES BY S.J.	TNT CONCENTRATION CONTOUR MAP OCTOBER 2007	DATE JAN 2008
SCALE AS SHOWN	CHK BY S.J.	UMATILLA CHEMICAL DEPOT WASHOUT AREA	FIGURE 3-10
CAD FILE FIGURE3-10	APP BY M.V.		

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TECHNICAL MEMORANDUM

To:	Said Amali, IRZ Consulting		
From:	Bryan Black, PE Anna Zaklikowski	Project:	Umatilla Basin Regional Aquifer Recovery Assessment
Date:	4 February 2009	Job No:	86502
Re:	Task 1.H – Assess Water Treatment Needs and Regulatory Approach		

The Oregon Water Resources Department (OWRD) designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in the CGAs has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. To increase water availability in the CGAs, OWRD has begun a technical assessment of the feasibility of storing water from Columbia River and other surface sources during high flow periods in shallow sediment and deeper basalt aquifers for subsequent recovery and use during the irrigation season. The project has been divided into several tasks.

This technical memorandum includes a summary of information regarding the regulatory framework that governs treatment requirements for aquifer injection of source water. The following discussion is presented in the context of the current Oregon Administrative Rules (OARS). In fall of 2009, it is expected that the Oregon Department of Human Services (DHS) will finalize proposed revisions to the OARs to incorporate language from recently promulgated federal drinking water regulations. Once the OARs are finalized, the revised rules should be compared against the ASR approach as currently envisioned to identify any impacts to the project.

1.0 EXECUTIVE SUMMARY

The feasibility of the winter water storage approach is heavily dependent on the level of water treatment that will be required for the injection of alluvial aquifer stored water into the Columbia River Basalt Group aquifer (basalt aquifer). The Oregon Administrative Rules (OAR) 690-350 for Aquifer Storage and Recovery (ASR) require that injection source water comply with drinking water standards, treatment requirements, and performance standards established by the Department of Human Services (DHS) Drinking Water Program under OAR 333-061 or maximum measurable levels of regulated compounds administered by the Department of Environmental Quality (DEQ).

A review of OAR 333-061-0032(7) indicates that as long as the project is designed to withdraw alluvial groundwater in aquifers consisting of coarse sand, gravel, or boulders from locations greater than 200 feet from a surface water source, it is classified as "groundwater" and is thus not required to provide filtration or disinfection. However, disinfection could be triggered by OAR 333-061-0032(6) depending on the results of groundwater quality monitoring for presence of total coliforms. If triggered, disinfection will be required to inactivate biological contaminants prior to injection. It should be understood that these rules have been adopted to regulate operation of public water systems. Application of these rules to the types of systems proposed in this project will require further discussions with DHS and DEQ once a specific permit application has been submitted to OWRD as part of overall project permitting process.

A comparison of water quality parameters detected in native groundwater samples with drinking water standards (Primary Maximum Contaminant Levels [MCLS]) indicates that nitrate is the only compound exceeding its standard of 10 milligrams per liter (mg/L) as nitrogen in several samples. Nitrate concentrations as nitrogen ranged up to 17.4 mg/L. Water containing nitrate concentrations exceeding the Maximum Contaminant Level will not be used for ASR injection.

2.0 OBJECTIVES

The main objective of this task is to develop alternatives for treating ASR source water that are cost effective and meet regulatory standards. This objective and the following objectives are addressed in this technical memorandum as well as other memoranda submitted as part of Task 1.H (HDR, 2009):

- Review available recharge source water and native alluvial aquifer groundwater quality data. Augment the available data with new data collected during this project.
- Review regulations pertaining to water quality requirements governing ASR and surface water treatment.
- With input from DHS and DEQ, establish guidelines for ASR source water quality using groundwater, natural treatment approaches and engineered approaches (with emphasis in how the filtration standard in the Safe Drinking Water Act can be evaluated and achieved cost effectively).
- Develop a regulatory strategy and approach applicable to this project and other future projects.

3.0 INTRODUCTION

The storage approach currently under investigation in this project is to convey and apply surface water from the Columbia and Umatilla Rivers to recharge shallow alluvial aquifers in Morrow and Umatilla counties. Groundwater from the shallow aquifers will be withdrawn, conveyed to ASR injection wellheads, and injected into the basalt aquifer for storage and later recovery during the summer irrigation season. This approach was the focus of a pilot alluvial aquifer recharge study in the Echo Meadows site in Umatilla County conducted during the spring of 2008. Additional surface water and groundwater samples were collected for analysis in 2008 during annual recharge activities conducted by the County Line Water Improvement District. The test wells at both sites are located greater than 500 feet from surface water sources and recharge areas. The sites are identified in the area map shown in Appendix A. The approach under evaluation and water quality data collected during the pilot recharge study are compared against ASR regulations to identify treatment requirements applicable to the storage approach.

4.0 AQUIFER STORAGE AND RECOVERY REGULATIONS

In Oregon, ASR projects are jointly regulated by the OWRD, DHS, and Oregon Department of Environmental Quality’s (DEQ) Water Quality Program. In general, OWRD regulates licensing, permitting, and water rights for ASR projects while incorporating DEQ and DHS comments and recommended conditions into ASR limited licenses and permits. DEQ works with OWRD to ensure that ASR projects meet Oregon’s groundwater quality requirements under OAR 340-040 and other applicable rules (e.g., Underground Injection Control (UIC) requirements OAR 340-044). As the regulatory agency responsible for administering and enforcing drinking water regulations in Oregon, DHS ensures that ASR source water meets national drinking water standards, as referenced in OAR 333-061.

Specifically, OAR 333-061-0032 establishes “Treatment Requirements and Performance Standards for Surface Water, Groundwater Under Direct Influent of Surface Water (GWUDI), and Groundwater.” It describes the level of treatment required for surface water, GWUDI, and groundwater as three types of source water for use by “public water systems”. Groundwater typically does not require filtration or disinfection. The level of treatment increases from a lower cost option of disinfection for groundwater (if microbial contaminants are found), to a combination of filtration and disinfection for GWUDI, to full filtration and disinfection treatment for direct surface water sources. The main difference between the level of treatment requirements between GWUDI and surface water is the degree to which natural filtration credits can be obtained by filtering surface water through natural sediments (e.g., stream bank infiltration, etc.). The proposed approach for classifying the source water used in this project and its commensurate level of treatment are presented in a next section below.

Additionally, OAR 690-350-0010(6) stipulates that “injection source water for ASR shall comply with drinking water standards, treatment requirements, and performance standards established by the Oregon Health Division (HD) under OAR 333-061-0030 and 0032 or the maximum measurable levels established by the Environmental Quality Commission (EQC) under OAR 340-040, whichever is more stringent.” OAR 333-061-0030 establishes “Maximum Contaminant Levels (MCLs) and Action Levels” for contaminants regulated under the Safe Drinking Water Act (SDWA) (40 CFR Parts 141 – 149), including inorganic and organic chemicals, disinfection byproducts, turbidity, microbiological contaminants, radionuclides, and secondary contaminants. Results from the surface water and alluvial aquifer water quality data collected during this project are compared against MCLs and action levels in the next section below.

Finally, OAR 340-040 establishes guidelines and standards for the protection of groundwater quality to its highest beneficial use, which in most cases and in the case of the CGAs, is drinking water (340-040-0020(3)). As indicated in OAR 690-350-0010(6)(d), if injection source water contains constituents that are detected at greater than 50 percent of the established levels, the ASR limited license permit “may require the permittee to employ technically feasible, practical and cost-effective methods to minimize concentrations of such constituents in the injection source water.” The water quality data available for this project are reviewed to assess compliance with these regulations and to consider feasible treatment alternatives.

5.0 ASR SOURCE WATER CLASSIFICATION AND TREATMENT REQUIREMENTS

As presented above, based on OAR 333-061-0032, the required level of treatment for ASR source water is dependent on the source water classification as surface water or groundwater. Groundwater can be further distinguished as either “groundwater” or GWUDI. These distinctions are important as the source water classification determines what set of drinking water treatment regulations apply. Because of the higher potential for bacteriological contamination, surface water and GWUDI sources are required to be provided with disinfection and in most cases, filtration (OAR 333-061-0032(1)(b)). On the other hand, groundwater is exempt from filtration requirements and in most cases from disinfection requirements depending on source water quality. Since the ASR source water considered in this project is not planned to be surface water, regulations applicable to surface water sources that are not naturally filtered will not be discussed further in this memorandum.

5.1 Groundwater Classification

As required by OAR 333-061-0032(7), groundwater sources used for the purposes of ASR injection must evaluate their source(s) for the potential to be GWUDI. GWUDI is defined in the National Primary Drinking Water Regulations and OARs as “Any water beneath the surface of the ground with significant occurrence of insects or other macro-organisms, algae, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium,* or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions (OAR 333-061-0020(74)).”

OAR 333-061-0032(7) includes criteria designed to determine whether a groundwater source is “groundwater” or GWUDI based on distance from surface water sources, as follows:

- 500 feet within a fractured bedrock or layered volcanic aquifer;
- 200 feet within a coarse sand, gravel and boulder aquifer;
- 100 feet within a sand and gravel aquifer;
- 75 feet within a sand aquifer;

Note that in February 2009, Oregon DHS published draft revisions to the OARs that incorporate language from the EPA Groundwater Rule. In addition to the four distance criteria established for the purposes of distinguishing GWUDI from groundwater sources, a fifth bullet is added that reads “Greater distances if geologic conditions or historical monitoring data indicate additional risk and the source” (Draft OAR 333-061-0032(8)(a)(A)(v)). Additional discussions with the DHS will have to be conducted during AR permit application process regarding the applicability and course of action on this subject.

Based on hydrogeolgic assessment of the proposed recharge areas for this project (IRZ 2009), the alluvial aquifer sediments primarily fall in the “sand and gravel” and “coarse sand, gravel and boulder” categories. Therefore, if the ASR source water is withdrawn from the recharged alluvial aquifer to meet the distance criteria above, it will be classified as “groundwater “. Groundwater that is used for injection must meet water quality criteria provided in OAR 333-061-0030. Filtration is not required under OAR 333-061-0032 and disinfection is not required unless triggered by microbial contamination according to the requirements of OAR 333-061-0032(6).

5.2 “Groundwater” Treatment Requirements

Disinfection requirements for systems using groundwater are addressed in OAR 333-061-0032 (6). Systems using groundwater are not required to provide continuous disinfection unless the following two conditions are met ((6)(a)):

(1) When there are consistent violations of the Total Coliform Rule attributed to source water quality;

(2) When a potential health hazard exists as determined by the Department.

However, these requirements have been established for “public water systems” and not the type of system proposed in this project. For example, the requirements for the monitoring of coliform bacteria in public water systems are to be consistent with the Total Coliform Rule provided in OAR 333-061-0030(4), which are based on the population served by the water system (OAR 333-061-0036(5)). This project proposes systems which will not produce water directly for drinking water distribution. Since this system is not a “public water system” the requirements of the Total Coliform Rule should not apply. The need for ongoing monitoring of the microbial quality of the injection water requirements of groundwater quality protection rules OAR 340-040 will have to be discussed further with DHS and DEQ.

5.3 GWUDI Treatment Requirements

If due to project design constraints, ASR source groundwater was classified as GWUDI, treatment requirements have to comply with the requirements of OAR 333-061-0032(1). Compliance with these rules generally requires removal and/or inactivation of pathogenic microorganisms through a combination of filtration and disinfection to meet the microbial treatment requirements provided in **Table 1**.

Table 1. Microbial Treatment Requirements for GWUDI Sources (OAR 333-061-0032(1)(a))

Organism	Log Removal and/or Inactivation
Cryptosporidium	2-log (99%)
Giardia	3-log (99.9%)
Viruses	4-log (99.99%)

It may be possible to obtain filtration credits of up to 2.0 log removal for *Giardia* and *Cryptosporidium* (OAR 333-061-0032(8)) for percolating surface water through native materials under the “Natural Filtration Credit” option described below. Otherwise, an engineered filtration system would be required. Regardless of filtration requirements, these systems would also require disinfection.

Natural filtration credit is granted based on the results of water samples collected for Microscopic Particulate Analysis (MPA) when the MPA risk scores are all less than 20. Natural filtration must be demonstrated to achieve at least 2.0 log removal of *Giardia* and *Cryptosporidium* through the completion of a site-specific study that establishes that the local hydrogeologic setting is capable of providing the adequate log reduction in the number of particles in the *Giardia* and *Cryptosporidium* size range between the surface water and the groundwater sources. If groundwater as ASR source water is classified as GWUDI, a demonstration of performance study must be completed which could include additional MPA sampling and sampling for surrogates of *Giardia* and/*or Cryptosporidium* in order to assess the degree of natural filtration credit that can be obtained.

6.0 SOURCE WATER QUALITY EVALUATION

Samples were collected from shallow alluvial aquifer wells during the period March through October of 2008 for the characterization of water quality and analysis of parameters regulated by the SDWA. The test well locations are referenced in the maps included in Appendix A. Results of the water quality analysis are presented in Appendix B. Primary MCLs, secondary MCLs, and action levels, where applicable, are indicated for each parameter measured.

All samples collected were in compliance will all primary MCLs with the exception of nitrate. Nitrate exceeded the MCL of 10 mg/L-N in test wells UMAT 1177 and DMPW2 in the Echo Meadows recharge site and wells UMAT 1571, MORR 968, and MORR 956 located in the County Line site. An additional seven wells were tested at the Echo Meadows site which had concentrations of nitrate below the MCL. Slight exceedences of the secondary MCLs for iron, manganese, and total dissolved solids were found in several wells. All results for synthetic and volatile organic compounds were below method detection limits as well as primary MCLs.

The current project plan is to operate the ASR system to achieve injection water nitrate concentrations less than the nitrate MCL required by ASR regulations.

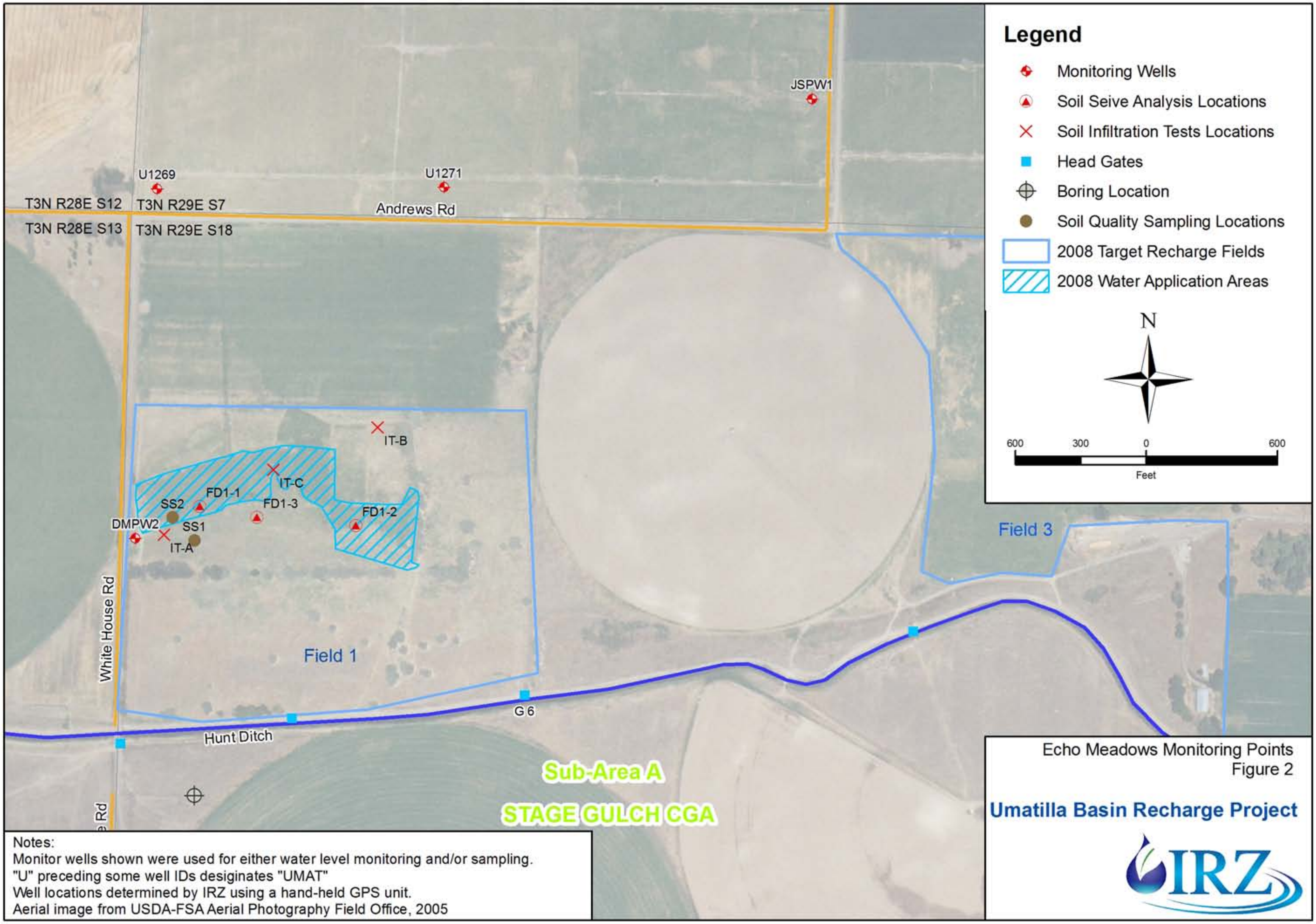
7.0 REFERENCES

HDR Engineering, Inc. 27 January 2009. *Technical Memorandum Task 1.H – Cost for Municipal-Type ASR Source Water Treatment Systems.* Prepared for IRZ Consulting LLC as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

HDR Engineering, Inc. 29 May 2009. *Technical Memorandum Task 1.H – Natural Filtration Evaluation.* Prepared for IRZ Consulting LLC as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

Oregon Water Resources Department. 2003. *Groundwater Supplies in the Umatilla Basin.* OWRD Groundwater Section, Pendleton, Oregon. April.

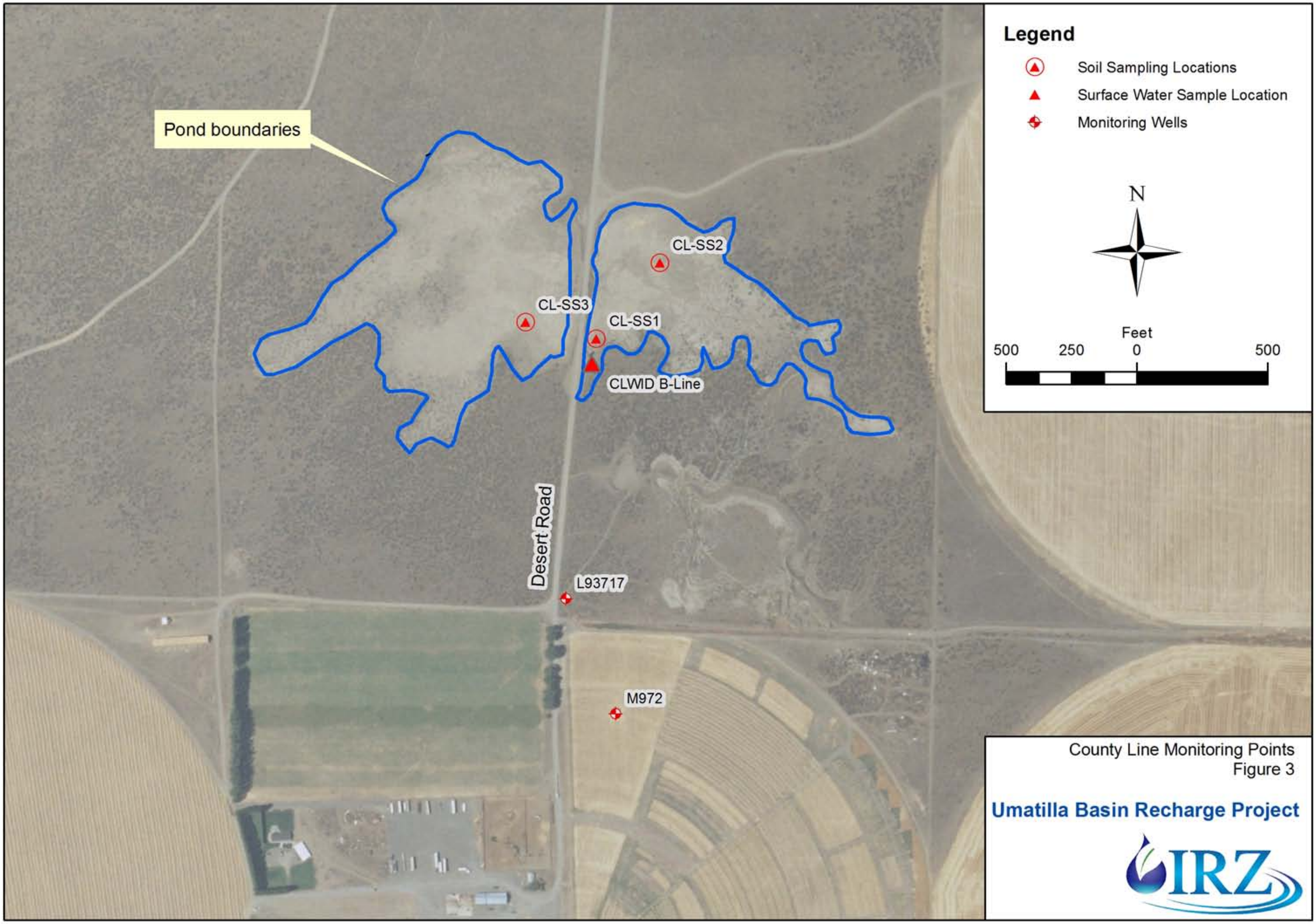
Appendix A: Test Well Locations



Echo Meadows Monitoring Points
Figure 2

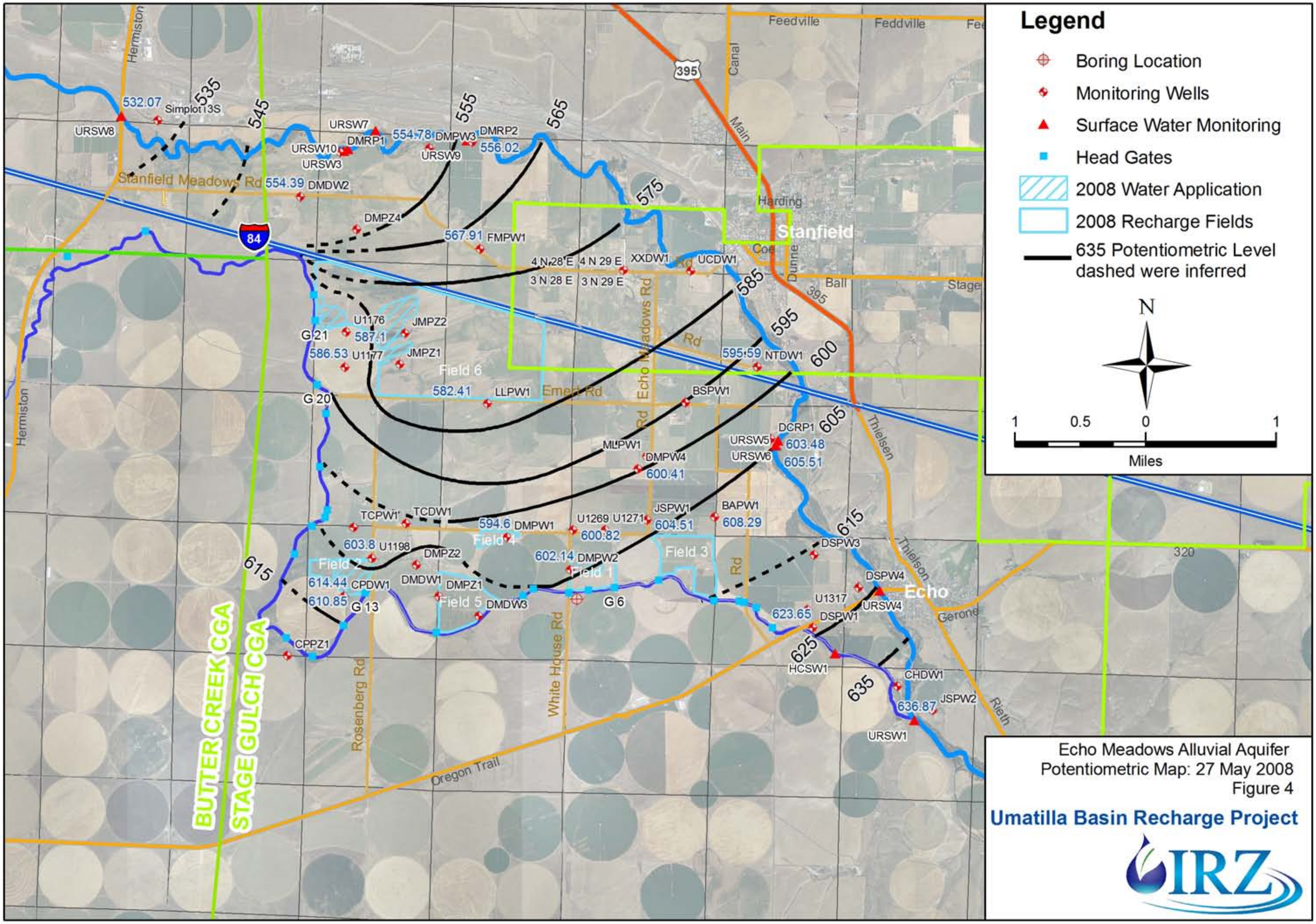
Umatilla Basin Recharge Project

Notes:
Monitor wells shown were used for either water level monitoring and/or sampling.
"U" preceding some well IDs desiginates "UMAT"
Well locations determined by IRZ using a hand-held GPS unit.
Aerial image from USDA-FSA Aerial Photography Field Office, 2005



County Line Monitoring Points
Figure 3

Umatilla Basin Recharge Project



Echo Meadows Alluvial Aquifer
Potentiometric Map: 27 May 2008
Figure 4

Umatilla Basin Recharge Project

IRZ

Appendix B: Water Quality Data

	Unit	SDWA MCL	MLPW1 10/22/2008	TCDW1 10/22/2008	Hunt Ditch 5/20/2008	DMPW2 5/20/2008	UMAT 1269 5/20/2008	McNary Pool 5/19/2008	UMAT 1571 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008	MORR 972 5/21/2008
Microparticulate												
Turbidity [N3]	NTU		0.71	0.4	42.6	0.44/<0.1	32.1	7.31	0.54	0.3/0.81	0.5	0.33
Disinfection Byproducts												
Haloacetic acids (HAA5) [N6]	mg/L	0.06	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
dichloroacetic acid	mg/L		<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
trichloroacetic acid	mg/L		<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
monochloroacetic acid	mg/L		<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002
bromoacetic acid	mg/L		<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
dibromoacetic acid	mg/L		<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Total Trihalomethanes (TTHMs) [N6]	mg/L	0.08	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
bromodichloromethane	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
bromoform	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
dibromochloromethane	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
chloroform	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Disinfectants												
Chloramines (as Cl2)	mg/L	4	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05
Chlorine (as Cl2)	mg/L	4	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05
Geochemical Parameters												
Cyanide (as free cyanide)	mg/L	0.2	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.01
Fluoride	mg/L	4	0.268	0.753	0.116	0.487/0.475	0.188	0.179	0.527	0.341/0.351	0.433	0.22
Silica	mg/L		21.6	24.2	13.2	24.7/23.4	19.9	7.01	28.9	24.5/22.2	28.8	16
Total Organic Carbon	mg/L		1.49	2.26	2.37	1.42/1.39	2.43	2.55	1.89	2.41/2.43	1.92	1.82
Metals												
Aluminum	mg/L	.05 - .2**	<0.01	<0.01	0.45	<0.01/<0.01	<0.01	0.351	<0.01	<0.01/<0.01	<0.01	<0.01
Antimony	mg/L	0.006	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Arsenic	mg/L	0.01	<0.001	0.00598	<0.001	0.00409/0.00417	<0.001	0.0015	0.00548	0.00521/0.00530	0.00457	0.00352
Barium	mg/L	2	0.0218	0.0567	0.0197	0.0382/0.0384	0.0769	0.0165	0.0722	0.0714/0.0724	0.0545	0.0111
Beryllium	mg/L	0.004	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Cadmium	mg/L	0.005	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Chromium (total)	mg/L	0.1	<0.001	0.002	<0.001	0.00115/0.00114	0.00143	<0.001	0.00276	0.00118/0.00109	0.00185	
Copper [N8]	mg/L	1.3*	0.00485	0.00289	0.00124	0.00128/<0.001	<0.001	0.00187	0.00216	0.00149/0.00119	0.00252	0.00106
Iron (Total)	mg/L	0.3**	0.0824	0.383	0.751	0.352/0.343	2.02	0.42	0.508	0.47/0.470	0.415	0.0907
Iron (Dissolved)	mg/L	0.3**	0.0689	0.344	0.111	0.31/0.329	0.0997	0.085	0.454	0.43/0.429	0.406	0.0704
Lead [N8]	mg/L	0.015*	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Manganese (Total)	mg/L	0.05**	<0.001	0.00109	0.0198	<0.001/<0.001	0.0887	0.0168	<0.001	<0.001/<0.001	<0.001	<0.001
Manganese (Dissolved)	mg/L	0.05**	<0.001	0.00117	<0.001	<0.001/<0.001	0.00185	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Mercury (inorganic)	mg/L	0.002	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001
Nickel	mg/L	-	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Selenium	mg/L	0.05	<0.001	<0.001	<0.001	0.00699/0.00706	0.00448	0.00128	<0.001	<0.001/<0.001	<0.001	<0.001
Silver	mg/L	0.1**	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Thallium	mg/L	0.002	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001	<0.001	<0.001/<0.001	<0.001	<0.001
Zinc	mg/L	5**	0.00579	0.0444	0.00142	0.071/0.0563	0.00193	0.00427	0.00153	<0.001/<0.001	<0.001	<0.001
Miscellaneous												
Color	CU	15**	5	5	10	<5/<5	10	<5	5	5/5	5	5
Corrosivity		Noncorrosive**	-2.16	0.11	-2.61	0.306/0.232	-0.00539	-1.38	0.16	0.26/0.28	0.4	-0.279
Foaming Agents	mg/L	0.5**	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05	<0.05
Odor	TON	3**	<1	<1	<1	<1/<1	<1	<1	<1	<1/<1	<1	<1

County Line Recharge Site: Water Quality Results for Shallow Aluvial Test Wells

Analyte	Unit	SDWA MCL	Test Well ID UMAT 1571 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008
Microrganisms/Microparticulate					
Total Coliform Bacteria	MPN/100 ml	TCR/TBD	<2	<2/<2	<2
Fecal Coliform Bacteria	MPN/100 ml	TCR/TBD	<2	<2/<2	<2
Geochemical Parameters					
Bicarbonate	mg/L		265	167/172	212
Calcium	mg/L		82.3	85.6/76.9	87.3
Carbonate	mg/L		<5	<5/<5	<5
Chloride	mg/L		30	34.1/34.0	29.1
Magnesium	mg/L		28.4	26.1/23.4	28.5
Nitrate (measured as Nitrogen)	mg/L	10	17.4	16.7/16.6	15.8
Nitrite (measured as Nitrogen)	mg/L	1	<0.1	<0.1/<0.1	<0.1
Potassium	mg/L		4.98	4.81/4.85	4.85
Sodium	mg/L		32.4	27.4/24.6	39.5
Sulfate	mg/L	SMCL: 250	49.6	86.7/86.4	50.1
TDS	mg/L	SMCL: 500	549	526/499	504
Alkalinity (as CaCO3)	mg/L		265	167/172	212
Hardness (as CaCO3)	mg/L		323	322/289	336
Biological Oxygen Demand	mg/L		--		
Field Parameters					
pH	pH	SMCL: 6.5-8.5	7.53	7.94	7.98
Temperature	°C		15.1	14.3	12.7
Specific Conductivity	µs/cm		986	1051	1026
ORP	mV		352	191	214
Dissolved Oxygen	mg/L		8.44	6.22	8.32
Herbicides					
2,4-D	µg/L		<0.01	<0.01/0.01	<0.01
Thifensulfuron methyl	µg/L		<0.08	<0.08/<0.08	<0.08
Tribenuron methyl	µg/L		<0.08	<0.08/<0.08	<0.08
Metsulfuron methyl	µg/L		<0.08	<0.08/<0.08	<0.08
MCPA (Clearmax)	µg/L		<0.1	<0.1/<0.1	<0.1
Diacamba (Banvel)	µg/L		<1	<1/<1	<1

Notes:

TCR: Total Coliform Rule
SDWA: Safe Drinking Water Act

Echo Meadows Recharge Site: Water Quality Results for Shallow Aluvial Test Wells

Analyte	Unit	SDWA MCL	well DMPW2					well U1269					well JSPW1				well DMPW4		well U1317		well U1193	well U1177	well U1198	well TCDW1	well TCDW1
Microrganisms/Microparticulate			3/11/2008	4/17/2008	5/20/2008	6/3/2008	7/22/2008	3/5/2008	4/17/2008	5/20/2008	6/3/2008	7/22/2008	3/6/2008	4/17/2008	5/20/2008	7/22/2008	3/10/2008	4/17/2008	6/3/2008	7/22/2008	6/3/2008	6/3/2008	6/3/2008	7/22/2008	10/22/2008
Total Coliform Bacteria	MPN/100 ml	TCR/TBD	--	--	--	--	--	--	--	--	--	--	--	--	30	--	--	--	--	--	--	--	--	--	<2
Fecal Coliform Bacteria	MPN/100 ml	TCR/TBD	17	--	2/<2	<2	--	<2	--	<2	<2/<2	--	<2	--	--	--	<2	--	<2	--	<2	23	<2	--	<2
Geochemical Parameters																									
Bicarbonate	mg/L		132	--	188/175	136	140	253	--	229	215	194	117	--	112	114		--	33.4	40	189	154	236	251	241
Calcium	mg/L		57.3	--	60.7/70.1	49.2	82.4	72.8	--	67.8	51.8	50.5	33.7	--	33.8	24.5		--	8.23	6.86	57	61.9	57.6	56.4	63.4
Carbonate	mg/L		<20	--	<5/<5	<10	<5	<20	--	<5	<10	<5	<20	--	<5	<5		--	<10	<5	<10	<10	<10	<5	<5
Chloride	mg/L		59	--	66.3/68.4	65.1	56.8	64.6	--	53.8	52.7	50.7	12.1	--	13.5	8.37	5.39	--	4.84	3.17	14.1	48.8	34.3	22.3	18.7
Magnesium	mg/L		23.6	--	24/27.6	19.8	34.1	35	--	30.4	23.1	23.4	14.1	--	14.1	10.7		--	3.31	2.81	15.8	14.5	18.6	19.6	20.5
Nitrate-N	mg/L	10	**13.2**	--	**16.3/16.4**	**15.4**	**13.7**	8.34	--	7.57	7.32/7.29	7.48	3.62	--	4.14 (a)	2.1	2.03	--	1.6	0.603	8.77	**14.3**	0.354	3.38	2.98
Nitrite-N	mg/L	1	<0.025	--	<0.1/<0.1	<0.01	--	0.046	--	<0.1	0.104/0.104	--	<0.025	--		--	<0.025	--	<0.01	--	<0.01	0.055	<0.01	--	<0.1
Potassium	mg/L		4.42	--	3.98/4.36	3.47	6.1	11.2	--	10.4	8.65	8.89	7.97	--	8.34	6.92		--	2.06	2.08	3.53	4.04	2.61	3.06	3.7
Sodium	mg/L		46.2	--	45.3/50.6	37.4	68.1	55	--	52.5	40.1	43.5	13.6	--	13.7	11.7		--	5.72	6.15	10.3	27.4	27.4	20.4	25.1
Sulfate	mg/L	SMCL: 250	64.1	--	78.9/81.5	77.8	72.5	83.3	--	76.5	75.4	70.7	20.3	--	18.1	14.5	6.59	--	8.96	3.77	22.5	52.1	30.6	34	28
TDS	mg/L	SMCL: 500	117.1	--	--	--	506	588.5	--	--	--	517	230.4	--	--	230	--	--	--	115	--	--	--	416	389
Alkalinity (as CaCO3)	mg/L		132	--	--	--	--	253	--	--	--	--	117	--	--	--	--	--	--	--	--	--	--	--	241
Hardness (as CaCO3)	mg/L		240	--	--	--	--	326	--	--	--	--	142	--	--	--	--	--	--	--	--	--	--	--	243
Biological Oxygen Demand	mg/L		<2	--	<2/<2	<2	--	<2	--	<2	<2/<2	--	<2	--	<2	--	<2	--	<2	--	<2	<2	<2	--	--
Field Parameters																									
pH	pH	SMCL: 6.5-8.5	6.7	8.5	8.5	5.73	7.3	7.7	7.3	--	6.14	6.7	6.7	6.9	6.84	6.4	6.7	7.3	6.11	6.3	8.98	10.6(b)	11.41(b)	7.1	7.66
Temperature	°C		13.3	16.1	16.1	12.7	15.1	14.5	16	--	12.7	15.5	12	14.5	14	14.5	12.9	14.3	13.3	18.5	15.6	14.9	12.1	17.1	13.6
Specific Conductivity	µs/cm		670	680	680	745	709	860	810	--	790	697	345	390	290	310	185	147	(a)	107	521	660	595	602	821
ORP	mV		--	--	--	154	241	--	--	--	88	129	--	--	20.3	291	--	--	116	323	12.9	-92	-116	283	455
Dissolved Oxygen	mg/L		4.5	--	--	8.25	7.45	0.6	--	--	2.58	2.9	1.3	--	7.27	5.11	0.8	--	8.77	6.3	6.58	7.78	1.28	7.3	4.44
Herbicides																									
2,4-D	µg/L		--	<0.08	<0.1/<0.1	--	--	--	<0.08	<0.1	--	--	--	<0.08	<0.1	--	--	<0.08	--	--	--	--	--	--	<0.01
Thifensulfuron methyl	µg/L		--	<0.008	<0.08/<0.08	--	--	--	<0.008	<0.08	--	--	--	<0.008	<0.08	--	--	<0.008	--	--	--	--	--	--	<0.08
Tribenuron methyl	µg/L		--	--	<0.08/<0.08	--	--	--	--	<0.08	--	--	--	--	<0.08	--	--	--	--	--	--	--	--	--	<0.08
Metsulfuron methyl	µg/L		--	<0.008	<0.08/<0.08	--	--	--	<0.008	<0.08	--	--	--	<0.008	<0.08	--	--	<0.008	--	--	--	--	--	--	<0.08
MCPA (Clearmax)	µg/L		--	<0.08	<0.1/<0.1	--	--	--	<0.08	<0.1	--	--	--	<0.08	<0.1	--	--	<0.08	--	--	--	--	--	--	<0.1
Diacamba (Banvel)	µg/L		--	<0.08	<0.1/<0.1	--	--	--	<0.08	<0.1	--	--	--	<0.08	<2	--	--	<0.08	--	--	--	--	--	--	<1

Notes

(a)	Rapid fluctuations
(b)	problem with meter reading.
	TCR: Total Coliform Rule
	SDWA: Safe Drinking Water Act

	Unit	SDWA MCL	MLPW1 10/22/2008	TCDW1 10/22/2008	Hunt Ditch 5/20/2008	DMPW2 5/20/2008	UMAT 1269 5/20/2008	McNary Pool 5/19/2008	UMAT 1571 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008	MORR 972 5/21/2008
UV Absorbance at 254 nm	cm^{-1}		--	--	0.091	0.024/0.024	0.05	0.023	--	--	--	0.028
Total Suspended Solids	mg/L		<1	<1	100	<5/<5	6.54	8.61	<1	<1/<1	<1	<5
Synthetic Organic Compounds (SOCs)												
Alachlor	mg/L	0.002	<0.0004	<0.0004	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004
Atrazine	mg/L	0.003	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002
Benzo(a)pyrene (PAHs)	mg/L	0.0002	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005
Carbofuran	mg/L	0.04	<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002
Chlordane	mg/L	0.002	<0.0004	<0.0004	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004	<0.0004	<0.0004/<0.0004	<0.0004	<0.0004
2,4-D	mg/L	0.07	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001
Dalapon	mg/L	0.2	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001
1,2-Dibromo-3-chloropropane (DBCP)	mg/L	0.0002	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005
Di(2-ethylhexyl) adipate	mg/L	0.4	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002
Di(2-ethylhexyl) phthalate	mg/L	0.006	<0.0006	<0.0006	<0.0006	<0.0006/<0.0006	<0.0006	<0.0006	<0.0006	<0.0006/<0.0006	<0.0006	<0.0006
Dinoseb	mg/L	0.007	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001	<0001	<0.0001/<0.0001	<0001	<0001
Diquat	mg/L	0.02	<0.00008	<0.00008	<0.00008	<8e-005/<8e-005	<0.00008	<0.00008	<0.00008	<8e-005/<8e-005	<0.00008	<0.00008
Endothall	mg/L	0.1	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.01	<0.01	<0.01/<0.01	<0.01	<0.01
Endrin	mg/L	0.002	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005
Ethylene dibromide (EDB)	mg/L	0.00005	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005	<2e-005	<2e-005/<2e-005	<2e-005	<2e-005
Glyphosate	mg/L	0.7	<0.009	<0.009	<0.009	<0.009/<0.009	<0.009	<0.009	<0.009	<0.009/<0.009	<0.009	<0.009
Heptachlor	mg/L	0.00004	<8e-005	<8e-005	<8e-005	<8e-005/<8e-005	<8e-005	<8e-005	<8e-005	<8e-005/<8e-005	<8e-005	<8e-005
Heptachlor epoxide	mg/L	0.0002	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005
Hexachlorobenzene	mg/L	0.001	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002
Hexachlorocyclopentadiene	mg/L	0.05	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002
Lindane (BHC-gamma)	mg/L	0.0002	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005	<4e-005	<4e-005/<4e-005	<4e-005	<4e-005
Methoxychlor	mg/L	0.04	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002	<0.0002	<0.0002/<0.0002	<0.0002	<0.0002
Oxamyl (Vydate)	mg/L	0.2	<.004	<0.004	<0.004	<0.004/<0.004	<0.004	<0.004	<0.004	<0.004/<0.004	<0.004	<0.004
Polychlorinated biphenyls (PCBs)	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Pentachlorophenol	mg/L	0.001	<8e-005	<8e-005	<8e-005	<8e-005/8e-005	<8e-005	<8e-005	<8e-005	<8e-005/8e-005	<8e-005	<8e-005
Picloram	mg/L	0.5	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001
Simazine	mg/L	0.004	<0.00015	<0.00015	<0.00015	<0.00015/<0.00015	<0.00015	<0.00015	<0.00015	<0.00015/<0.00015	<0.00015	<0.00015
Toxaphene	mg/L	0.003	<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002	<0.002	<0.002/<0.002	<0.002	<0.002
2,4,5-TP (Silvex)	mg/L	0.05	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001	<0.0001	<0.0001
Volatile Organic Compounds (VOCs)												
Benzene	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Carbon tetrachloride	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Chlorobenzene (monoclorobenzene)	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
o-Dichlorobenzene (1,2-Diclorobenzene)	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
p-Dichlorobenzene (1,4-Dichlorobenzene)	mg/L		<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
1,2-Dichloroethane	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
1,1-Dichloroethylene	mg/L	0.007	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
cis-1,2-Dichloroethylene	mg/L	0.07	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
trans-1,2-Dichloroethylene	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Dichloromethane	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
1,2-Dichloropropane	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Epichlorohydrin [N9]	mg/L	TT	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/L	0.7	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Styrene	mg/L	0.1	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Tetrachloroethylene	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Toluene	mg/L	1	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
1,2,4-Trichlorobenzene	mg/L	0.07	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005

		Unit	SDWA MCL	MLPW1 10/22/2008	TCDW1 10/22/2008	Hunt Ditch 5/20/2008	DMPW2 5/20/2008	UMAT 1269 5/20/2008	McNary Pool 5/19/2008	UMAT 1571 10/22/2008	MORR 968 10/22/2008	MORR 956 10/22/2008	MORR 972 5/21/2008
	1,1,1-Trichloroethane	mg/L	0.2	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
	1,1,2-Trichloroethane	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
	Trichloroethylene	mg/L	0.005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
	Vinyl chloride	mg/L	0.002	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
	Xylenes (total)	mg/L	10	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005	<0.0005	<0.0005/<0.0005	<0.0005	<0.0005
Radionuclides													
	Gross Alpha	pCi/L	15	<3	3.2	--	--	--	--	6.01	4.34/7.21	8.39	--
	Gross Beta	pCi/L	4 mrem/yr	3.81	3.4	--	--	--	--	5.71	5.14/5.1	5.37	--

Notes

Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

NTU =

CU = color number

TON = threshold odor number

pCi/L = picocuries per liter

*Action Level

ONE COMPANY
Many Solutions℠

Technical Memorandum

To: Said Amali, IRZ Consulting

From: Bryan Black, PE
Anna Zaklikowski

Project: Umatilla Basin Regional Aquifer Recovery Assessment

Date: May 29, 2009

Job No: 86502

Re: Task 1.H - Natural Filtration Evaluation Memorandum

The agricultural economy of Umatilla and Morrow counties is critically dependant on availability of water for irrigation. Due to overdraft of the groundwater aquifers in the area, the Oregon Water Resources Department (OWRD) designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) (OWRD 2003). Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability in the CGAs, OWRD has begun a technical assessment of the feasibility of storing water from the Columbia River, and other surface water sources, during high flow periods in shallow sediment and deep basalt aquifers for recovery of the stored water during the irrigation season.

This technical memorandum includes a summary of information and findings regarding the potential for shallow sediments at two locations in the CGAs to provide natural filtration capacity for recharged surface water before its potential injection in to the basalt aquifer.

1.0 EXECUTIVE SUMMARY

The recharge system at County line has been in continuous operation and is assumed to be at steady state with respect to surface water mixing with native groundwater at the groundwater sampling location. A sample of native groundwater was not available so it was not possible to infer the degree of surface water mixing. Based on an assumed percentage of surface water at the well of 100%, log removal of all organisms was between 2.3 (99.5% removal) and 7.2 (greater than 99.99999% removal).

The recharge system at Echo Meadows was operated for a period of about 40 days. Based on chemical comparisons of native ground water, surface water, and well samples, the well sample is inferred to contain about 30% surface water. Despite containing surface water, the sample did not contain the organisms initially present in surface water (no MPA organisms were detected in the sampled well water). This indicates that the native soil horizon may effectively filter the applied surface water in the recharge system tested.

Both sites contain fine soils and should provide effective filtration if the soil is homogeneous. The fine soils could be a hydraulic limitation for recharge and could require frequent maintenance to maintain permeability.

2.0 OBJECTIVES

Soil and water quality data were collected for the following objectives:

- Determine the fate of surface water and filtration effectiveness through the subsurface using geochemical and biological indicators
- Characterize soil conditions and compare with conventional filtration techniques

3.0 INTRODUCTION

In spring of 2008, a pilot study was conducted in the Echo Meadows area of the Stage Gulch CGA in Umatilla County to evaluate the potential for aquifer recharge and natural filtration through the application of surface water. Additionally, through the annual recharge activities by the County Line Water Improvement District (CLWID), water from the Umatilla River is diverted during the times of excess flow and is transported via an irrigation canal (Hunt Canal) to a recharge canal which straddles the Umatilla-Morrow County border. The canal is designed to maximize leakage as the main mechanism for recharge. The recharge canal ends in a pond in Morrow County where any remaining water infiltrates the soil. Figure 1 shows the locations of the Echo Meadows area and CLWID recharge system.

The pilot test at Echo Meadows involved conveying water to several parcels of unfarmed land (IRZ 2009). One property, Field 1, was instrumented for further evaluation. Field 1 comprises an area of approximately 20 acres in size. Surface water was applied to this area over the course of the period April 17 through May 27, 2008. A total volume of 58 acre feet (AF) was applied during this time. Unlike the Echo Meadows site, recharge of the County Line site occurs continuously and was not piloted for a distinct period of time. Field 1 is shown on Figure 2. The boundary of the County Line recharge ponds are shown on Figure 3.

In late May, near the end of the available recharge period for Echo Meadows, surface water and well water samples were collected at both Echo Meadows Field 1 and County Line recharge pond sites and analyzed for geochemical and biological parameters. In addition, soil sieve analysis was performed on soil samples collected at both sites to characterize soil conditions. Sample locations are identified on Figures 2 and 3. County line pond sampling site was located adjacent to Desert Road and designated sample “CLWID B-Line” and the groundwater sample was collected from well MORR 972, located approximately ¼ mile south of the surface water sample site. At Echo Meadows, surface water samples were collected from Hunt Canal and groundwater samples were collected from well UMAT 1269, located approximately 0.5 miles downgradient of Hunt Canal. Figure 4 shows the groundwater potentiometric levels indicating direction of groundwater flow at Field 1 and the locations of well UMAT 1269 relative to the Field 1 water application site.

4.0 WATER QUALITY ANALYSIS RESULTS

4.1 Geochemical and Field Parameters

Results of the analysis of field and geochemical parameters for the County Line and Echo Meadows sites are presented in Tables 1 and 2, respectively. Field parameters included temperature, conductivity, pH, redox potential (ORP), and dissolved oxygen (DO). Seven geochemical parameters were analyzed: bicarbonate, calcium, chloride, magnesium, potassium, sodium, and sulfate. Details of sampling and laboratory analysis procedures, as well as laboratory reports, are provided in IRZ (2009).

Surface water and groundwater samples at County Line were collected on May 21, 2008. Samples were collected at the Echo Meadows site before the pilot test began (March 5-6, 2008) and immediately following the conclusion of surface water application (June 3, 2008). This was intended to provide a baseline so that the effect of applying surface water could be compared with the native groundwater.

Comparison of analysis results for surface water and well water samples at the County Line site shows a significant difference in the seven geochemical parameters tested. Concentrations are much higher in well samples than in surface water samples, as is to be expected in ground water. Dissolved oxygen and pH are similar for both samples; however, ORP and conductivity are higher in well samples. Because no data is available that describes the ground water chemistry before the canal was built, it is difficult to evaluate the impact of applied surface water on groundwater. Comparison with the background well sample taken at the Echo Meadows site suggests that the groundwater at County Line could have originally been much higher in cations, anions, and conductivity prior to the influence of canal water.

For Echo Meadows, the mineral content of well samples decreased significantly following application of surface water for recharge. Because surface water is less mineralized, the decrease in minerals in well samples is inferred to be due to mixing of surface water with native ground water. The Echo Meadows data for the seven geochemical parameters was analyzed using a least squares approach to estimate the potential relative contribution of surface water in the well sample. This approach suggested that the well sample consisted of a mixture that contained one-third surface water and two-thirds groundwater.

4.2 Microscopic Particulate Analysis

Microscopic Particulate Analysis (MPA) was performed by CH Diagnostics and Consulting Service, Inc. Berthoud, Colorado, on samples collected from surface water and well sites in the County Line and Echo Meadows CGAs. The MPA results are used to detect bio-indicators that normally only occur in surface water as opposed to groundwater sources. These bio-indicators may include diatoms, algae, coccidian, plant debris, pollen, rotifers, crustaceans, ameba, nematodes, and insects/larvae. The MAP analysis results are summarized in Table 3. The laboratory reports are enclosed in Appendix A.

The MPA results can be used to estimate the effectiveness of a filtration technology or natural filtration mechanism by comparing the filtered to the raw water sample and determining the reduction in various groups of bio-indicators. As required by the analysis guidelines, MPA results for surface water and ground water are reported in units per 100 Liter and per 100 gallons, respectively.

To determine the reduction of organisms/particles present in surface water as it was filtered through the soil, log removals for each of the biological parameters were calculated using the methodology in “Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization” (EPA, 1996). These results are presented in Table 4. Many of the parameters included in the analysis were not detected in well water samples. To calculate the log removal in these instances, a protocol described in “ICR Protozoan Method for Detecting *Giardia* Cysts and *Cryptosporidium* Oocysts in Water by a Fluorescent Antibody Procedure” (EPA, 1995) was used to estimate the minimum log removal. The log removals presented serve as an indication of the soil’s natural ability to filter particles and organisms in the applied surface water. However, the well samples collected were partially influenced by groundwater supplies and as such any conclusions that are based on these results should consider the groundwater influence.

According to Oregon Administrative Rules (OAR) 333-061-0032-8.a, “Requirements for groundwater sources under the direct influence of surface water with a natural filtration credit,” for a groundwater source to be eligible for natural filtration credit, the MPA risk scores must be less than 20. This criterion was met for well samples collected at both sites. In the “Long Term 2 Enhanced Surface Water Treatment Rule” (LT2ESWTR), the EPA assigns credit of one log treatment of Cryptosporidium for wells that have at least a 50-foot groundwater flow path measured from the surface water source.

5.0 SOIL CHARACTERIZATION

Soil sieve analysis was performed on three samples each from the County Line and Echo Meadows sites to determine the soil characteristics of the sites and compare with conventional filtration technologies. Echo Meadows samples were collected from Field 1 at locations shown on Figure 2. The sample designations and depths included FD1-1 from 6 inch to 3 ft bgs, two samples at FD1-2 from 6 inch to 2.5 and 2.5 to 4 ft bgs, FD1-3 from 6 inch to 3 ft bgs. At County Line samples CL SSD-1, CL SS-2, and CL SS-3 were collected from 6 inch to 3 ft bgs, the locations of which are shown on Figure 3. The samples were collected by soil augers and were composited prior to shipping to Northwest Testing, Inc., Wilsonville, Oregon for analysis. The laboratory reports are enclosed in Appendix A.

Soil sieve analysis results for County Line and Echo Meadows sites are shown in Table 5. Soil grain effective sizes (D_{10}) and uniformity coefficients (D_{60}/D_{10}) are calculated in Table 6. The soil grain effective size is defined as the sieve opening diameter that will pass the percentage of particles in a soil sample specified by the subscript. The sieve analysis shows that for all the of samples, more than 97% of the soil passed through the #16 sieve, indicating that the soil samples were primarily comprised of soil of grain size 1.2 mm and smaller. For all samples except for County Line soil sample 2, the effective size was less than the opening of the smallest sieve size (0.075 mm). For this reason, the uniformity coefficients for these samples could not be calculated and are expressed as greater than a uniformity coefficient having a D_{10} less than 0.075 mm.

Uniformity coefficients for slow sand filters typically range from 1.5 to 3.6 (2 is most common) with effective sizes (D_{10}) ranging from 0.15 to 0.40 mm (AWWA, 1999). The soil test results for the County Line and Echo Meadows sites indicate that the native soil is much finer and more stratified (has a higher uniformity coefficient) than what is specified for a typical slow sand filter. The low effective size of the soil will result in better filtration of the water; however, the soil characteristics are such that the soil will restrict the flow rate of water through the soil, limiting the amount of water can be applied. It is expected that the filtration rate through the CGAs would be substantially less than through a slow sand filter, which typically ranges from 0.016 to 0.16 gpm/ft^2 (1 -10 MGD per acre) (AWWA, 1999). The application rate of water at the Echo Meadows site was estimated to be 0.002 gpm/ft^2, an order of magnitude less than the value given on the lower end of the range for slow sand filters.

In its “Long Term 2 Enhanced Surface Water Treatment Rule” (LT2ESWTR), the EPA requires that only wells in granular aquifers are eligible for bank filtration treatment credit. This is defined as those aquifers comprised of sand, clay, silt, rock fragments, pebbles, or cement where in at least 90 percent of a core sample length, grains less than 1.0 mm in diameter constitute at least 10 percent of the core material. All soil samples evaluated from the two sites meet this requirement, per Table 6.

6.0 REFERENCES

American Water Works Association. 1999. *Water Quality and Treatment: A Handbook of Community Water Supplies*. McGraw Hill, Inc., New York, NY.

IRZ Consulting LLC. June 2009. *Report: Conceptual Hydrogeology of Alluvial Aquifers and Echo Meadows Recharge Report, Umatilla Basin Recharge Project*. Prepared for Oregon Water

Resources Department as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

Oregon Water Resources Department. 3 April 2003. *Ground Water Supplies In The Umatilla Basin*. OWRD Ground Water Section, Pendleton, Oregon.

U.S. EPA. April 1996. *Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization*. Region 10 Office of Environmental Assessment.

U.S. EPA. June 1995. *ICR Protozoan Method for Detecting Giardia Cysts and Cryptosporidium Oocysts in Water by a Fluorescent Antibody Procedure*. Office of Ground Water and Drinking Water, Washington DC.

Table 1: Geochemical and Field Data for County Line Recharge Site

Parameter	CLWID B-Line	Well MORR 972
Bicarbonate (mg/L)	7.34	70.4
Calcium (mg/L)	4.22	18.6
Chloride (mg/L)	0.67	1.95
Magnesium (mg/L)	1.53	5.36
Potassium (mg/L)	1.44	2
Sodium (mg/L)	2.86	6.64
Sulfate (mg/L)	0.874	2.56
Temperature (°C)	12.8	16.3
Conductivity (μS/cm)	65	145
DO (mg/L)	7.6	7.6
pH	7.3	7.2
ORP (mV)	56	29.9
Turbidity (NTU)	20.1	0.33

Table 2: Geochemical and Field Data for Echo Meadows Recharge Site

Parameter	Hunt Canal Samples[(a)]		Well UMAT 1269	
	3/6/08	6/3/08	3/5/08	6/3/08
Bicarbonate (mg/L)	34	30.1	253	215
Calcium (mg/L)	6.99	4.09	72.8	51.8
Chloride (mg/L)	2.04	1.03	64.6	52.7
Magnesium (mg/L)	2.76	1.64	35	23.1
Potassium (mg/L)	16.4	1.37	11.2	8.65
Sodium (mg/L)	5.01	2.63	55	40.1
Sulfate (mg/L)	2.09	1.19	83.3	75.4
TDS (mg/L)	88.74	--	588.5	--
Alkalinity (mg/L as CaCO3)	34	--	253	--
Hardness (mg/L as CaCO3)	28.8	--	326	--
Biological Oxygen Demand (mg/L)	<2	<2	<2	<2/<2
pH	7.2	4.22	7.7	6.14
Temperature (°C)	7.7	13	14.5	12.7
Specific Conductivity (µs/cm)	90	60-215	860	790
ORP (mV)	--	162	--	88
Dissolved Oxygen (mg/L)	8.2	12.6	0.6	2.58
Turbidity (NTU)	--	42.6	--	ND

Notes:

(a) The sample dated 3/6/08 corresponds to sample HCSW1 and sample dated 6/3/08 to sample HCSW2 in Table 3 of IRZ (2009).

Table 3: MPA Log Removal Results for Echo Meadows and County Line Sites

Parameter	County Line		Echo Meadows	
	CLWID B-Line (per 100 L)	Well MORR 972 (per 100 gal)	Hunt Canal (per 100 L)	Well UMAT 1269 (per 100 gal)
Algae	5,000,000	6.0	100,000	ND
Diatoms	9,000,000	2.0	500,000	ND
Plant Debris	ND(a)	ND	ND	ND
Rotifers	ND	ND	ND	ND
Nematodes	3,000	54.0	500	ND
Pollen (Pine)	1,000	1.0	2,000	ND
Ameba	2,000	34.0	1,000	ND
Ciliates	ND	ND	ND	ND
Colorless Flagellates	ND	4.0	ND	ND
Crustaceans	ND	ND	ND	ND
Other Arthropods	ND	ND	ND	ND
Other	ND	ND	ND	ND

Notes:

(a) ND: Not Detected

Table 4: MPA Log Removal Results for Echo Meadows and County Line Sites

Parameter	Log Removal (per 100 gallons)	
	Echo Meadows	County Line
Algae	>3.4	6.5
Diatoms	>4.1	7.2
Plant Debris	ND[(a)]	ND
Rotifers	ND	ND
Nematodes	>1.1	2.3
Pollen (Pine)	>1.7	3.6
Ameba	>1.4	2.3
Ciliates	ND	ND
Colorless Flagellates	ND	3.0
Crustaceans	ND	ND
Other Arthropods	ND	ND
Other	ND	ND

Notes:

(a) ND: Calculation could not be performed since parameter was not detected in surface water sample

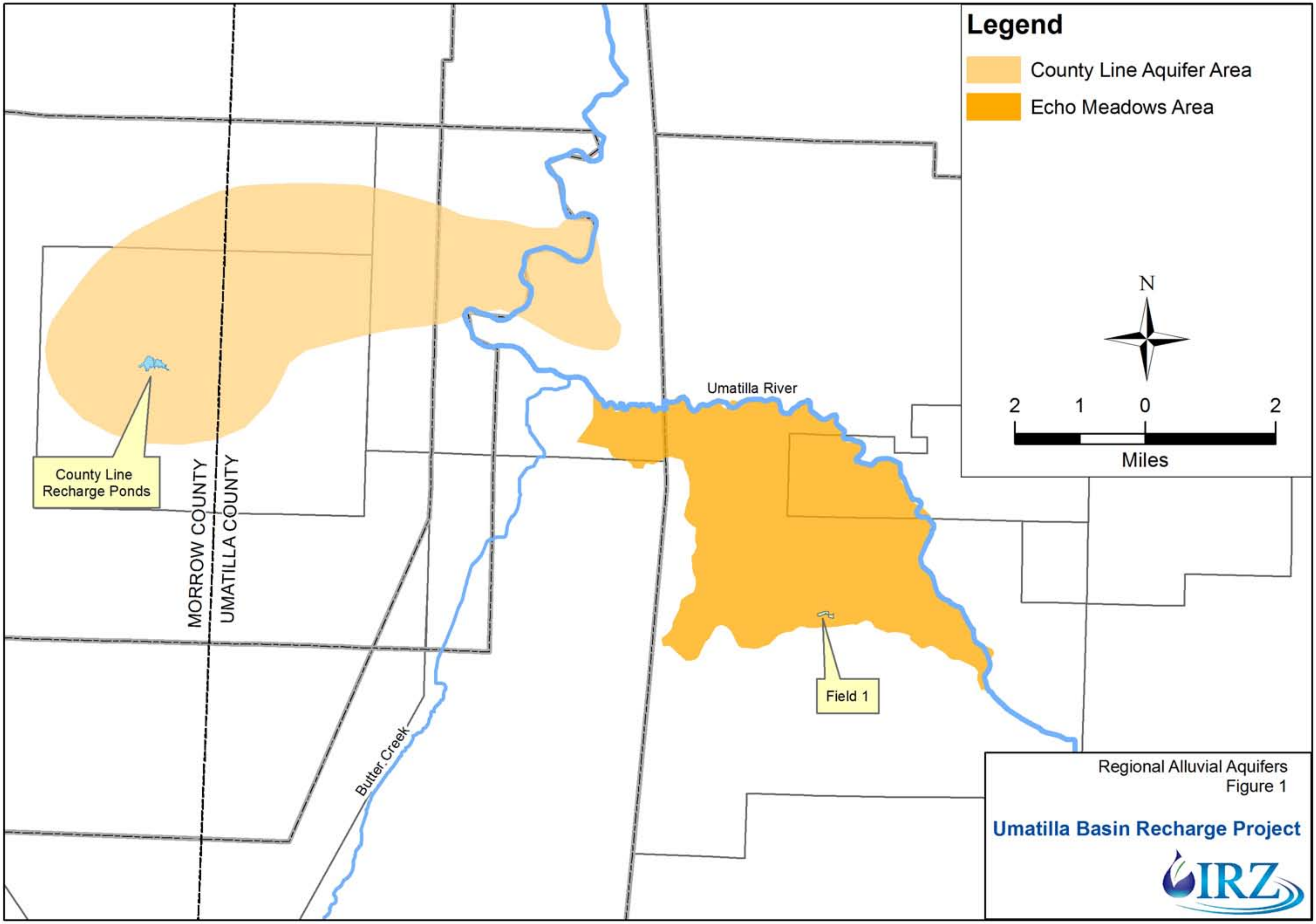
Table 5: Soil Analysis Results for Echo Meadows and County Line Sites

Sieve Size	Opening Size (mm)	Percent Passing						
		CL SS1 6" - 3'	CL SS2 6" - 3'	CL SS3 6" - 3'	FD 1-1 6" - 3'	FD 1-2 6" - 2.5'	FD 1-2 2.5' - 3'	FD 1-3 6" - 3'
1/2"	12.5					100	100	100
3/8"	9.50	100	100	100	100	100	99	100
1/4"	6.35	99	100	100	100	99	98	100
#4	4.75	99	100	99	100	99	98	100
#8	2.36	98	100	99	100	99	98	100
#10	2.00	98	99	98	100	99	98	99
#16	1.18	95	98	97	100	98	97	99
#30	0.60	73	80	80	99	97	95	96
#40	0.43	49	60	55	97	94	92	93
#50	0.30	27	36	32	91	89	86	86
#100	0.15	16	14	17	53	61	66	67
#200	0.08	12.7	9.8	10.8	31.5	40.4	50.7	44.3

CLSS: County Line Site Sample
FD: Echo Meadows

Table 6: Effective Sizes and Uniformity Coefficients for Soil Samples

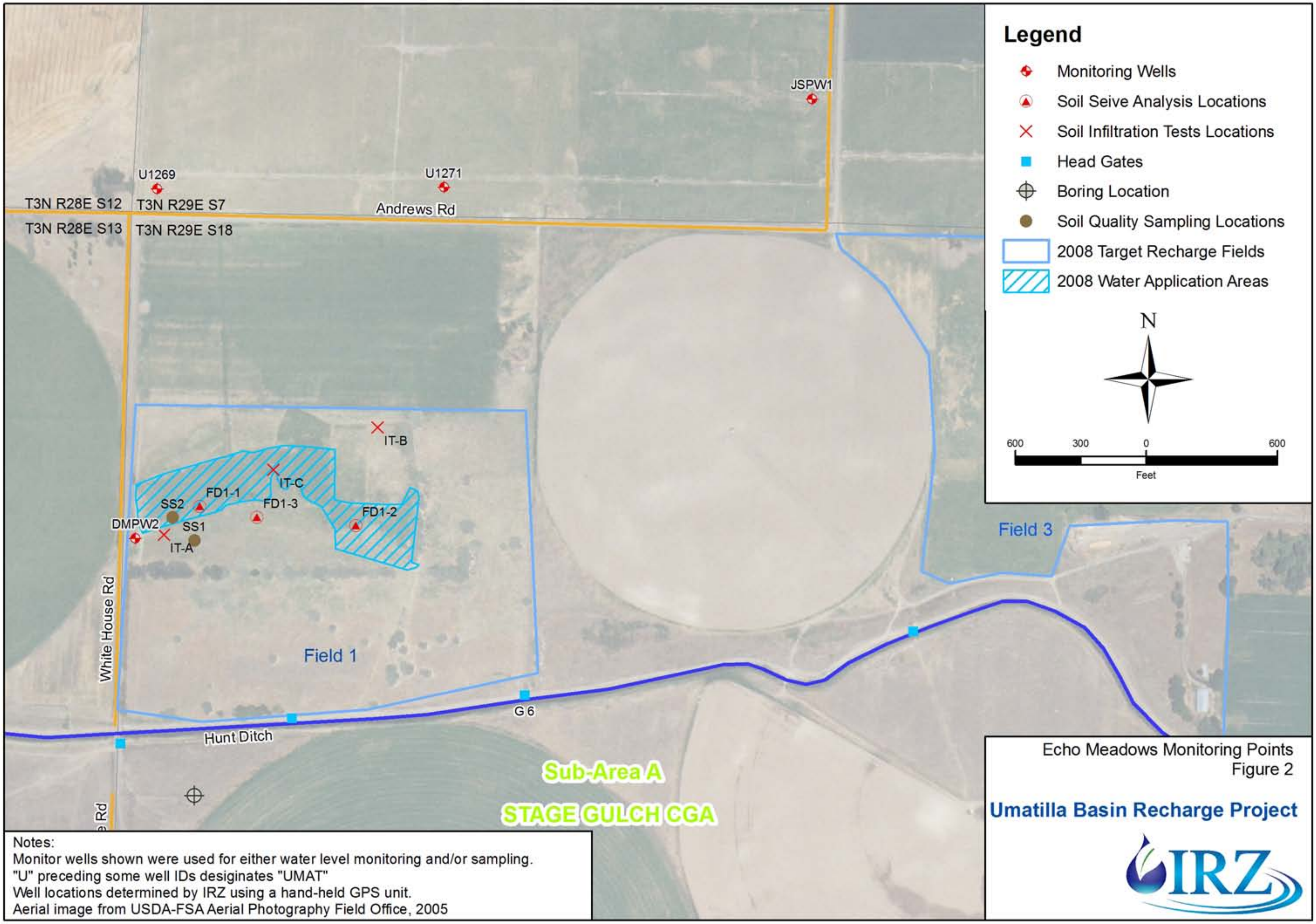
Sample	Effective Size, D_{10} (mm)	Uniformity Coefficient, D_{60}/D_{10}
CL SS1 6" – 3'	<0.075	>6.74
CL SS2 6" – 3'	0.079	5.41
CL SS3 6" – 3'	<0.075	>6.13
FD 1-1 6" - 3'	<0.075	>2.37
FD 1-2 6" - 2.5'	<0.075	>1.95
FD 1-2 2.5' - 3'	<0.075	>1.61
FD 1-3 6" - 3'	<0.075	>1.69



Regional Alluvial Aquifers
Figure 1

Umatilla Basin Recharge Project

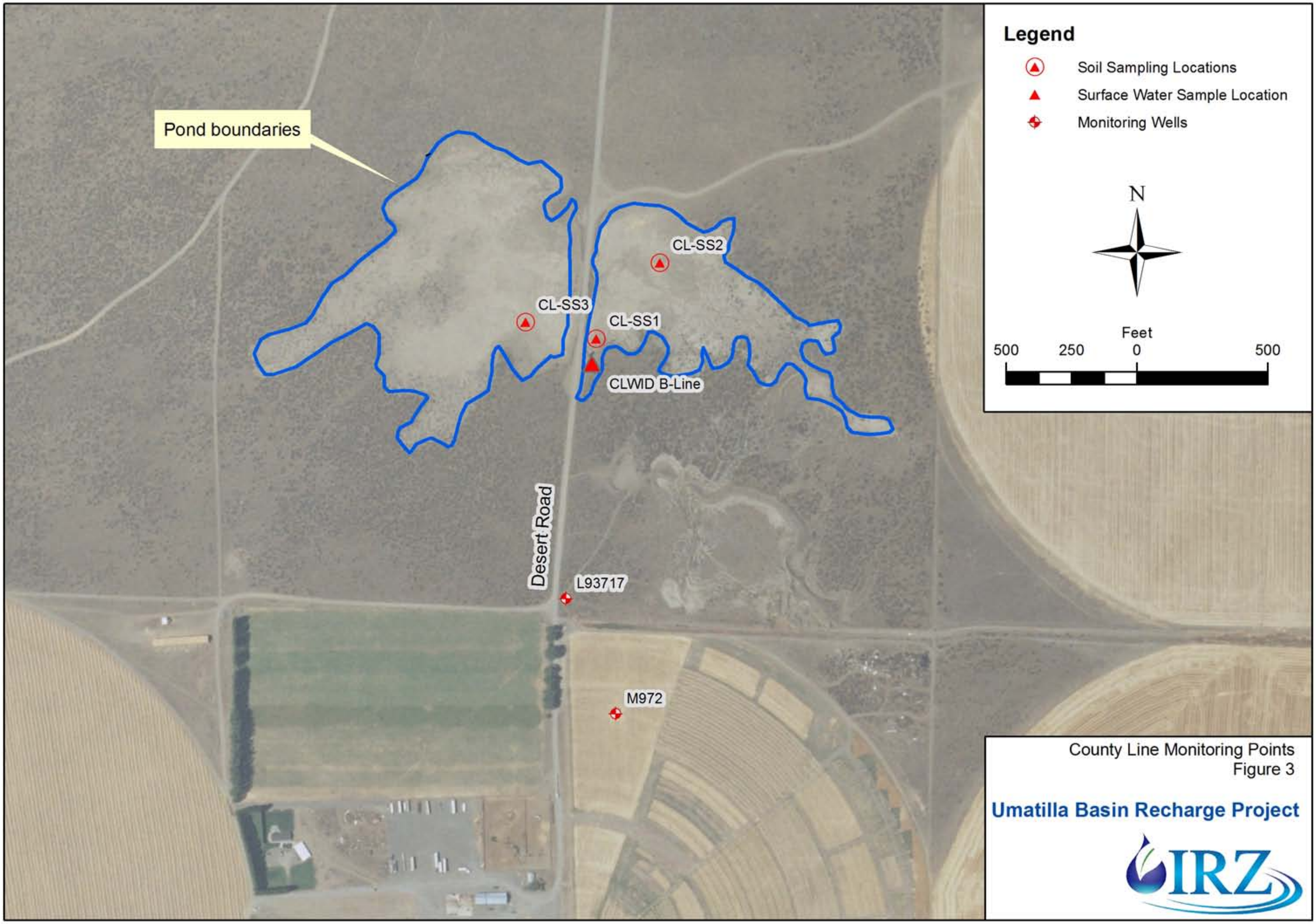
IRZ



Echo Meadows Monitoring Points
Figure 2

Umatilla Basin Recharge Project

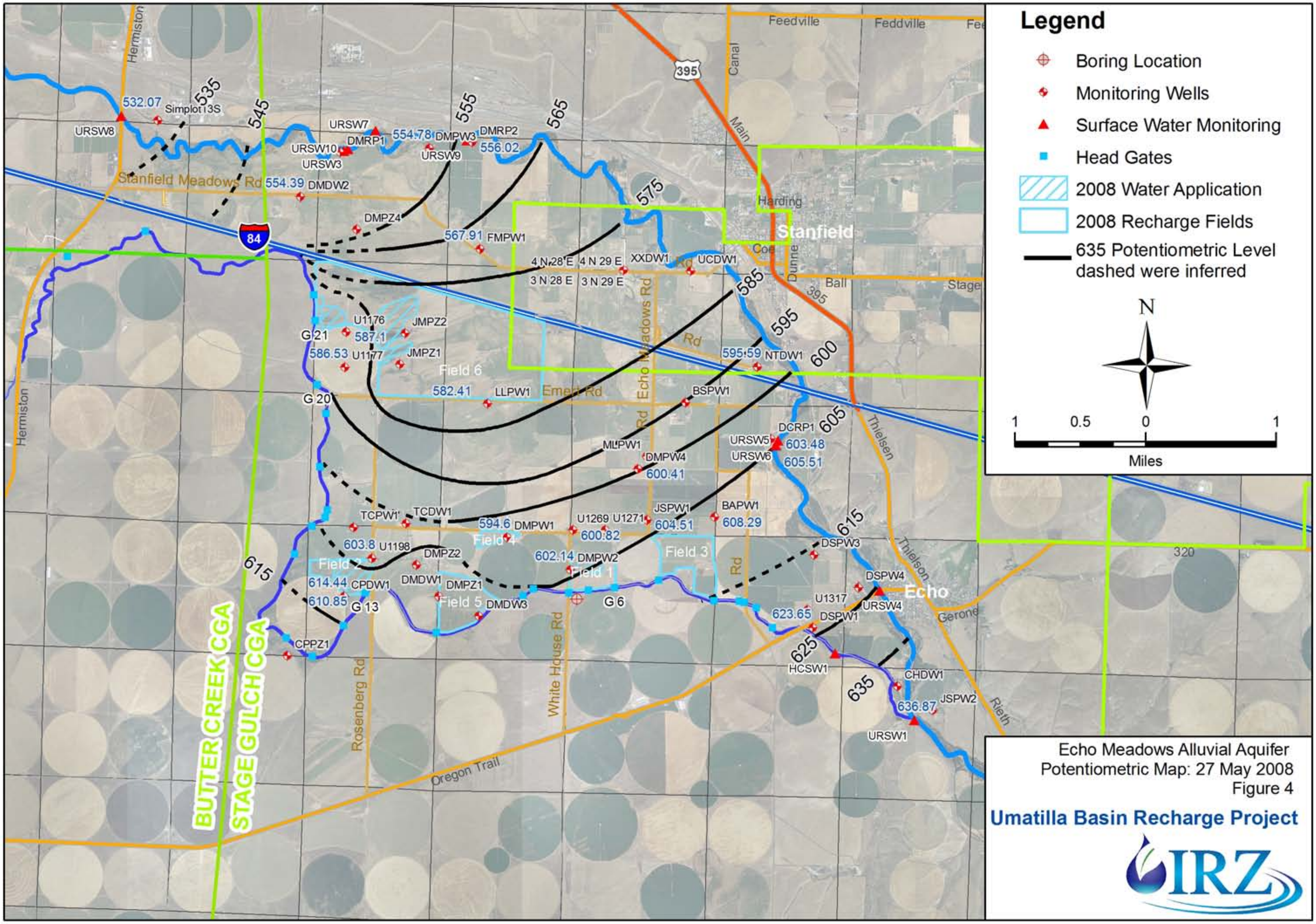
Notes:
Monitor wells shown were used for either water level monitoring and/or sampling.
"U" preceding some well IDs desiginates "UMAT"
Well locations determined by IRZ using a hand-held GPS unit.
Aerial image from USDA-FSA Aerial Photography Field Office, 2005



County Line Monitoring Points
Figure 3

Umatilla Basin Recharge Project

IRZ



Echo Meadows Alluvial Aquifer
Potentiometric Map: 27 May 2008
Figure 4

Umatilla Basin Recharge Project

IRZ

APPENDIX A

Laboratory Analytical Reports

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Invoice 20080514

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information
UPS; 6/19/2008; 0940 Hrs; 17.6°C; Wound
Results submitted by:
TJC

Sample Identification: Echo Meadows, U1269

Sample Information: SOURCE: Drilled Well; Unchlorinated

Sample Date & Time: 6/16/2008 06:00 PM —» 6/17/2008 12:14 PM **Sampler:** Said Amali

Amount: 1981.448 L (523.5 gal) **Filter Color:** Rust **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 6/19/2008 01:41 PM **Centrifugate:** 0.265 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 9 L

Amorphous Debris	silt (2-50 µm), clay (1-2 µm)
Algae	ND
Diatoms	ND
Plant debris	ND
Rotifers	ND
Nematodes	ND
Pollen (pine)	ND
Ameba	ND
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

Giardia and Coccidia are none detected (ND) by MPA unless reported under "Other".

This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). 1992. USEPA, Port Orchard, WA, EPA 910/9-92-029. All limitations stated in the methods apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, particulate extraction was modified.

COMMENTS: Score: 0-Low Risk per EPA Consensus Method referenced above.

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To:
Mr. Said Amali
IRZ Consulting, Inc.
505 E. Main
Hermiston, Oregon 97838

Date: 8/6/08

Lab No.: 08-223

Project: Laboratory Testing – Umatilla Recharge Project

Project No.: 2065.1.1

Report of: Sieve analysis

Sample Identification

As requested, NTI provided sieve analysis on samples delivered to our laboratory on July 28, 2008 by an IRZ Consulting, Inc. representative. All testing was performed in general accordance with the methods indicated. Our laboratory's test results are summarized on the following table and attached page.

Laboratory Test Results

Sieve Analysis of Aggregate (ASTM C136/ C117)				
Sieve Size	**CL SS 1 @ 6" – 3.0' Percent Passing**	**CL SS 2 @ 6" – 3.0' Percent Passing**	**CL SS 3 @ 6" – 3.0' Percent Passing**	**FD 1-1 @ 6" – 3.0' Percent Passing**
⅜"	100	100	100	100
¼"	99	100	100	100
#4	99	100	99	100
#8	98	100	99	100
#10	98	99	98	100
#16	95	98	97	100
#30	73	80	80	99
#40	49	60	55	97
#50	27	36	32	91
#100	16	14	17	53
#200	12.7	9.8	10.8	31.5

Copies:
Addressee
Bryan Black, HDR, Inc.

REVIEWED BY: Bridgett Adame

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To: Mr. Said Amali
IRZ Consulting, Inc.
505 E. Main
Hermiston, Oregon 97838

Date: 8/6/08

Lab No.: 08-223

Project: Laboratory Testing – Umatilla Recharge Project

Project No.: 2065.1.1

Laboratory Test Results

Sieve Analysis of Aggregate (ASTM C136/ C117)			
Sieve Size	**FD 1-2 @ 6" – 2.5' Percent Passing**	**FD 1-2 @ 2.5' – 3.0' Percent Passing**	**FD 1-3 @ 6" – 3.0' Percent Passing**
½"	100	100	100
⅜"	100	99	100
¼"	99	98	100
#4	99	98	100
#8	99	98	100
#10	99	98	99
#16	98	97	99
#30	97	95	96
#40	94	92	93
#50	89	86	86
#100	61	66	67
#200	40.4	50.7	44.3

REVIEWED BY: Bridgett Adame

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080400

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information

Federal Express; 5/23/2008; 1110 Hrs; 7.2°C; Wound
Results submitted by:
President Secretary 6/5/08

Sample Identification: Echo Meadows, HC, Raw water

Sample Information: SOURCE: Irrigation Canal; Unchlorinated; pH 5.65; 10.31ºC

Sample Date & Time: 5/21/2008 03:18 PM —» 5/21/2008 03:56 PM **Sampler:** Said Amali

Amount: 115.4425 L (30.5 gal) **Filter Color:** Brown **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:33 PM **Centrifugate:** 0.303 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.1924 L

Amorphous Debris	silt (2-50 µm), clay (1-2 µm), sand (50-2000 µm), inorganic precipitate, aggregates
Algae	100,000/100 L, predominantly Chlorophytes, Chlamydomonas, Scenedesmus, Zygnematales
Diatoms	500,000/100 L, predominantly Pennales, Synedra, Navicula, Nitzschia, Cymbella, Diatoma, Cocconeis, Achnanthes, Fragilaria, Gomphonema, Rhoicosphenia, some Centrales, Melosira
Plant debris	ND
Rotifers	ND
Nematodes	500/100 L
Pollen (pine)	2,000/100 L
Ameba	1,000/100 L, test
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber; Section 11.1.1 omitted. All limitations stated in the method apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, then particulate extraction was modified.

FILE

ANALYSIS FOR WATERBORNE PARTICULATES

Invoice 20080400

CH Diagnostic and Consulting Service, Inc.
512 5th Street, Berthoud, CO 80513
P: (970) 532-2078 F: (970) 532-3358

Laboratory Information

Federal Express; 5/23/2008; 1110 Hrs; 8.2°C; Wound
Results submitted by:
President/Secretary 6/5/08

Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Sample Identification: Morrow County, Dr., CLWID-B Line, Raw water

Sample Information: SOURCE: Lake or Reservoir; Unchlorinated

Sample Date & Time: 5/21/2008 11:21 AM —» 5/21/2008 12:10 PM **Sampler:** Said Amali

Amount: 193.035 L (51 gal) **Filter Color:** Light brown **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:33 PM **Centrifugate:** 0.259 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.09652 L

Amorphous Debris	clay (1-2 µm), silt (2-50 µm), inorganic precipitate, aggregates
Algae	5,000,000/100 L, predominantly Chlorophytes, Chlamydomonas, Scenedesmus, Spirogyra, Ulothrix, Oedogonium, Pediastrum, Closterium, some Cyanophytes, Merismopedia, Oscillatoria, some Cryptomonads, Chroomonas
Diatoms	9,000,000/100 L, predominantly Pennales, Synedra, Fragilaria, Gomphonema, Navicula, Nitzschia, Cymbella, some Centrales, Cyclotella
Plant debris	ND
Rotifers	ND
Nematodes	3,000/100 L
Pollen (pine)	1,000/100 L
Ameba	2,000/100 L, test
Ciliates	ND
Colorless Flagellates	ND
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber; Section 11.1.1 omitted. All limitations stated in the method apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, then particulate extraction was modified.

FILE

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Customer 20081746
IRZ Consulting LLC
505 E. Main St.
Hermiston, OR 97838

Laboratory Information
Federal Express; 5/23/2008; 1110 Hrs; 7.6°C; Wound
Results submitted by:
President/Secretary 6/5/08

Sample Identification: Morrow County, Dr., CLWID-Well

Sample Information: SOURCE: Drilled Well; Unchlorinated

Sample Date & Time: 5/21/2008 01:37 PM —» 5/22/2008 08:40 AM **Sampler:** Said Amali

Amount: 2937.16 L (776 gal) **Filter Color:** Off white **Filter Type:** Polypropylene wound cartridge

Date/Time Eluted: 5/23/2008 12:07 PM **Centrifugate:** <0.001 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 590 L

Amorphous Debris	clay (1-2 μm), silt (2-50 μm), inorganic precipitate, aggregates
Algae	6/100 Gal, some Chlorophytes, Cosmarium, Didymocystis
Diatoms	2/100 Gal, some Centrales, Stephanodiscus
Plant debris	ND
Rotifers	ND
Nematodes	54/100 Gal
Pollen (pine)	1/100 Gal
Ameba	34/100 Gal, test
Ciliates	ND
Colorless Flagellates	4/100 Gal
Crustaceans	ND
Other Arthropods	ND
Other	ND

Giardia and Coccidia are none detected (ND) by MPA unless reported under "Other".
This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). 1992. USEPA, Port Orchard, WA, EPA 910/9-92-029. All limitations stated in the methods apply. If HV capsule or foam filter was received, method was modified by filtering sample through a Pall Envirochek™ HV capsule or IDEXX Filta-Max™ filter at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, particulate extraction was modified.

COMMENTS: Score: 10-Moderate Risk per EPA Consensus Method referenced above.

GSI
Water Solutions, Inc.

REGISTERED
OREGON
DENNIS D. NELSON
G 1224
GEOLOGIST

TECHNICAL MEMORANDUM

To: IRZ Consulting
From: Dennis Nelson, RG, and Jeff Barry, RG

Subject: Task 1H - **Geochemical Compatibility Evaluation**

Date: 18 June 2009
Project: Umatilla Basin Regional Aquifer Recovery Assessment
GSI Project No.: 290 001

Overview

In February 2009, GSI Water Solutions, Inc. (GSI), in cooperation with IRZ Consulting, Inc. (IRZ), submitted the report "ASR Feasibility, Umatilla Basin Regional Aquifer Recovery Assessment" as an evaluation of the potential for Aquifer Storage and Recovery (ASR) in the Umatilla Basin of Oregon. The February 2009 report focused on the characteristics of the basalt aquifer, suitability of the basalt aquifer for ASR, and general water quality issues. Water quality issues associated with the presence of nitrate, total dissolved solids, and other constituents associated with agricultural chemicals present in shallow groundwater that affect the suitability of using shallow alluvial groundwater as ASR source water are discussed in the February 2009 ASR report (GSI, 2009; IRZ, 2009).

This technical memorandum supplements the earlier report by evaluation of the chemical compatibility of injected source water and receiving water within the basalt aquifer. The evaluation of the chemical compatibility of injected source water(s) with the ambient groundwater in the receiving aquifer is an important consideration in ASR operations. In the ASR process, two waters of very different composition and chemical state are mixed. It is important to be able to predict the chemical characteristics and possible geochemical reactions that may take place as a result of the physical mixing. The concern is that the mixing of two incompatible waters ultimately may lead to the precipitation of mineral phases that could result in significant loss of production produced by the clogging of the aquifer or the well screens. An additional impact of mixing of two incompatible waters is the potential mobilization of metals or nonmetals within the receiving aquifer that may produce potential health impacts.

Two separate waters will be considered to be compatible if, during ASR operations, the mixing of these two waters does not lead to physical, geochemical, or biological reaction that may result in damage to the aquifer, or reduce the efficiency of the ASR operation or the quality of the recovered water. From the geochemical reaction perspective, two primary reactions may occur: (1) the precipitation (formation) of solids that may clog the aquifer or the well screens, or (2) the acquiring of undesirable water quality changes, resulting from mineral dissolution or water-rock reactions, from the perspective of either public health or aesthetic character.

To evaluate the ASR process on a regional basis, geochemical compatibility is considered from several different ASR sites within the Umatilla Basin. By doing so, the conclusions of this memorandum will be representative of the geochemical compatibility of injected and ambient groundwater applicable throughout the Umatilla Basin.

The public health issue is explored by considering what materials might be mobilized within the matrix of the basalt aquifer, either by dissolution of mineral phases, or by surface reactions.

Table 1, at the end of this memorandum, presents the water data used for this document. The data include samples collected from alluvial wells, basalt wells, and surface water as part of the Umatilla Basin Aquifer Recharge Project. It also includes selected data obtained from previous studies conducted by the U.S. Geological Survey (USGS) and from results from the Madison and McCarty ASR projects.

Executive Summary

The findings in this memorandum are based on geochemical modeling using the computer program PHREEQC, developed by the U.S. Geological Survey. PHREEQC has been used widely in the scientific community to address the issues described here. The program identifies the active chemical species in the water as a function of temperature, pH, and oxidizing vs. reducing conditions. The model uses those calculations to predict potential chemical reactions that can change the composition of the water. These reactions include dissolving/precipitating minerals and reactions that take place at mineral surfaces during varying physical process such as mixing, migrations through the aquifer, or both. PHREEQC is not applicable for highly saline waters, e.g., seawater, and it does assume that chemicals behave ideally, i.e., are not influenced by other constituents, during surface reactions. As with any model, the program is not capable of ensuring realistic conclusions, and the results must be checked to see if they are consistent with the overall hydrogeological-geochemical environment.

PHREEQC is used here to evaluate the chemical compatibility of ASR source water and ambient groundwater in the basalt aquifer. These separate waters may have very different chemical histories and our purpose is to determine whether their mixing will result in reactions that could ultimately result in changes in the mixed water that would lead to a potential human health impact or result in a physical clogging of the aquifer, perforations, or screens. If the model results suggest that such impacts will occur, then the waters would be incompatible with one another.

In this study, geochemical compatibility has been evaluated through comparisons with actual project results from within the Umatilla Basin and from elsewhere in Oregon where ASR settings are such that they can readily be extrapolated to the Umatilla Basin.

Following is a list of key findings from this water quality compatibility assessment:

1. Geochemical modeling results indicate that significant mineral preciptiation will not occur that could result in clogging of the ASR wells or aquifer.

2. The consistency of the data and geochemical modeling results support the contention that the water quality compatibility observed at the Madison and McCarty ASR sites are applicable across the Umatilla Basin.

3. The potential for oxidized ASR source water mixed with reduced basalt groundwater to dissolve and release metals into solution that could result in public-health-related water quality problems is not significant.

4. Given the oxygenated character of the injected alluvial source water, and iron concentration within the ambient groundwater, alluvial groundwater, and recovered waters, it is possible that the growth of iron bacteria could occur. However, at the basalt-based ASR operations at Madison Farms and McCarty Ranch, and elsewhere in Oregon, e.g., Beaverton, Tualatin Valley Water District, etc., the growth of iron bacteria has not presented a significant problem. Periodic routine maintenance of the wells has been adequate to control growth.

5. The data sets collected for this evaluation and in the results of the chemical modeling do not suggest significant chemical compatibility problems associated with ASR projects within the Umatilla Basin.

6. Oregon ASR operations involving basalt aquifers, e.g., Salem and Beaverton, have been in operation for more than 10 years without evidence of significant loss of production as a result of clogging from mineral precipitation, or potential water quality concerns related to mineral reactions between the injected water and the basalt aquifer.

Objectives

This memorandum evaluates the geochemical compatibility of the injected and native groundwater through the following questions:

- What are the variations in composition of the alluvial and ambient groundwater in different parts of the Umatilla Basin and at different times? Do either the temporal or spatial variations observed have the potential for altering the relative compatibility of the waters involved?

- Are the water quality test results at the Madison Farms and McCarty Ranch ASR sites comparable to other locations in the basin? What do these existing ASR sites tell us about water quality compatibility elsewhere in the basin?

- What are the saturation indices (see Attachment 1) of the alluvial source waters and ambient groundwater over time and across the Umatilla Basin? Do they indicate the potential for significant mineral precipitation during storage?

- Can the composition of the recovered waters be explained by simple mixing of source waters and ambient groundwater? What mineral reactions, e.g., dissolution or precipitation, are predicted, and what impact will that have on the ASR process?

- Are these findings applicable across the Umatilla Basin?

Results and Findings

Conceptual Model

Before setting up the geochemical modeling, it is important to have a conceptual understanding of the physical setting. This provides the framework for establishing model pathways and boundaries. The schematic diagram in Figure 1 provides a conceptual view of the ASR process as it takes place in the Umatilla Basin and presents the following processes (numbers below refer to designated steps in Figure 1):

1. Water is extracted from its surface water source and is applied as surface recharge to non-cultivated farm fields or infiltration basins.
2. The applied water infiltrates through the soil and percolates down to the alluvial aquifer or a subsurface collection system.
3. The shallow groundwater moves, either by natural gradient or by a gradient induced by pumping, during step 4.
4. The shallow groundwater is pumped from the alluvial aquifer, disinfected, and injected into the deeper basalt aquifer.
5. The injected water displaces ambient groundwater in the basalt aquifer, with a mixing zone occurring at the interface of the source water and the groundwater of the receiving aquifer.
6. After storage, the water is pumped from the deeper basalt aquifer for use.

Geochemical Modeling

The USGS has developed a water chemistry software package called PHREEQC that performs mineral solubility calculations using the analysis and chemical state parameters of the individual water samples (Parkhurst et al., 1980; Parkhurst, 1995). PHREEQC also allows for the mixing of two or more separate waters and will calculate the solubility of a given mineral in the resulting mixture. This program is useful for performing predictive simulations as part of a geochemical compatibility evaluation. Precursors of PHREEQC, i.e., NETPATH and PCWATEQ, were used to model groundwater evolution in the alluvium and shallow basalt aquifer(s) in the Umatilla Basin associated with the development of the Lower Umatilla Basin Groundwater Management Area (Grondin and Nelson, 1995).

As described above, the ASR process results in the mixing of site-specific source water with an ambient groundwater (step 5 in the conceptual model above). These waters often have very different histories and therefore characteristics (see Table 2 at the end of this document), and the resulting mixture likely will be out of equilibrium with the matrix (minerals) of the receiving basalt aquifer.

When these different waters mix, the hybrid water's chemical state may not vary directly with the mixing proportions of surface water and groundwater, and therefore, the relative solubility of a given mineral won't necessarily either. For example, two waters, both saturated with respect to calcite, can mix to yield water that is undersaturated with respect to calcite. This is yet another advantage of using PHREEQC, as it predicts the correct chemical state for each of the solutions.

Variation of Composition

One way of evaluating the compositional variation observed in the various waters involved in ASR is a simple comparison of analyses. This is often difficult to do from a table containing multiple constituents. For example, in the consideration of what constitutes a significant variation in a single component between two or more water samples? The question that is being asked is not whether a variation exists, but whether the compositional variation observed may result in a specific reaction or produce an undesirable change in the water quality. To answer this, compositional variations or chemical states are displayed graphically in this memorandum. A graph showing an array of chemical components in water in the same view constitutes a relatively unique "geochemical fingerprint" and compositional similarities or differences between two or more waters can be recognized. This memorandum focuses on three chemical classes of water: the source water (or alluvial groundwater), derived from the shallow alluvial aquifer being recharged by the application of surface water (see steps 1 and 2 in Figure 1); the deep ambient groundwater residing within the basalt aquifer (basalt groundwater); and the water recovered from the basalt aquifer after a period of storage (recovered water).

The temporal variation in composition will be evaluated using the collective analyses from the Madison Farms and McCarty Ranch ASR sites (Plate 1) during the ASR cycles that occurred from 2006 through 2008. After the extent of temporal variability has been evaluated, the conclusions reached from these ASR sites will be evaluated to determine if they can be extended throughout the Umatilla Basin.

Figures 2 and 3 represent Piper Tri-Linear and Stiff diagrams, traditionally used to graphically display chemical compositions of water. In the Piper and Stiff diagrams, the mass of a given element or molecule is expressed as milli-equivalents/liter as opposed to milligrams/liter. The equivalents of a given element or molecule in a solution is the number of moles of the substance times the valence of the ion per liter, with a mole being equal to the atomic or molecular weight in grams. In contrast to other compositional representations, the Piper and Stiff diagrams include the charge that the constituent possesses in solution.

In Figure 2a, the basaltic groundwater from the Madison Farms site exhibits a tight cluster of compositions in the Piper plot, a characteristic also seen in the Stiff diagrams (see green shapes in Figure 3a). In Figure 2b, the basaltic groundwater from the McCarty Ranch site plots separately from the other compositions and exhibits a broader variation in composition, primarily with respect to chloride and sulfate (see also Figure 3b). At both sites, the ambient groundwater is of a mixed cation-bicarbonate type, similar to the basaltic groundwater from the Echo Meadows site (Plate 1) and, in general, the basaltic groundwater in the Grande Ronde, Wanapum, and Saddle Mountain Formations.

It is important to determine how these differences manifest themselves with respect to potential water-rock reactions that result when oxidized source water is injected into the reducing environment that is characteristic of the basalt aquifer.

Figure 4 illustrates the geochemical fingerprints, including chemical state parameters, for the alluvial groundwater that is injected (Step 4 in the Conceptual Model) at Madison Farms (Figure 4a) and McCarty Ranch (Figure 4b). The data reflect the compositional variability observed during Cycles 2 (2006), 3 (2007), and 4 (2008), reflecting operations from 2006 through 2008 (see also Figures 2 and 3). Although the patterns of the source water at each site appear quite similar internally, there are some important differences that need to be explored to ensure that the compatibility of the source water and the basaltic groundwater are not affected. Specifically, at each site, the bicarbonate (HCO_3), silica (Si), and sulfate (SO_4) concentrations vary significantly. Calcium (Ca) and Chloride (Cl) show some variations in the Madison source water. Iron (Fe) and manganese (Mn) occur only in isolated samples of the source waters. The chemical state parameters are pulled out and displayed for the combined sites in Figure 4c. Importantly, these parameters do not change significantly from one site to the other, except temperature (see below), or with time.

Also shown in both diagrams are the patterns for alluvial groundwater reflecting single samples from the Echo Meadows and County Line projects (Plate 1), collected in 2008. Of the sites considered in this memorandum, all derive their water originally from the Umatilla River. The one exception is the County Line system, which obtains its water from the Columbia River. Figure 5 provides a snapshot of the Umatilla and Columbia Rivers' raw waters sampled in 2008 (note the difference in scales between the diagrams). It is clear that the differences observed between the County Line and Echo Meadows alluvial source waters cannot be explained solely on the basis of differences between the surface waters involved, implying additional processes are involved within the alluvial aquifer. The processes in the soil zone and alluvial aquifer, however, do not play a direct role in those that occur during ASR storage in the basalt aquifer and will not be considered further (see Grondin and Nelson, 1995, for further discussion).

Compositional diagrams are shown for the ambient groundwater in the basalt aquifer at Madison Farms (a) and McCarty Ranch (b) in Figure 6. As with the alluvial groundwater, these data reflect variations in the compositions of the basalt groundwater during Cycles 2, 3, and 4, during the period of 2006 through 2008. Figure 6c displays the chemical state parameters for the basalt aquifer for both sites from 2006 through 2008. It is apparent that although the pe and pH values are consistent in the basalt at both sites, the groundwater temperature at the McCarty site is consistently 7-9 ^{o}C warmer than that at Madison Farms.

Not suprisingly, given the age and stability of the basalt aquifer, the respective concentrations of the chemicals shown tend to show less variation. Silica (Si), chloride (Cl), and sulfate (SO_4) are the exceptions, however. It is worthy of note, that the compositional excursions shown by these elements do not reflect the same year, and therefore, do not reflect a single event in time. Iron (Fe) and manganese (Mn) occur at low levels in nearly all of the basalt groundwaters.

Another relevant observation, although not particularly evident in Figure 6, is that compared to the alluvial source waters for the Madison and McCarty sites, the basalts consistently have higher temperatures (15.7 to 24.9^{o}C as compared to 10.9 to 12.9^{o}C) and lower redox potential (pe = -2.72 to 0.54 as compared to 1.0 to 2.75) than the alluvial source waters, the latter is particularly important in controlling both sulfur and iron in solution.

A question exists whether the observed variations in the raw surface water, the allluvial (source water) groundwater, and the groundwater in the basalt aquifer, may result in variable, and to some extent, unpredictable effects, associated with mixing. Particularly, whether mineral precipitation will occur, and if it does, to what extent. This question will be discussed in the chemical compatibility section below.

Figures 4 through 6 indicate that although there are some differences with time, the respective compositions of the alluvial source water and the groundwater in the deep basalt aquifer are quite consistent with one another. A relative constancy should be expected in how the compositions behave when they are mixed.

It is evident from these diagrams (see also the Stiff diagrams in Figure 3) that there are real chemical variations between the ambient basalt groundwater and alluvial source waters. Further examination indicates that the differences appear to be similar, though certainly not identical, when compared from year to year and from site to site. Specifically, relative to the ambient basalt groundwater, the alluvial source waters are higher in calcium (Ca), sodium (Na), magnesium (Mg), sulfate (SO_4), and redox (pe) character, and lower in temperature (T) and silicon (Si). Potassium (K) and pH are similar in both waters, chloride (Cl) is variable.

Figures 7a and 7b display the chemical fingerprints of the recovered waters for the Madison Farms and McCarty Ranch ASR sites during the 2006-2008 period (see also Figures 2 and 3). As expected, the recovered waters have similar patterns to the source water and basalt groundwater. Note that Fe and Mn are found above detection limits in most recovered waters. This is explored in more depth below.

Figures 8 and 9 compare, for a given year, and for the Madison and McCarty ASR sites, respectively, the differences between the alluvial source water that was injected into the basalt aquifer and the ambient basalt groundwater with which the injected source water interacted. Figure 10 compares all three water types: the ambient groundwater, the alluvial source water, and the recovered water from the Madison and McCarty ASR sites for the 2008 period. As can be seen, the recovered water from both sites falls in between the ambient groundwater and the source water compositionally, strongly suggesting that simple mixing is the primary process that operates during the injection and storage process. Mixing also is suggested by the linear array of compositions depicted in the Piper Plots (Figures 2a and 2b). Mixing is also apparent if the predicted concentration of ions in a mixture of 50 percent ambient and 50 percent alluvial groundwater are compared with the analyses for water from both the Madison and McCarty ASR sites (Figure 11).

Saturation Indices and Mineral Stability

Overview

Because of the potential impact of mineral precipitation (growth) in the aquifer and in well screens or perforations, it is important to be able to predict whether such reactions might take place during ASR operations. As described in Attachment 1, the saturation index (SI) is a measure of the tendency for a given mineral to precipitate from a solution or dissolve if present in the aquifer. The solubility of the mineral in solution is defined as how much of the mineral will dissolve in that solution. Solubilitiy is controlled by factors of pH, ORP (pe), temperature, and the presence of other dissolved constituents in the solution. If, for a given water, the geochemical factors just described above change abruptly, such that a mineral's concentration exceeds the solubility, there is a tendency for the mineral to precipitate. If the concentration is below the solubility, the mineral would tend to dissolve if present in the aquifer.

This tendency to precipitate can be determined for a given solution and presented as the SI of the mineral. PHREEQC, a computer program originally developed by the USGS (Parkhurst et al., 1980), was used because of the number of variables that must be considered when making this determination. PHREEQC uses the chemical analysis and chemical state parameters to determine the SI values for all possible minerals that might form or interact with the solution.

Numerical values of the Sis provided by the program are expressed as logarithms of the ratio of component concentration relative to the solubility limit concentrations (see Attachment 1). When a mineral is in equlibrium with the water there is no tendency for the mineral to either dissolve or precipitate. At these concentrations, the ratio of actual to theoretical concentrations is one, and therefore the log of that ratio (the SI) for the mineral is zero. If the mineral's SI is less than zero, the mineral will tend to dissolve, if greater than zero, the mineral would tend to precipitate.

Minerals identified by PHREEQC as having an SI value > 0 may pose a potential clogging problem with respect to the ASR operation. The SI only reflects a tendency, however, as other factors, especially the energy required to form a nucleus from which the mineral may grow, may actually control whether the mineral precipitates and, if so, at what rate (see below). The following subsections discuss mineral stability calaculations for the Madison and McCarty ASR sites. In a subsequent section, the analysis considers mineral stability and compatibility for a range of potential alluvial (source water) water qualities observed in the basin, compared with what has been observed at the Madison and McCarty ASR sites.

Mineral Stability of Individual Waters

Saturation indices for common mineral phases are presented in Figures 12 and 13 for the basalt groundwater and alluvial source water for the Madison and McCarty ASR sites, respectively. These SI values represent the chemical state of the receiving (basalt) and source (alluvial) waters before the injection process.

An examination of Figures 12 and 13 indicates that in both the native groundwater from the basalt and the alluvial source water, the waters are oversaturated (SI > 0) with respect to chalcedony (a silica mineral) and goethite (FeOOH). The waters are undersaturated (SI<0)with respect to the minerals dolomite ($MgCO_3$), gypsum ($CaSO_4{:}2H_2O$), halite (NaCl), iron oxyhydroxide ($Fe(OH)_3$), manganite (MnOOH), and sepiolite (a clay mineral). The waters are, in general, in equilibrium (SI = ~0) with respect to calcite ($CaCO_3$). Iron and manganese are found in the basalt groundwater more frequently than in the alluvial source water. This reflects the higher solubility of iron, as Fe^{2+}, and manganese, as Mn^{2+}, under the reducing (suboxic) environment of the basalt aquifer. Manganese was not detected in the alluvial source waters and iron was detected in only one alluvial source water and that analysis is suspect. Under the oxidizing (oxygen-rich) environment, iron and manganese are relatively insoluble.

The above observations are common to both the Madison and McCarty ASR sites. The implication of the above is that the minerals chalcedony and goethite have a tendency to precipitate within the respective aquifers in which these waters reside. It is relevant to this evaluation that there does not seem to be evidence to date at either the Madison or McCarty ASR projects reflecting precipitation and consequent clogging within either aquifer.

A question of interest, described earlier in this document, is whether the introduction of oxygenated water, derived from the recharged alluvium, into the suboxic environment of the basalt aquifer, may result in mineral precipitation, and subsequent clogging, in the basalt aquifer. Common clogging minerals include calcite, dolomite, gypsum, and iron and manganese minerals. There is no indication from the saturation indices, that precipitation of either dolomite or gypsum is likely to occur in either the alluvial or basalt aquifer. As described elsewhere in this memorandum, however, one cannot necessarily extend conclusions based on the saturation indices of the two individual waters to the water that results from the mixing of the two.

Mineral Stability of Mixed Waters

To evaluate this potential, PHREEQC calculates the saturation indices of the mixed water to be able to include the chemical state parameters of temperature, pH, and oxidation reduction potential as part of the mixing process.

Figure 14 illustrates the hypothetical mixing of ambient basalt groundwater and the alluvial source waters for the Madison ASR site (2008 ASR cycle) and the McCarty ASR site (2007 ASR cycle). These two cycle years were chosen to reflect the level of variation of waters at the respective ASR locations.

It is clear from Figure 14 that there are no surprises in the patterns of the mixed compositions relative to the actual data from the ambient basalt groundwater and the alluvial source water. The conclusions reached above regarding individual mineral saturation indices for the two existing water sets also applies to the hypothetical mixed waters.

Figure 15 extends that conclusion to all three ASR cycles at the Madison and McCarty ASR sites by displaying saturation indices of hypothetical 50:50 mixtures of ambient groundwater and alluvial source water for the 2006-2008 ASR cycles at both Madison Farms and McCarty Ranch.

Comparing that data with the Sis for the recovered waters from the two sites (Figure 16) indicates an agreement between the hypothetical mixed waters and the recovered waters with respect to the saturation indices and confirms that simple mixing is the dominant process controlling the composition of waters that are stored within the basalt aquifer.

Inverse Stabiliity Modeling to Estimate Clogging

The PHREEQC mixing models described earlier, and the compositonal data and calculated Sis of the recovered waters, all predict that the Sis for chalcedony, goethite, and for some mixtures, $Fe(OH)_3$, are greater than zero and, therefore, the precipitation of these three mineral phases and the resultant potential for clogging of the aquifer and well screens during the ASR process, theoretically does exist.

A more quantified evaluation of the potential effects of the precipitation of chalcedony and geothite on the basalt aquifer can be accomplished by inverse modeling using PHREEQC. Using the actaul analytical data that have been input, the program finds acceptable solutions to the equation:

xAmbient Groundwater + yAlluvial Source Water = Recovered Water ± mineral phases

where x and y are mixing proportions and $x + y = 1.0$. The recovered water composition is assumed to be a sample of the mixed water after some time period, which represents the time between injection of the source water and the pumping of the recovered water. The "± mineral phases" represents minerals that have been dissolved (+) from the aquifer and/or minerals that have precipitated (-) within the aquifer.

At this stage, the latter term above is of most concern because it represents the potential clogging of the aquifer, perforations, or the screens by those mineral phases that might precipitate within the aquifer. The preliminary inverse modeling of the ambient and source water indicate that mixing, as suggested by the compositional data above, is the dominant process operating during the injection-recovery phases of ASR. However, as suggested by the saturation indices, most of the models predict variable levels of potential precipitation by iron oxyhydroxide ($Fe(OH)_3$), chalcedony (SiO_2), manganite ($MnO(OH)$), and calcite ($CaCO_3$). In contrast to the SI data, goethite is not recognized as a potentially precipitating phase. This likely reflects the control of reaction kinetics and the difficulty in achieving a sufficient concentration of Fe in solution for goethite nuclei to spontaneously form. Reaction kinetics apparently favor iron oxyhydroxide over goethite.

The table below provides the results from the prelimnary models that have been developed for the Madison and McCarty ASR sites. These values do not represent a single model result, but rather are the maximum amount that might be precipitated considering all the models. They therefore represent a probable upper limit to the volume of mineral precipitates in a single site.

Maximum amount of mineral precipitate that potentially could precipitate within the aquifer. Volumes assume a 20 percent porosity within the aquifer. Results from collective models and do not represent a single aquifer.			
Mineral (Formula)	**Density (g/cm3)**	**Maximum Precipitated (Moles/Liter)**	**Volume (cm3) in 1 m3 of aquifer[1]**
Chalcedony (SiO_2)	2.6	5.7×10^{-4}	2.6
Iron Oxyhydroxide ($Fe(OH)_3$)	4	8×10^{-7}	0.004
Calcite ($CaCO_3$)	2.71	2.6×10^{-4}	1.91
Manganite (MnO(OH))	4.3	9.6×10^{-7}	0.004
1. See Attachment 2 for discussion of method of calculation.			

If the water-bearing zones within the basalt aquifer represent the highly porous interflow zones between successive lava flows, a porosity of 20 percent is reasonable. In a cubic meter, a 20 percent porosity would accommodate 200 liters of water, corresponding to 200,000 cm^3. The total potential precipitation indicated in the table above would fill approximately 4.5 cm^3, or 0.002 percent of the porosity volume. The potential impact of clogging, therefore, is considered insignificant, even when considered over an extended time period of ASR operation.

Clogging Caused by Iron Bacteria

The occurrence of dissolved iron (Fe^{2+}) in water may result in the growth of iron bacteria, organisms that obtain energy for growth from the oxidation of Fe^{2+} to Fe^{3+}. These bacteria are often filamentous and can foul well screens. They are aerobic and therefore require the presence of oxygen to grow. They operate within a pH range of 5 to 8 and “prefer” that Fe^{2+} concentrations in the water exceed 0.1 mg/L (Langmuir, 1997), even higher concentrations are required if the water is stagnant.

Given the oxygenated character of the injected alluvial source water, and iron concentration within the ambient groundwater, alluvial groundwater, and recovered waters, which vary from non-detection to greater than 0.1 mg/L, it is possible that the growth of iron bacteria could occur. In other basalt-based ASR operations in Oregon, e.g., Beaverton, Tualatin Valley Water District, etc., however, the growth of iron bacteria has not presented a significant problem. Periodic routine maintenance of the wells has been adequate to control growth.

Public Heath Issues

Thus far, the potential of chemical reactions to affect the operation of the ASR process, specifically, the loss of production as a result of depostion of mineral matter in the aquifer and around the perforations in the casing have been discussed. Chemical reactions also have the potential of mobilizing metals, e.g., Cr, Cu, Cd, Pb, Zn, Ni, etc., or nonmetals, such as As , that might be, or have the perception of being, a public health concern. Often, these potential contaminants are naturally occurring chemicals that are within or attached to existing minerals in the aquifer.

Here, two types of reactions are explored: elements released during the dissolution of aquifer minerals as discussed above, and elements released by surface reactions between the injected or mixed waters and the surfaces of the existing minerals (see disscussion in Attachement 3).

As described in more detail in Attachment 3, heavy metals may substitute for similar-sized elements that comprise the primary structural framework of a mineral. In the basalt lavas, as they were crystallizing, these metals and nonmetals were incorporated in the growing minerals in trace quantities. Because these minerals formed at high temperatures, (> 1,000^{o}C) and from a molten lava, they are not stable at the temperatures they occur at now, and certainly not in the presence of groundwater. In the latter environment, the primary minerals, i.e., plagioclase, pyroxene, + olivine, + Fe-Ti oxide (Hoover and Murphy, 1989) slowly, over geologic time, alter to minerals such as clay and Fe-oxyhydroxide. Basaltic glass can be found in some of the interflow zones (GSI, 2009). This glass is also unstable and will alter to a similar set of minerals.

The presence of water can make these reactions proceed faster, however, the solubility of silicate minerals is extremely low in water. Furthermore, the alteration minerals, e.g., $Fe(OH)_3$, tend to incorporate the metals into their structure when they grow (Appelo and Postma, 2007). Therefore, the alteration of these minerals would not result in elevated concentrations of the heavy metals in the recovered groundwater.

Heavy metals also may occur in the aquifer as adsorbed ions on existing mineral surfaces. This is the result of unsatisfied bonds occuring on the surface of minerals that make up the aquifer. This results in an electrostatic charge, generally negative in the pH range of most groundwater, at the mineral surface as well. The negative charge attracts positively charged ions (elements with a charge) in the solution to that mineral face. This attraction may result in the ions, including the heavy metals, becoming attached to that surface at a concentration that depends in part on the concentration of the ion in the water.

If a subsequent mixing event occurs that brings together two compositionally different waters, some of the elements may be subsequently removed or added to that surface. In this way, heavy metals can be transferred from the adsorbed sites to the mixed water. Adsorption is discussed in more detail in Attachment 3.

To date, no heavy metals at concentrations that result in public health concerns have been observed in recovered groundwater from Columbia River Basalt aquifers from ASR sites in the Umatilla Basin or at ASR sites in the western part of the state. These observations strongly suggest that adsorptiondesorption of heavy metals during the ASR process does not constitute a risk to water quality in the Umatilla Basin.

Regional Variation in Compostions Compared to Madison and McCarty ASR sites

When viewed as a function of time, compositional variability of ambient groundwater, alluvial source water, and recovered water is minor. Although some variability is noted, the state of the waters, as indicated by the saturation indices, are not significant from the perspective of potential mineral reactions. Now the evaluation considers other sites within the Umatilla Basin to determine if conclusions regarding the water compatibility are applicable there as well.

In conducting this regional evaluation, the objective is to determine if the chemical state, composition, and level of mineral saturation observed in ambient groundwater and alluvial source water data collected from various sites within the Umatilla Basin are similar to those of the Madison Farms and McCarty Ranch sites discussed in detail above. Two sites were selected where sufficient data are available for this evaluation: the County Line aquifer recharge (AR) site in Township 4N, Range 27E, and the Echo Meadows AR site in Township 3N, Ranges 28E and 29E (Plate 1). Not only are these sites separated by 5 or more miles, they fall on opposite sides of the Service Anticline (Plate 1), a structural high in the Columbia River Basalt. The compositions of these sites are displayed in traditional Piper Plots (Figure 17a) and Stiff Diagrams (Figure 17b). Note that the alluvial waters at these sites might best be described as Ca-HCO_3 waters.

<u>Ambient Basalt Groundwater</u>. Analyses of regional samples of ambient groundwater from the Grande Ronde Formation (GRB) of the Columbia River Basalt Group (CRBG), the formation that is the primary target as a receiving aquifer for the ASR operations (GSI, 2009), are available. Area wide sampling was accomplished by the USGS in 1983, and individual analyses and the median compostion of the GRB are available (see Table 1). No chemical state parameters, i.e., pH, pe, or ORP, are available for most of these samples however. In addition, as part of this project, IRZ collected a series of samples in October 2008, from the Echo Meadows and County Line ASR sites (Plate 1), comprising one ambient groundwater and six alluvial source water samples (also refer to Table 1).

In Figure 18, the individual chemical concentrations from the ambient groundwater from the Madison Farms and McCarty Ranch are normalized to (divided by) the median concentration of constituents from the GRB within the CRBG aquifer. This plot allows a quick view of how the ambient groundwater from the Madison and McCarty ASR sites compare to the “typical” groundwater within the CRBG. Normalized concentrations of 1.0 reflect that the concentration in the groundwater in question is equal to the average CRBG groundwater composition.

It is apparent from Figure 18 that most of the normalized constituents from the two sites have values very close to 1.0 and, therefore, compare favorably to what has been found in the CRBG elsewhere in the basin. Exceptions include chloride and sulfate, but, as can be seen, the Madison and McCarty data tend to bracket the median compositions of these two constituents.

It is important to recall from the modeling results above, that precipitation of either chloride- or sulfate-bearing minerals are not expected. The primary minerals that do display oversaturation (saturation index > 0) and could precipitate and clog the aquifer, include calcite, iron-oxyhydroxide, goethite, and chalcedony. The oversaturated characteristic for the latter two minerals is common in ambient groundwater (Figures 12 and 13). However, there is scant evidence that precipitation has occurred, even with the long residence time (years) that groundwater has been in contact with the aquifer. Although chemically possible, other reasons suggest that neither goethite nor chalcedony will precipitate during the short residence time (< 6 months) that the injected water resides in the aquifer.

In Figure 19, the actual and normalized compositions of ambient basalt groundwater from the McCarty and Madison sites are compared to the October 2008 ambient groundwater sample collected from well UMAT 1214 located near the Echo Meadows site (Plate 1). The compositions are seen to be very similar, with the exception, again, of chloride and sulfate.

Figures 20 and 21 demonstrate further that the compositions of the Madison and McCarty sites ambient groundwater compare favorably to the median CRBG groundwater and the 1983 USGS samples of the GRB groundwater. As stated above, saturation indices for the 1983 data cannot be determined because of the lack of chemical state parameters for the samples.

For the reasons stated in this section, the conclusions reached regarding the ambient basalt groundwater at the Madison and McCarty ASR sites are considered to be applicable to ambient CRBG groundwater throughout the basin.

Alluvial Source Water. For the evaluation of the applicability of conclusions related to the composition of the alluvial source water for the ASR projects, data collected at the County Line and Echo Meadows ASR sites in May and October of 2008 are considered (see Table 1). The compositions of the alluvial source water from Madison Farms and McCarty Ranch are compared with the County Line and Echo Meadows, and the respective patterns of the saturation indices are explored.

Figure 22 compares the composition and chemical state parameters of the four locations. Because of the large number of data sets, separate diagrams of the Madison and McCarty data, and a collective diagram of the Echo Meadows and County Line data are provided. The similarity in the general pattern of the compositional plots is evident, however, the two samples, CLWID 1 (MORR972 from County Line) and MLPW1 (a very shallow well from Echo Meadows) show much lower bicarbonate (HCO_3) levels than that observed at either Madison Farms or McCarty Ranch, while two samples from the County Line site, MORR956H and UMAT1571C, and one sample from a domestic well at the Echo Meadows site, TCDW1, have higher bicarbonate concentrations (see Plate 1 for sample locations). All of the samples tend to have higher calcium concentrations relative to the Madison and McCarty sites (compare Figures 17a and 17b with Figures 2 and 3).

The Ca and HCO_3^- concentrations are important with respect to the saturation levels of calcite, therefore the difference in these concentrations between the County Line-Echo Meadows alluvial source waters and that from the Madison-McCarty sites may be significant with respect to the potential of calcite precipitation (Drever, 1982). Under these conditions of elevated calcium and lower and higher bicarbonate, are the conclusions reached above regarding calcite precipitation at the Madison and McCarty sites still applicable in the basin?

Perhaps the simplest method of evaluation is to determine the SI values for calcite and dolomite (also a carbonate mineral) to determine how those values compare between the two sites. These values are shown in the table below. Recall that SI values >0 indicate that the water is oversaturated (possible precipitation) with respect to the phases in question, and SI values <0 indicate a state of undersaturation (possible dissolution).

Saturation Index **Phase**	**CLWID1 MORR972**	**MLPW1**	**MORR956H**	**UMAT1571C**	**TCDW1**
Calcite	-1.36	-1.79	0.64	0.30	0.29
Dolomite	-3.09	-3.75	0.96	0.35	0.27

As seen above, the alluvial source water samples CLWID1 (MORR972) and MLPW1 are, as one might expect with lower HCO_3 concentrations, highly undersaturated with respect to either calcite or dolomite and therefore, precipitation of either mineral will not occur. The remaining three samples have SI values for both calcite and dolomite greater than zero and, therefore, the potential for precipitation (and perhaps clogging) of these phases is possible.

Mixing of Water During Storage. The potential for clogging under these conditions may best be described by reviewing the SI values of a mixture of ambient basalt groundwater and the bicarbonate-rich alluvial waters. In the table below, the SI values for calcite and dolomite are given for two mixing models: Echo Meadows ambient groundwater (UMAT1214) with Echo Meadows TCDW1 and County Line MORR956H at mixing proportions of ambient and alluvial waters of 20:80, 50:50, and 80:20.

Predicted saturation indices, particularly for the mix between UMAT1214 (ambient) and MORR956H (alluvial) waters, are all oversaturated with respect to both of the carbonate minerals. Therefore, it is theoretically possible that these mineral phases could precipitate from the mixed solution.

A value of SI >0 indicates that mineral growth through precipitation is possible, especially if there is an existing site for the mineral to grow. Many authors have discussed the nucleation step as a part of the mineral growth process (Stumm and Morgan, 1981; Drever, 1982; Langmuir, 1997) and have noted that the formation of a nucleus upon which the mineral can grow serves as an energy-related barrier to mineral growth. Generally, the level of supersaturation has to exceed saturation by 1 to 2 orders of magnitude (SI = 1.0 to 2.0), depending on whether an existing mineral phase in the aquifer with similar mineral structure exists that the mineral can grow upon (Stumm and Morgan, 1981). Even then, the statistical survival of a mineral nucleus is not particularly favored because of its small size. With respect to mineral structure, neither calcite's nor dolomite's mineral structure is comparable to the structure of the silicate minerals that comprise the basalt aquifer.

The above argument, coupled with the lack of evidence for mineral growth for those minerals with SI values greater than zero in the basalt aquifer, suggest that neither calcite nor dolomite will precipitate from the mixed water during the short time frame typically associated with the storage phase of ASR.

Saturation Indices (SI) for calcite and dolomite for mixed water resulting from variable proportions of ambient groundwater and alluvial source water.						
Mixing UMAT1214 (ambient) and TCDW1 (Echo Meadows alluvial source water)						
	Ambient	Alluvium	Ambient	Alluvium	Ambient	Alluvium
Alluvium ratio	20	80	50	50	80	20
Calcite	0.27		0.25		0.24	
Dolomite	0.27		0.29		0.35	
Mixing UMAT1214 (ambient) and MORR956H (County Line alluvial source water)						
	Ambient	Alluvium	Ambient	Alluvium	Ambient	Alluvium
Alluvium ratio	20	80	50	50	80	20
Calcite	0.60		0.53		0.41	
Dolomite	0.92		0.85		0.68	

Figure 23 compares the saturation indices for the respective compositions shown in Figure 22. Again patterns are similar, however, the SI values for $Fe(OH)_3$ are significantly higher. To explore this and the HCO_3 variation, the saturation indices of mixtures of representative compositions from the alluvial source water and the ambient groundwater collected at Echo Meadows (UMAT 1214) during the same period were modeled. As expected, the table below indicates that the mixed waters have elevated SI values for both $Fe(OH)_3$ and goethite.

The discussion regarding the energy barrier that needs to be overcome for precipitation to occur still applies, however, the SI values in the table are greater than 2 orders of magnitude above saturation and the potential impact of precipitation of these phases should be estimated.

There may be some legitmite reasons to question the analytical data for dissolved iron in both the County Line and Echo Meadow alluvial groundwater samples. As already discussed, iron tends to dissolve under reducing (oxygen deficient) conditions and precipitate under oxidizing conditions. Given that situation, it is difficult to explain the very high iron content (up to 0.344 mg/L) in the source water in the sample TCDW1, even more so given the highly oxidized character (ORP = 455) of this water. It is possible that some of the “dissolved” iron is actually particulate iron that did not get fully separated before analysis.

Saturation Indices (SI) for $Fe(OH)_3$ and goethite for mixed water resulting from variable proportions of ambient groundwater and alluvial source water at Echo Meadows.						
Mixing UMAT1214 (ambient) and TCDW1 (Echo Meadows alluvial source water)						
	Ambient	Alluvium	Ambient	Alluvium	Ambient	Alluvium
Alluvium ratio	20	80	50	50	80	20
$Fe(OH)_3$	2.87		2.57		2.21	
Goethite	8.42		8.23		7.99	
Mixing UMAT1214 (ambient) and MLPW1 (Echo Meadows alluvial source water)						
	Ambient	Alluvium	Ambient	Alluvium	Ambient	Alluvium
Alluvium ratio	20	80	50	50	80	20
$Fe(OH)_3$	1.93		1.97		1.97	
Goethite	7.50		7.65		7.75	

If the analysis is accepted, however, a “worst case scenario” can be determined with respect to the amount of $Fe(OH)_3$ that would be precipitated. Assuming that the entire amount of “dissolved” iron (0.44 mg/L) precipitates (actual PHREEQC models predict much less), and perform the calculations described above and in Attachment 2, the the amount of pore space that would be filled with $Fe(OH)_3$ would be 0.02 percent, a negligible amount. A similar conclusion was reached for recovered (mixed and stored) water at the Madison Farms and McCarty Ranch sites, indicating a low probability of clogging by the precipitation of iron-oxyhydroxide.

Conclusions

1. **The chemical data indicate that compositional variations exhibited by the alluvial source water and the ambient basalt groundwater are similar during the 2006-2008 time period and are similar between the Madison and McCarty ASR sites.**
    a. The data shown in Figure 4 suggest that, during the period from 2006 through 2008, the relative composition of the alluvial source waters for the Madison Farms and McCarty

Ranch display similar patterns, with the possible exception of HCO_3, Si, and SO_4, and suggest compositons that do not vary significantly with time.

   b. Chemical data for the groundwater from the basalt aquifer are very consistent during the 2006-2008 period, suggesting that temporal variations within the receiving aquifer are not likely to change with time. As with the source waters, the concentrations of HCO_3, Si, and SO_4 show variations.

   c. Real differences occur in the composition of ambient groundwater and allluvial source waters as illustrated in Figures 8 and 9, but as indicated in a and b above, those differences remain very similar over time and space.

2. **The calculated saturation indices (SI), which indicate whether specific minerals will precipitate from the water or will dissolve from the aquifer, for the ambient basalt groundwaters and source waters are consistent with time and between the Madison and McCarty ASR sites.**

   a. Similarities exist with respect to those minerals that are oversaturated, e.g., chalcedony and goethite, and undesaturated, e.g., dolomite, gypsum, and halite (Figures 12 and 13).

   b. Calcite is near saturation at both sites.

   c. Calculated saturation indices for hypothetical mixtures of variable proportions and over time do not show significant variations over time or between ASR sites (Figures 14 and 15).

   d. Introduction of oxygenated source water into the suboxic basalt aquifer in some cases result in the minerals manganite and ferric oxyhydroxide to become oversaturated with respect to the mixed water.

3. **The composition of the recovered waters for the Madison and McCarty ASR sites have similar compositional characteristics to the alluvial source water and ambient basalt groundwaters, including the variations of HCO_3, Si, and SO_4.**

   a. The composition of the recovered water generally falls between the respective compositions of the alluvial source water and ambient basalt groundwater (Figures 10 and 11), suggesting that mixing of these two waters is the dominant process operating within the basalt aquifer.

   b. The saturation indices for the recovered waters at both the McCarty Farms and Madison Ranch sites show similar patterns to the indices for the basalt and alluvial source waters, including the minerals that are oversaturated and undersaturated with respect to the mixed waters.

4. **The consistency of the data and model results presented in this memorandum support the contention that the water quality compatibility observed at the Madison and McCarty ASR sites are applicable across the Umatilla Basin.**

    a. Chemical state parameters (Figures 4c and 6c), which fundamentally control the compatibility issue, of the ambient basalt groundwaters show marked consistency through time at the McCarty and Madsion ASR sites, as well as at Echo Meadows and the County Line projects and the median composition of groundwater from samples collected by the USGS of the GRB (Figure 18), which represents a regional value.

    b. The saturation indices of the ambient basalt groundwater from the Madison and McCarty ASR sites compare favorably to the those indices of the median GRB groundwater values (Figure 20).

    c. The composition of ambient basalt groundwater from the Madison and McCarty ASR sites, when compared with the ambient basalt groundwater from the basalt well located near Echo Meadows , as well as individual samples of groundwater from the GRB, are very similar in nature (Figure 21).

    d. The composition of alluvial source waters from the Madison Farms and McCarty Ranch ASR sites are similar to the alluvial source waters at the County Line and Echo Meadows ASR sites (Figure 22), with the notable exception of

        i. Calcium (Ca) and bicarbonate (HCO_3), where the data from the latter two sites show a larger variation, and

        ii. Iron oxyhydroxide, where reported concentrations of dissolved iron are higher than that observed at the Madison-McCarty sites.

5. **The potential for the ASR process of mixing oxidized and reduced waters to result in public-health-related water quality problems is not significant.**

    a. The silicate minerals that comprise the basalt aquifer have very low solubiites and will not contribute significantly, at least on the time scale of ASR operations, to the injected water.

    b. A potential result of mixing oxidized and reduced groundwater, as indicated in the PHREEQC modeling done here, is the precipitation of iron-oxyhydroxide. This substance is known to strongly adsorb metals from solution.

    c. To date, there is no evidence of the occurrence of heavy metals in the recovered water from ASR operations in basalt aquifers in the Umatilla Basin.

6. **The data set described here and the results of the chemical modeling do not suggest that there are significant chemical compatibility problems associated with ASR projects within the Umatilla Basin**

    a. Ambient groundwater from the basalt at the two sites have existed with supersaturated conditions for calcite, chalcedony, iron-oxyhydroxide, and goethite, for a time period much longer than a typical ASR cycle without noticeable degradation, suggesting that factors related to nucleation and mineral growth have an impact on mineral precipitation.

    b. Introduction of oxygenated source water into the suboxic basalt aquifer may result in the precipitation of manganite and ferric oxyhydroxide. However, the calculated worst-case scenarios for mineral precipitation indicate that if precipitation of chalcedony, calcite, iron-oxyhydoxide and manganite all took place simultaneously, they would occupy no more than 0.02 percent of available pore space in the basalt aquifer and, therefore, likely would not reduce production levels.

    c. Oregon ASR operations involving basalt aquifers, e.g., Salem and Beaverton, have been in operation for more than 10 years without evidence of significant loss of production because clogging as a result of mineral precipitation, or potential water quality concerns related to mineral reactions between the injected water and the basalt aquifer.

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Table 1. Water Quality Data Table

Umatilla Basin Aquifer Recharge Project

		Data Source	Samples Collected by IRZ for Umatilla Basin Aquifer Recharge Project									USGS Samples
		Original Sample ID	HCSW2	U1269	TCDW1	MLPW1	MORR972	U1571	MORR968W	MORR968W_Dup.	McNary Pool	03N28E35BAA
		Well ID	Hunt Ditch	UMAT1269			MORR 972	UMAT 1571	MORR 968	MORR 968_Dup.		UMAT 1229 (6356)
		Water Type	Surface Water	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Surface Water	Groundwater
Analytes	**Unit**	**Standard**	5/20/2008	5/20/2008	10/22/2008	10/22/2008	5/21/2008	10/22/2008	10/22/2008	10/22/2008	5/19/2008	7/21/1983
Alkalinity as CaCO3 (Lab.)	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA	151
Dissolved Oxygen	mg/L	None	8.6	NA	4.44	3.04	7.6	8.44	6.22	6.22	NA	NA
ORP	mV	None	71	NA	455	557	29.9	352	191	191	NA	NA
pH	pH	6.5-8.5	5.65	NA	7.66	6.66	7.2	7.53	7.94	7.94	NA	8.1
pH (Lab.)			NA	NA	NA	NA	NA	NA	NA	NA	NA	7.7
Specific Conductance	µs/cm	None	43	NA	821	240	145	986	1051	1051	NA	328
Temperature	°C	None	10.3	NA	13.6	14.4	16.3	15.1	14.3	14.3	NA	26.2
Alkalinity (as CaCO3)	mg/L	None	NA	NA	241	65	70.4	265	167	172	NA	166
Bicarbonate	mg/L	None	18.4	229	241	65	70.4	265	167	172	NA	202
Calcium	mg/L	None	4.15	67.8	63.4	13.4	18.6	82.3	85.6	76.9	NA	21
Carbonate	mg/L	None	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	0
Chloride	mg/L	250	0.72	53.8	18.7	3.78	1.95	30	34.1	34	NA	20
Hardness (as CaCO3)	mg/L	None	NA	NA	243	57.2	68.6	323	322	289	NA	89
Magnesium	mg/L	None	1.5	30.4	20.5	5.75	5.36	28.4	26.1	23.4	NA	8.8
Nitrate (measured as N)	mg/L	10	0.1 U	7.57	2.98	1.22	0.314	17.4	16.7	16.6	NA	NA
Nitrite (measured as N)	mg/L	1	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA
NO3+NO2 as N	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Potassium	mg/L	None	1.44	10.4	3.7	3.44	2	4.98	4.81	4.85	NA	7
Silica	mg/L	None	13.2	19.9	24.2	21.6	16	28.9	24.5	22.2	7.01	75
Sodium	mg/L	None	2.72	52.5	25.1	8.3	6.64	32.4	27.4	24.6	NA	39
Sulfate	mg/L	250	0.967	76.5	28	4.86	2.56	49.6	86.7	86.4	NA	1.3
Total Dissolved Solids	mg/L	500	NA	NA	389	146	98	549	526	499	NA	NA
Total Organic Carbon	mg/L	None	2.37	2.43	2.26	1.49	1.82	1.89	2.41	2.43	2.55	NA
Iron (Dissolved)	mg/L	0.3	0.111	0.1	0.344	0.069	0.07	0.454	0.43	0.429	0.085	0.03
Iron (Total)	mg/L	None	0.751	2.02	0.383	0.082	0.091	0.508	0.47	0.47	0.42	NA
Manganese (Dissolved)	mg/L	0.05	0.001 U	0.002	0.001	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01
Manganese (Total)	mg/L	None	0.02	0.089	0.001	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.017	NA

Note:
Est. = Estimated value.
U = not detected at indicated method reporting limit
NA = Not Analyzed
GRB = Grande Ronde Basalt Groundwater

GSI
Water Solutions, Inc.

Table 1. Water Quality Data Table
Umatilla Basin Aquifer Recharge Project

		Data Source	USGS Samples					Madison Farms ASR Project by GSI				
		Original Sample ID	01N26E05BBA	01N 25E10CDD	01N 27E05CCB	02N28E10ABD	Median GRB	Native Groundwater	Native Groundwater	MAD-NBG-C4-1 Native Groundwater	MAD-C2SW-1 Source Water	MAD-C3SW-1 Source Water
		Well ID	MORR 412	MORR 395	MORR 455 (50530)	UMAT 476						
		Water Type	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Source Water	Source Water
Analytes	**Unit**	**Standard**	7/25/1983	7/28/1983	7/28/1983	8/2/1983		3/9/2006	3/13/2007	3/3/2008	3/22/2006	3/13/2007
Alkalinity as CaCO3 (Lab.)	mg/L		145	139	153	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen	mg/L	None	0.1	0.8	1.6	0.2	NA	NA	NA	8.6	NA	NA
ORP	mV	None	NA	NA	NA	NA	-176 Est	-160	23	-128	70	67
pH	pH	6.5-8.5	8.1	7.9	7.8	7.8	7.89	7.96	7.64	7.78	7	7.47
pH (Lab.)			8	8.1	7.8	7.9	NA	NA	NA	NA	NA	NA
Specific Conductance	µs/cm	None	342	318	310	342	312	304	356	383	564	697
Temperature	°C	None	24.2	17.2	22.4	23.9	18.3	16.9	15.7	16.2	11.5	11.1
Alkalinity (as CaCO3)	mg/L	None	144	139	157	176	NA	148	155	164	197	262
Bicarbonate	mg/L	None	176	169	192	214	169.9	181	190	164	240	320
Calcium	mg/L	None	22	24	27	31	22.9	18.9	20	19.1	47.6	58
Carbonate	mg/L	None	0	0	0	0	18.7	ND	2	10 U	ND	2 U
Chloride	mg/L	250	20	11	11	9.7	6.9	22	14	13.6	16	17
Hardness (as CaCO3)	mg/L	None	100	110	120	130	NA	84.9	91	83.8	184	230
Magnesium	mg/L	None	11	13	13	13	10.3	9.2	9.9	8.75	15.9	21
Nitrate (measured as N)	mg/L	10	NA	NA	NA	NA	0.68	ND	0.1 U	ND	5.54	6.4
Nitrite (measured as N)	mg/L	1	NA	NA	NA	NA	NA	ND	0.1 U	ND	ND	0.2 U
NO3+NO2 as N	mg/L		0.1 U	0.45	0.7	0.1 U	NA	NA	NA	NA	NA	NA
Potassium	mg/L	None	8.3	7.4	5.7	6.8	4.9	7.2	6.9	5.82	4.52	4.8
Silica	mg/L	None	67	61	67	66	57.2	60.3	68	24.4	39.8	54
Sodium	mg/L	None	35	23	23	20	27.7	39	37	33.4	49.6	58
Sulfate	mg/L	250	20	18	9.1	0.9	14	ND	5.9	7.4	26.9	46
Total Dissolved Solids	mg/L	500	NA	NA	NA	NA	NA	218	240	227	354	432
Total Organic Carbon	mg/L	None	NA	NA	NA	NA	NA	ND	0.58	1.07	4.5	2.9
Iron (Dissolved)	mg/L	0.3	0.03	0.02	0.03		0.051	ND	0.072	0.154	ND	0.02 U
Iron (Total)	mg/L	None	NA	NA	NA	NA	NA	0.044	0.1	0.159	ND	0.02 U
Manganese (Dissolved)	mg/L	0.05	0.02	0.001 U	0.001 U	0.14	0.015	ND	0.039	0.043	ND	0.002 U
Manganese (Total)	mg/L	None	NA	NA	NA	NA	NA	0.027	0.034	0.0406	ND	0.002 U

Note:
Est. = Estimated value.
U = not detected at indicated method reporting l
NA = Not Analyzed
GRB = Grande Ronde Basalt Groundwater

GSI Water Solutions, Inc.

Table 1. Water Quality Data Table
Umatilla Basin Aquifer Recharge Project

		Data Source	Madison Farms ASR Project by GSI						McCarty Ranch ASR Project by GSI			
		Original Sample ID	MAD-SW-C4-1 Source Water	MAD-C2R-2 Recovery	MAD-C3R-1 Recovered Water	MAD-C3R-2 Recovered Water	MAD-RW-C4-1 Recovery	MAD-RW-C4-2 Recovery	Native Groundwater	Pre-Injection Groundwater	MCC-NBG-C4-1 Native Groundwater	MCC-C2bSW-1 Source Water
		Well ID										
		Water Type	Source Water	Recovered Water	Recovered Water	Recovered Water	Recovered Water	Recovered Water	Groundwater	Groundwater	Groundwater	Source Water
Analytes	**Unit**	**Standard**	2/4/2008	8/17/06 9:20AM	6/11/2007	6/27/2007	8/4/2008	9/8/2008	2/9/2006	12/19/2006	Jan-08-2008	6/7/2006
Alkalinity as CaCO3 (Lab.)	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen	mg/L	None	8.8	NA	NA	NA	5.8	5.3	NA	NA	3.9	NA
ORP	mV	None	79	-114	16	3	-1	1	-95	32	-31	162
pH	pH	6.5-8.5	7.5	7.62	7.69	7.76	7.25	7.62	7.82	8.17	7.48	7.32
pH (Lab.)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific Conductance	µs/cm	None	783	399	497	429	567	526	0.271	0.295	321	0.506
Temperature	°C	None	12.3	18.7	18.4	19.7	14.5	15.5	24.9	22.9	23.1	12.9
Alkalinity (as CaCO3)	mg/L	None	261	170	207	183	237	219	114	131	149	203.6
Bicarbonate	mg/L	None	261	170	250	220	237	219	139	160	149	248.2
Calcium	mg/L	None	60.9	27.7	36	27	41.8	36.4	20.1	19	21	49.9
Carbonate	mg/L	None	5 U	0	2 U	2	5 U	5 U	ND	2 U	5 U	ND
Chloride	mg/L	250	28.2	13.1	13	7.6	10.9	8.62	100	7.5	31.6	4
Hardness (as CaCO3)	mg/L	None	235	119	160	120	175	152	85.9	83	88.3	198
Magnesium	mg/L	None	20.2	12.1	16	13	17	14.8	8.66	8.7	8.69	17.8
Nitrate (measured as N)	mg/L	10	8.99	ND	0.2 U	0.2 U	ND	ND	ND	0.1 UH	ND	5.52
Nitrite (measured as N)	mg/L	1	0.5	ND	0.2 U	0.2 U	ND	ND	ND	0.1 UH	ND	ND
NO3+NO2 as N	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	mg/L	None	4.9	7.45	7.3	7	6.31	6.08	7.39	6.7	6.34	3.71
Silica	mg/L	None	21.6	31.4	64	70	31.7	25.9	36	76	31.2	14.1
Sodium	mg/L	None	57	52.7	48	43	52.9	44.4	29.1	26	26.7	43.2
Sulfate	mg/L	250	70.8	15.1	25	11	54.3	18.6	2.65	0.0005 U	56.3	46.4
Total Dissolved Solids	mg/L	500	466	272	326	280	370	343	204	194	211	286
Total Organic Carbon	mg/L	None	3.12	1.1	2	0.98	3.26	2.84	1 U	0.3 U	1.03	NA
Iron (Dissolved)	mg/L	0.3	0.535	0.033	0.02	0.02 U	0.0488	0.24	NA	0.02 U	0.0592	ND
Iron (Total)	mg/L	None	0.489	0.049	0.034	0.032	0.0782	0.308	0.027	0.02 U	3.15	ND
Manganese (Dissolved)	mg/L	0.05	0.001 U	0.053	0.066	0.048	0.0249	0.0588	NA	0.0095	0.0065	ND
Manganese (Total)	mg/L	None	0.001 U	0.055	0.065	0.048	0.0717	0.0745	NA	0.015	0.0348	ND

Note:
Est. = Estimated value.
U = not detected at indicated method reporting l
NA = Not Analyzed
GRB = Grande Ronde Basalt Groundwater

Table 1. Water Quality Data Table
Umatilla Basin Aquifer Recharge Project

		Data Source	McCarty Ranch ASR Project by GSI								
		Original Sample ID	MCC-C3SW-1 Source Water	MCC-C3SW-2 Source Water	MCC-SW-C4-1 Source Water	MCC-SW-C4-2 Source Water	MCC-C2bR-1 Recovery	MCC-C3R-1 Recovery	MCC-C3R-2 Recovery	MCC-RW-C4-1 Recovery	MCC-RW-C4-2 Recovery
		Well ID									
		Water Type	Source Water	Source Water	Source Water	Source Water	Recovered Water	Recovered Water	Recovered Water	Recovered Water	Recovered Water
Analytes	**Unit**	**Standard**	12/19/2006	3/27/2007	Dec-12-2007	Apr-14-2008	6/15/2006	5/15/2007	6/27/2007	7/8/2008	9/8/2008
Alkalinity as CaCO3 (Lab.)	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen	mg/L	None	NA	NA	6.8	7.7	NA	NA	NA	1.7	-0.5
ORP	mV	None	59	109	105	95	-46	6	2	4	4
pH	pH	6.5-8.5	7.29	7.48	6.96	7.06	6.9	7.59	7.79	6.94	7.5
pH (Lab.)			NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific Conductance	µs/cm	None	0.549	0.504	590	513	0.319	0.485	0.394	526	447
Temperature	°C	None	12.5	9.6	11.8	12.1	22.9	16.2	21.6	12.7	16.8
Alkalinity (as CaCO3)	mg/L	None	233	208	254	206	150	225	181	224	212
Bicarbonate	mg/L	None	280	254	254	206	183	270	220	224	212
Calcium	mg/L	None	51	45	46.2	38.5	26.2	39	30	43	32.9
Carbonate	mg/L	None	2 U	2 U	5 U	10 U	ND	2 U	2 U	5 U	5 U
Chloride	mg/L	250	8.2	7.7	8.04	8.4	5	8.2	13	6.13	12.6
Hardness (as CaCO3)	mg/L	None	200	180	184	156	112	160	130	172	135
Magnesium	mg/L	None	18	16	16.6	14.5	11.2	16	13	15.6	12.7
Nitrate (measured as N)	mg/L	10	3.4 H	6	5.36	4.84	ND	0.2 U	0.2 U	ND	ND
Nitrite (measured as N)	mg/L	1	0.2 U	0.1 U	ND	ND	ND	0.2 U	0.2 U	ND	ND
NO3+NO2 as N	mg/L		NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	mg/L	None	4.3	3.7	3.2	3.31	7.94	5.3	6.8	4.19	5.4
Silica	mg/L	None	56	52	0.001 U	49	29.5	56	67	23.9	24.6
Sodium	mg/L	None	39	40	31.5	36.7	32.7	36	33	39.2	32.2
Sulfate	mg/L	250	15	18	18.9	20.6	ND	18	15	21.4	47.8
Total Dissolved Solids	mg/L	500	373	316	337	364	198	246	256	299	551
Total Organic Carbon	mg/L	None	2.1	4	2.06	4.98	NA	13	1.4	3.53	3.01
Iron (Dissolved)	mg/L	0.3	0.02 U	0.02 U	0.256	0.01 U	0.063	0.02 U	0.02 U	0.01 U	0.227
Iron (Total)	mg/L	None	0.02 U	0.02 U	0.25	0.01 U	0.068	0.02 U	0.02 U	0.365	0.189
Manganese (Dissolved)	mg/L	0.05	0.002 U	0.002 U	0.001 U	0.001 U	NA	0.024	0.024	0.0136	0.001 U
Manganese (Total)	mg/L	None	0.002 U	0.002 U	0.001 U	0.001 U	NA	0.027	0.024	0.0138	0.0279

Note:
Est. = Estimated value.
U = not detected at indicated method reporting l
NA = Not Analyzed
GRB = Grande Ronde Basalt Groundwater

Table 2. Generalized Observations Regarding the Differences between Surface Water and Deep Groundwater

Surface Water	Groundwater
Oxidizing: In contact with the atmosphere	Reducing: Oxygen deficient as a result of oxygen consuming reactions
Lower pH (6 – 7): Water dominated by precipitation; pH of Oregon precipitation ~5.7	Neutral to slightly alkaline pH (7.5-8.5): Hydrogen ion consumed by water-rock reactions
Higher in total/dissolved organic carbon (TOC/DOC)	DOC generally less than 2.0 mg/L
Lower total dissolved solids (TDS): water in contact with solid phases only briefly	Higher TDS: Longer residence time for water in contact with solids
Water temperatures often cooler in winter months (<12°C, ~52°F); may be large seasonal variations	Water temperatures often warmer in winter months (>15°C,~60°F); little seasonal variation

.

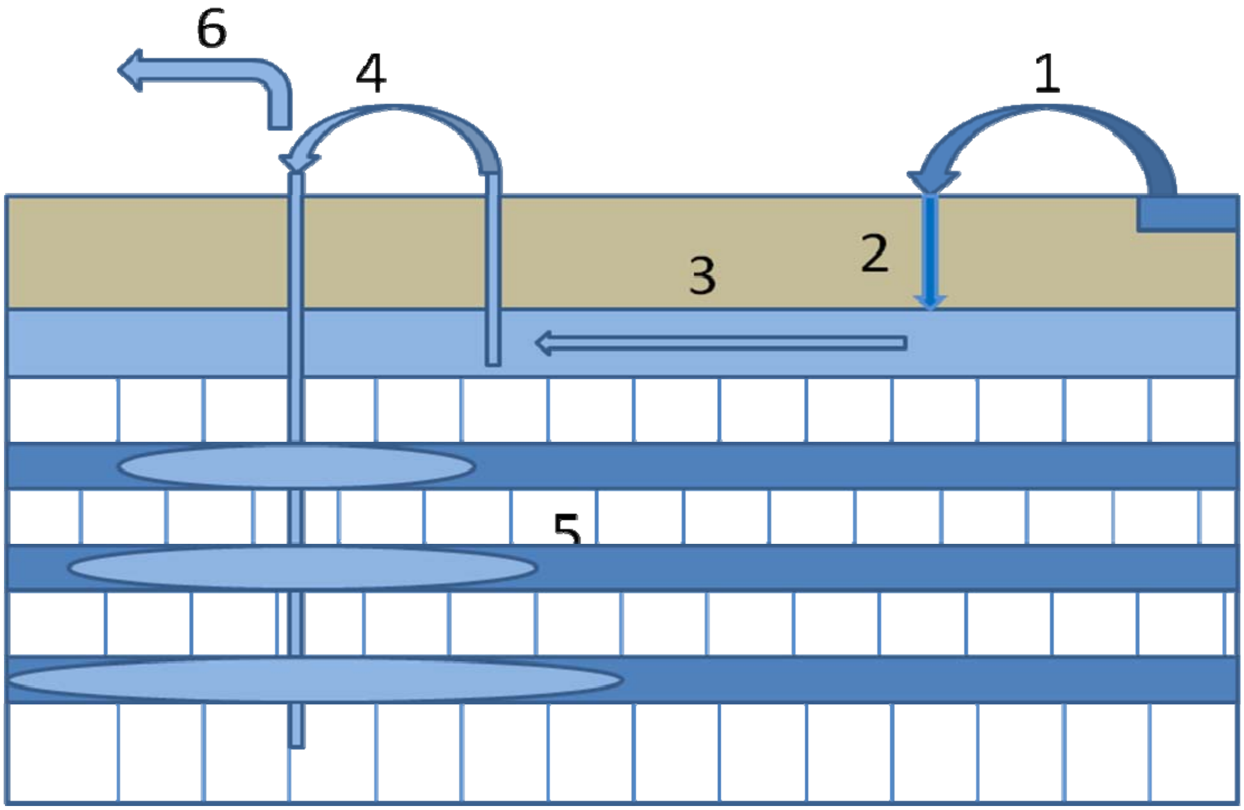
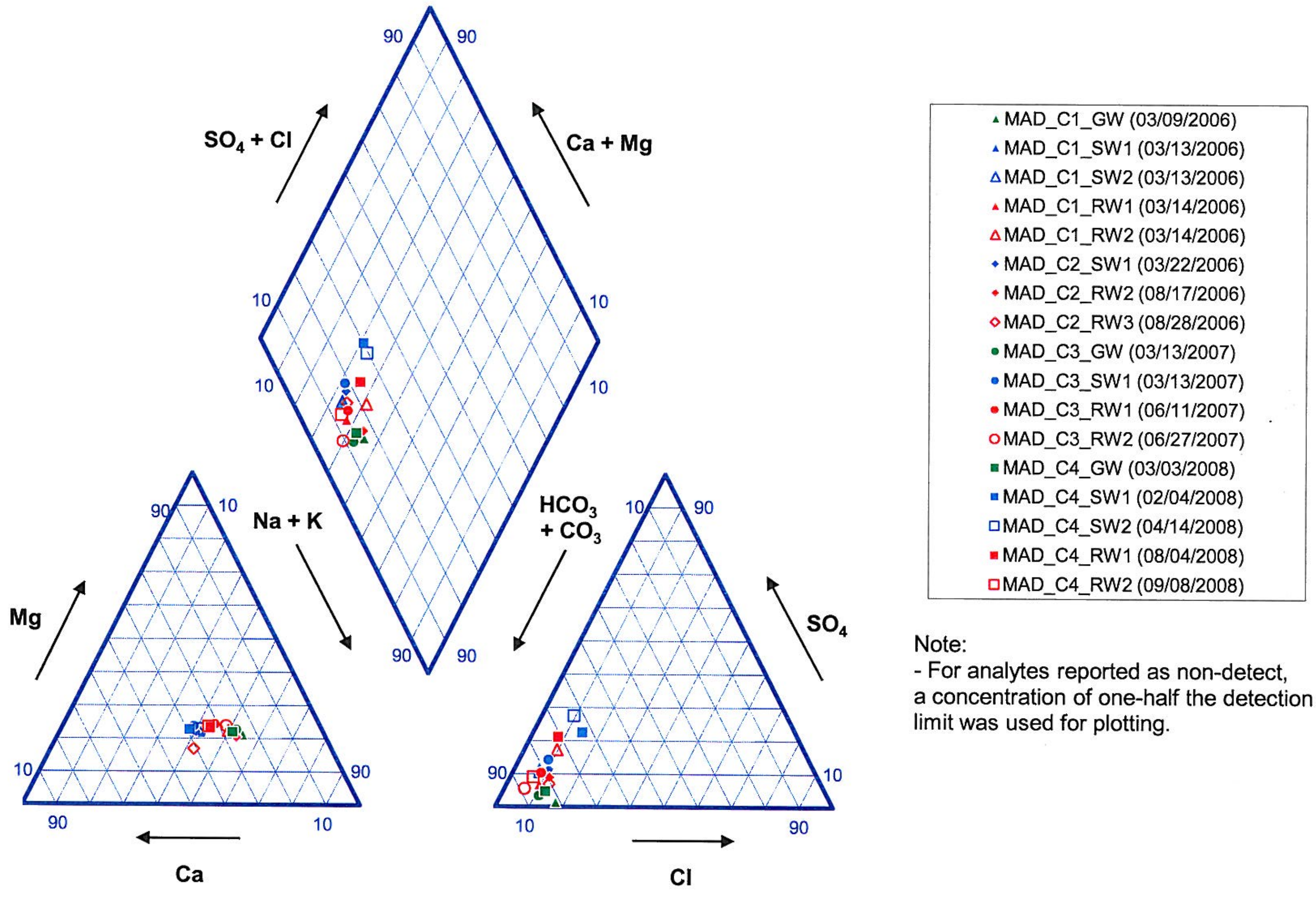


Figure 1. Conceptual model of the ASR operations in the Umatilla Basin.

Chemical reactions and physical mixing can occur along steps 2, 3, and 5. Chlorination at 4 also may result in the formation of disinfection by products. For the purpose of this evaluation, the primary concern is those reactions that would take place during step 5 to ensure compatibility between the injected alluvial groundwater and the groundwater in the receiving basalt aquifer. Water is injected during step 4. The injected water (light blue) displaces the ambient groundwater (dark blue) and mixing occurs. After an appropriate storage time, the stored water, potentially modified by mixing and chemical reactions, is extracted (step 6).



Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used for plotting.

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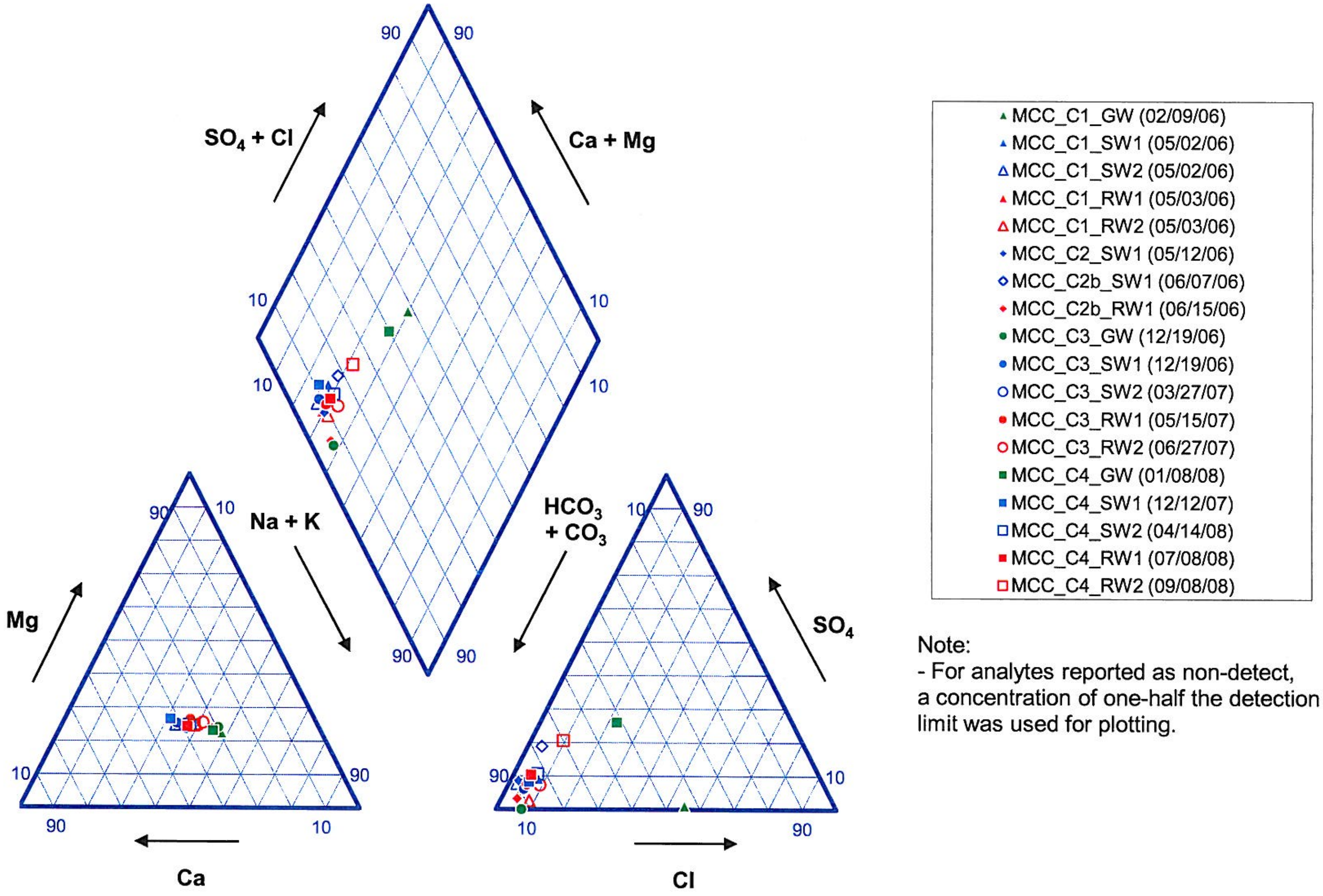
Figure 2a
Piper Diagram for the Madison samples
Umatilla Basin ASR Program



Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used for plotting.

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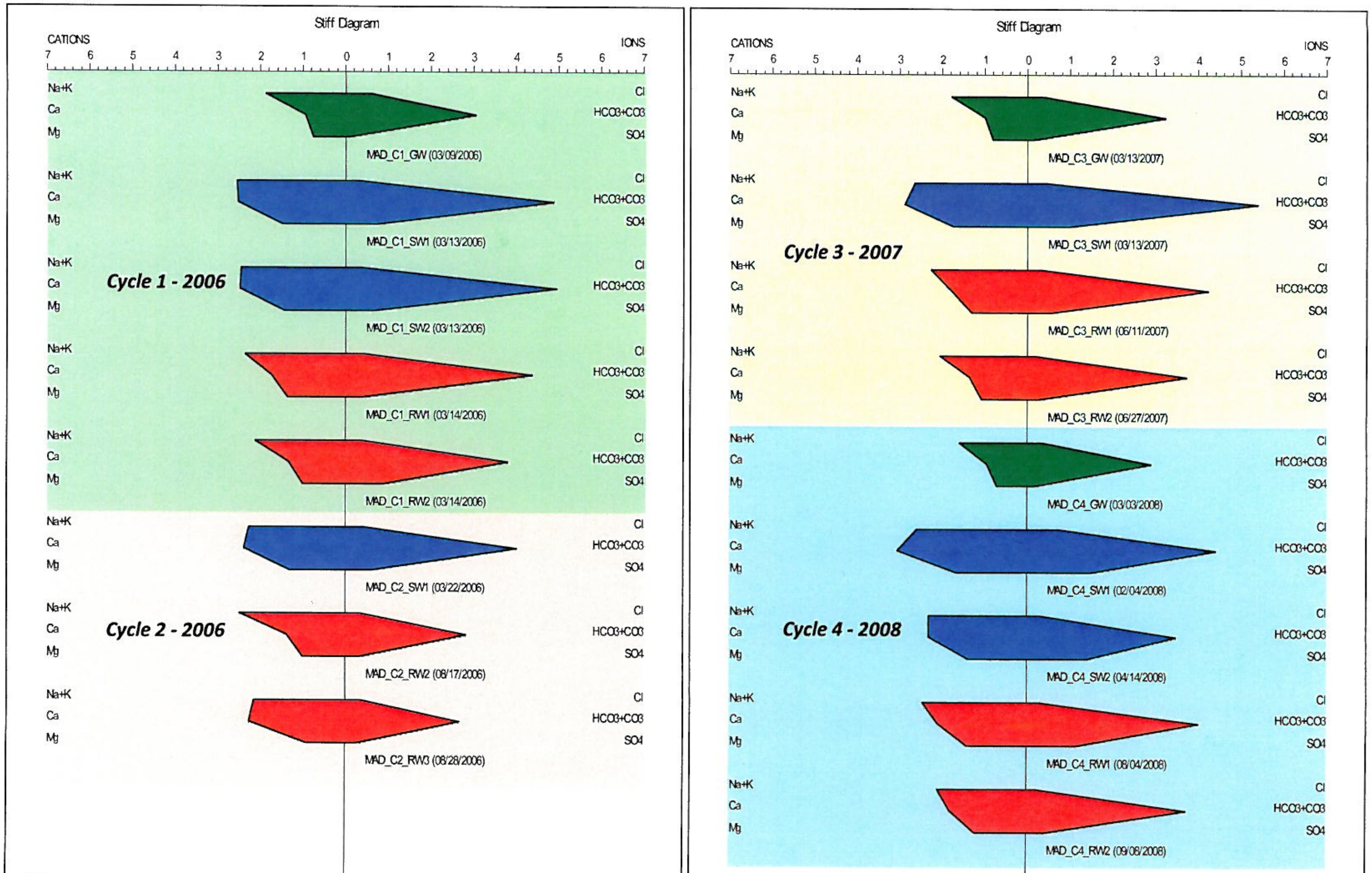
Figure 2b
Piper Diagram for the McCarty samples
Umatilla Basin ASR Program



Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used For plotting.

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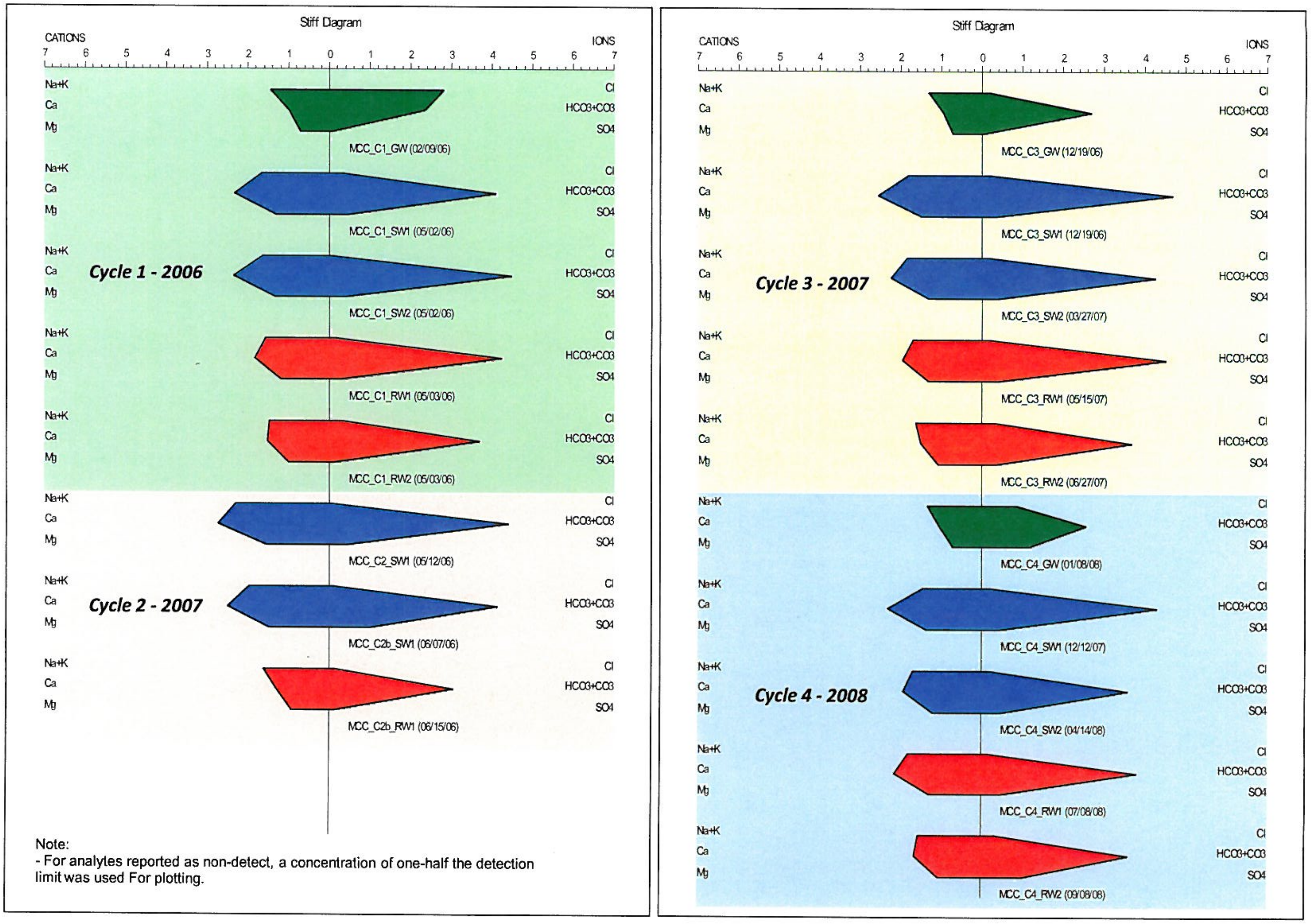
Figure 3a

Stiff Diagram for the Madison samples

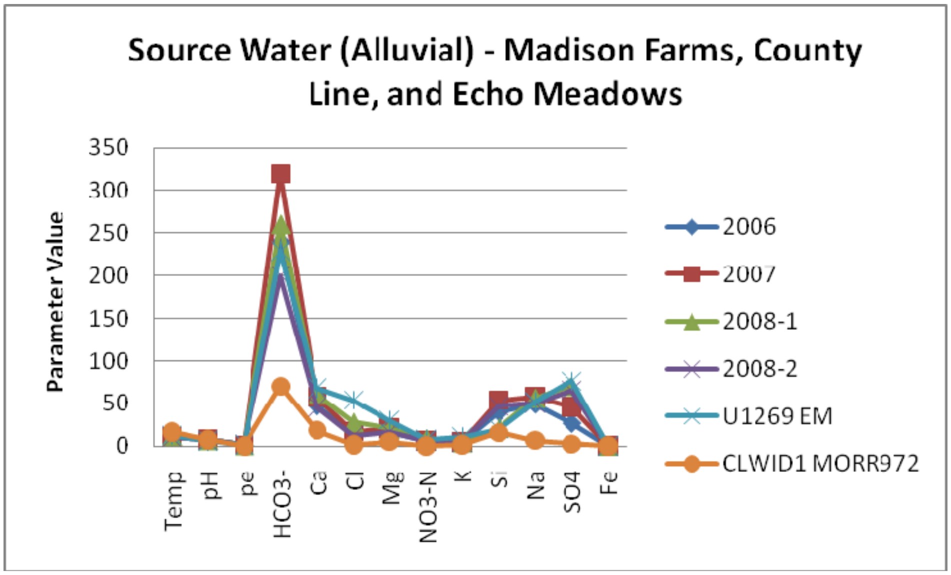
Umatilla Basin ASR Project



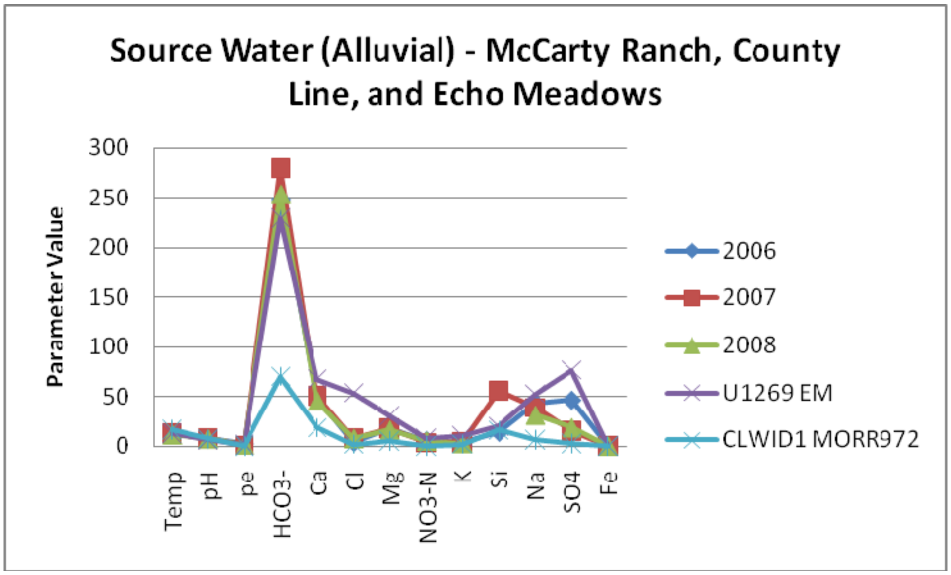
Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used For plotting.

GSI Water Solutions, Inc.

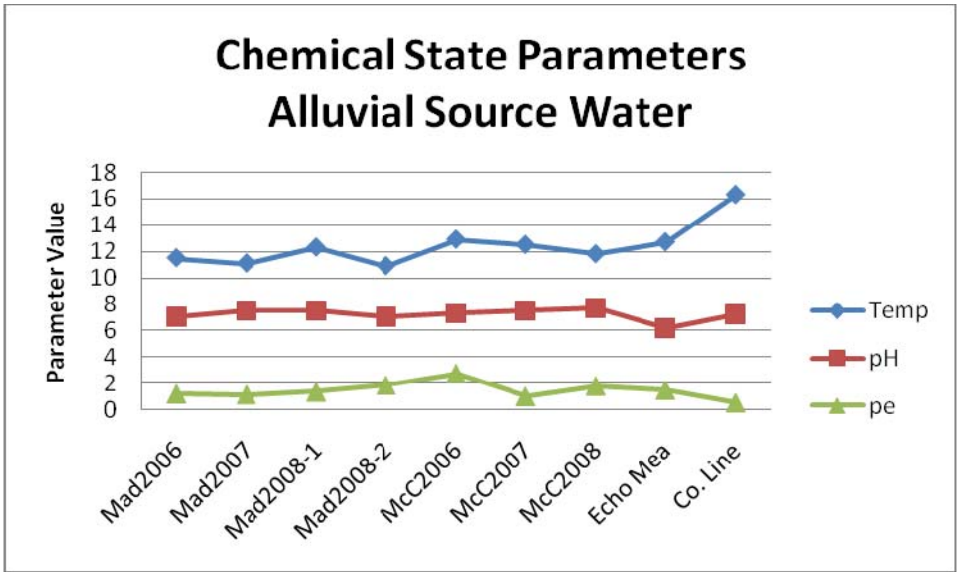
Figure 3b
Stiff Diagram for the McCarty samples
Umatilla Basin ASR Project



(Figure 4a)



(Figure 4b)



(Figure 4c)

Figure 4. Compositional diagrams for the groundwater derived from the shallow alluvial aquifer to be used for injection for the (Figure 4a) Madison Farms and (Figure 4b) McCarty Ranch ASR sites. Figure 4c represents the chemical state parameters for the combined ASR sites. The data span the time period from 2006 through 2008. Alluvial groundwater from the County Line (MORR972) and Echo Meadows (U1269) projects are included for comparison.

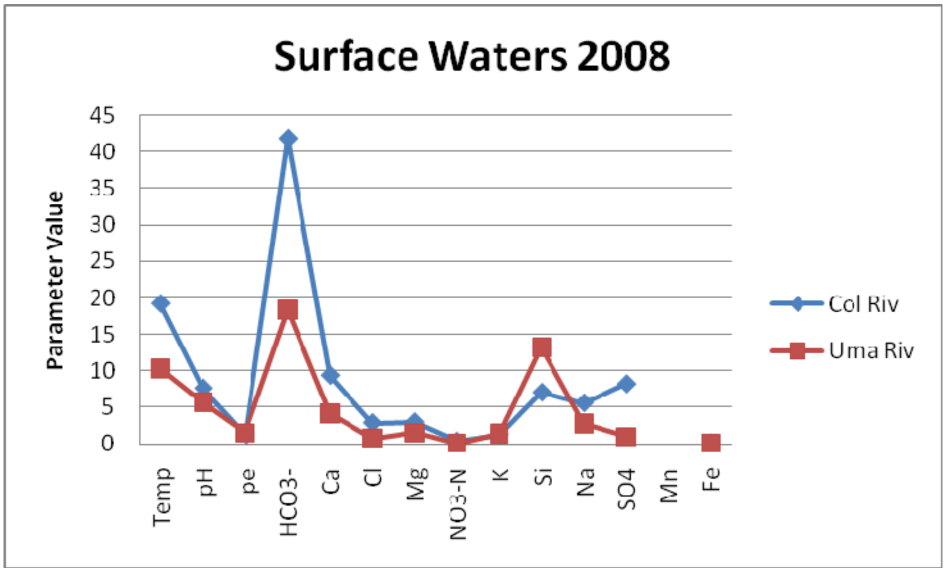
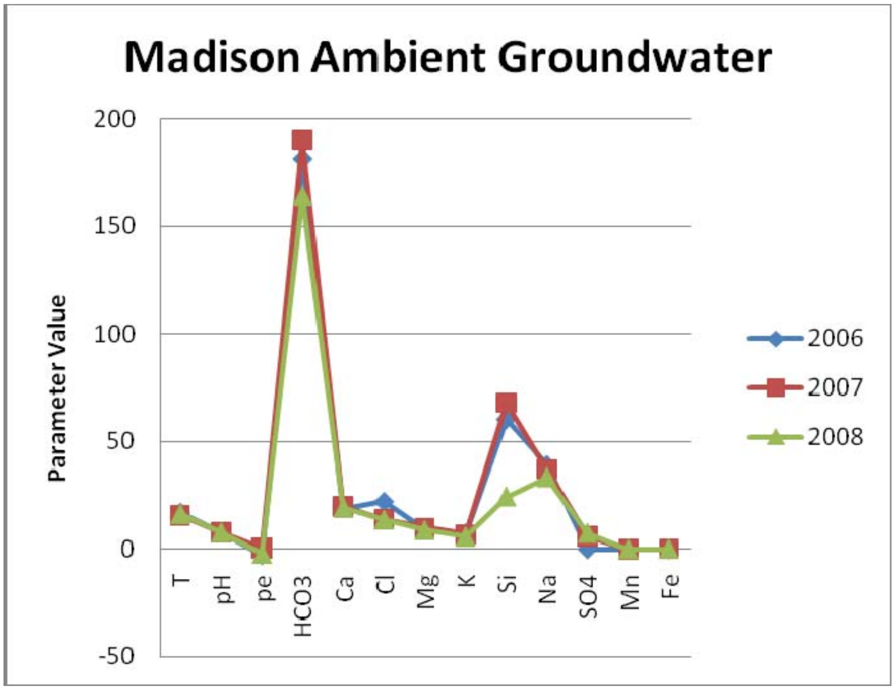
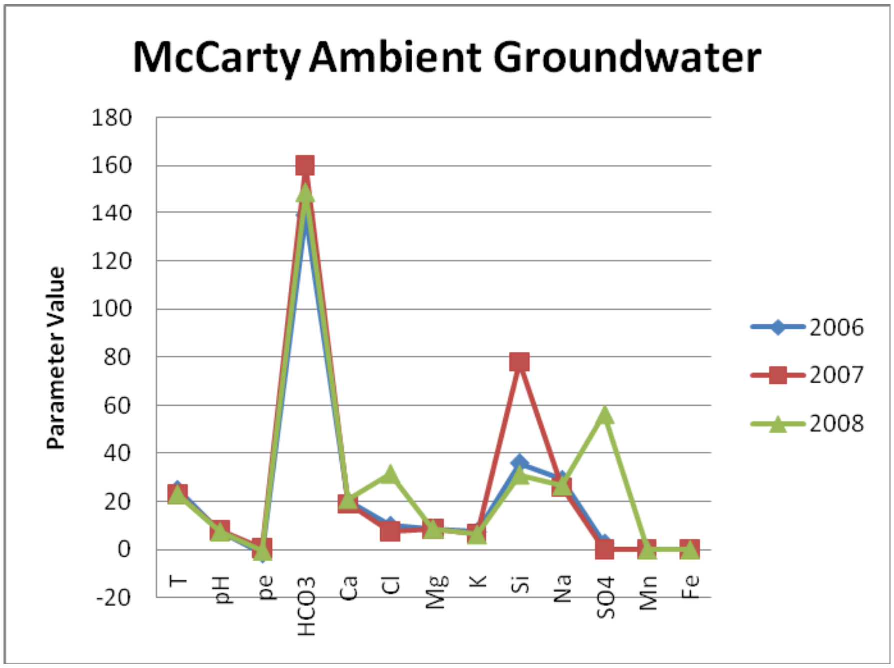


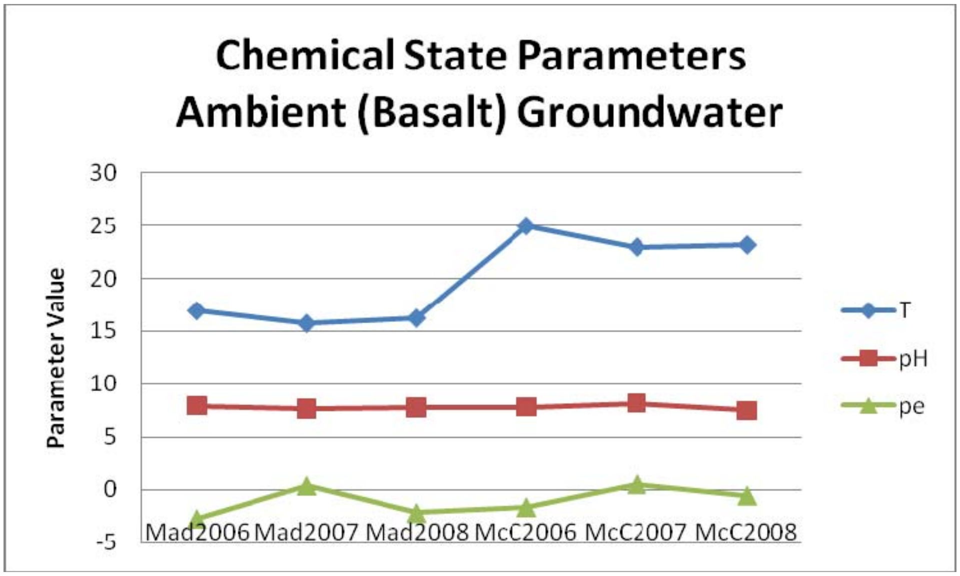
Figure 5. Compositional diagram comparing water from the Columbia River and the Umatilla River. Data were collected in 2008.



(Figure 6a)

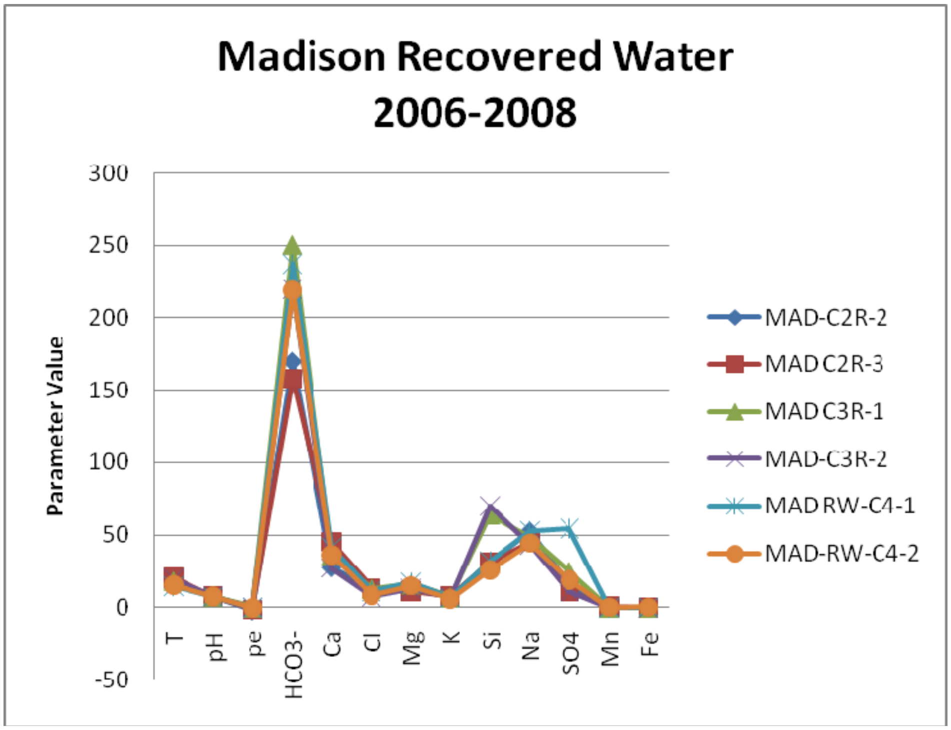


(Figure 6b)

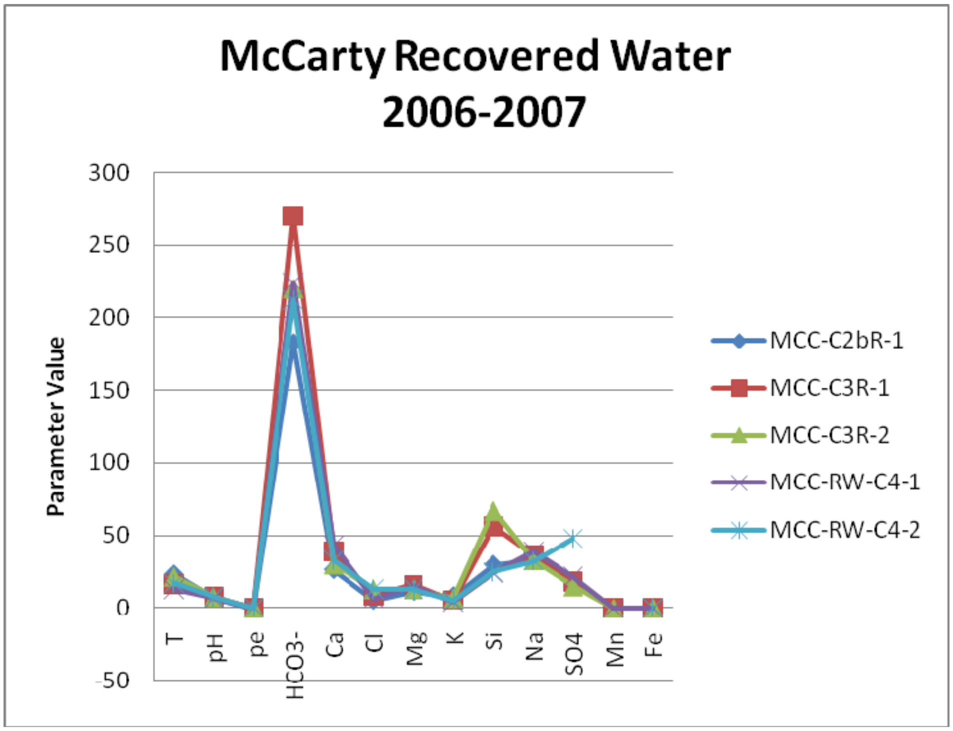


(Figure 6c)

Figure 6. Compositional diagrams for the groundwater derived from the ambient groundwater in the basalt aquifer for the (Figure 6a) Madison and (Figure 6b) McCarty ASR sites. Chemical state parameters for the Madison (Mad) and McCarty (McC) combined sites are shown in Figure 6c. The data span the time period from 2006 through 2008. Note that the 2006 chloride concentration at McCarty Ranch was reported as 100 mg/L, but in this diagram and in the PHREEQC models that follow, a concentration of 10.0 mg/L was used.



(Figure 7a)



(Figure 7b)

Figure 7. Observed compositional variations in recovered waters from the Madison (Figure 7a) and McCarty (Figure 7b) sites.

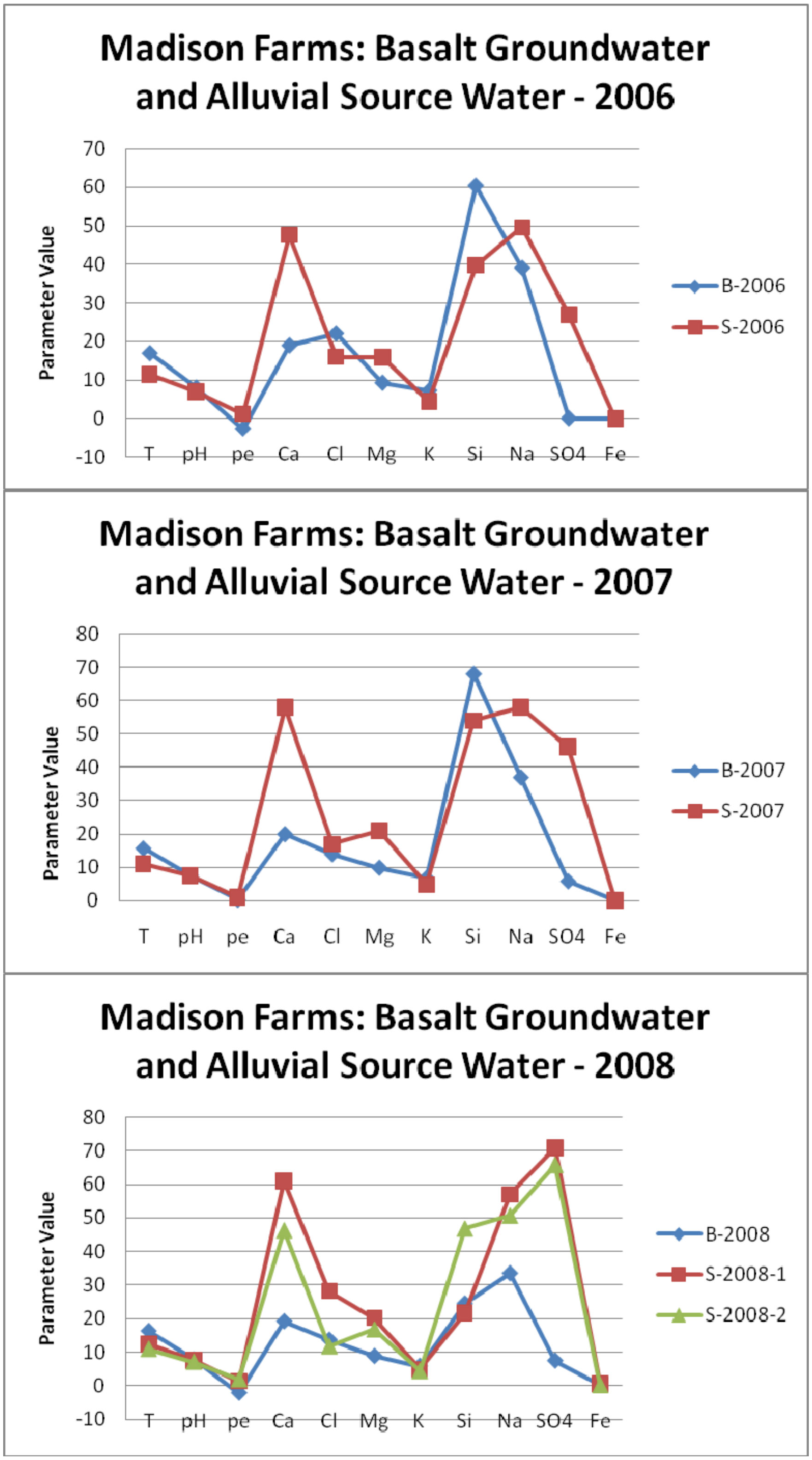


Figure 8. Comparison of the chemical character of the alluvial source water (S) and the ambient basalt (B) groundwater for the Madison Farms site from 2006 to 2008.

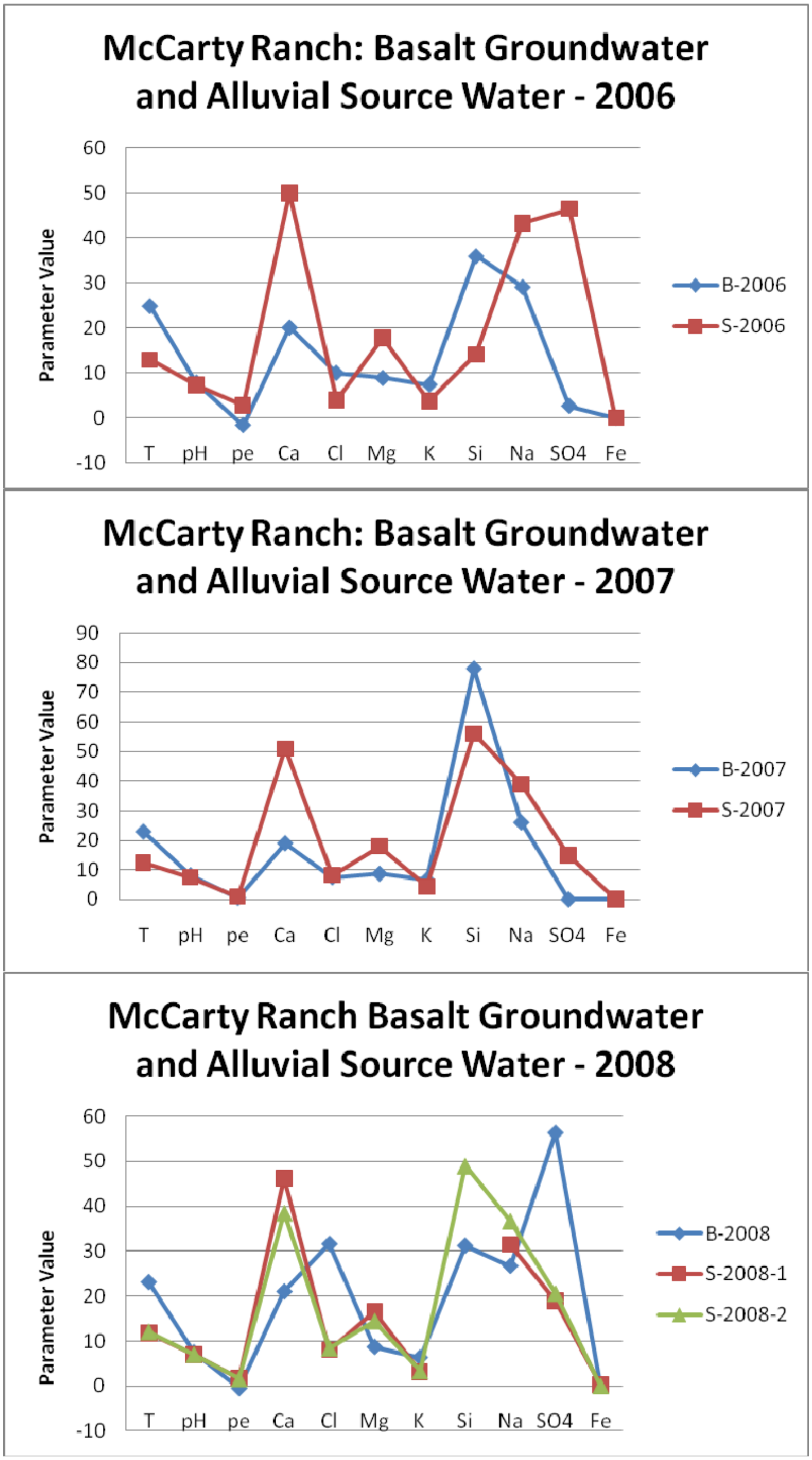


Figure 9. Comparison of the chemical character of the alluvial source water (S) and the ambient basalt (B) groundwatewater and for the McCarty Ranch site from 2006 to 2008.

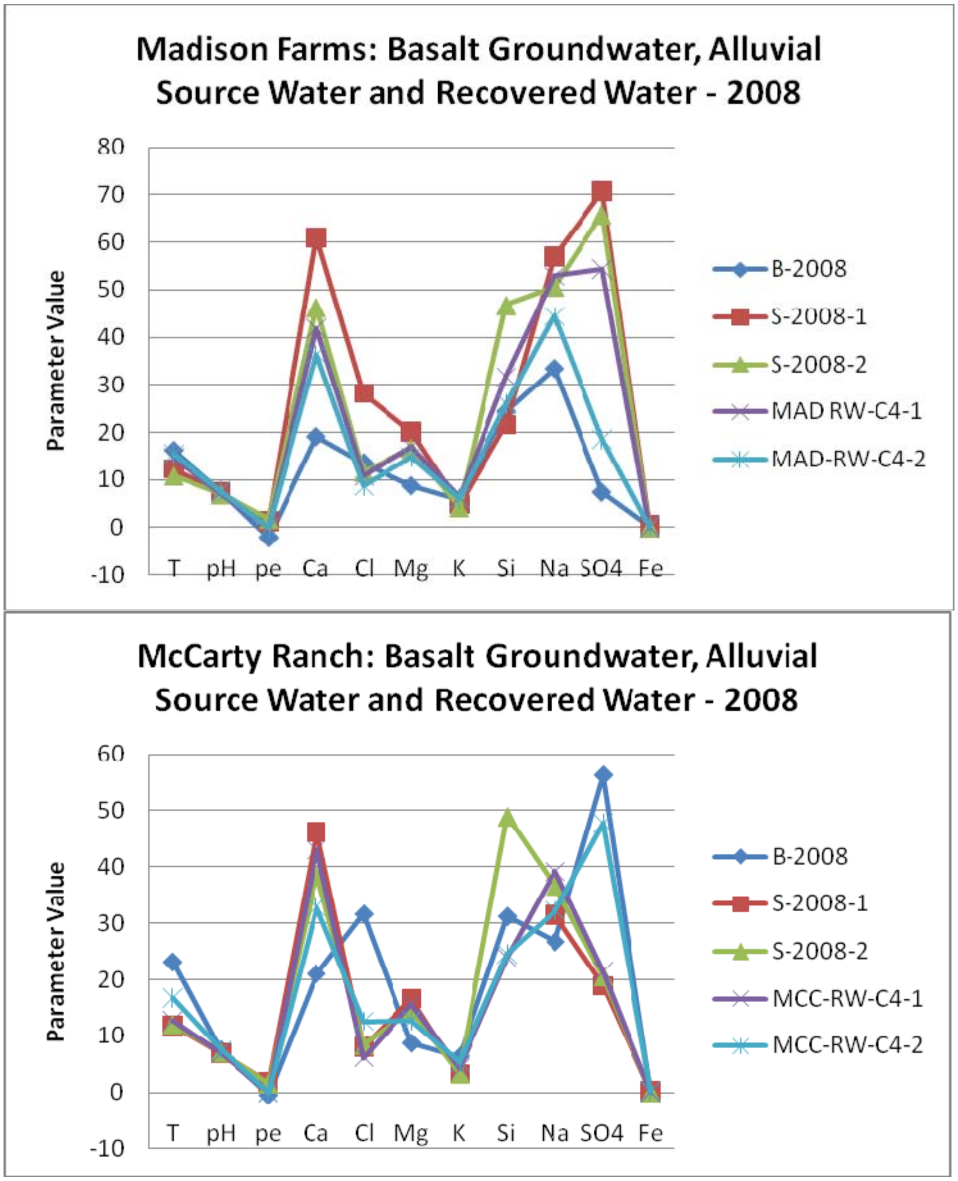


Figure 10. Compositional characteristics of the ambient groundwater (B), alluvial source water (S), and the recovered water (RW) during cycle 4 from the Madison Farms and McCarty Ranch sites.

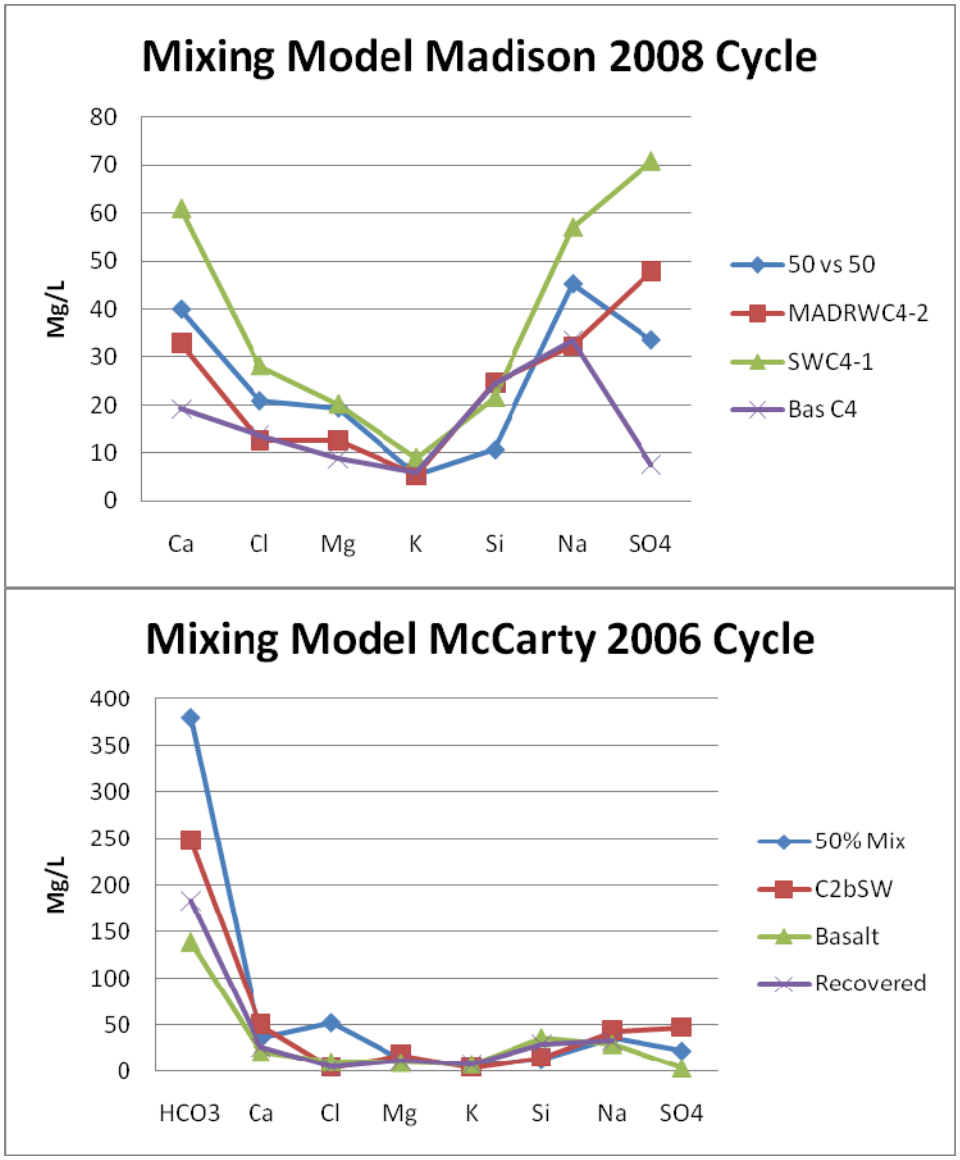


Figure 11. Concentrations of a mix of ambient groundwater, alluvial source water (SWC4-1 and C2bSW), and recovered water for the specific cycle year shown for the Madison and McCarty sites. Also shown are the concentrations of a 50:50 mixture of the ambient and source waters for each, assuming simple mixing.

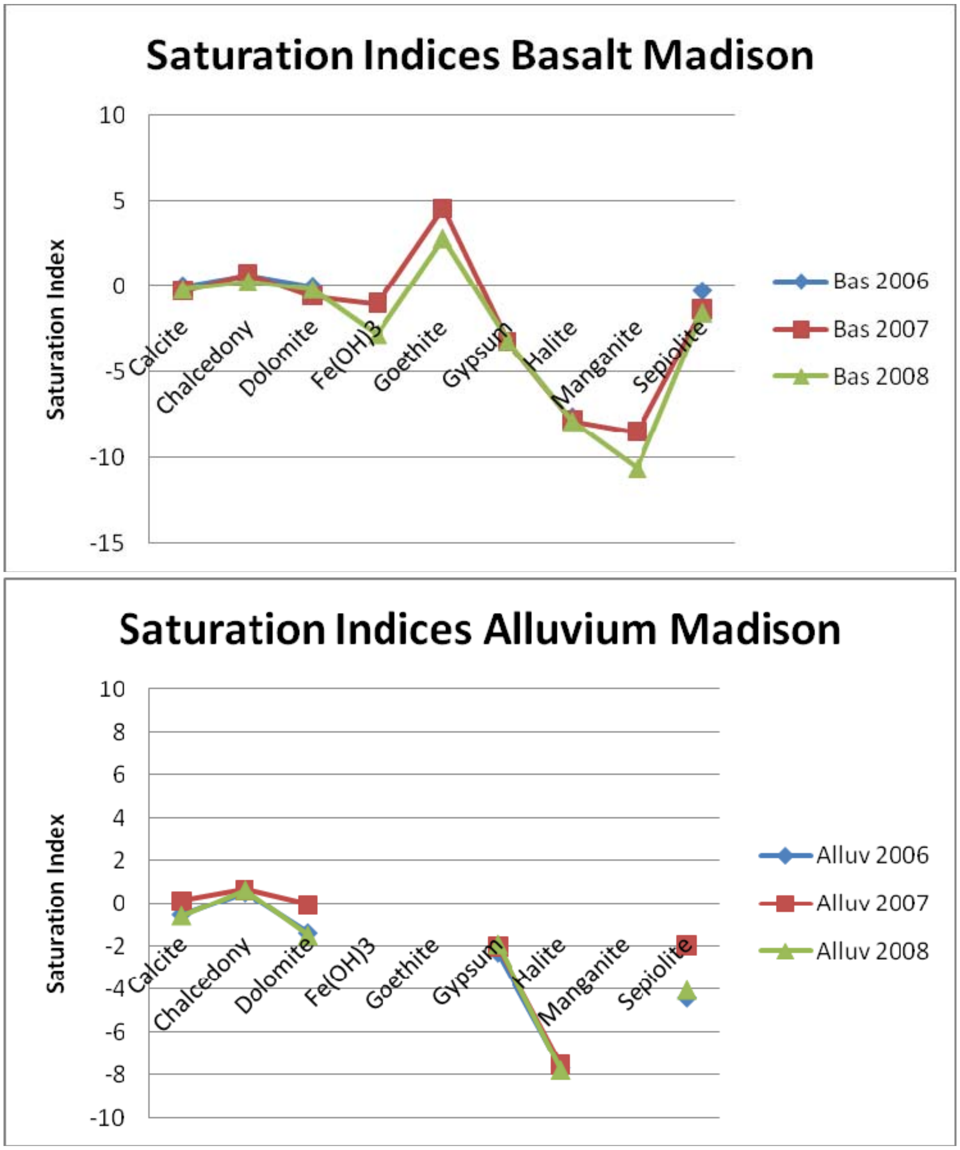


Figure 12. Saturation indices for common minerals for the basalt groundwater and alluvial source water for the Madison Farms ASR project site. Saturation indices indicate the tendency of a mineral to precipitate (SI >0) or dissolve (SI<0). Saturation indices are presented for the 2006 through 2008 ASR cycles. SI values for Fe(OH)3, goethite, and manganite are absent in the alluvial source water because iron (Fe) and manganese (Mn) were not detected in the water.

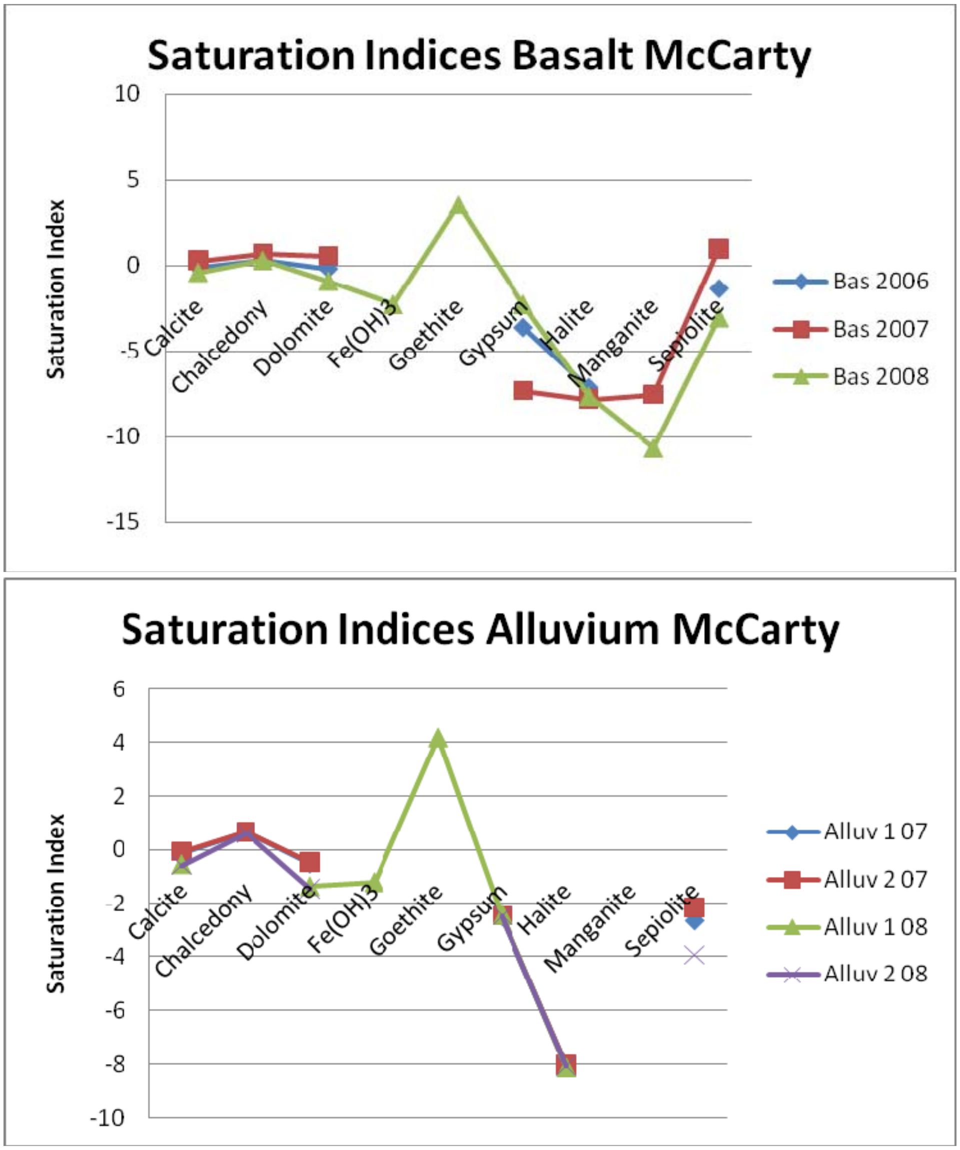


Figure 13. Saturation indices for common minerals for the basalt groundwater and alluvial source water for the McCarty Ranch ASR project site. Saturation indices indicate the tendency of a mineral to precipitate (SI >0) or dissolve (SI<0). Saturation indices are presented for the 2006 through 2008 ASR cycles. SI values for Fe(OH)3 and goethite are absent in both the basalt groundwater and alluvial source water because iron (Fe) was not detected in either water. Manganite is absent from the alluvial source waters because manganese was not detected in these waters.

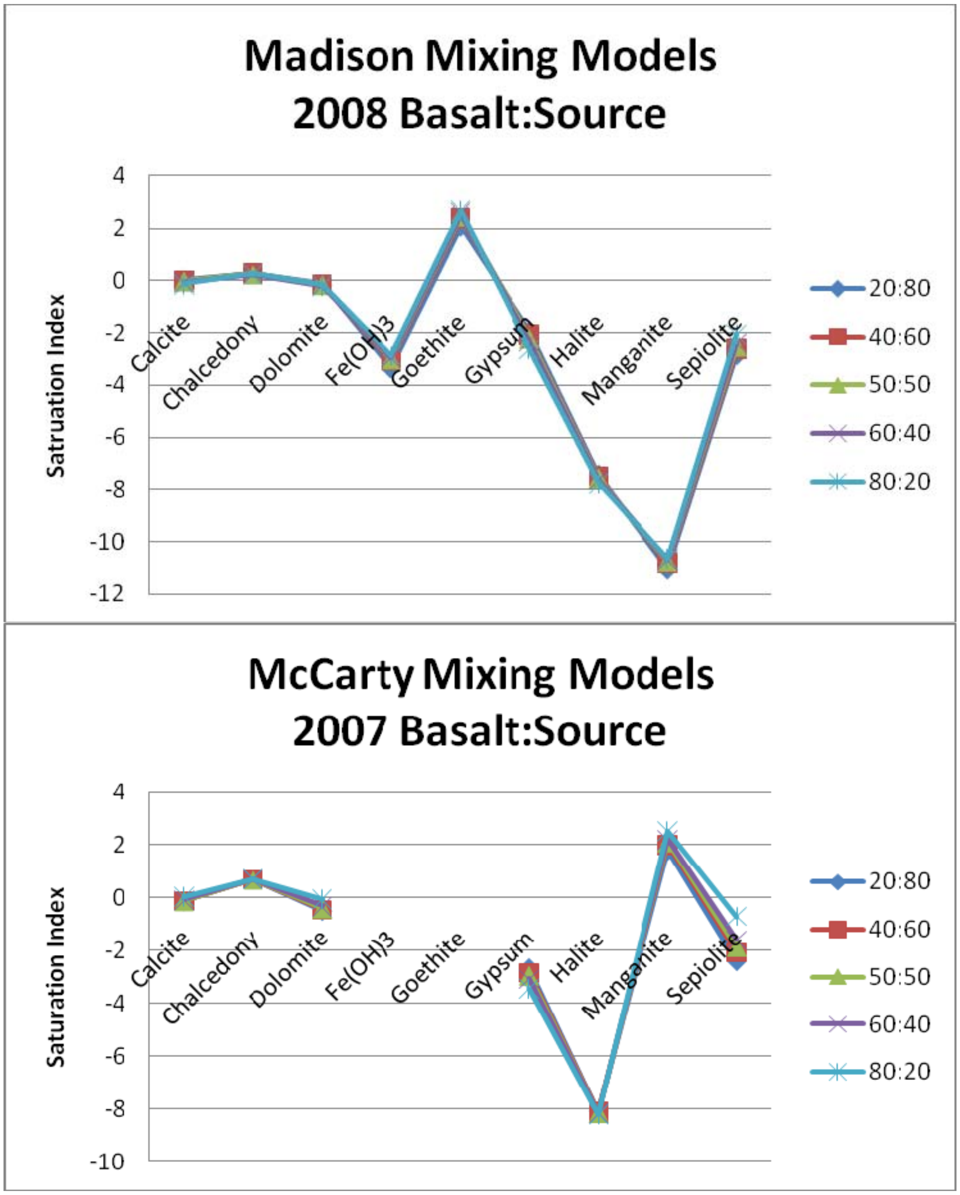


Figure 14. Saturation indices calculated for various mixtures of ambient groundwater from the basalt aquifer and for the alluvial source waters, considering the 2008 ASR cycle for the Madison Farms and the 2007 ASR cycle for the McCarty Ranch. Iron was not detected in either the ambient or source waters during the 2007 ASR cycle at McCarty Ranch. The legend depicts the mixing proportions for the ambient groundwater and source water, e.g., 20:80 represents a mixture comprising 20 percent ambient groundwater and 80 percent source water.

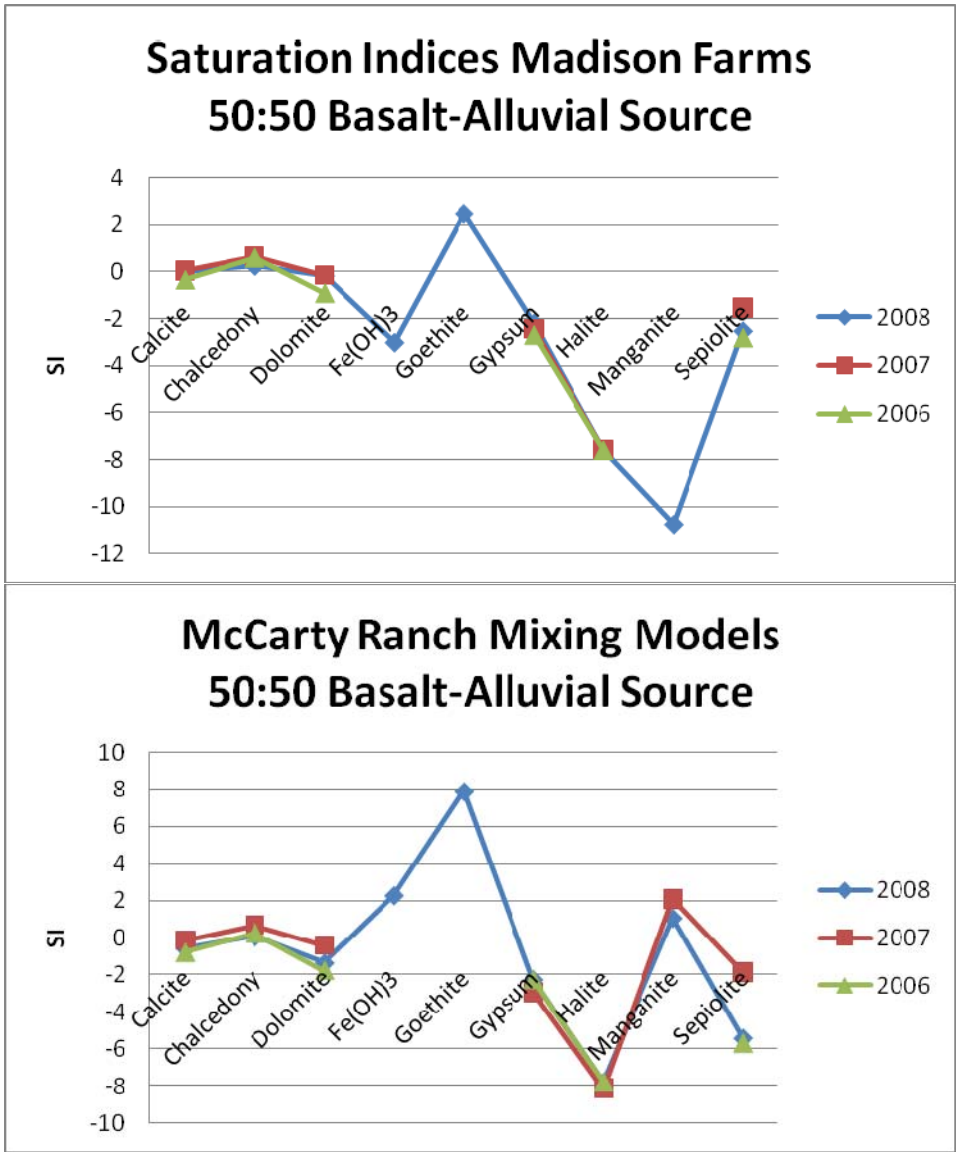


Figure 15. Comparative mixing models for ambient groundwater and alluvial source water for Madison Farms and McCarty Ranch sites for the period of 2006 through 2008. Each graph represents the saturation indices assuming a 50:50 mixing ratio between the two water types.

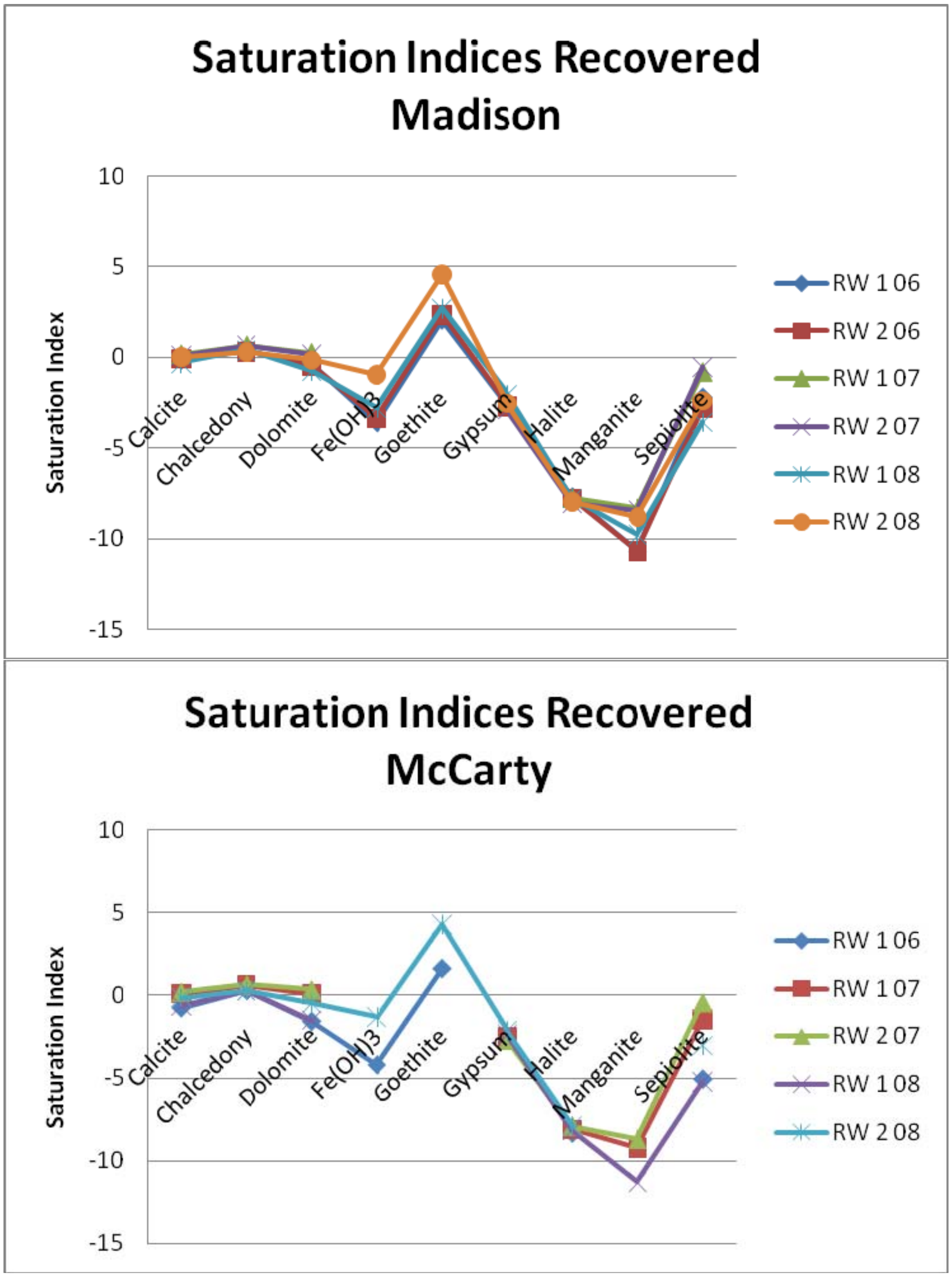
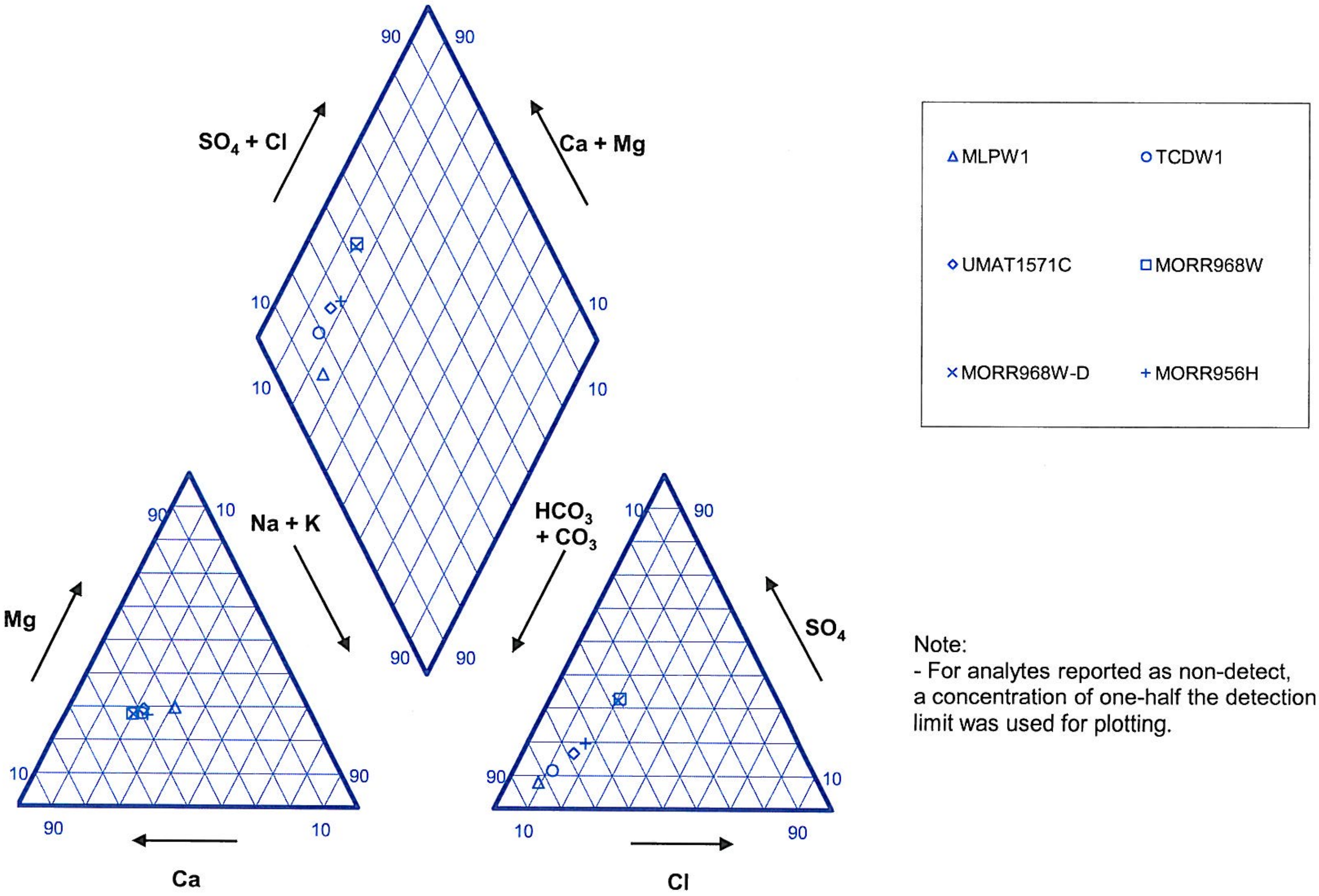


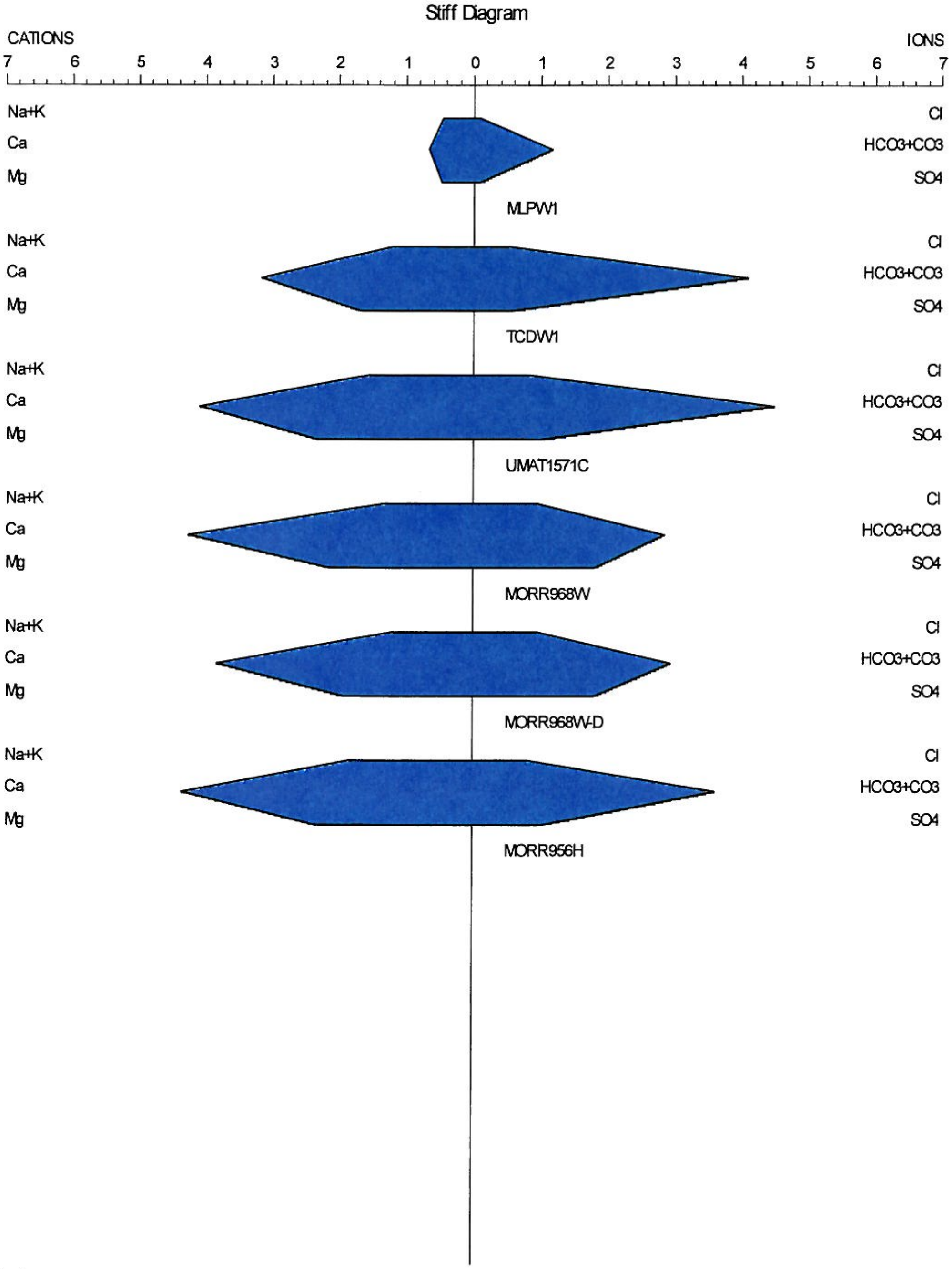
Figure 16. Saturation indices for common minerals in the recovered water from the Madison and McCarty ASR sites from the 2006-2007 ASR cycles. The recovered water represents a mixture of the injected alluvial source water and the ambient groundwater that was recovered after a specific amount of storage time. As SI patterns shown here are very similar to the SI patterns of the alluvial source water and ambient groundwater for the Madison Farms (Figure 12) and McCarty Ranch (Figure 13) sites.



Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used for plotting.

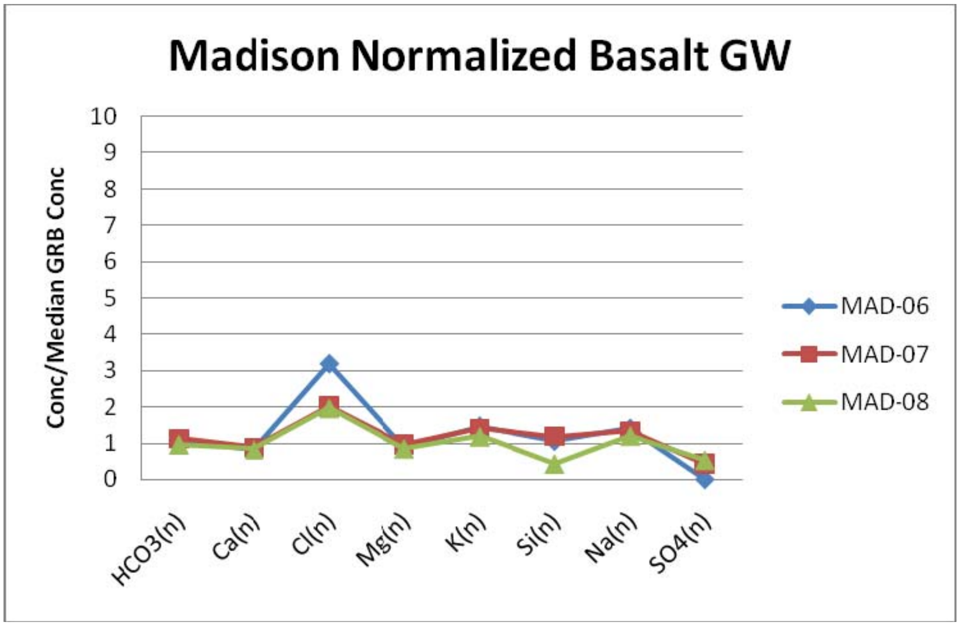
GSI Water Solutions, Inc.

Figure 17a
Piper Diagram for the County Line and Echo Meadows samples
Umatilla Basin ASR Program

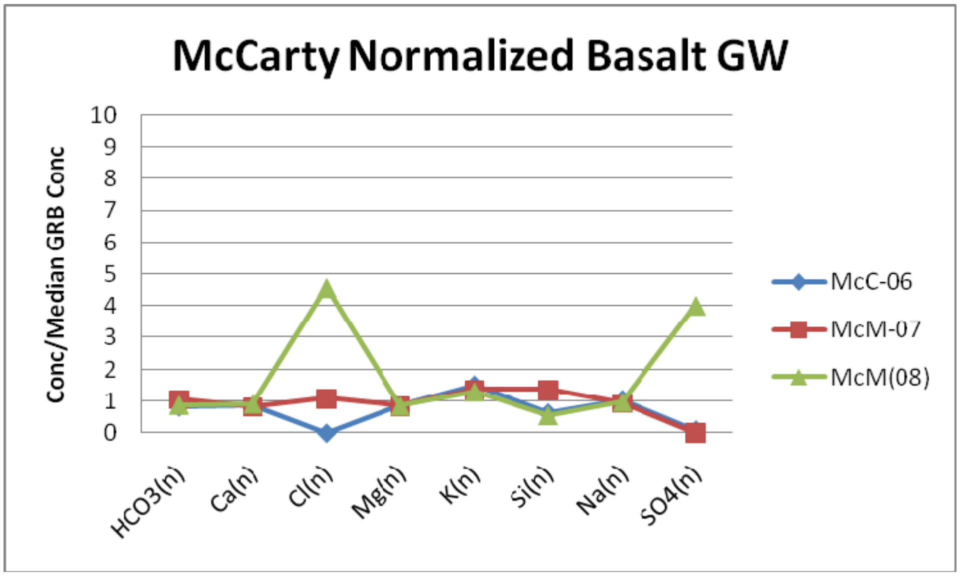


Note:
- For analytes reported as non-detect, a concentration of one-half the detection limit was used For plotting.

Figure 17b
Stiff Diagram for the County Line and Echo Meadows samples
Umatilla Basin ASR Project

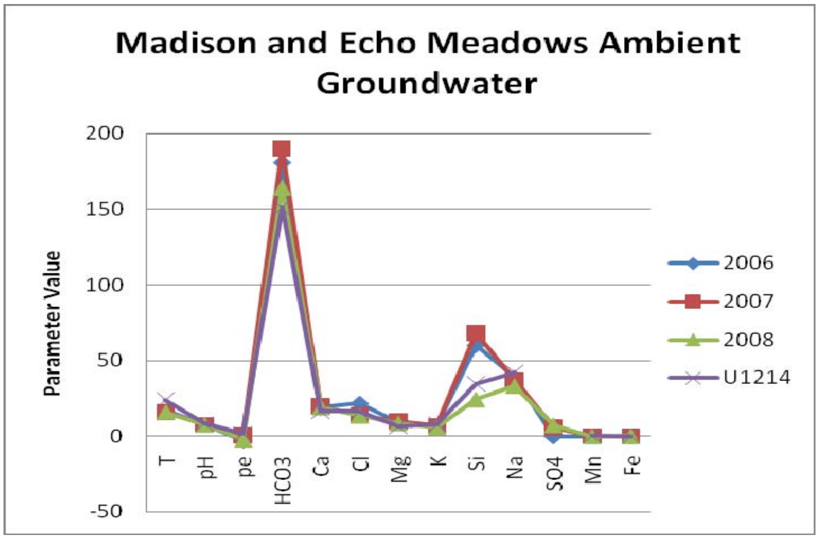


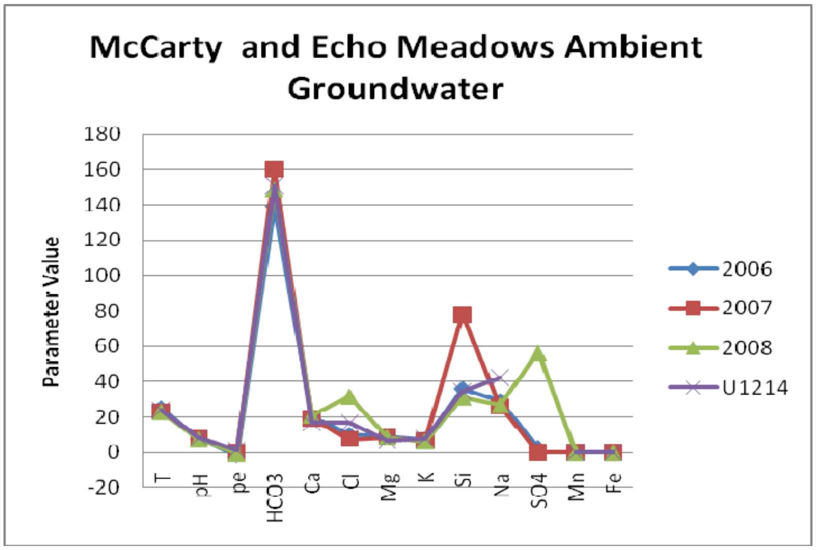
(Figure 18a)



(Figure 18b)

Figure 18. Groundwater concentrations for ambient groundwater from the Madison (Figure 18a) and McCarty (Figure 18b) sites. Individual chemical concentrations normalized (divided by) the average concentration for that chemical from groundwater collected from the Grande Ronde Basalt aquifer. Normalized concentrations of 1.0 reflect that the concentration in the groundwater in question is equal to the average Grande Ronde groundwater composition.





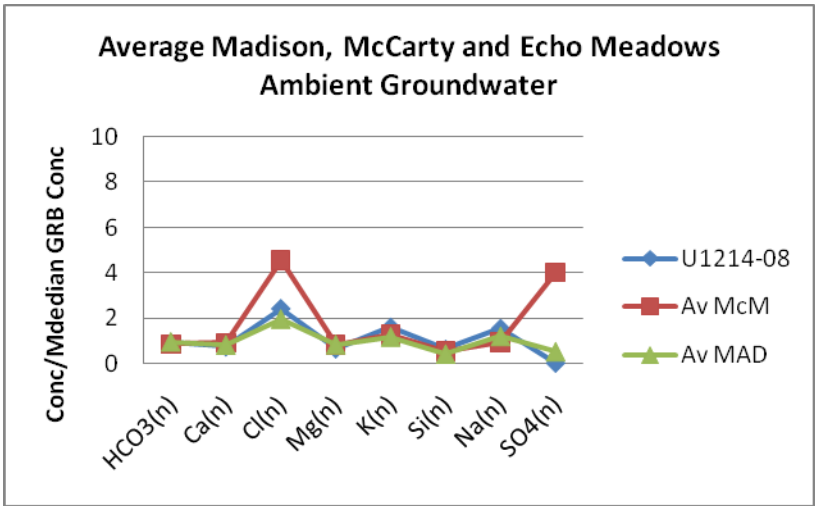
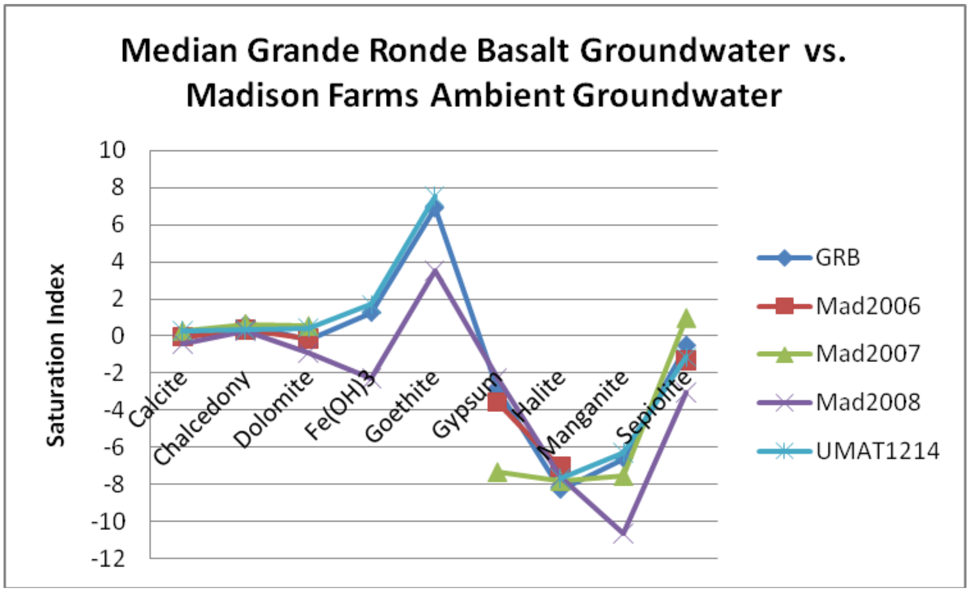


Figure 19. Comparison of Echo Meadows ambient groundwater with Madison and McCarty 2006-2008 ambient groundwater, and Echo Meadows with averages of Madison and McCarty 2006-2008 ambient groundwater, all normalized to the median Grande Ronde Basalt ambient groundwater



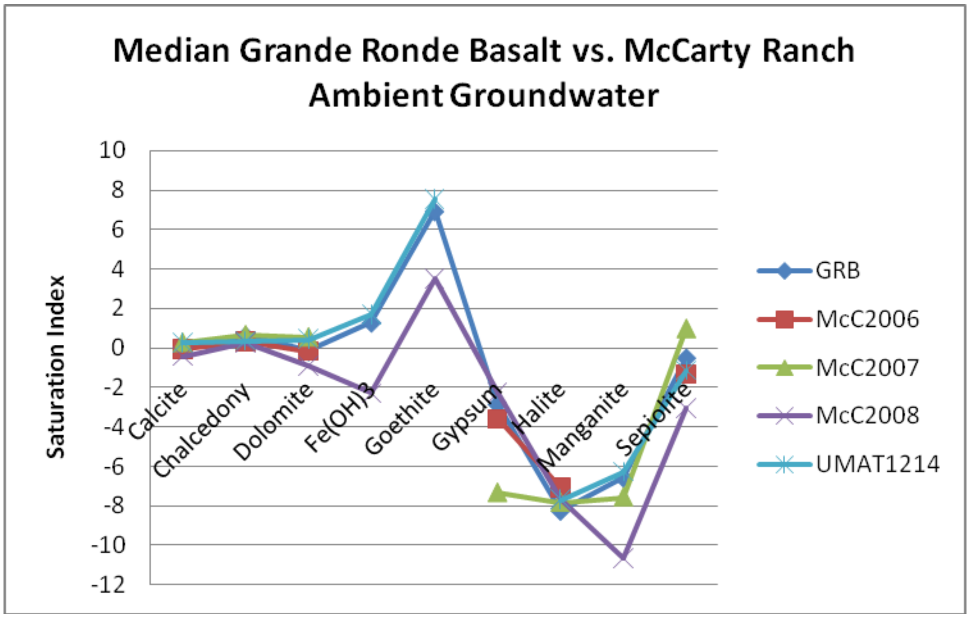


Figure 20. Saturation indices for common minerals in the median groundwater composition of the Grande Ronde Formation compared to the Madison Farms (upper) and McCarty Ranch (lower) and Echo Meadows (UMAT1214) ASR sites.

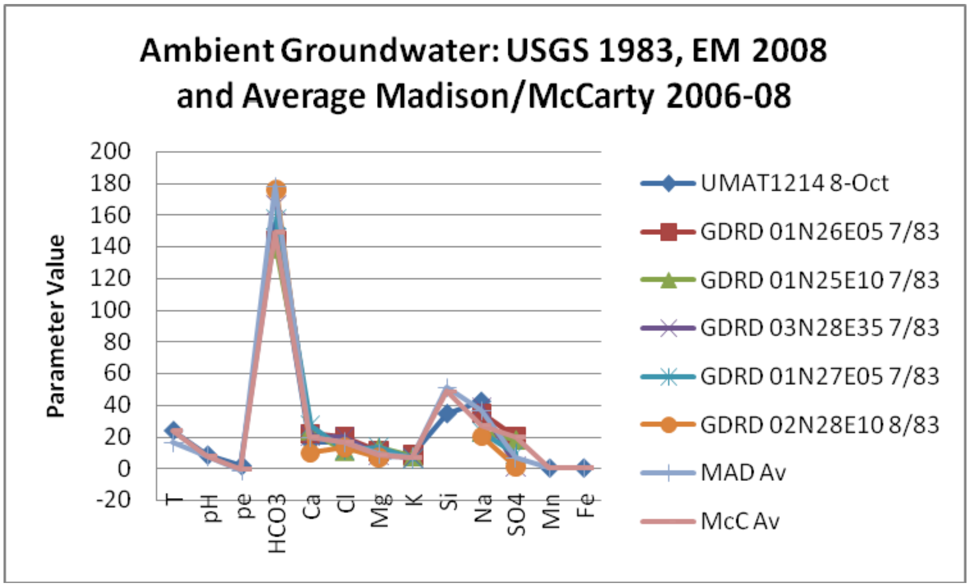


Figure 21. Comparison of constituent concentrations (mg/L) and chemical state parameters in Grande Ronde ambient groundwater from the various sites in the Umatilla Basin, collected by the U.S. Geological Survey (1983) and Madison Farms, and analyses of ambient groundwater at Madison Farms.

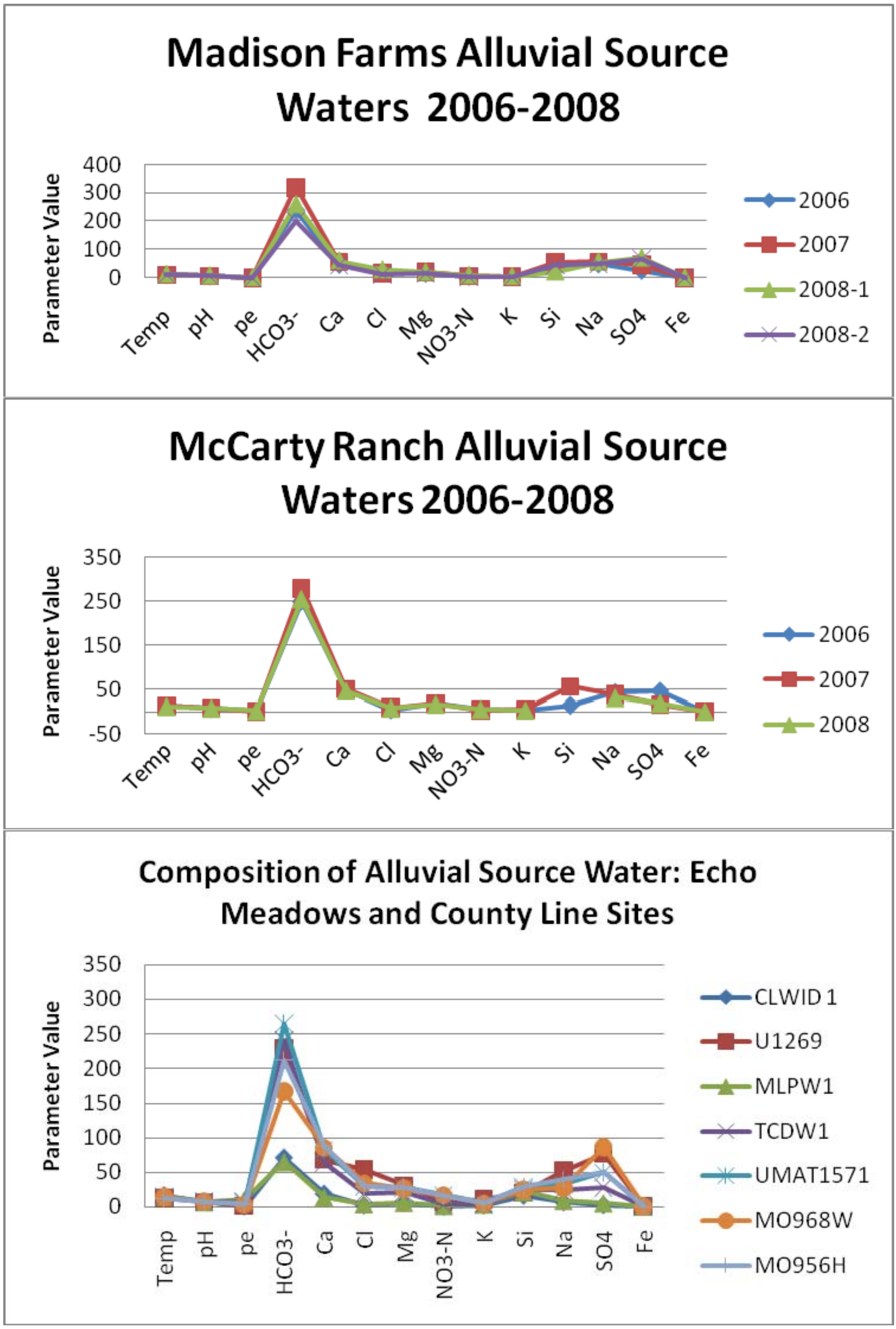


Figure 22. Comparison of compositions of the alluvial source water from the Madison Farms and McCarty Ranch 2006-2008 time periods with the alluvial source waters from Echo Meadows (MLPW1 and TCDW1) and County Line (all others) sites, collected in 2008. CLWID1 refers to Well MORR972.

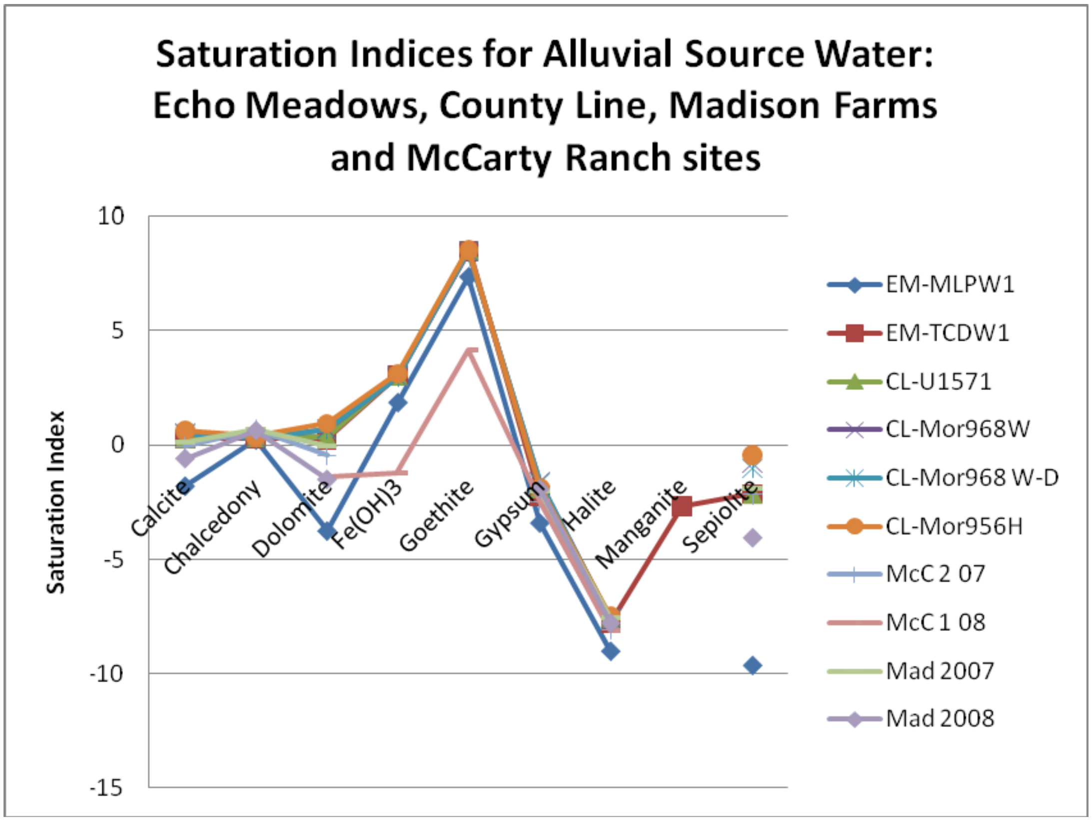


Figure 23. Comparison of saturation indices for the alluvial source waters from Echo Meadows and County Line ASR sites with those of the McCarty Ranch and Madison Farms sites.

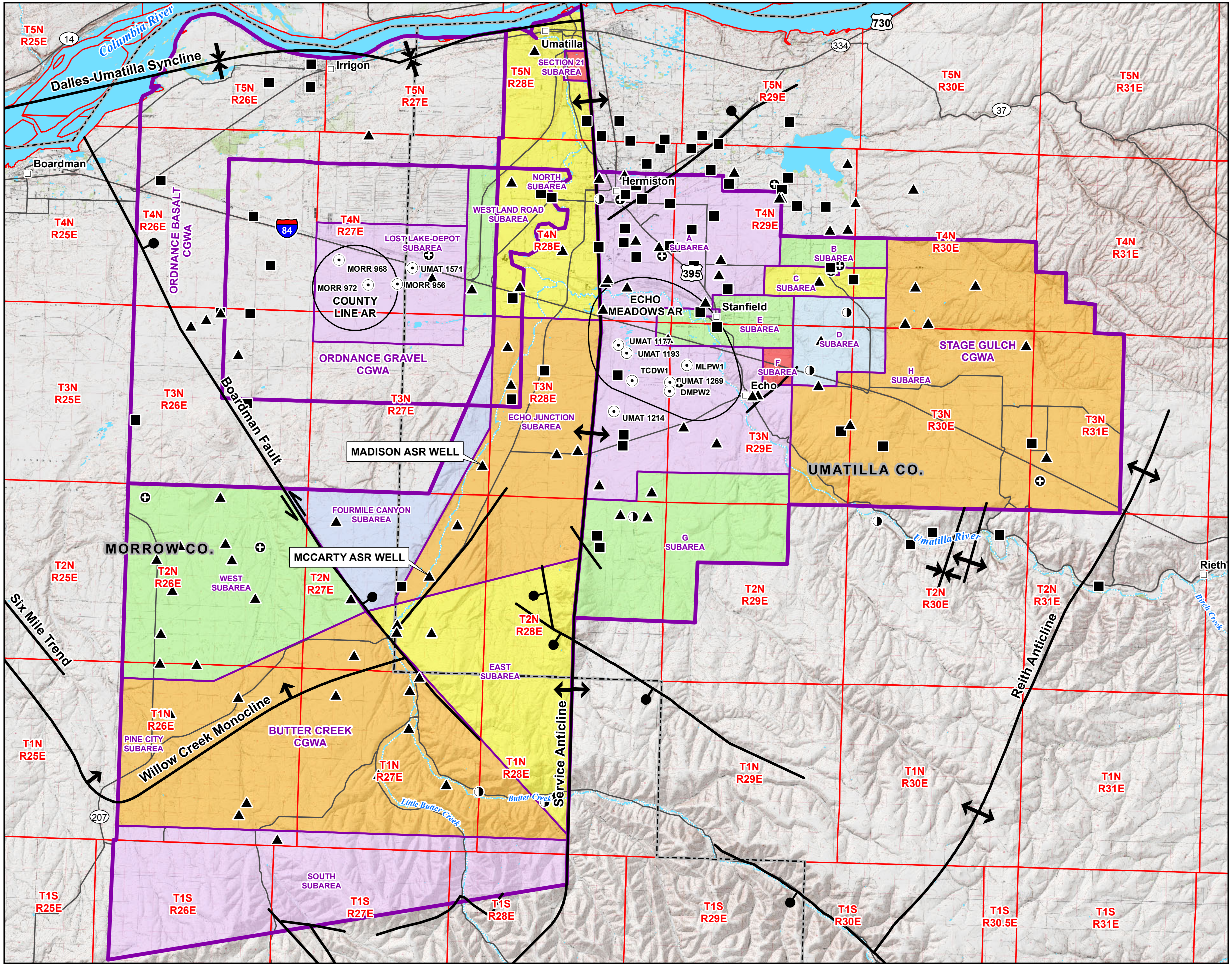


PLATE 1

Critical Groundwater Areas, Artificial Recharge Areas, and ASR Projects

Umatilla Basin Regional Aquifer Recovery Assessment

LEGEND

⊙ Sampled Wells[1]

OWRD Wells Used in Analysis

- ▲ Pump Test
- ■ Air Lift/Bailer Test
- ◑ Artesian Well
- ⊕ All Other Wells
- Fault
- Monocline
- Anticline
- Syncline
- Critical Groundwater Areas (CGWAs)
- CGWA Subunits
- Aquifer Recharge Areas
- □ Cities
- Counties
- Township and Range
- Highways and Major Roads
- Major Watercourses
- Waterbodies

NOTES:

1. Well locations within Echo Meadows and County Line Aquifer Recharge Areas need to be verified.
2. See Appendix A for source information for Critical Groundwater Areas and OWRD Wells.
3. Locations of features not from sources in Appendix A are approximate.

N

0 1.5 3 4.5 6

Miles

MAP NOTES:

Projection: Universal Transverse Mercator
Datum: North American Datum of 1983
Date: April 29, 2009
Data Sources: IRZ, Oregon Geospatial Data Clearinghouse, OWRD, USGS, ESRI

GSI Water Solutions, Inc.

File Path: \\pdx\projects\290 - Umatilla\001 - Umatilla Basin Critical Area Recharge Project\Project_GIS\Project_mxds\Report_Figures\Plate1_CGWAs_AR_Areas_and_ASR_Projects.mxd, Date: April 29, 2009 3:45:17 PM

Attachment 1

Geochemical Background

Water is a very complex solution, the characteristics of which are a function of reactions with the atmosphere, solid mineral phases, or biological processes. What controls the geochemical behavior of water is its chemical state, i.e., the temperature, pH, and oxidation-reduction potential (ORP). The ORP often is related to the dissolved oxygen content of the water. For a given groundwater, the composition and chemical state of the water are a function of factors that include the dissolved gases in the water, the solid mineral phases of the aquifer, and the length of time (residence time) that the water has been in contact with these phases.

When two waters of different chemical state and history are mixed, the hybrid water produced generally will have a composition and chemical state intermediate from the two mixed waters, the values of which reflect the various mixing proportions between those two end-members. That is not always the case, however, as the mixed water actually may react with the subsurface material leading to two undesirable processes listed above. Such mixing may result in solid phases being precipitated from the hybrid water. Common clogging minerals include calcite ($CaCO_3$) and iron oxyhydroxide ($Fe\ (OH)_3$). The hybrid water also may be out of equilibrium with metals that are attached (sorbed) onto the surface of the aquifer minerals. This may result in chemicals such as arsenic (As), uranium (U), iron (Fe), manganese (Mn), and others being transferred from the solid phases to the hybrid water, often degrading its quality.

For a specific water solution, with a given chemical state, what controls whether a mineral precipitates is what is termed the ion activity product (K_{iap}), and how it compares to the solubility (K_{sp}) of the mineral in the specific The K_{iap} is defined as

$$K_{iap} = [Ca] \times [CO_3]$$

If the K_{iap} is greater than the $K_{sp,,}$ then the water is oversaturated with respect to the mineral and solid phase will tend to precipitate, i.e., the constituents that make up the mineral will be extracted from the solution. If the two parameters are equal, the water is saturated with respect to the mineral phase, or the water is in equilibrium with the phase, and the mineral will neither dissolve nor precipitate. Finally, if the K_{iap} is less than the $K_{sp,}$ the water is undersaturated with respect to the phase and the mineral will tend to dissolve, releasing its constituents to the water. ,

If the ion activity product for calcite can be calculated, and the solubility of calcite in water at a given temperature is known, then a determination can be made whether the mineral will precipitate or dissolve in the water. This is obviously easier said than done, however, because although the solubility of calcite is known, the ion activity product varies as a function of the composition and chemical state of the water. For example, the expression for calcium [Ca] in the above equation is not just the simple concentration; rather it is the “effective concentration”. Because of the presence of other ions in solution besides Ca^{2+} and CO_3^{2-}, such as Na^+, Mg^{2+}, SO_4^{2-} and HCO_3^-, the ions do not behave independently. Their potential combination according to the reaction below is hindered, and therefore, higher concentrations of each are required before the reaction proceeds, i.e., the solubility of calcite is increased.

$$Ca^{2+} + CO_3^{2-} = CaCO_3 \text{ (calcite)}$$

Calculating the actually solubility, then, and therefore being able to predict whether a given mineral phase will precipitate, is truly a formidable task. Fortunately, there is computer software that performs those calculations for us.

PHREEQ is a program originally developed in 1990 by the U.S. Geological Survey (USGS) that is capable of making a number of water related determinations (Parkhurst et al., 1990). The program has gone through many revisions and upgrades and is probably the widest used program to evaluate questions concerning mineral solubility, component speciation in water, exchange and mixing reactions, etc.

For this memorandum, three questions were explored using PHREEQC: (1) How are the chemical components distributed in a water sample and what are the mineral saturation indices? (2) What is the chemical result of mixing two separate waters? and (3) What water mineral reactions are predicted as a result of a mixing event to yield a hybrid water type, e.g., mixing alluvial source water with ambient groundwater to yield a recovered water composition?

Compositional and chemical state data are entered into the program as separate files and specific Key Words, e.g., Mixing, to start the model run. It is of fundamental importance that the chemical state data, i.e., temperature, pH and ORP or Redox Potential (or dissolved oxygen), be measured at the time the sample is collected. The absence of the chemical state data precluded making use of many of the older pre-existing water analyses that were available during this study.

Attachment 2

Estimating the Potential Volume of Precipitated Minerals

Evaluating the potential of clogging of the basalt aquifer or the well screens was accomplished on the basis of the amount of mineral precipitation as determined by the PHREEQC and translating that information into a specific volume that potentially would be filled by this mineral precipitation. Calculations were performed on four minerals that were routinely predicted by the model to precipitate during the mixing of source and ambient waters to achieve the composition represented by a specific recovered water: calcite ($CaCO_3$), chalcedony (SiO_2), ferric oxyhydroxide ($Fe(OH)_3$), and manganite ($MnO(OH)$). The amount of mineral potentially precipitated was given by PHREEQC in terms of moles/liter. A mole is a chemical mass term that is defined as the molecular weight of the molecule (the sum of the individual atomic weights from the periodic table) expressed as grams.

For example, 1 mole of ferric oxyhydroxide equals 106.85 grams, representing the sum of the individual atomic weights.

$$\text{Fe } (55.85) + 3\text{ O } (3 \times 16 = 48) + 3\text{ H } (3 \times 1 = 3) = 106.85$$

The volume of a mole of ferric oxyhydroxide is determined by dividing the molecular weight by the mineral density (4 g/cm3):

$$(106.85\ \text{g/mole})/(4\ \text{g/cm}^3) = 26.7\ \text{cm}^3/\text{mole}$$

PHREEQC predicted that the maximum amount of ferric oxyhydroxide that potentially could precipitate during the mixing process as 8.0×10^{-7} moles/liter. Therefore, the volume of that mineral can be calculated as follows:

$$0.0000008\ \text{moles/L} \times 26.7\ \text{cm}^3/\text{mole} = 0.00002\ \text{cm3/L}$$

To put this volume in perspective relative to the aquifer, consider one cubic meter of the basalt aquifer having an approximate porosity (percent open space) of 20 percent. One cubic meter is equivalent in volume to 1,000 liters. Therefore in an aquifer having a porosity of 20 percent, there is 200 liters of open space that would be filled with water under saturated conditions.

The volume of the potentially precipitate ferric oxyhydroxide in a cubic meter of aquifer is

$$200\ \text{L} \times 0.00002\ \text{cm}^3/\text{L} = 0.004\ \text{cm}^3$$

Similar calculations were performed on the other minerals and are summarized in Table 2-1.

Table 2-1. Volume of mineral potentially precipitated from solution in one cubic meter of an aquifer containing a porosity of 20 percent, i.e., containing 200 liters of water.

Mineral	**Density g/cm^3**	**Molecular Wt**	**Volume/Mole (cm^3)**	**Predicted Precipitation moles/L**	**Volume Precipitated cm^3/m^3**
Ferric Oxyhydroxide	4.0	106.8	26.7	0.0000008	0.004
Chalcedony	2.6	60	23.0	0.00057	2.6
Calcite	2.71	100	36.9	0.00026	1.91
Manganite	4.3	87.9	20.44	0.00000096	0.004

Attachment 3

Mobilization of Heavy Metals

Dissolution. When a mineral dissolves in water, the elements that make up the mineral are released into that water (shown diagrammatically in Figure 3-1a and 3-1b). Metals are common constituents in the minerals that comprise an aquifer. Minerals are rigorous structures, comprising a rather specific collection of elements, commonly comprising two or more of the following “major elements”: Si, Al, O, Ca, Mg, Na, K, Cl, Fe, Mn, and S. These elements differ in size and charge, and as a result, each mineral is element specific, e.g., calcite is primarily $CaCO_3$. Other common minerals, e.g., quartz (SiO_2), pyrite (FeS_2), plagioclase feldspar (NaAlSiO3 or $CaAl_2Si_2O_8$), and pyroxene ($Ca (Mg, Fe, Al)(Si, Al)_2O_6$), have similar compositional limits.

Heavy metals can, under the right conditions, form their own elements, e.g., chromite (Cr_2O_3) and galena (PbS), however more commonly, the heavy elements will exist in trace quantities, and/or conditions favorable for their formation do not exist. Elements that are similar in size and charge can substitute for one another. As a result, many of the heavy elements occur within the common minerals, again, at trace quantities. If the mineral dissolves in the groundwater surrounding the aquifer, those elements will be taken into solution (Figure 3-1a and 3-1b).

In some cases, the elements be may be immobilized quickly by association with other stable minerals that occur nearby. For example, if Fe minerals such as goethite or ferric oxyhydroxide are forming as a result of the interaction of groundwater with the primary minerals, they may serve as sinks (they will remove constituents from solution) for the heavy metals (and elements such as arsenic).

Surface Reactions. Minerals grow by progressively adding new elements on to the mineral’s margin. New elements bond with the growing structure. In groundwater, the mineral would grow until it reaches saturation (see Attachment 1) in the solution. When the mineral stops growing, the mineral’s surface still has many unsatisfied bonds exposed. The unsatisfied bonds result in the margin of the mineral having an electrostatic charge. Although strongly controlled by the pH of the solution, commonly the surface possesses a negative charge. This negatively charged surface will attract elements in solution that have a positive charge. These positively charged ions (cations) will become attached to the surface, and as long as the chemistry does not change, will become attached to the mineral surface. This condition is shown diagrammatically in Figure 3-1c.

There is a finite limit to the number of ions that can become attached. However, under stable conditions, the amount of a given cation, e.g., Ni^{2+}, Pb^{2+}, Co^{2+},etc., that can become attached to the surface is controlled by the concentration of the cation in the surrounding groundwater. At a given temperature, pH, and solution composition, the ratio of the concentrations of the cation in solution and attached to the surface is controlled by the equation below:

$$C_S/C_L = K$$

Where C_S = the concentration of the cation attached to the mineral surface, and C_L = the concentration of the cation in solution. K is a constant that is controlled by temperature, pH, redox, and the total composition of the solution. As long as those conditions remain the same, the relative concentrations will be held constant.

If, however, the chemical state of the solution changes, the value of the constant K also will change. As a result, the ratio of the concentration of the cation in solution to the concentration attached to the mineral surface will have to change to satisfy the equation above. This is shown diagrammatically below in Figure 3-1d.

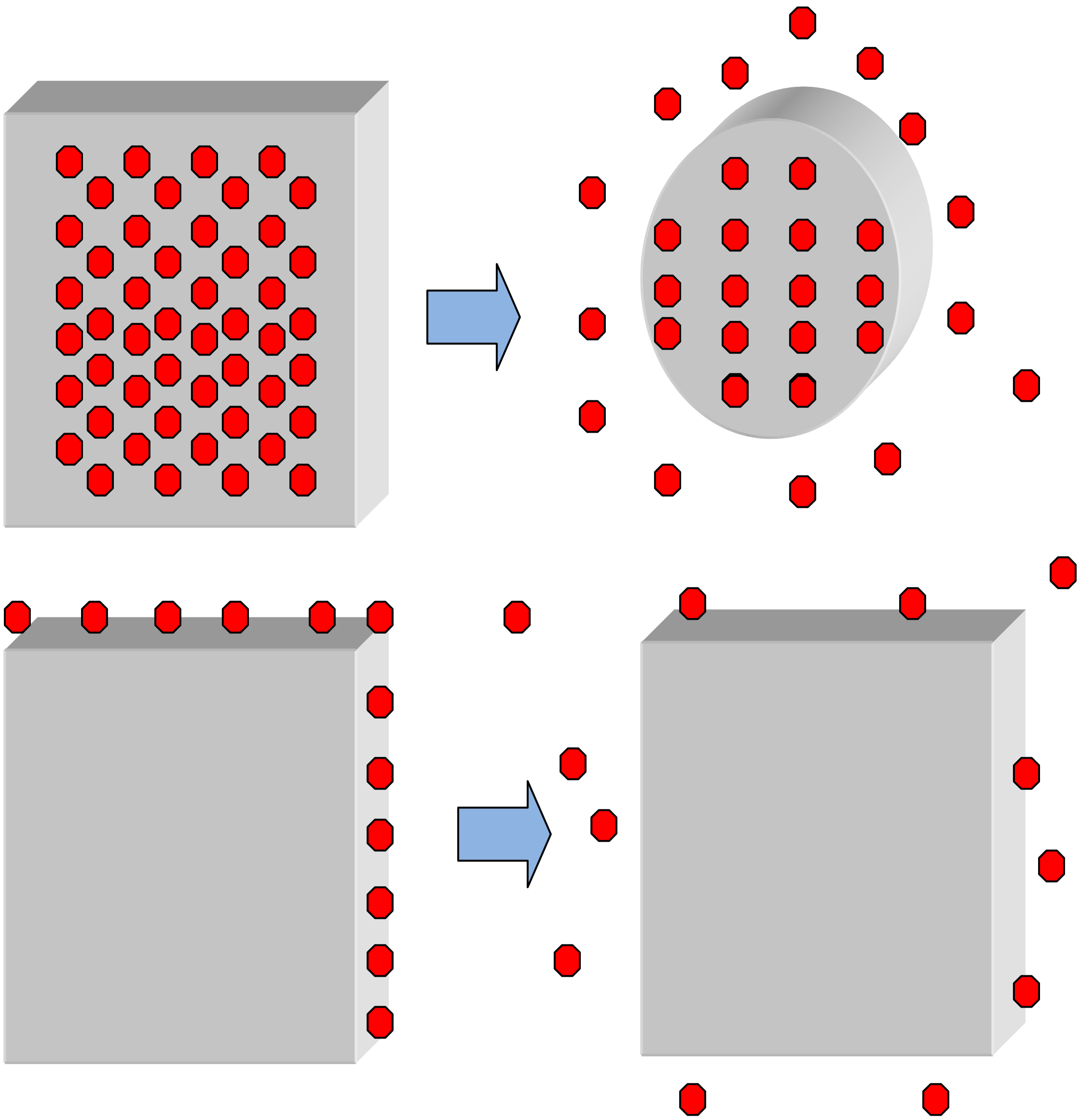


Figure 3-1a

Figure 3-1b

Figure 3-1c

Figure 3-1d

Figure 3-1. Chemical constituents that make a mineral can be mobilized in a water solution by (1) dissolution of a mineral phase, where elements are part of the structure (Figure 3-1a) are released as the mineral dissolves (Figure 3-1b), or (2) elements that are attached to the mineral surface (Figure 3-1c) are released (Figure 3-1d) as a result of a change in the chemistry of the solution.

TECHNICAL MEMORANDUM

TO:	Barry Norris - OWRD	DATE:	18 June 2009
FROM:	Said Amali, Ph.D., PE Paul Wattenburger, Ph.D., PE	PROJECT:	Umatilla Basin Regional Aquifer Recovery Assessment
SUBJECT:	Tasks 1.J & 3.D – Conceptual Engineering Designs	IRZ Project No.: 08-016	

The Oregon Water Resources Department (OWRD) has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

This technical memorandum includes a description of a feasibility-level engineering design concepts and cost to divert surface water, store it in the aquifers, and distribute it to beneficial users in the CGAs. This memorandum fulfils the requirements of Tasks 1.J and 3.D of the study scope of work. Figure 1 depicts the boundary of the CGAs.

1.0 EXECUTIVE SUMMARY

This technical memorandum contains conceptual engineering systems to deliver winter water from the Columbia and Umatilla Rivers to the CGAs. Concept-level cost estimates are also provided for each system. The systems utilize the private irrigation water supply infrastructure which exists in the Umatilla Basin and will need construction of new infrastructure. The use of public infrastructure is envisioned for one of the CGAs.

Other technical memoranda have shown the availability of two suitable alluvial aquifers for recharge of the imported river water, one in the County Line area, and one in the Echo Meadows area. The memoranda also indicate that the aquifer recharge water can be further stored in the basalt aquifers across the three CGAs. Although groundwater quality indicates presence of nitrate-nitrogen in some areas of the alluvial aquifers, it is expected that the design of the engineering system can blend the native groundwater and imported water to allow basalt aquifer injection.

The conceptual engineering systems include three Supply, Storage, Recovery, and Distribution (SSRD) systems 1 through 3. SSRD 1 is intended to pump water from the Columbia River to beneficial users in the Butter Creek and Ordnance Gravel CGAs. SSRD 2 is intended to receive water from the Umatilla River and supply it to beneficial users in the Stage Gulch CGA Sub-Area G and the part of Sub-Area A located south of the Umatilla River. The remaining sub-areas in the Stage Gulch CGA were to be supplied through SSRD 3. However, there is no specific design for system 3 due to lack of suitable aquifer recharge sites. Instead concepts are proposed for future consideration and additional discussion and assessment.

At full build out, the SSRD 1 system is intended to supply a total of approximately 100,000 acre feet (AF) of water for use in the Ordnance Gravel and Butter Creek CGAs. This total includes 69,000 AF of unmet irrigation groundwater need, 24,000 AF of Umatilla River flow augmentation, 1,000 AF of additional domestic and municipal use, and 6,000 AF for basalt aquifer replenishment. The recommended system is to be built in three phases as the volume of imported water begins at 25,000 AF and is raised to 55,000 AF and eventually to full capacity. The second and third phases will be built based on evaluations of aquifer, system, and other data and information collected during implementation of the first phase. The total capital cost ranges from $22 to $100 million for the various engineering options considered in the first through third phase systems. The cost per AF of imported water ranges from $760 to $1,360. The operation and maintenance cost ranges from $2.5 to $9 million, or $88 to $100 per AF of water diverted.

At full build out, the SSRD 2 system is intended to supply up to 25,000 AF of water for use in the Stage Gulch CGA Sub-Areas G and that portion of Sub-Area A located west of the Umatilla River. Of this total 20,000 AF will be to address the unmet irrigation groundwater rights, 3,000 AF to augment Umatilla River flow, and 2,000 AF for basalt aquifer replenishment. However, at this time only 7,500 AF of water supply can be envisioned for this area. Therefore, this system was only designed for this capacity. The total capital cost estimated for the SSRD 2 system is $7 million or $900 per AF, and the annual operation and maintenance cost is $500,000 or $70 per AF.

The SSRD 3 system would need to supply a total of 34,000 AF of water for use in the Stage Gulch CGA sub-areas east of the Umatilla River including Sub-Areas D, H, and the part of A north and east of the river. This total amount includes 25,000 AF of unmet irrigation groundwater rights, 6,000 AF of additional domestic and municipal use, and 3,000 AF for basalt aquifer replenishment. A combination of systems will need to be developed based on existing private and public infrastructure to provide the total amount of need in this area. Concepts to provide this volume of water include one or a combination of small-scale aquifer recharge and basalt aquifer storage, small-scale surface storage reservoirs, creative use of Phase II facilities, potential use of proposed Phase III facilities, additional conservation efforts, water reuse, creative use of Hermiston aquifer groundwater, and creative use of infrequent Umatilla River excess flow.

2.0 OBJECTIVES

The main goal of Tasks 1.J and 3.C is to develop conceptual engineering alternatives for the CGAs with commensurate approximate cost. The alternatives are developed to include the following general components:

1) Supply water from the Columbia and Umatilla Rivers to aquifer recharge (AR) locations.
2) Store river water in alluvial groundwater reservoirs through AR.
3) Recover the AR water for beneficial uses.
4) Distribute the recovered water either for direct on-farm use (during irrigation season), or for further storage in basalt aquifers (during non-irrigation season) through aquifer storage and recovery (ASR).

The following information will be summarized for each alternative:

- Conceptual descriptions and locations of alluvial and basalt recharge projects including the diversion systems (pump station), conveyance and delivery systems, water treatment systems, recovery systems for ASR source water and direct irrigation, and basalt ASR well systems.
- Estimates of the amount of storage, recovery, and return flow to the Umatilla River that may be possible.
- Description of how source water rights will be secured.
- Regulatory and permitting constraints, uncertainties, and limitations.
- Concept-level engineering cost estimates.
- Approximate implementation timeline.
- Other identified key advantages and disadvantages.

3.0 INTRODUCTION

Existing private and public irrigation water supply infrastructure with adequate capacity is available to be incorporated in the conceptual design of the alternatives (IRZ August 2008). Incorporation of the existing infrastructure into the alternatives is a working assumption of this project. Our professional experience and knowledge of many water supply systems in the Umatilla Basin and their cost, permitting challenges, and operational requirements indicate that, without the advantage of existing infrastructure, new water supply systems of the scale considered in this project will have high costs and be economically infeasible. Figure 2 depicts the locations and general layout of the key private and public irrigation water supply systems in the CGAs.

Suitable alluvial aquifers have been identified in two areas with the potential for large scale storage and/or treatment of surface water (IRZ June 2009). The County Line aquifer, located within the Ordnance Gravel CGA provides substantial storage and treatment of imported river water for further use. The Echo Meadows aquifer provides limited storage capacity but can provide a significant treatment capacity of imported water. The locations of these aquifers are depicted on Figure 2.

Storage of AR groundwater in basalt aquifers underlying the CGAs appears to be feasible (GSI Water Solutions Inc. June 2009a). Sub-areas A, D and E in the Stage Gulch CGA (Figure 1) may have reduced feasibility for ASR relative to other sub-areas due to differences in hydrogeologic conditions, and high density of domestic and public water supply wells in these sub-areas.

Adequate volume of water is available from the Columbia River during October, December, January, February, and March to allow sufficient diversion volumes HDR Inc. (January 2009). Water availability for diversion from the Umatilla River is extremely limited and critically depends on timing and duration of spring melt events to create live flow greater than existing allocations. This makes availability of additional out-of-stream uses for recharge extremely unreliable from year to year.

Water needs in the Ordnance Gravel, Butter Creek, and Stage Gulch CGAs were estimated and prioritized in IRZ (July 2008). Total curtailed irrigation groundwater rights for the high-priority sub-areas add up to approximately 115,000 acre feet (AF). Figure 3 depicts the irrigation water needs for the high priority sub-areas in each CGA. The total estimated need also includes 24,000 AF of water to augment Umatilla River stream flow along its lower reaches (below Echo) during the low flow months. Additionally, 7,000 AF of water will be targeted to be left behind in the aquifers to meet future additional, and as yet unspecified, domestic and/or municipal water needs. Finally, up to 10 percent of the water injected in the basalt aquifers will be targeted to be left behind to aid in reversing the rate of over-draft of these aquifers. These volumes will constitute the total needs to be considered when sizing specific engineering systems.

Based on the above factors and bisection of the Stage Gulch CGA into eastern and western parts by the Umatilla River, three Supply, Storage, Recovery, and Distribution (SSRD) systems 1 through 3 were envisioned to provide water to the three CGAs. The SSRD 1 system provides water to the beneficial users in the Butter Creek and Ordnance gravel CGAs. The SSRD 2 system is intended to provide water to beneficial users in the Stage Gulch CGA Sub-Area G and the part of Sub-Area A located south of the Umatilla River. Options for potential future development of the SSRD 3 system to serve the Stage Gulch

CGA areas east of the Umatilla River will be discussed in Section 4.3. Acquisition of source water rights and regulatory and permitting challenges/opportunities are presented in IRZ (January 2009). A road map to permit the AR portion of the SSRD 1 system is explained in IRZ (June 2009). Finally, the results of an analysis of the hydrogeologic and operational constraints on realizing the environmental benefits of the SSRD 1 and 2 systems is presented in GSI Water Solutions, Inc. (June 2009b).

None of the SSRD systems can be implemented without modifications to the existing infrastructure and construction of new components. These systems will have to tie into the existing structures and provide for winterization upgrades. The three SSRD systems, components, layouts, assumptions, and cost estimates are presented below.

4.0 SUPPLY, STORAGE, RECOVERY, AND DISTRIBUTION (SSRD) SYSTEMS

The feasibility-level conceptual designs for the three SSRD systems are presented in this section. The concepts presented below will need to be refined in a follow-up project based on additional analyses to allow completion of detailed system design and implementation.

4.1 SSRD 1 System

At full build out, the SSRD 1 system is intended to supply a total of approximately 100,000 AF of water for use in the Ordnance Gravel and Butter Creek CGAs. Table 1 includes a summary of the water needs identified in these two CGAs. The needs and their basis include the following:

1. Total curtailed irrigation groundwater rights amounting to approximately 69,000 AF. Of this total amount, 8,000 AF is to be used in the Ordnance Gravel CGA Lost Lake-Depot Sub-Area, and the remaining 61,000 to supply needs in the Butter Creek CGA.

2. A total stream flow augmentation need of 24,000 AF. Since the SSRD 1 system currently offers the greatest opportunity for water storage and a ready pathway to the Umatilla River, this amount is targeted to be met through this system. It should be noted that it is likely that the total need may be met through a combination of benefits gained from the three SSRD systems together.

3. An assumed domestic and municipal water need of 1,000 AF out of a total of 7,000 AF identified in IRZ (July 2008). The remaining 6,000 AF are needs assigned to domestic users and cities which are present in the Stage Gulch CGA.

4. A volume of approximately 6,000 AF to be left in the Butter Creek basalt aquifer to aid in replenishment of these aquifers. This amount was estimated based on the assumption that all of

the irrigation needs in the Butter Creek CGA will have to be stored in the basalt aquifer. In addition, the domestic/municipal need is to be stored in the basalt aquifer. These assumptions are subject to change depending on whether the total storage will be accomplished in the basalt aquifers. However, at this stage, they may be thought of as the target volumes to remain in the basalt aquifers by system design.

The total volume of 100,000 AF will be supplied in phases. The phases selected for this feasibility-level assessment are 25,000 AF, 20,000 AF for a total of 55,000 AF, and 45,000 AF for a total of 100,000 AF. The rationale for selecting the supply increment of 25,000 AF is as follows:

- The County Line Water Improvement District (CLWID) has been recharging the County Line aquifer since the late 1970s. Their recharge volume has averaged 6,000 AF and has reached a maximum of more than 10,000 AF. A volume greater than 10,000 AF was selected to allow a clear documentation of the effects of this recharge project as compared with historical CLWID recharge volumes.
- Recharge needs to be at a sufficiently high volume to affect a large part of the aquifer so that adequate data can be collected regarding extent of groundwater spreading, effects on adjacent areas, and flow to Umatilla River. This data will be used to evaluate the feasibility of attaining the next recharge increment.
- Recharge needs to be at a sufficiently high volume to allow a true evaluation of the operational and maintenance needs of the various components of the system and provide design factors before the next increment can be implemented.

The 45,000 or 55,000 AF supply increments are based on the maximum capacities of two private existing irrigation water supply systems that may be used for this project (identified in the next section). The maximum need of 100,000 AF can be met through operating the two systems together within the assumed design parameters selected for this project. Note that the exact value of the three increments will have to be determined during detailed design phase discussions.

Two additional factors were strongly considered in developing the SSRD 1 system. These factors include a need to simplify management of the system components to increase operational flexibility for the operators and reduce operation and maintenance (O&M) cost. Additionally, the designs were intended to simplify future multi-party negotiations, as much as possible, for use of the private systems included in the design. These factors were considered in the system designs and their cost estimates, based on our professional experience and knowledge of the existing infrastructure and local conditions.

Based on the above discussion, seven engineering options were developed for SSRD 1 system. The assumptions underlying these options are described below in Section 4.1.1. Descriptions of the options are presented in Sections 4.1.2 through 4.1.7.

4.1.1 Assumptions

The following assumptions were made in developing system engineering options:

- Source of water is the Columbia River.
- Columbia River diversion and County Line aquifer recharge is completed in 90 days. Currently, it is assumed that this time period will be achieved within the months of October, December, January, February, and March. If diversion during additional months can be negotiated, the cost of the project will decrease by a significant amount.
- The existing river pump stations, booster pump stations, pipelines, canal and related infrastructure owned and operated by the Columbia Improvement District (CID) and Greenwood Resources, Inc. (BTF) could be used. Components and characteristics of these systems are summarized in IRZ (August 2008).
- Secondary use of the stored AR water for irrigation will be conducted through groundwater pumping throughout the year, 365 days. During the non-irrigation season, the stored AR water will be pumped to be injected into the basalt aquifers for further storage. During the irrigation season, the stored AR water will be pumped directly to irrigation systems.
- Secondary use of the stored AR water for river flow augmentation does not require construction of additional infrastructure or O&M cost. Stored AR groundwater which is not pumped will flow toward Umatilla River.
- The layouts of the AR recovery system and the pipelines to distribute the pumped water are only conceptual. The terminal points of the distribution system were taken to be the approximate centers of the Sub-Areas. However, the general topography of the landscape was considered in deciding the branches and locations of booster pump stations for each Sub-Area.
- The AR location was assumed to be within the non-farmed Section 29 of Township 4 North, Range 27 East. A well field for extraction of the stored AR water was assumed to be clustered within this section. An AR well pumping rate of approximately 2,500 gallons per minute (gpm) was assumed based on the well yields in the area. The actual design will consider other recharge locations and will have to distribute the extraction wells and determine rates to accomplish hydraulic control of the stored water.
- Private irrigation wells currently existing in the Lost Lake-Depot Sub-Area in Ordnance Gravel CGA will pump groundwater from the County Line aquifer to meet their needs. This project doesn't include installation of any additional irrigation wells in this sub-area.

- Basalt aquifer ASR can be accomplished via injection into existing wells. An injection rate of between 1,170 and 1,640 gpm was assumed based on the yield of wells in the area basalt aquifers. The construction quality of these wells has to be evaluated prior to detailed system design.

- Existing private irrigation wells in the Butter Creek CGA sub-areas will pump groundwater from the basalt aquifers to meet their needs. This project doesn't include installation of any additional irrigation wells in these sub-areas.

- The AR water supplied to ASR wells in the center of a given sub-area in Butter Creek CGA will increase the supplies for all users in the sub-area by increasing groundwater storage. The irrigated acreage and farm locations in each sub-area will need to be determined to refine this assumption for final design.

- Some level of flow apportionment between the beneficial uses and between the irrigation needs in each sub-area is acceptable. The apportionment levels were selected to meet the incremental (or phased) approach to full build-out of the SSRD 1 system.

- Inclusion of specific values for flow augmentation and domestic/municipal uses does not imply that the exact mechanisms by which these two uses can be served has been determined in this project. Since both of these uses are heavily dependent on additional information regarding aquifer hydraulic behavior during and following AR and ASR, further hydrogeology assessment must be conducted to include them in the detailed design of the SSRD system.

- All ASR wells need wellhead chlorination systems installed for water disinfection prior to injection.

- All systems are assumed to be designed so that the resulting AR groundwater subject of pumping will be a sufficiently-mixed blend of native groundwater and imported river water so that water quality issues do not limit use of AR water as ASR source water.

4.1.2 SSRD 1 System Engineering Option 1

Engineering Option 1 includes diverting the full volume of 100,000 AF of water from the Columbia River. Both the CID and BTF systems including river pump stations, booster pump stations, pipelines, and canal will be used to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas. The conceptual system layout is shown on Figure 4. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- The CID river pump station with a maximum power rating of 13,500 Horsepower (HP) pumping up to their combined rate of 138,400 gpm, equal to 307 cubic feet per second (cfs) or 614 AF per day.
- The BTF river pump station with a maximum power rating of 9,950 HP pumping up to their combined rate of 113,200 gpm (252 cfs or 503 AF per day).
- The CID pipelines, booster stations, and canal to approximately the canal terminal point.
- The BTF pipeline to the main booster station located just south of Highway I-84.
- Approximately 40,000 feet (ft) of new 78-inch diameter conveyance pipeline capable of carrying 113,200 gpm of water from the BTF system along the south side of Highway I-84 to the AR site.
- Approximately 18,000 ft of new 90-inch diameter gravity-flow conveyance pipeline capable of carrying 138,400 gpm of water from the CID canal to the AR site.
- Sixteen AR extraction wells with 150-HP pumps. The wells will be manifold together to pump a combined flow of approximately 42,000 gpm into the main distribution pipeline.
- Approximately 21,000 ft of new 60-inch diameter main distribution pipeline capable of carrying 41,340 gpm of water from the AR site to the Echo Junction Branch pipeline.
- Approximately 30,000 ft of new 24-inch diameter branch pipeline capable of carrying 6,710 gpm of water from the branching location via a 400 HP booster pump to the serve needs in the Echo Junction Sub-Area.
- Approximately 22,000 ft of new 54-inch diameter main distribution pipeline capable of carrying 34,630 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with a 3,000 HP booster pump station. The pipeline is routed to pass the center of this sub-area and eliminate the need for an additional branch pipeline.
- Approximately 5,000 ft of new 51-inch diameter main distribution pipeline capable of carrying 32,000 gpm of water from the Fourmile Canyon Sub-Area to the West Sub-Area Branch.
- Approximately 19,000 ft of new 42-inch diameter branch pipeline capable of carrying 26,850 gpm of water from the main pipeline to the West Sub-Area.

- Approximately 26,000 ft of new 24-inch diameter main distribution pipeline capable of carrying 5,220 gpm of water via a 450 HP booster pump station from the West Sub-Area branch to the Pine City sub-Area.

4.1.3 SSRD 1 System Engineering Option 2

Engineering Option 2 includes diverting 55,000 AF of water from the Columbia River. Only the CID system, including river pump stations, pipelines, and the CID canal, need to be used to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas. The total amount diverted and supplied to each beneficial use is 55 percent of Option 1 based on the maximum CID system capacity. The conceptual system layout is shown on Figure 5. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- The CID river pump station with a maximum power rating of 13,500 HP pumping up to their combined rate of 138,400 gpm (307 cfs or 614 AF per day).
- The CID pipelines, booster stations, and canal to a location before the canal terminal point.
- Approximately 18,000 ft of new 90-inch diameter gravity-flow conveyance pipeline capable of carrying approximately 138,400 gpm of water from the CID canal to the AR site.
- Nine AR extraction wells with 150-HP pumps. The wells will be manifold together to pump a combined flow of 23,000 gpm into the main distribution pipeline.
- Approximately 2,600 ft of new 48-inch, and 18,500 ft of new 45-inch, diameter main distribution pipelines capable of carrying 23,000 gpm of water, respectively, from the AR site to the Echo Junction Branch pipeline. The branch pipeline between the two size pipes will carry 375 gpm of water via an 8-inch pipeline for domestic/municipal uses.
- Approximately 30,000 ft of new 20-inch diameter branch pipeline capable of carrying 3,700 gpm of water from the branching location via a 200 HP booster pump to the serve needs in the Echo Junction Sub-Area.
- Approximately 22,000 ft of new 42-inch diameter main distribution pipeline capable of carrying 19,000 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with a

1,500 HP booster pump station. The pipeline is routed to pass the center of this sub-area and eliminate the need for an additional branch pipeline.

- Approximately 5,000 ft of new 42-inch diameter main distribution pipeline capable of carrying 32,000 gpm of water from the Fourmile Canyon Sub-Area to the West Sub-Area Branch.
- Approximately 19,000 ft of new 30-inch diameter branch pipeline capable of carrying 15,000 gpm of water from the main pipeline to the West Sub-Area.
- Approximately 26,000 ft of new 16-inch diameter main distribution pipeline capable of carrying 2,900 gpm of water via a 350 HP booster pump station from the West Sub-Area branch to the Pine City sub-Area.

4.1.4 SSRD 1 System Engineering Option 3

Engineering Option 3 includes diverting 55,000 AF of water from the Columbia River. Only the CID system, including river pump stations, pipelines, and the CID canal, need to be used to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas.

This option is similar to Option 2 in that full capacity of the CID system will be used and it will only meet partial need of each beneficial user (60 percent in this case) but no water is supplied to the Pine City Sub-Area which is located at the farthest distance and highest elevation from the AR site. The conceptual system layout is shown on Figure 6. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- The CID river pump station with a maximum power rating of 13,500 HP pumping up to a combined rate of 138,400 gpm (307 cfs or 614 AF per day).
- The CID pipelines, booster stations, and canal to approximately the canal terminal point.
- Approximately 18,000 ft of new 90-inch diameter gravity-flow conveyance pipeline capable of carrying 138,400 gpm of water from the CID canal to the AR site.
- Nine AR extraction wells with 150-HP pumps. The wells will be manifold together to pump a combined flow of 22,000 gpm into the main distribution pipeline.

- Approximately 2,600 ft of new 48-inch, and 18,500 ft of new 42-inch, diameter main distribution pipelines capable of carrying 22,000 gpm of water, respectively, from the AR site to the Echo Junction Branch pipeline. The branch pipeline between the two size pipes will carry 410 gpm of water via an 8-inch pipeline for domestic/municipal uses.

- Approximately 30,000 ft of new 20-inch diameter branch pipeline capable of carrying 4,000 gpm of water from the branching location via a 250 HP booster pump to the serve needs in the Echo Junction Sub-Area.

- Approximately 22,000 ft of new 42-inch diameter main distribution pipeline capable of carrying 18,000 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with a 1,450 HP booster pump station. The pipeline is routed to pass the center of this sub-area and eliminate the need for an additional branch pipeline.

- Approximately 5,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 18,000 gpm of water from the Fourmile Canyon Sub-Area to the West Sub-Area Branch.

- Approximately 19,000 ft of new 36-inch diameter branch pipeline capable of carrying 16,000 gpm of water from the main pipeline to the West Sub-Area.

4.1.5 SSRD 1 System Engineering Option 4

Engineering Option 4 includes diverting 45,000 AF of water from the Columbia River. Only the BTF system, including river pump stations and the two 54-inch pipeline are used in this option to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas. The total amount supplied to each beneficial use is 45 percent of Option 1 based on the maximum BTF system capacity. The conceptual system layout is shown on Figure 7. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- The BTF river pump station with a maximum power rating of 9,950 HP will be used to pump at a combined rate of 113,200 gpm (252 cfs or 503 AF per day).

- The BTF pipeline to the main booster station located just south of Highway I-84.

- Approximately 40,000 ft of new 78-inch diameter conveyance pipeline capable of carrying 113,200 gpm of water from the BTF system along the south side of Highway I-84 to the AR site.

- Eight AR extraction wells with 150-HP pumps. The wells will be manifold together to pump a combined flow of 19,000 gpm into the main distribution pipeline.

- Approximately 21,000 ft of new 42-inch diameter main distribution pipeline capable of carrying 23,000 gpm of water from the AR site to the Echo Junction Branch pipeline. An 8-inch branch pipeline along this reach carries 310 gpm of water for domestic/municipal uses.

- Approximately 30,000 ft of new 16-inch diameter branch pipeline capable of carrying 3,000 gpm of water from the branching location via a 100 HP booster pump to the serve needs in the Echo Junction Sub-Area.

- Approximately 22,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 16,000 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with an 850 HP booster pump station. The pipeline is routed to pass the center of this sub-area and eliminate the need for an additional branch pipeline.

- Approximately 5,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 14,500 gpm of water from the Fourmile Canyon Sub-Area to the West Sub-Area Branch.

- Approximately 19,000 ft of new 30-inch diameter branch pipeline capable of carrying 12,000 gpm of water from the main pipeline to the West Sub-Area.

- Approximately 26,000 ft of new 14-inch diameter main distribution pipeline capable of carrying 2,400 gpm of water via a 250 HP booster pump station from the West Sub-Area branch to the Pine City sub-Area.

4.1.6 SSRD 1 System Engineering Option 5

Engineering Option 5 includes diverting 45,000 AF of water from the Columbia River. Only the BTF system, including river pump stations and the two 54-inch pipeline are used in this option to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas.

This option is similar to Option 4 in that full capacity of the BTF system will be used and will meet partial need of each beneficial user (49 percent in this case) but no water is supplied to the Pine City Sub-Area which is the farthest and at the highest elevation relative to the AR site. The conceptual system layout is shown on Figure 8. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- The BTF river pump station with a maximum power rating of 9,950 HP pumping up to a combined rate of 113,200 gpm (252 cfs or 503 AF per day).
- The BTF pipeline to the main booster station located just south of Highway I-84.
- Approximately 40,000 ft of new 78-inch diameter conveyance pipeline capable of carrying 113,200 gpm of water from the BTF system along the south side of Highway I-84 to the AR site.
- Eight AR extraction wells with 150-HP pumps. The wells will be manifold together to pump a combined flow of 18,000 gpm into the main distribution pipeline.
- Approximately 21,000 ft of new 42-inch diameter main distribution pipeline capable of carrying 18,000 gpm of water, respectively, from the AR site to the Echo Junction Branch pipeline. A branch pipeline in this reach will carry 330 gpm of water via an 8-inch pipeline for domestic/municipal uses.
- Approximately 30,000 ft of new 16-inch diameter branch pipeline capable of carrying 3,300 gpm of water from the branching location via a 150 HP booster pump to the serve needs in the Echo Junction Sub-Area.
- Approximately 22,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 14,000 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with a 900 HP booster pump station. The pipeline is routed to pass the center of this sub-area and eliminate the need for an additional branch pipeline.
- Approximately 5,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 13,000 gpm of water from the Fourmile Canyon Sub-Area to the West Sub-Area Branch.
- Approximately 19,000 ft of new 30-inch diameter branch pipeline capable of carrying 13,000 gpm of water from the main pipeline to the West Sub-Area.

4.1.7 SSRD 1 System Engineering Options 6 and 7

Engineering Options 6 and 7 include diverting 25,000 AF of water from the Columbia River using either the CID or BTF systems. Option 6 uses the BTF, and Option 7 the CID, system including river pump stations, pipelines, and canals to convey the diverted water to the AR site. The irrigators in the Lost lake-Depot Sub-Area will pump groundwater directly from the aquifer. To supply the sub-areas in the Butter Creek CGA, the stored AR groundwater will be pumped and conveyed via a main pipeline and several branches to the sub-areas.

In these two options, the Lost Lake-Depot Sub-Area is designed to receive 75 percent of its total need, and the Echo Junction and Fourmile Canyon Sub-Areas and the domestic/municipal and basalt aquifers their full needs. The Umatilla flow augmentation need will be only partially met and the West and Pine City Sub-Areas will not receive water. Although this apportionment plan is based on several practical considerations, the allocations between users can be revised during additional discussions in the implementation phase of the project. The conceptual system layouts are shown on Figures 9 and 10. Table 2 lists the target volumes of water for each beneficial use served in this Option.

The conceptual system includes a number of existing and new components. The operating characteristics of the existing facilities are tabulated in IRZ (August 2008). The system components include the following:

- Option 6 includes use of the BTF river pump station and pipelines to supply 63,000 gpm (140 cfs or 280 AF per day) of water. The BTF pipeline to the main booster station located just south of Highway I-84 will be used. The water will be conveyed via a 54 and then a 60-inch pipeline to the AR site.

- Option 7 includes use of the CID river pump station to pump at a rate of 63,000 gpm (140 cfs or 280 AF per day). The CID pipelines, booster stations, and canal will be used to approximately the canal terminal point where the water will be conveyed via a 60-inch diameter gravity-flow pipeline to the AR site.

- Four AR extraction wells with 150-HP pumps will be used for recovery. The wells will be manifold together to pump a combined flow of 10,000 gpm into the main distribution pipeline.

- Approximately 2,600 ft of new 30-inch, and 19,000 ft of 28-inch, diameter main distribution pipeline capable of carrying 10,000 gpm of water from the AR site to the Echo Junction Branch pipeline. A branch pipeline in this reach will carry 680 gpm of water via an 8-inch pipeline for domestic/municipal uses.

- Approximately 30,000 ft of new 24-inch diameter branch pipeline capable of carrying 6,700 gpm of water from the branching location via a 200 HP booster pump to serve the needs in the Echo Junction Sub-Area.

- Approximately 22,000 ft of new 16-inch diameter main distribution pipeline capable of carrying 67,000 gpm of water from the Echo Junction Branch to the Fourmile Canyon Sub-Area with a 150 HP booster pump station.

4.1.8 Concept-Level Engineering Cost Estimate

Cost estimates were prepared for each of the conceptual engineering options described above. It must be noted that these cost estimates are only feasibility-level estimates designed to provide an initial approximate assessment of the overall cost of the project and must be refined for further planning purposes. The cost estimates do provide relative comparisons between the seven engineering options.

The cost estimates are listed in Table 3 for the seven options. The total capital cost ranges from $22 to $100 million, or from a low of approximately $760 to a high of $1,360 per AF of water diverted. Consistently, the per-AF cost of connecting to the BTF system is greater than the CID system, due to the higher cost associated with having to install a much longer pipeline. The O&M cost ranges from $2.5 to $9 million, or from approximately $88 to $100 per AF of water diverted. The O&M cost is generally lower for use of the BTF system for diversion due to its relatively less complex system management needs.

In preparing the estimates, the cost for the supply and AR storage components were combined. Likewise, the cost for groundwater recovery from AR storage and its distribution to farms or ASR wells were combined. Estimates of both capital cost of initial system construction and the annual O&M cost are included in Table 3. The following initial capital cost items and assumptions were included in developing the estimates:

- *Pipelines, Booster Pumps, Appurtenances, and Installation –* The current cost for PVC pipe was used. Note that construction cost estimates will have to use updated pipe cost at the time of purchase. The installation cost was developed based on discussions with private contractors. Appurtenances included fittings, steel piping, valves, etc.

- *Winterization –* As much as possible, the time duration for diversion and storage will be selected to avoid freezing conditions. However, some level of winterization of the key components of the system including pump and booster stations and others was included in the conceptual design.

- *Loss of Crop –* Installation of new components will incur cost of removing and in some instances replacing crops, such as poplar trees. This cost was deemed significant enough that it was included as a specific line item in the cost spreadsheets. The cost was approximated based on anticipated area of disturbance and an assumed tree replacement cost.

- *AR Wells, Pumps, Pipelines to the Manifold Location, Electrical Components and Panels*

- *ASR Well Pumps, Valves, Electrical Components, Wellhead Water Treatment Facilities*

- *Engineering, Legal/Permitting, and Contingency –* These cost items were included at 10, 5, and 20 percent of the total cost of the above items, respectively. These rates are generally accepted in the industry for similar concept-level feasibility assessments.

The O&M cost included the cost of power, labor required for the additional operation and maintenance of the CID and/or BTF systems as well as the new components, and routine environmental and system monitoring and reporting. No other cost categories such as legal, contingency, etc. were included.

4.2 SSRD 2 System

At full build out, the SSRD 2 system is intended to supply up to 25,000 AF of water to beneficial uses in the Stage Gulch CGA Sub-Areas G and that portion of Sub-Area A located west of the Umatilla River. The identified needs and their basis include the following:

1. Total curtailed irrigation groundwater rights amount to approximately 10,000 AF in the Stage Gulch CGA Sub-Area G and approximately 10,000 AF in the portion of Stage Gulch CGA Sub-Area A that is located west of the Umatilla River, for an estimated total of 20,000 AF.
2. A stream flow augmentation of 3,000 AF. If the SSRD system succeeds in providing the full amount of targeted stream flow augmentation, this amount may not be needed from SSRD 2 system.
3. A volume of 2,000 AF to be left in the Stage Gulch basalt aquifer to aid in replenishment of these aquifers. This amount was estimated based on the assumption that all of the irrigation need in the Butter Creek CGA will have to be stored in the basalt aquifer. These assumptions are subject to change depending on whether the total storage will be accomplished in the basalt aquifers. However, at this stage, they may be thought of as the target volumes to remain in the basalt aquifers by system design.

It will not be feasible to import water from the Columbia River to meet the needs of these sub-areas based on the relatively long distance from the river, sparse distribution and relatively small size of existing infrastructure, and the low capacity of the Echo Meadows alluvial aquifer to provide storage and/or treatment capacity. The Umatilla River flow is unreliable to provide consistent water for annual diversion in excess of current allocated in-stream and out-of-stream amounts. Therefore, at this time, the realistic opportunity to provide water to this area includes developing a plan with the CLWID to get access to their Umatilla River water right in exchange for satisfying their need via SSRD 1 system from the Columbia River. In this case, the maximum volume of water subject of exchange, based on the CLWID water right, is assumed to be 7,500 AF. Therefore, the SSRD 2 system will be conceptually designed for this capacity. We further assume that all of this water will be used to satisfy the unmet irrigation groundwater right.

As conceptualized, the SSRD 2 system will supply 7,500 AF of the total 25,000 AF need in this portion of the Stage Gulch CGA. The remaining 17,500 AF will need to be satisfied through other mechanisms or opportunities described in Section 4.3.

Similar to the SSRD 1 system, the design of the SSRD 2 system considered the need to simplify management of system components and simplify future multi-party negotiations, as much as possible, for use of private systems.

4.2.1 Assumptions

Several assumptions were made in developing the conceptual design. These assumptions and their rationale are as follows:

- Source of water is through exchange with CLWID.
- Recharge of the Echo Meadows aquifer will only be permitted during 120 days. Currently, it is assumed that this time period will be achieved during the non-irrigation seasons. It is conceivable that, depending on Umatilla River flow (source of water to CLWID), water may be available in the early part of the irrigation season also. However, constraints on Hunt Canal operations such as available canal capacity, may limit the extent to which the canal can be used.
- The existing Hunt Canal and its components adjacent to the Echo Meadows aquifer will be available for use. Components and characteristics of this system are summarized in IRZ (August 2008).
- Secondary use of the stored AR water for irrigation will be conducted through groundwater pumping within the same 120-day recharge period. The secondary use will be to pump groundwater as source water for ASR injection. However, the current design does not provide for the possibility to pump the AR water directly to irrigation systems if AR storage is permitted to extend into the irrigation season (i.e., after April 15).
- The layouts of the AR recovery system and the pipelines to distribute the pumped water are only conceptual. The terminal points of the distribution system were opportunistic locations based on professional judgment and local information.
- No specific AR location was assumed during design since the exact locations do not significantly change the cost estimates for this concept-level design. A pumping rate of 1,400 gpm was assumed for alluvial wells based on area well capacities. The actual design will have to consider actual recharge locations and sizes.
- Private irrigation wells in the basalt aquifer will pump groundwater from this aquifer to meet their need. This project doesn't include installation of any additional irrigation wells in these sub-areas.

- Basalt aquifer ASR can be accomplished via injection into existing wells. An injection rate of 1,400 gpm was assumed based on the yield of the wells. The construction quality of these wells has to be evaluated prior to detailed system design.

- The AR water supplied to ASR wells in a given sub-area will increase the supplies for all users in the sub-area by increasing groundwater storage. The irrigated acreage and farm locations in each sub-area will need to be determined to refine this assumption for final design.

- The assumed available volume of 7,500 AF is equally divided between the two sub-areas.

- All ASR wells will need wellhead chlorination systems for water disinfection installed prior to injection.

- All systems are assumed to be designed so that the resulting AR groundwater subject of pumping will be a sufficiently-mixed blend of native groundwater and imported river water so that water quality issues do not limit use of AR water as ASR source water.

4.2.2 SSRD 2 System Engineering Option

One option was considered for this system to annually divert 7,500 AF of water from the Umatilla River using the Hunt Canal as the diversion and supply mechanism. The water will be used to recharge the Echo Meadows aquifer so that treated groundwater can be pumped and conveyed via a pipeline and branches to the sub-areas. Each sub-area will receive half of the available volume of 7,500 AF. The conceptual system layout is shown on Figure 11.

The conceptual system includes the following new components:

- Six AR extraction wells with 150-HP pumps will be used for recovery. The wells will be manifold together to pump a combined flow of 14,000 gpm into the main distribution pipeline.

- Approximately 11,000 ft of new 36-inch diameter main distribution pipeline capable of carrying 14,000 gpm of water from the AR site to the Sub-Area A branch with a 90 HP booster pump.

- Approximately 8,500 ft of new 24-inch diameter Sub-Area A branch pipeline capable of carrying 7,000 gpm of water.

- Approximately 13,000 ft of new 24-inch diameter main distribution pipeline capable of carrying 7,000 gpm of water to Sub-Area G from the branching location with a 440 HP booster pump station.

4.2.3 Concept-Level Engineering Cost Estimate

The total capital cost estimated for the SSRD 2 system is $7 million, and the annual O&M cost is $500,000. These cost values are equivalent to approximately $900 and $70 per AF for construction and annual O&M cost, respectively. It must be noted that these cost estimates are only feasibility-level estimates designed to provide an initial approximate assessment of the overall cost of the project and must be refined for further planning purposes.

4.3 SSRD 3 System

The SSRD 3 system is intended to supply a total of 34,000 AF of water for use in the Stage Gulch CGA sub-areas east of the Umatilla River including Sub-Areas D, H, and the part of A north and east of the river. The identified needs and their basis include the following:

1. Total curtailed irrigation groundwater rights amount to approximately 25,000 AF.
2. An assumed domestic and municipal water need of 6,000 AF out of a total of 7,000 AF identified in IRZ (July 2008). Most of the assumed future needs of the towns and cities in the three CGAs are concentrated in this area.
3. A volume of 3,000 AF to be left in the Stage Gulch basalt aquifer to aid in replenishment of these aquifers. This volume was estimated based on the assumption that all of the irrigation needs in the Butter Creek CGA will have to be stored in the basalt aquifers. In addition, the domestic/municipal need was also assumed to be stored in the basalt aquifers. These assumptions are subject to change depending on whether the total storage will be accomplished in the basalt aquifers. However, at this stage, they may be thought of as the target volumes to remain in the basalt aquifers by system design.

The SSRD 3 system would primarily rely on pumping winter flow from the Columbia River for subsequent storage. However, an initial assessment of area geology, and follow-up site specific drilling and data collection in the area, did not indicate presence of sedimentary units of sufficient storage and permeability, at a suitable location, and with a suitable overlying land use for a feasible aquifer recharge operation (IRZ June 2009). This precludes design of a system similar to SSRD 1 and 2. Therefore, other mechanisms or combinations of other opportunities will need to be considered.

Several concepts are presented below for further consideration and discussion. No attempt has been made in this project at detailed evaluation of their technical and permitting aspects due to project budgetary and time constraints. Additional focused assessments, in consultation with the local stakeholders, will be needed to select and develop feasible engineering options for this area of the Stage Gulch CGA. The concepts, in no order of priority, are listed below.

1. *Small-Scale Aquifer Storage* – Although a suitable large-scale shallow aquifer is not present in the area, the overall geology indicates that small-scale (up to approximately 5,000 AF) shallow sedimentary units may be available locally to meet individual growers' needs. This project did not include an investigation of the locations and extent of such aquifer opportunities. However, we are aware of several private initiatives over the years to begin such evaluations. The capital and annual O&M cost per AF for one of these initiatives were approximately $300 and $80, respectively (IRZ 2007). Additionally, areas east and southeast of Hermiston may offer some potential in this regard (James M. Montgomery 1987). The source of water for these small-scale projects would be winter diversions from the Columbia River and conveyance to the recharge locations using a combination of existing and new structures.

2. *Small-Scale Surface Reservoirs* – Small-scale off-channel dams may provide some storage opportunity in the area. The Bureau of Reclamation (1999) provides information regarding several potential sites. The BOR analysis was conducted for many sites located in the southern upstream areas of the Umatilla Basin. Similar assessments, focused on smaller reservoir sites, needs to be conducted within and near the Stage Gulch CGA.

3. *Excess Umatilla River Flow* – There are infrequent winter and spring flood events in Umatilla River which are not captured for out-of-stream uses due to their short-duration high flow nature. In recent years, there have been applications to use the flood flows in excess of appropriated flows for aquifer recharge below the town of Echo. Instead of attempting to capture flood waters that may be currently "uncapturable", these excess flows may be recorded and credited for later use. The credited volume would be pumped from the Columbia River and stored in Cold Springs Reservoir for later release through the Hermiston Irrigation District and/or Stanfield Irrigation District systems, or via new pipelines to specific points of use such as AR/ASR sites or for direct on-farm use. Additionally, this option only provides a very opportunistic access to this source of water due to unreliable spring flood flows between years.

   Availability of additional capacity in the Cold Springs Reservoir for this purpose needs to be evaluated relative to timing of water diversions. The reservoir was originally constructed to have a capacity of 50,000 AF but currently offers 38,000 AF due to siltation since its construction in 1907-08 (IRZ 2000). Options to dredge the sediments may be necessary to increase its operating capacity.

4. *Umatilla Basin Project Phase II Infrastructure* – The Phase II infrastructure provides partial replacement flow from the Columbia River to the Stanfield Irrigation District after early June (Stanfield Irrigation District Water Conservation Plan 1996). Between April 1 and early June, the district relies upon diversion of Umatilla River live flow. It is conceivable that the live flow diversions could be supplied through the Phase II system leaving that water in Umatilla River which may be used for storage in the Stage Gulch CGA east of the river.

The Phase II pump station additionally has the capability to pump water from the Columbia River to the Cold Springs Reservoir. The reservoir is filled up via the Hermiston Irrigation District Feed Canal with water from the Umatilla River typically during November through May. The Phase II system is used to provide some water from the Columbia River during the other months (IRZ 2000). The total volume delivered to the reservoir is nearly 50,000 in a year. It is conceivable that the flow diversions from the Umatilla River could be supplied through the Phase II system to the reservoir leaving that water in Umatilla River which may be used for storage in the Stage Gulch CGA east of the river.

5. *Umatilla Basin Project Proposed Phase III System* – The local stakeholders and the Bureau of Reclamation have been evaluating options to exchange Columbia River water for WID's Umatilla River irrigation water rights through the proposed Umatilla Basin Project Phase III process. With a Phase III supply to WID, significant flow would remain in the Umatilla River. The opportunities to use the proposed system to increase flexibility in river flow management or provide for additional out-of-stream uses in the Stage Gulch CGA in combination with the SSRD 1 and 2 systems need to be explored further.

6. *Water Conservation* - Additional water conservation may be possible through lining and/or piping the remaining earthen portions of the HID canals. This would increase system efficiencies which then could be used for use elsewhere in the CGA. Assessment findings summarized in IRZ (2000) can be updated and to estimate potential water savings and costs.

7. *Reuse* – The City of Hermiston's wastewater treatment plant currently generates approximately 1,000 gpm of Level II effluent, equivalent to approximately 1,600 AF of effluent per year. The effluent is currently used for irrigation of crops in an area west of the Umatilla River. The effluent may be used at a different location east of the river for irrigation purposes through a land application permit and the current users may be supplied through the SSRD 2 system. New pipelines will have to be constructed to convey the effluent to the new site. A land application permit needs to be issued and contract negotiations with between the City and new users will have to be conducted.

8. *Use of Hermiston Aquifer Groundwater* – Although the significant sand and gravel sediments underlying Hermiston and its vicinity do not provide a large-scale opportunity for AR/ASR activities, relatively small-scale groundwater pumping may be conducted from this aquifer for use on nearby farms or for piping elsewhere for ASR storage.

5.0 FULL BUILD-OUT PROJECT CONCEPT DESIGN

A phased implementation approach is presented in this section for the SSRD 1 system to supply the Ordnance Gravel and Butter Creek CGAs. No phased approach need be considered at this time for the SSRD 2 system, unless additional water becomes available to this area of Stage Gulch CGA through any opportunity from the SSRD 1 system, through the options presented in Section 4.3, and/or other ideas. The SSRD 2 system may be designed as part of SSRD 1 design process, depending on timeline and available budget. Finally, until practical options for the SSRD3 system can be developed, no additional engineering work is envisioned for that area of Stage Gulch CGA.

At full build-out, the SSRD 1 system is intended to withdraw 100,000 AF of water from the Columbia River. This total volume will have to be reached in increments as explained previously. The SSRD 1 Engineering Options one through seven provide alternative designs to achieve the three increments of 25,000, 55,000, and 100,000 AF. A corresponding three-phase approach can be described as follows:

1. The first phase of the project will include building a system to convey 25,000 AF of water via the CID conveyance system (Option 7 Figure 10). Aquifer and system operating data and information will be collected prior to and during design. Components of the system may be designed to allow easy integration into the next phase of the system. Operate the system for at least one year to collect post-recharge aquifer and system operational data. The first phase may also include designing the SSRD 2 system if provisions to provide a source of water, either from an exchange with the CLWID or from private water rights, can be negotiated.

2. In the second phase, the system components and operation will be modified to divert and recharge an additional 20,000 AF via the CID system for a total water volume of 55,000 AF (Options 2 or 3, Figures 5 and 6). The data and information from the first phase system will be critical in designing the expanded system.

3. The third phase will include designing and constructing upgrades and operational changes as may be required to divert and store 100,000 AF of water from the Columbia River (Option 1, Figure 4). This phase will be critically dependant on the information and data obtained during the first and second phases. Principally, the data and information will be needed to indicate whether the alluvial and basalt aquifers can accommodate the target volume of water, and whether the operations and maintenance requirements can be satisfied at a reasonable cost.

Implementation of the SSRD 1 system will include completing the following key tasks:

- Obtain permits, specifically AR and ASR water right permits.

- Collect and evaluate pre-recharge aquifer and systems data and information.

- Develop engineering design.
- Construct Phase 1 systems.

Anticipated timeline for completion of Phase 1 system is dependent on the timelines to secure the permits and local negotiations. Assuming these steps follow a “normal” path without complicated legal or administrative challenges, the key tasks above can be completed between one and two years from when funds become available. We should point out that this timeline is very approximate and should only be used for preliminary planning purposes.

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TABLES

TABLE 1
Ordnance Gravel & Butter Creek CGAs[(a)] Maximum Annual Water Needs[(b)]
Conceptual Engineering Designs

Use Type	Volume (AFY[(c)])	
Irrigation		
Ordnance Gravel CGA – Lost Lake-Depot Sub-Srea	8,000	
Butter Creek CGA – Echo Junction Sub-Area	9,846	
Butter Creek CGA – Four Mile Canyon Sub-Area	3,764	
Butter Creek CGA – West Sub-Area	39,396	
Butter Creek CGA – Pine City Sub-Area	7,658	
Sub-Total Irrigation		68,664
Umatilla River Flow Augmentation	24,000	
Domestic/Municipal Use[(d)]	1,000	
Left in Basalt Aquifer[(e)]	6,166	
TOTAL		**99,830**

Notes:

(a) CGA = Critical Groundwater Area
(b) The water need values and their basis are presented in IRZ (July 2008).
(c) AFY = Acre Feet per Year
(d) The total need included in IRZ (July 2008) is 7,000 AF, of which 1,000 AF was assumed to be applicable to the Ordnance Gravel and Butter Creek CGAs.
(e) This amount corresponds to 10 percent of the maximum amount that will be stored in the basalt aquifers in the Butter Creek CGA, as explained in the text.

TABLE 2
Apportionment of Stored Groundwater
Engineering Options 1 Through 7, SSRD 1 System
Conceptual Engineering Designs

Beneficial Use	Engineering Option 1[a] (AF)[g]	Engineering Option 2[b] (AF)	Engineering Option 3[c] (AF)	Engineering Option 4[d] (AF)	Engineering Option 5[e] (AF)	Engineering Options 6 & 7[f] (AF)
Irrigation by Sub-Area						
Lost Lake-Depot	8,000	4,400	4,800	3,600	3,920	6,000
Echo Junction	9,846	5,415	5,908	4,431	4,825	9,846
Fourmile Canyon	3,764	2,070	2,258	1,694	1,844	3,764
West	39,396	21,668	23,638	17,728	19,304	0
Pine City	7,658	4,212	0	3,446	0	0
Sub-Total Irrigation	**68,664**	**37,765**	**36,604**	**30,889**	**29,893**	**19610**
Umatilla River	24,000	13,200	14,400	10,800	11,760	3,092
Domestic/Municipal	1,000	550	600	450	490	1,000
Basalt Aquifer Storage	6,166	3,392	3,240	2,775	2,646	1,461
TOTAL	**99,830**	**54,907**	**54,844**	**44,924**	**44,789**	**25,163**

Notes:

(a) All values all 100 percent of identified need, served using both CID and BTF systems.
(b) All values are 55 percent of Option 1 full apportionment, served using the CID system only.
(c) All values are 60 percent of Option 1 full apportionment, with no service to Pine City Sub-Area, served using the CID system only.
(d) All values are 45 percent of Option 1 full apportionment, served using the BTF system only.
(e) All values are 49 percent of Option 1 full apportionment, with no service to Pine City Sub-Area, served using the BTF system only.
(f) Percentage of service variable between users, served via either CID or BTF systems.
(g) AF = acre feet.

TABLE 3
Concept-Level Cost Estimates
Engineering Options 1 Through 7, SSRD 1 System
Conceptual Engineering Designs

Engineering Option	Supply System	Type	Supply & AR Storage (Million $)	AR Recovery & Distribution (Million $)	Total (Million $)
1 – 99,830 AFY[a]	CID and BTF	Capital Cost	56	44	100
		O&M Cost	5	4	9
2 – 55,000 AFY, w/PC[b]	CID	Capital Cost	17	25	42
		O&M Cost	3.2	2	5.2
3 – 55,000 AFY, w/o PC	CID	Capital Cost	17	25	42
		O&M Cost	3.2	2	5.2
4 – 45,000 AFY, w/PC	BTF	Capital Cost	40	20	60
		O&M Cost	2	2	4
5 – 45,000 AFY, w/o PC	BTF	Capital Cost	40	20	60
		O&M Cost	2	2	4
6 – 25,000 AFY	BTF	Capital Cost	24	10	34
		O&M Cost	1.5	1	2.5
7 – 25,000 AFY	CID	Capital Cost	12	10	22
		O&M Cost	1.5	1	2.5

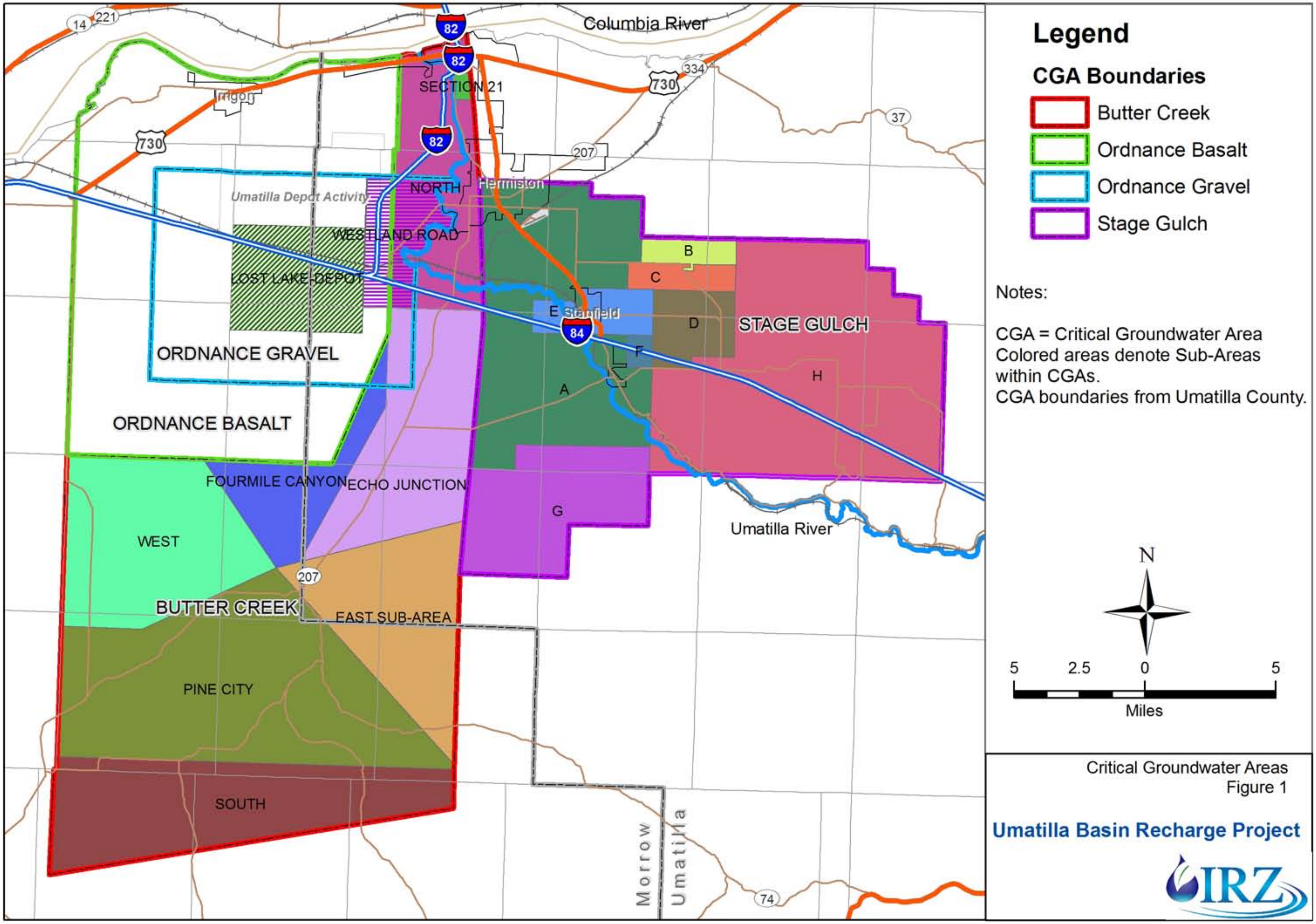
Notes:

TABLE 3
Concept-Level Cost Estimates
Engineering Options 1 Through 7, SSRD 1 System
Conceptual Engineering Designs

(a) AFY = acre feet per year.

(b) w/PC = With service to Pine City Sub-Area. w/o PC = Without service to Pine City Sub-Area.

FIGURES



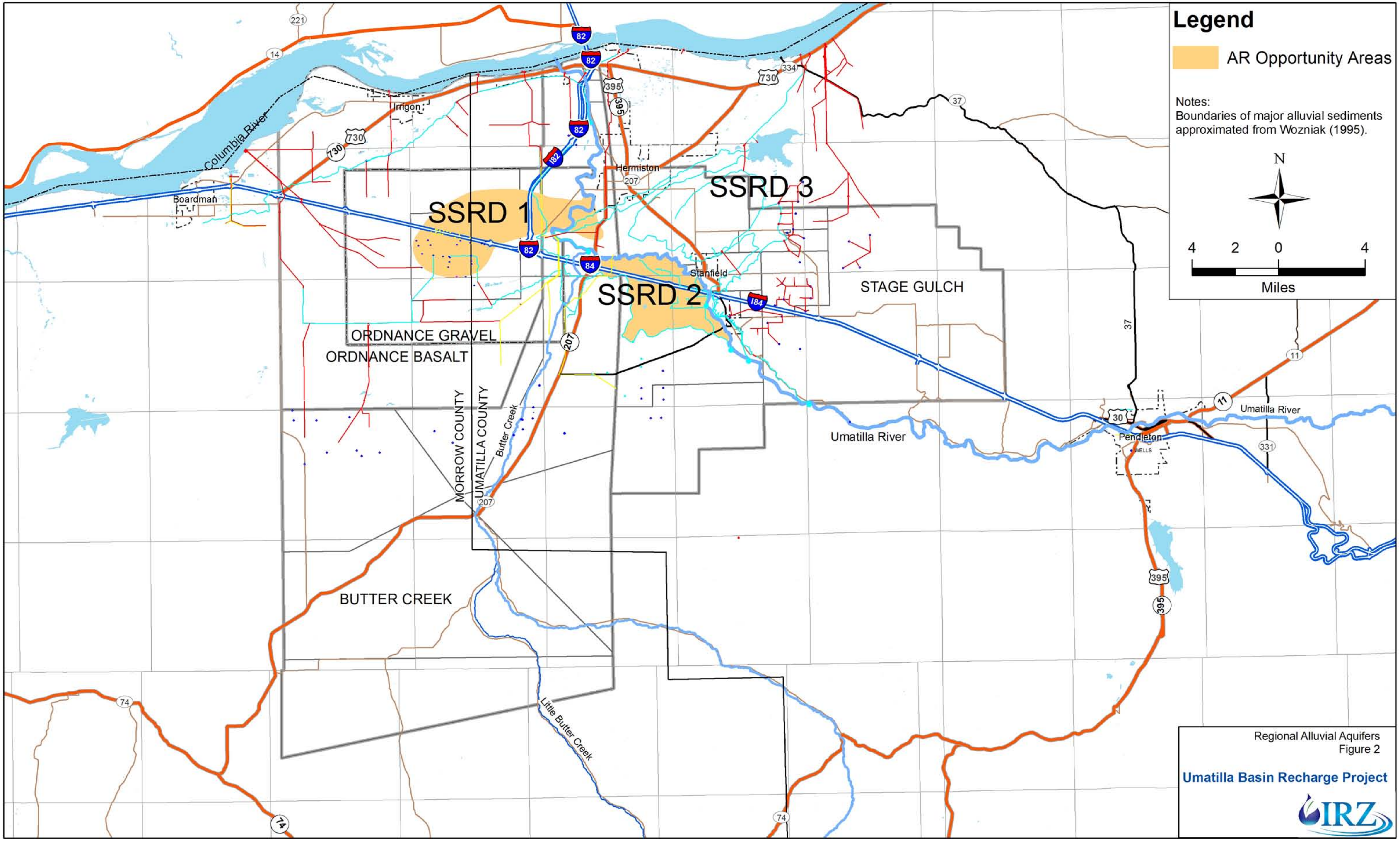
Notes:

CGA = Critical Groundwater Area
Colored areas denote Sub-Areas within CGAs.
CGA boundaries from Umatilla County.

Critical Groundwater Areas
Figure 1

Umatilla Basin Recharge Project

IRZ

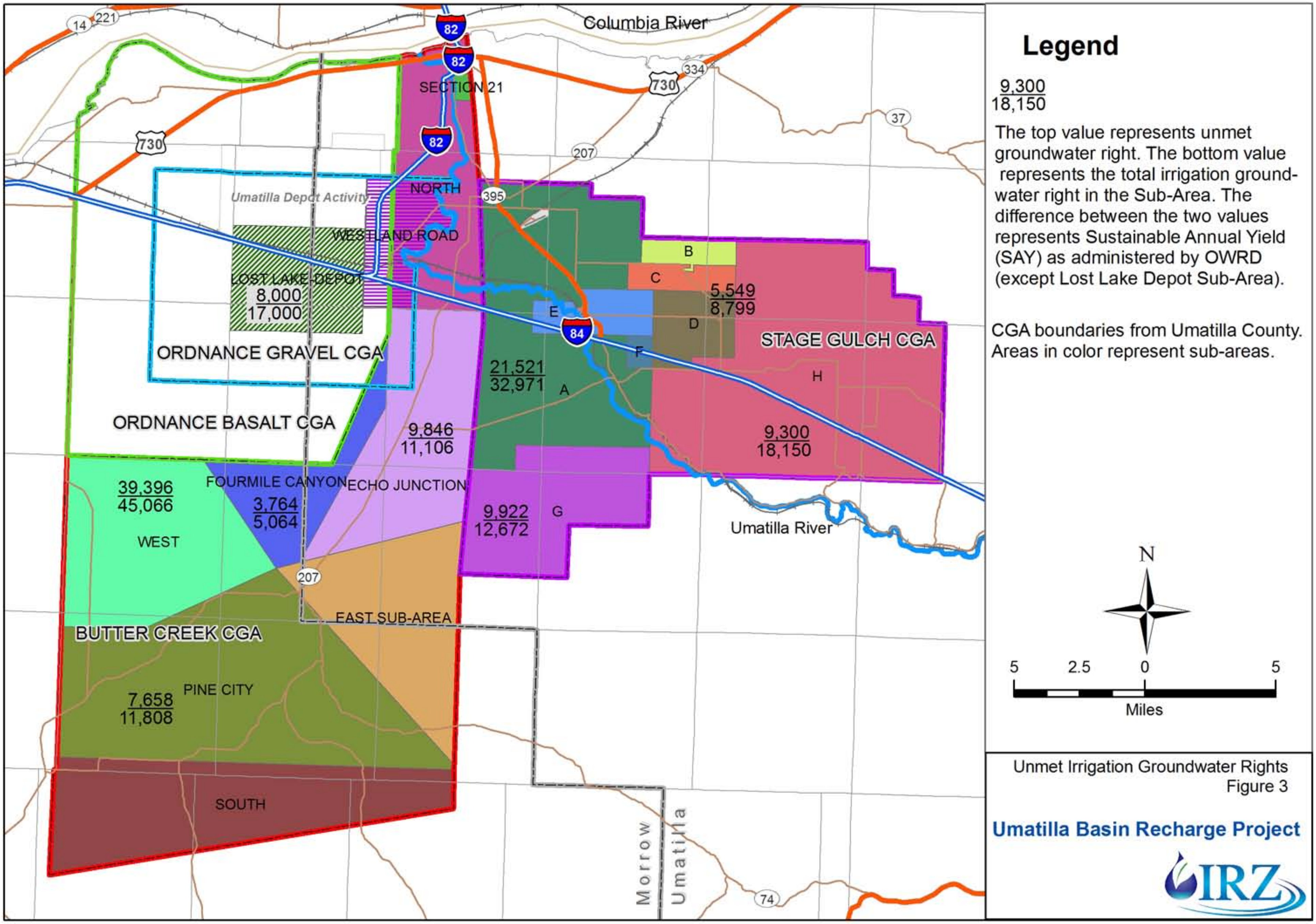


Notes:
Boundaries of major alluvial sediments approximated from Wozniak (1995).

Regional Alluvial Aquifers
Figure 2

Umatilla Basin Recharge Project

IRZ



Legend

9,300
18,150

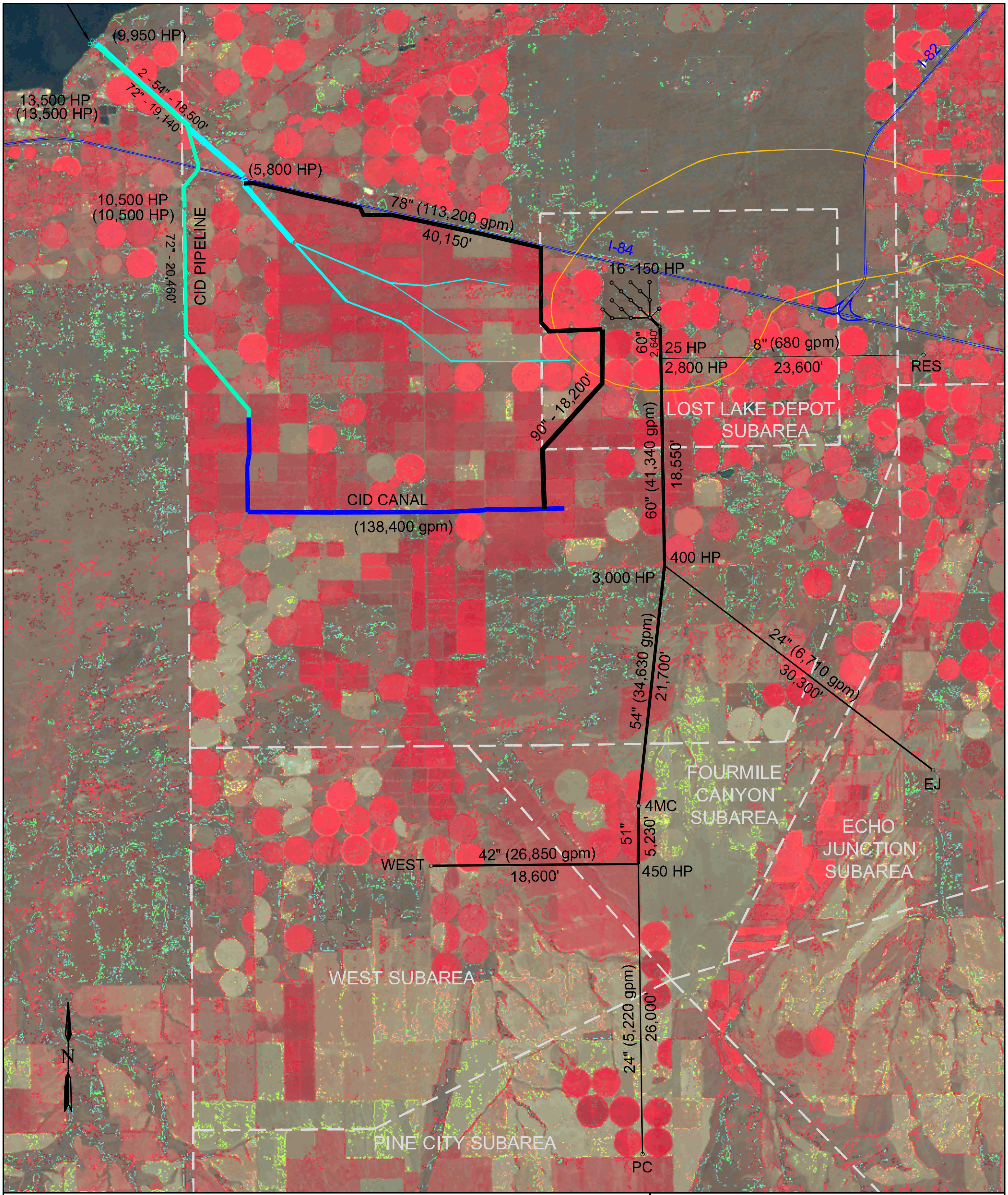
The top value represents unmet groundwater right. The bottom value represents the total irrigation groundwater right in the Sub-Area. The difference between the two values represents Sustainable Annual Yield (SAY) as administered by OWRD (except Lost Lake Depot Sub-Area).

CGA boundaries from Umatilla County. Areas in color represent sub-areas.

Unmet Irrigation Groundwater Rights
Figure 3

Umatilla Basin Recharge Project

IRZ



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

— Boundary of County Line Aquifer

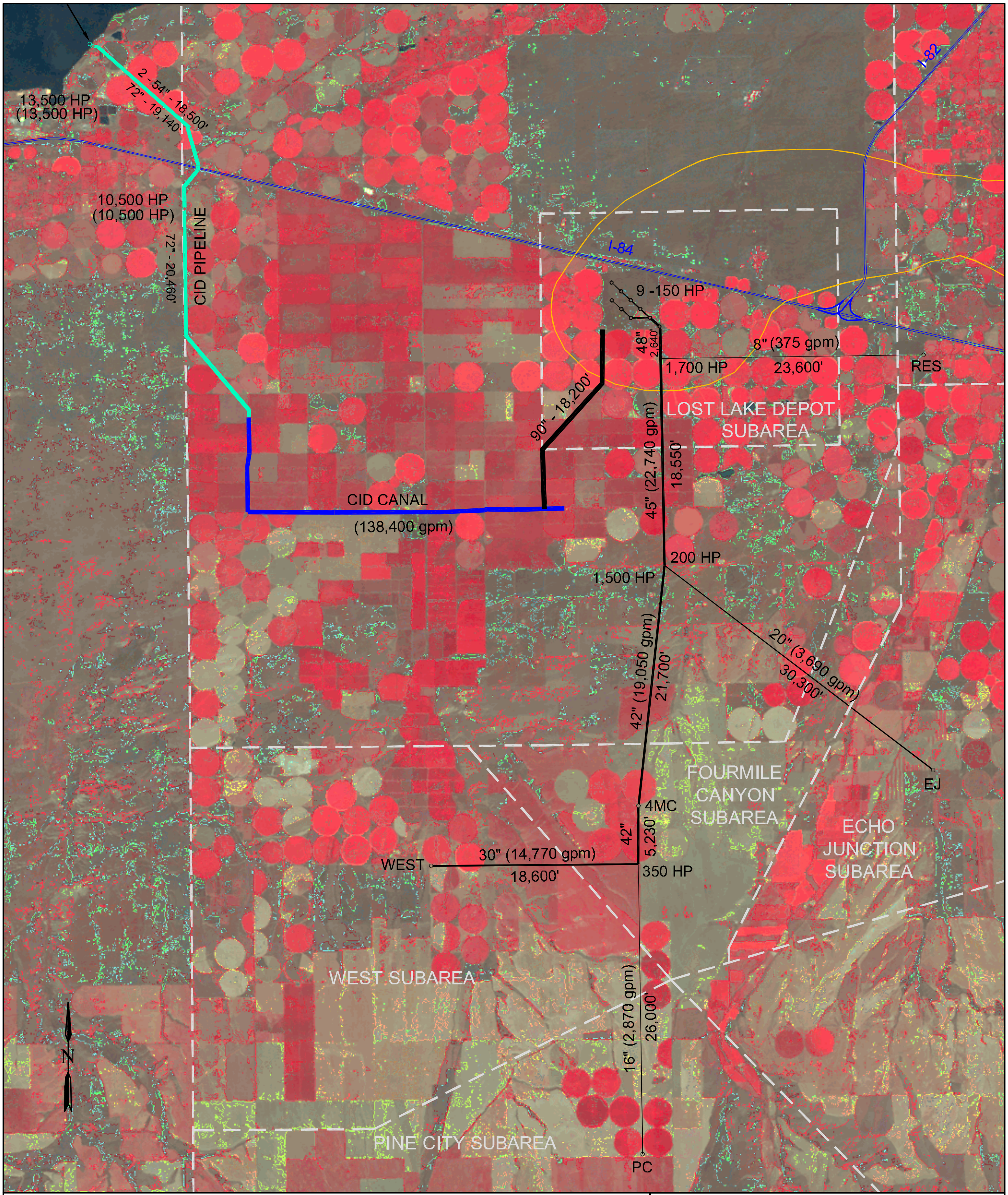
Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 1
Figure 4

Umatilla Basin Recharge Project

IRZ



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

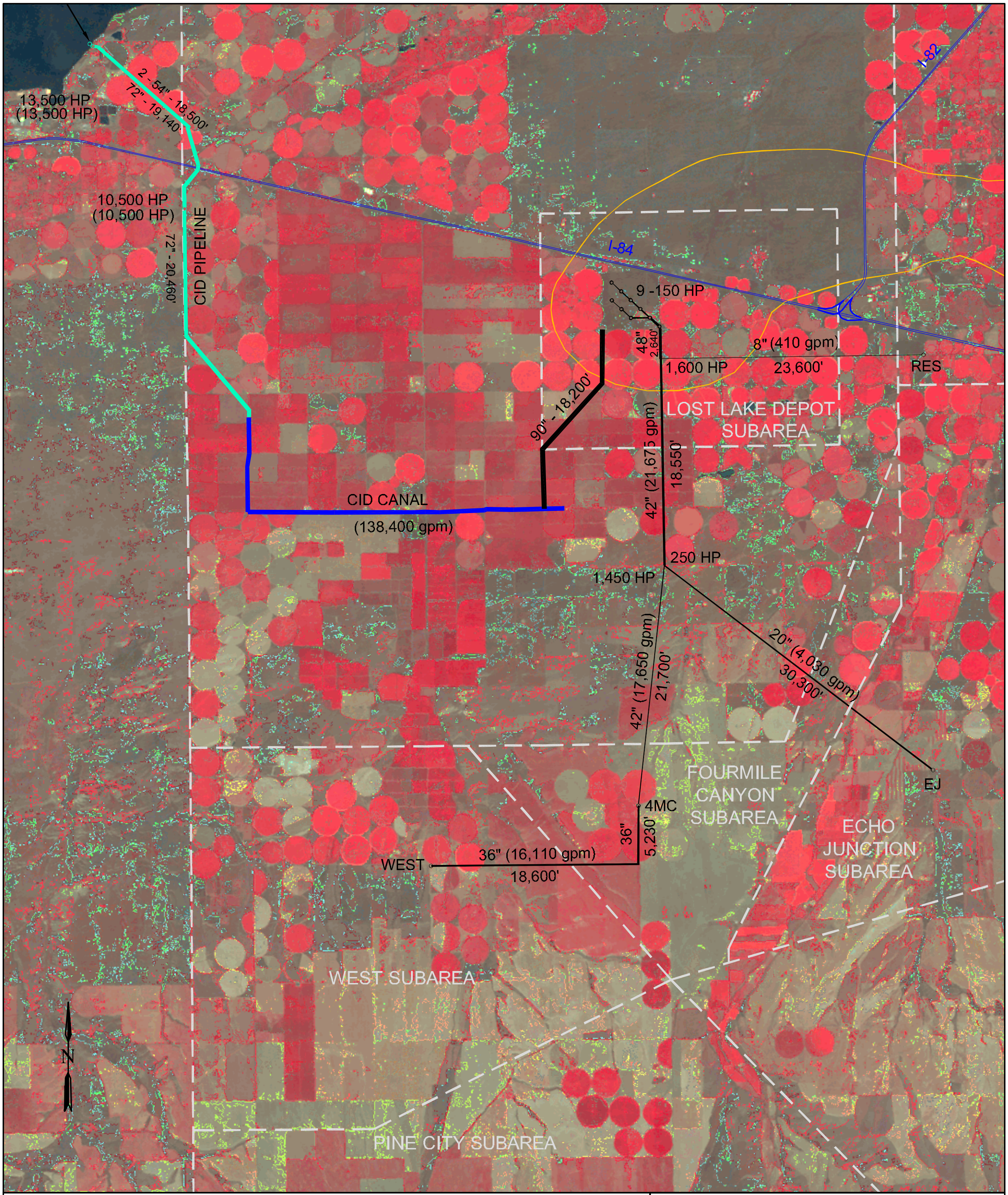
━━ Boundary of County Line Aquifer

Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 2
Figure 5

Umatilla Basin Recharge Project



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

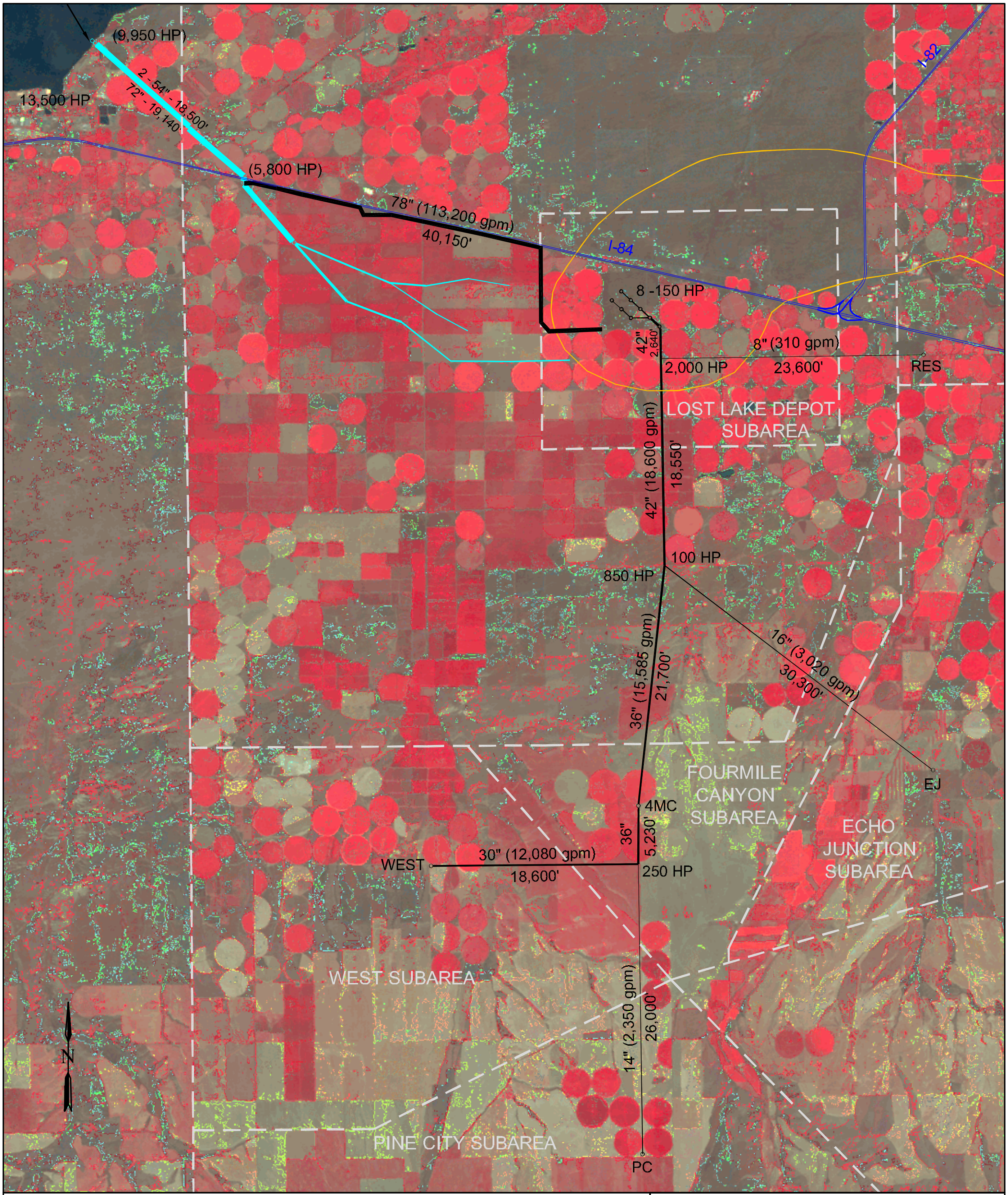
— Boundary of County Line Aquifer

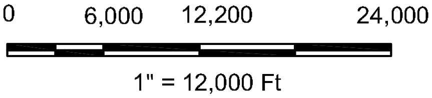
Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 3
Figure 6

Umatilla Basin Recharge Project





Legend

Boundary of County Line Aquifer

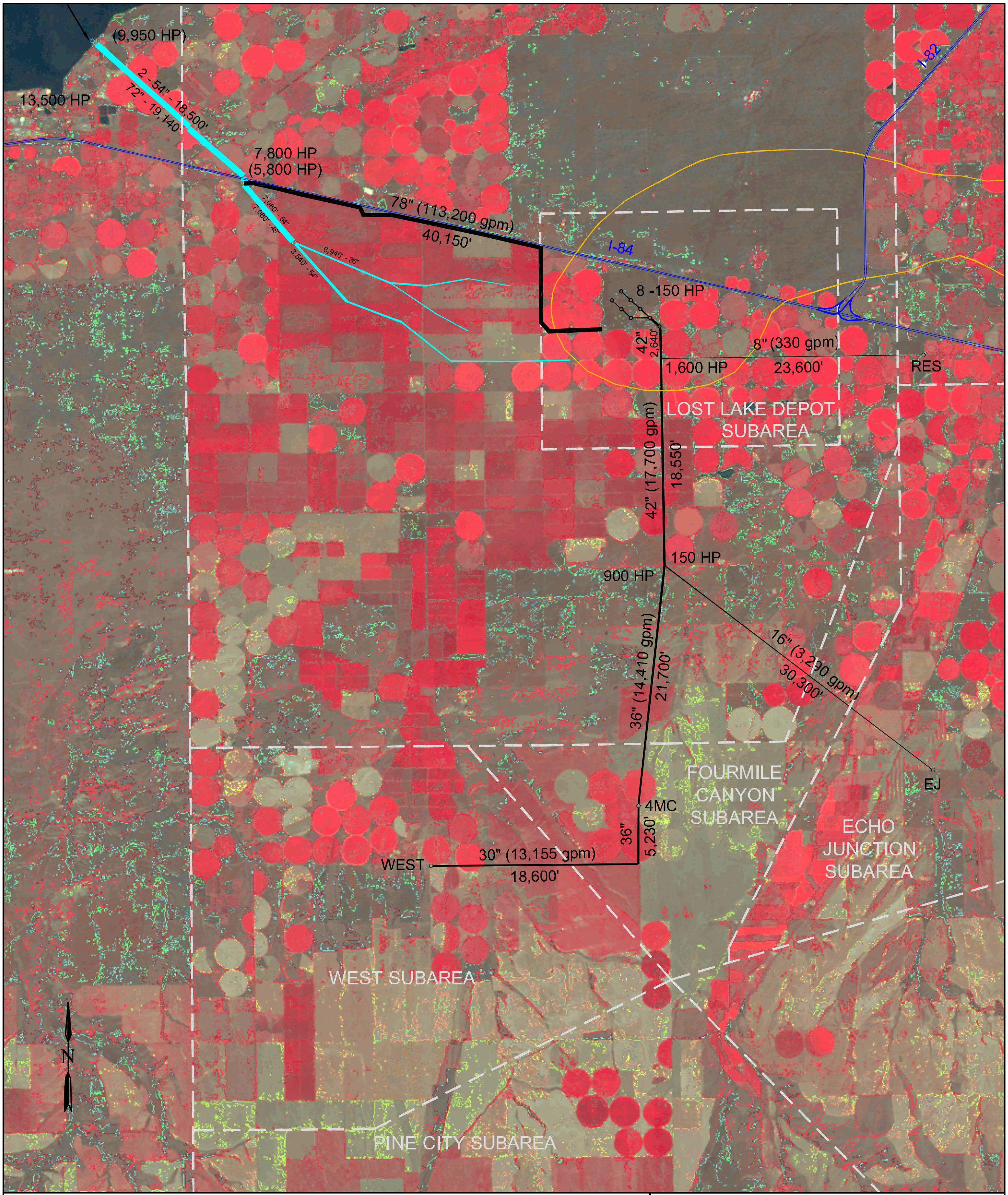
Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 4
Figure 7

Umatilla Basin Recharge Project

IRZ



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

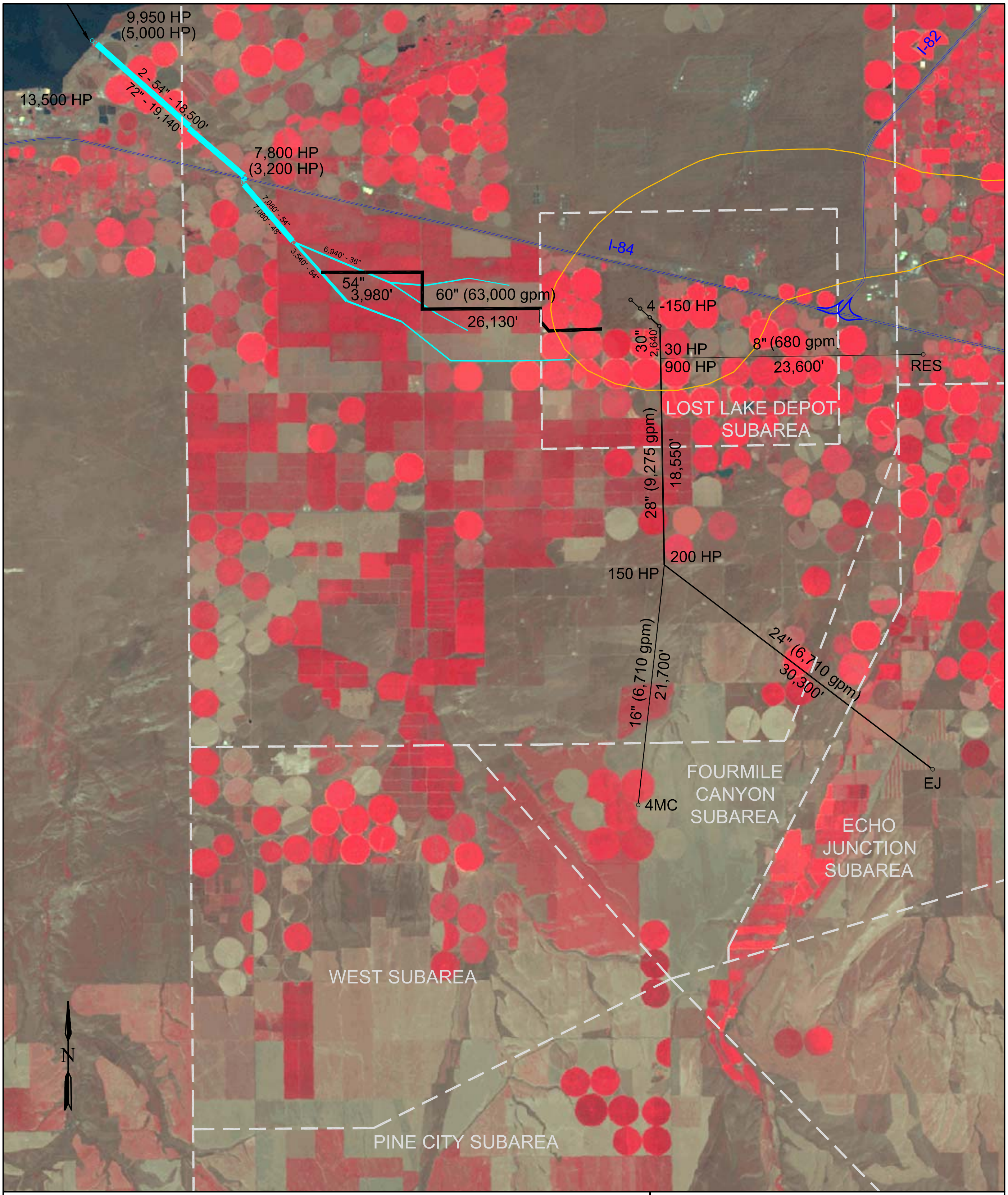
— Boundary of County Line Aquifer

Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 5
Figure 8

Umatilla Basin Recharge Project



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

Boundary of County Line Aquifer

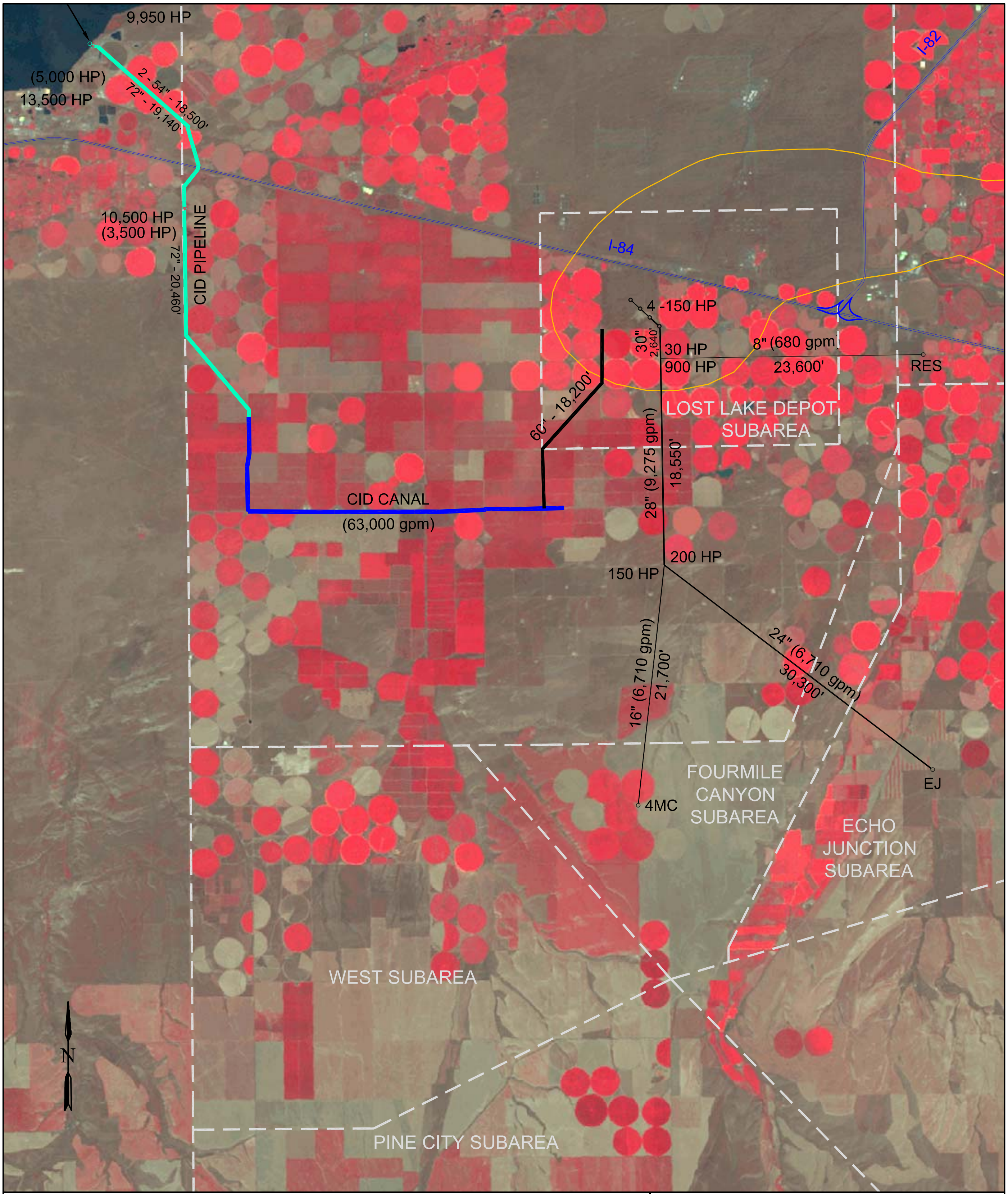
Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 6
Figure 9

Umatilla Basin Recharge Project

IRZ



0 6,000 12,200 24,000

1" = 12,000 Ft

Legend

— Boundary of County Line Aquifer

Notes:

New Pipelines are shown in black.

SSRD 1 System
Engineering Option 7
Figure 10

Umatilla Basin Recharge Project

IRZ

FINAL REPORT

ECONOMIC BENEFITS ANALYSIS

Umatilla Basin Regional Aquifer Recovery Assessment

Task 1.K

April 2009

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Optimizing Water Resources Through Technology

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Table of Contents

1.0 EXECUTIVE SUMMARY

The Oregon Water Resources Department (OWRD) has designated four Critical Groundwater Areas (CGAs) in the Umatilla Basin due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits. The objective of this report is to evaluate the economic benefits of selected engineering alternatives identified in this feasibility assessment.

Two separate economic analyses were performed. The first analysis includes a description of the economic structure of the Basin (consisting of Umatilla and Morrow Counties), identification of the sectors that constitute the economic engine of the region, and estimates of the economic contribution of agricultural industry (consisting of farm production, agricultural services, and food processing) to the Basin and the State's economies. The following summarizes the key findings of the first analysis:

- Contrary to the counties in other eastern parts of the State, the Basin relies on employment as its main source of income. In 2006, earned income accounted for 65% of total personal income, which is consistent with the State's average of 65%.
- The Basin's 2006 per capita personal income (PCPI) of $25,254 represents 76% of Oregon's PCPI and 69% of the national PCPI.
- Farm production, frozen food manufacturing, vegetable canning and drying, cheese manufacturing, mining, utilities, transportation, warehousing, and manufacturing sectors constitute the economic base (or engine) of the basin. This implies that these sectors provide the core employment and income on which the rest of the local economy depends. This report estimated that these sectors accounted for more than 50% of the Basin's total jobs.
- The Basin's farm production accounted for 12% of Oregon's 2006 total farm sales (or $536 million). In 2006, the Basin ranked first in production of grains ($102 million), hay and silage ($62 million), field crops ($75 million), vegetable ($58 million), and livestock production ($95 million) among the other 34 counties of Oregon.
- In 2006, agricultural industry of the basin accounted for 21% (or $1.4 billion) of the Basin's total direct value of output and 22% (or 10,090 jobs) of the Basin's total direct employment. In the same period, the Basin's growers and food processors together exported more than $1,027 million to domestic and foreign markets. The $1,027 million accounted for 42% of total Basin's export.

- Including the secondary effects, in 2006, agriculture industry accounted for 27% of the Basin's total value of output ($1.8 billion), 30% of the Basin's total private employment (14,326 jobs), and 16% of the Basin's total labor income ($697 million).
- In 2006, the agricultural industry of the Basin, directly and indirectly, supported about 19,000 jobs in Oregon.
- In 2006, the agricultural industry of the Basin, directly and indirectly, generated about $2.6 billion in economic activities and $1.1 billion in personal income in Oregon.
- Majority of economic contribution of agriculture industry is attributed to the Basin's irrigated agriculture.

The second economic analysis assesses the economic benefits of the engineering alternatives, whose findings will be summarized further below. Please note that the engineering alternatives evaluated in this report are conceptual feasibility-level options and necessary data for a detailed economic analysis, such as cost-benefit analysis, are not yet determined. The focus of this economic benefits analysis is to provide information to stakeholders to evaluate the potential benefits of the proposed alternatives relative to their implementation cost.

In accordance with federal principles and guidelines for evaluation of federal water resources projects, this economic benefits analysis was performed from both National Economic Development (NED) and Regional Economic Development (RED) perspectives. Additionally, for comparison purposes, the costs and benefits presented in this report are expressed as annual values in 2006$.

Three Supply, Storage, Recovery, and Distribution (SSRD) systems have been developed for this project (IRZ 2009). The SSRD system 1 includes seven options to import Columbia River water for beneficial uses in the Ordnance Gravel and Butter Creek Basalt CGAs. Option 1 was developed to supply the full irrigation and other needs of approximately 100,000 AF per year (AF per year). Options 2 and 3 provide 55,000 AF. Additionally, this analysis includes evaluation of the economic benefits associated with supplying the full water need in the three CGAs (Full Project) subject of this feasibility assessment. Based on early analysis, the total need had been estimated at approximately 160,000 AF. Table ES-1 displays the annual total water withdrawals from the Columbia River, the proposed annual allocation of stored water for irrigation, river flow augmentation, municipalities & domestic use, and basalt aquifer replenishment for the three options.

Table ES-1: Annual Withdrawals and Allocations of Imported Water for the Engineering Alternatives

Alternatives	Total Withdrawal (AF)	Proposed Allocation of Stored Water (AF)			
		Irrigation	River Flow Augmentation	Municipals & Domestic	Basalt Aquifer Replenishment
SSRD 1 – Options 2&3	55,000	37,000	14,000	600	3,300
SSRD 1 – Option 1	100,000	68,664	24,000	1,000	6,166
Full Project	158,330	113,664	27,000	7,000	10,666

Economic Benefit Analysis from the NED Perspective: The Economic and Environmental Principals for Water and Related Land Resources Implementation Studies (P&G) requires that a project should be undertaken if the water diverted for the project has a positive direct net value. The direct net value is a measure of net contribution to NED (social welfare) and is calculated by subtracting total costs from total benefits (broadly stating it includes salaries and net profits). For the engineering alternatives in this analysis, it implies that the direct contribution to the national economy of the water diverted for irrigation, enhancing stream flows for fish migration and spawning in the Umatilla River, municipal, and groundwater replenishment should be weighed against the net value of the Columbia River water for instream uses such as hydropower production, fish enhancement program, recreational activities and other uses. If the federal funding is used to finance the project, then the construction and operation and maintenance (O&M) costs should be included in the calculation. If the sum of net direct value of Columbia River water diverted exceeds the total cost of the project, this implies the proposed project should be undertaken from NED prospective.

This report uses the following methodologies to estimate the direct net value of diverted water for alternative uses:

- Using a residual value method based on enterprise crop budget, the economic value of irrigation water for the Basin was estimated to be approximately $95/AF.
- Using alternative cost of water delivery for flow augmentation in the Umatilla River, and documented water exchanges for instream use in Washington and Oregon, the economic value of stored water for flow augmentation in the Umatilla River was estimated to range between $85 and $124 per AF, with a mid-range of $104/AF.
- Based on the opportunity cost of the stored water, the economic value of water stored for aquifer replenishment was estimated to be approximately $95/AF.

- Using the wholesale value of water for municipalities in the Western States, the economic value of stored water for municipal use was assumed to be approximately $234/AF.

Based on the above information, the direct net value of diverted water from the Columbia River for SSRD 1 system Options 2&3, Option 1, and the Full-Project were estimated to be $99, $99, and $103 per AF, respectively.

Among alternative instream uses of the Columbia River water diverted for aquifer recharge in the CGAs, only hydropower use has been found to have a measurable economic impact. The foregone hydropower generation for the SSRD 1 system Options 2&3, Option 1, and the Full-Project were estimated to be $4.13, $4.22, and $4.44 per AF of diverted water, respectively. Comparing the instream uses of the Columbia River water to the diversions associated with each option shows a significant net gain of between $95 and $99 per AF .

If federal financing is sought is sought for this project, construction and O&M costs should also be included in NED calculation. Using 50 years as a planning horizon and 2.44% discount rate (current U.S. Treasury Real Long-Term Rate), the annualized initial capital costs for the SSRD 1 system Options 2&3, Option 1, and the Full-Project were estimated to be $26, $33, and $33 per AF, respectively. Realizing an O&M cost of $90, $87, and $85 per AF for the three options, respectively, the total annualized project costs (sum of annualized initial capital cost and annual O&M cost), for the three options are estimated at $116, $120, and $118 per AF, respectively.

Table ES-2 displays the total benefits and total costs of the UBAGR for three project options. It indicates that total project costs for three project options exceed their respective total benefits.

Table ES-2: Total Annual Benefits and Total Annual Costs

Alternatives	Annual Total Benefit ($/AF)	Annual Total Cost* ($/AF)	Net NED ($/AF)
SSRD 1 – Options 2&3	$ 99	$120	($21)
SSRD 1 – Option 1	$ 99	$124	($25)
Full Project	$103	$122	($19)

* Total cost includes the annual project cost plus hydropower lost.

The following points should be considered before making a conclusion regarding the economic feasibility of the project from the NED perspective:

- There are other direct benefits of the proposed project that were not included in the NED benefit estimates such as: a) potential lower pumping costs as a result of an increase in aquifer water table, b) cost savings by irrigators, municipalities, and residential users as a result of a decreased need to deepen wells, c) potential improvement in ground water quality, d) potential increase in recreation and fishery activities in the Umatilla River, e) potential economic benefits of accumulated stored water as a result of proposed aquifer replenishment program (in drought years, the accumulated stored water could be used for irrigation, municipalities/domestic uses, and the flow augmentation program in the Umatilla River).

- The cultural value of potential improved fish population, as a result of a potential increase in flow augmentation in the Umatilla River.
- Given that the project would contribute a significant portion of stored water for non-commercial use for fisheries resources and aquifer replenishment, it is desirable to evaluate the project using a lower discount rate and/or longer planning horizon as argued by Platt (2008).
- The NED account emphasizes economic efficiency and is neutral to distributional impact of a project. However, economic efficiency, although an important objective, is not the sole objective of the stakeholders or the State. How a project would contribute to a region's economy in terms of output, employment, and labor income might be as important as economic efficiency.

Economic Benefits Analysis from the RED Perspective: The economic benefits of the three engineering alternatives were evaluated based on their direct and indirect contribution to the Basin's economy in terms of output (or business activities), employment, and labor income. The total economic impact is the sum of the direct impacts and secondary impacts (or ripple effects). The direct impacts, included in the analysis, are the increases in farm production and induced regional direct value-added activities beyond the farm gate. The regional economic impacts were estimated using the IMPLAN input-output model of the Basin developed by MIG Group. IMPLAN has been widely used to measure regional economic impacts. The key benefits from the RED analysis are summarized in Table ES-3 and explained below:

- The increase in regional business activities ranges from $116 to $344 million, depending on the alternative. Of this, $80 to $239 million are from direct impacts and $36 to $105 million are the result of secondary impacts.
- The alternatives add between 679 and 2,074 jobs (330-1,040 jobs are direct and 349-1,034 jobs are indirect).
- The annual regional labor income (employee compensation plus proprietor's income) will increase $24-$72 million.
- Assuming a 7 percent marginal tax rate, the increase in annual State tax revenue is $1.7-$5 million.

Table ES-3: Regional Economic Impacts

Alternatives	Output (Business Activities) (2006$)		Labor Income[*] (2006$)		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
SSRD 1 – Options 2&3	$80,635,422	$116,265,246	$12,573,426	$24,150,857	330	679
SSRD 1 – Option 1	$144,770,763	$208,720,310	$ 22,656,434	$ 43,452,201	606	1,233
Full Project	$239,020,310	$344,264,806	$37,346,288	$71,600,591	1,040	2,074

* Labor income consists of employee compensation plus proprietor's income.

Since the change in labor income reflects the net contribution of a regional resource to the Basin's social welfare, this report has used the change in labor income to calculate the Basin's direct value of irrigation water. The Basin direct value for irrigation water, for the SSRD 1 Options 2&3, Option 1, and Full Project were estimated to be approximately $340, $330, and $328 per AF, respectively. The Basin total value of irrigation water (including the secondary impact) was estimated to be $652, $633, and $629 per AF, respectively.

The Basin benefits of diverted water for a combination of irrigation, fishery, municipal/domestic and aquifer replenishment for the SSRD 1 Options 2&3, Option 1, and Full Project were estimated to be around $264-$502, $257-$489, and $256-$486 per AF, respectively. The range is due to lack of a general agreement among economists as to whether to include direct regional impact or total regional impact (direct plus the secondary impact) in calculating the regional economic benefits of a project. Since the secondary economic impact usually takes more than a year to have its full impact, then incorporating the total secondary impact in economic benefit analysis will overstate the annual contribution of the project. For this reason, a mid-range of direct value of irrigation water and total value of irrigation water are used in this report to represent the regional value of irrigation water for the selected engineering alternatives.

Table ES-4 compares the annual total Basin benefit with the total annual cost for the SSRD 1 Options 2&3, Option 1, and Full Project. It shows that for all three options, the total annual benefit significantly outweigh the total annual cost. Based on the assumed discount rate and planning horizon, these alternatives are economically feasible from the RED perspective.

Table ES-4: Basin Total Annual Benefits and Costs

Alternatives	Total Annual Benefit ($/AF)	Total Annual Cost* ($/AF)	Net RED ($/AF)
SSRD 1 – Options 2&3	$383	$116	$267
SSRD 1 – Option 1	$373	$120	$253
Full Project	$371	$118	$253

* Total cost excludes the hydropower loss since it is incurred outside of the Basin.

2.0 INTRODUCTION

The Umatilla Basin consists of Umatilla and Morrow counties (hereafter is referred to as the Basin). The Basin is a rural community located in the north eastern half of Oregon, bordered by the Columbia River to the north and the Blue Mountains to the south. The region is comprised of 5,245 square miles of land area. Elevations in the region range from 200 feet (ft) at the Columbia River to over 6,000 ft in the Blue Mountains.

The Basin climate is semi-arid, with hot, dry summers and wet winters with low to moderate temperatures. The region is semi-arid due to the influence of mountains in the Coast Range and the Cascade Range. Annual basin precipitation amounts range from 8 inches near the Columbia River to more than 12 inches near the Blue Mountains. Most of the precipitation in the basin occurs from October through March with very little rain falls during the summer months. The major stream in the basin is the Umatilla River, which is a tributary of the Columbia River, joining it just below the McNary Dam.

Water is the wealth of the Basin. Water is essential to Basin's agriculture and its related value-added industries, power generation, fish resources and its cultural identity. Development of a vast network of irrigation infrastructure through the years has made the Basin the bread basket of Oregon. In 2006 (due to exceptionally high prices in 2007 and 2008, we determined 2006 is the most comparable period for this study), the Basin accounted for 12% of Oregon's total farm sales (or $536 million). The Basin grows over 20 crop varieties including a number of high value crops such as potatoes, onions, sweet corns, green peas, peppermints, and carrots among others. Nearly all of the Basin's row crops and fruit trees are irrigated. The majority of the high value crops are used by local food processors to produce variety of products. Vegetable processing has become a major industry in the Basin. The Basin has also a significant beef and dairy industry. The livestock industry in the southern part of the Basin relies heavily on local production of alfalfa and field corn, and byproducts from local food processors.

In 2006, the Basin ranked first in production of grains ($102 million), hay and silage ($62 million), field crops ($75 million), vegetable ($58 million), and livestock production ($95 million) among the other 34 counties of Oregon. Agriculture industry, including farm production and food processing, constitutes the economic base of the Basin. The 2006 estimates show that agriculture contributed over 21% (or $1.4 billion) of the Basin's total direct value of output and 22% (or 10,090 jobs) of the Basin's total direct employment. In the same period, the Basin growers and food processors together exported more than $1,027 million to domestic and foreign markets. The $1,027 million accounted for 42% of the Basin's 2006 total export. These exports represent new income to the Basin and Oregon's economy. The resultant income is subject to spending and re-spending, which leads to further gains in economic activity throughout the Basin. When considering these secondary effects, in 2006, agriculture industry accounted for 27% of total business activities ($1.8 billion), 30% of the Basin's total private employment (14,326 jobs) and 16% of the Basin's total income ($697 million).

To this end, the reliability and availability of a water supply is essential for future economic development and retention of economic base of the region. Due to overdraft of the aquifers in the area, OWRD designated four CGAs in the Basin (OWRD 2003). There are 63,489 acres of farmland within the four CGAs which are irrigated with groundwater pumped from alluvial and basalt aquifers. The total amount of certificated irrigation groundwater rights for this acreage is 190,466 AF (OWRD 2008). However, due to declining levels of water in the alluvial and basalt aquifers in the CGAs, the curtailed volume of groundwater rights adds up to a total of 127,038 AF or 67% of the total groundwater rights. Currently, around 33% of the water right holders are allowed to use water for irrigation. Approximately, more than 21,000 acres of Basin's irrigated lands that had relied on water from Umatilla Basin groundwater has been converted to dryland farming. Water shortage problem however is not confined to irrigators only. Several cities in the Basin rely heavily on groundwater as a source of water supply and would like to have access to alternative secure sources of water supply to meet their growing water demand. The CGAs are presently closed to further appropriation of groundwater other than for exempt and stock watering uses. Additionally, surface water sources from the Columbia River and its tributaries within the Umatilla Basin are not available for further appropriation between April through September. Due to higher land values and concerns about environmental issues and the costs, the potential to construct large surface reservoirs is not currently a feasible option. Since, there is no alternative to ground water immediately available, according to OWRD (2003), the conjunctive use of groundwater and surface water is the most viable solution to water supply problems in the Basin.

To enhance irrigation water supplies in the CGAs, OWRD has begun a technical assessment of the feasibility of artificially recharging the aquifers in the Basin by diverting water from the Columbia River during high flow months. As planned, the aquifer recharge project would use existing private and public infrastructure to divert water to the CGAs where it would be stored in the alluvial and basalt aquifers that would serve as underground storage. The stored water will then be used for irrigation, municipal/residential uses, increased stream flow in the Umatilla River, and aquifer replenishment.

3.0 OBJECTIVES

Table 1 shows the various engineering design options currently being considered as part of SSRD systems 1, 2, and 3 (IRZ 2009). Three options were selected in this economic analysis including the SSRD system 1 Option1, Options 2&3, and the Full Project. The Full Project corresponds to the importation and use of the combined diversions envisioned by the three SSRD systems.

Table 1: Engineering Designs and Potential Annual Allocations of Stored Water

SSRD System	**System Option**	**Total Withdrawal** (AF)	**Proposed Allocations of Stored Water** (AF)			
			Irrigation	Umatilla River Flow Augmentation	Municipal & Domestic	Basalt Aquifer Replenishment
1	1	100,000	68,664	24,000	1,000	6,166
1	2&3	55,000	37,000	14,000	600	3,300
1	4&5	45,000	30,000	11,500	475	2,700
1	6&7	25,000	19,610	3,092	1,000	1,461
2		25,000	20,000	3,000	-	2,000
3		33,500	25,000	-	6,000	2,500
Full Project**		160,000	113,664	27,000	7,000	10,666

The purpose of this report is to assess the potential economic benefits derived from the implementation of the recharge project. However, understanding and identifying the economic forces that shape the Basin economy are necessary to develop a rational strategic plan for the Basin's resources and its economic future. For this reason, this study performs two separate economic analyses, as follows:

- The first analysis focuses on the past and current economic conditions in the Basin, identifies the sectors that constitute the economic base of its economy, and provides the role of agriculture on the economies of the Basin and Oregon.
- The second analysis focuses on the potential economic benefits of the recharge project from national and Basin perspectives. From the national perspective, the analysis estimates the direct net value of diverted water from the Columbia River for the aquifer recharge project. This is achieved by estimating the direct net value of the Columbia River water for alternative uses such as irrigation, hydropower, recreation, fish resources, and municipalities. From Basin perspective, the study will identify the direct and indirect economic impacts of the aquifer recharge project on the Basin's economy. The impacts will be defined in terms of changes in Basin employment, income, and economic activities.

It should be noted that the aquifer recharge project is a feasibility-level assessment. Thus, the necessary data are not yet fully available for a more detailed cost-benefit analysis. The focal point of this report is to provide information for policy makers to evaluate the potential benefits and weigh them against the costs of the project for further investigation of the proposed project.

4.0 ECONOMIC PROFILE OF THE BASIN

This section first provides an economic profile of the Basin in terms of population trends, personal per capita trends, and employment trends. The section follows with a discussion of economic condition of the Basin in 2006 and identifies the important industries within the Basin based on a) their direct contributions to the Basin economy's in terms of economic output, earned income, and employment and, b) an economic base analysis. For equivalent comparison, all costs and benefits presented in this report are expressed as annual values in 2006$.

4.1 Population Trends in the Basin

Given the premise that people "follow the job," population changes provide insight into how economy performs and how it has performed over time. The 2006 population count for the Basin totaled 85,053 persons (Table 2). In 2006, population of Umatilla and Morrow Counties located in the Basin, ranked 13th and 29th, respectively, among Oregon's 36 counties.

From 1980 to 2006, the population of the Basin increased by 28% or 18,434 persons (Table 2). Within the same period, the population of Oregon has risen by 40% (1,059,540 persons). During 1980-2006, the compounded annual population growth for the Basin was 0.9% (Table 2), while during the same time, Oregon has experienced 1.3% compounded annual growth rate.

The population trends for the Basin and Oregon are presented in Figures 1 and 2. Figure 1 compares the Basin and Oregon population trends using 1980 as a base year (assuming their respective populations in 1980 are equal to 100). Figure 2 shows the annual percentage population changes from 1980 to 2006.

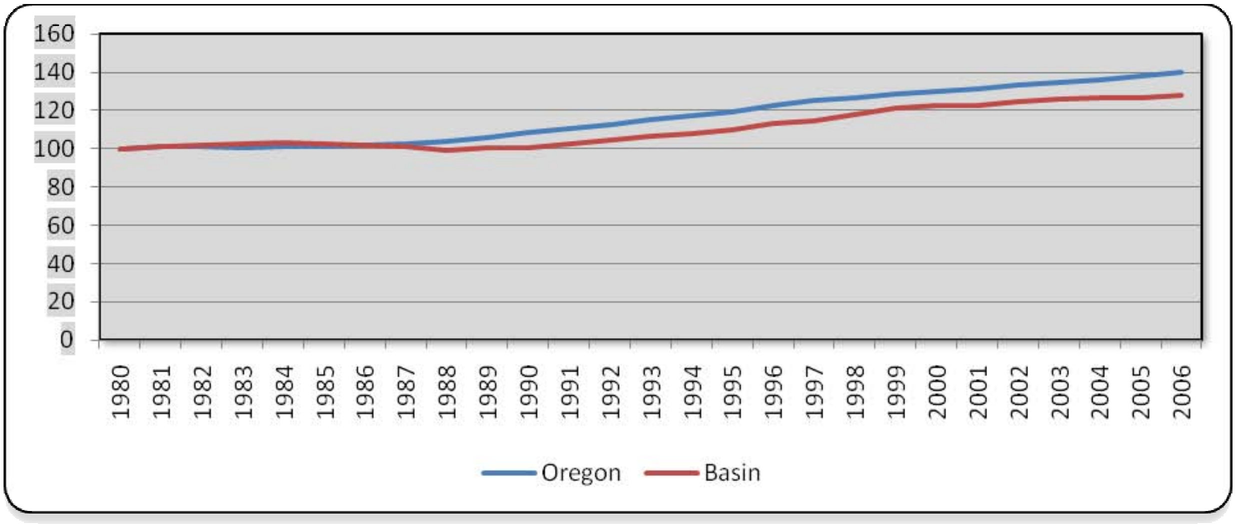
As indicated in Figures 1 and 2, in 1980s, the Basin experienced a decline in population. However, during the 1990s, as a result of economic development and growth, the region regained population lost in 1980s. The region had experienced 22% increase in population during 1990s, while the State had a population increase of 20%. In 2000s, the region's population increased by 4%, while the State population increased by 8%. Although, the population growth in 2000s was slower than the State average, the Basin performed better compared with many counties in central and eastern Oregon that have been dealing with the population declines.

Table 2: Population Trends in the Basin and Oregon, 1980-2006

	Basin	Oregon
POPULATION, persons		
1980	66,619	2,641,218
1990	66,989	2,858,757
2000	81,752	3,431,530
2006	85,053	3,700,758
Change in Population from 1980 to 2006	18,434	1,059,540
% Change in Population		
from 1980 to 2006	28	40
from 1980 to 1990	1%	8%
from 1990 to 2000	22%	20%
from 2000 to 2006	4%	8%
Compounded Annual Growth Rate from 1980 to 2006	0.9%	1.3%

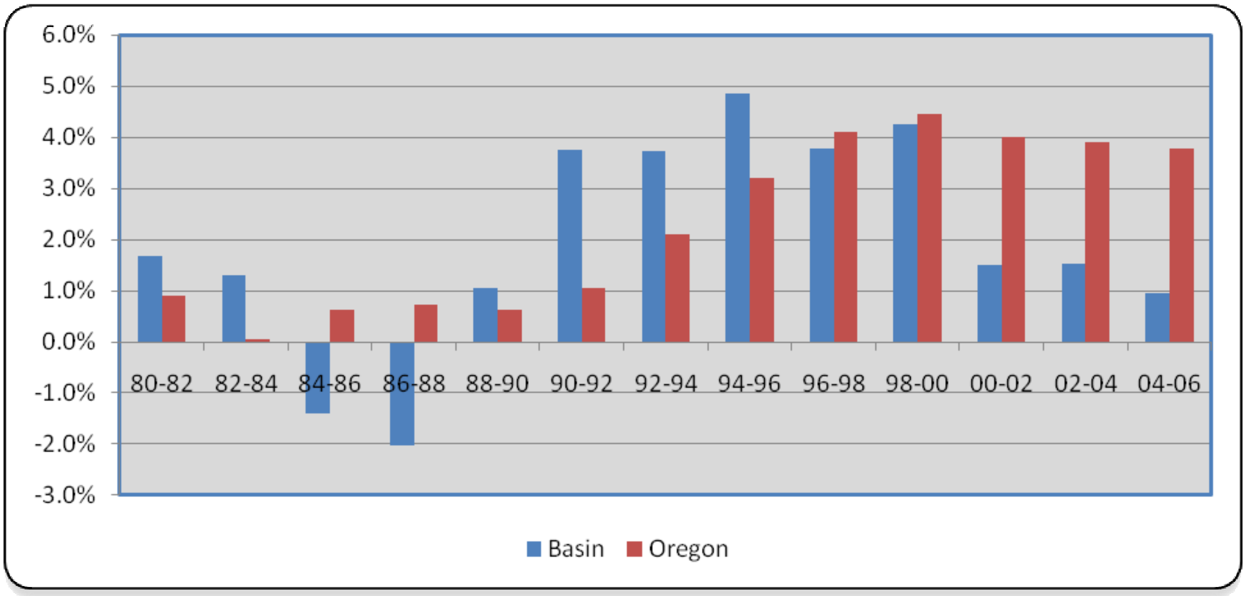
***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Figure 1: Population Trends in the Basin and Oregon, 1980-2006



***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Figure 2: Annual Percentage Changes in Population of the Basin and Oregon, 1980-2006



***Source**: Regional Economic Information Services (REIS)*

4.2 Economic Trends in the Basin

Economic changes and population changes are closely linked to each other. Full understanding of the population changes requires knowledge of the change in economic conditions in terms of income and employment. This section discusses the recent trends in income and employment in the Basin and Oregon.

4.2.1 Personal Income Trends

Personal income is generally seen as a key indicator of economic vitality and well being of the residents. Personal income can come from two sources: (1) labor or earned income, consisting of wages and salaries, other labor income and proprietors' income and (2) non-labor income, which includes transfer payments (e.g., Social Security, Medicare, food stamps, unemployment insurance) and interest (or investment) income (consisting of dividends, interest and rent).

The Basin and Oregon's PCPI and their respective PCPI trends are presented in Table 3. Total personal income received by Basin's residents in 2006 was $2,135 million. On a per capita basis, Basin's 2006 PCPI of $25,254 was significantly below the statewide average of $33,299. The Basin's 2006 PCPI represents 76% of Oregon's PCPI, and 69%, of the national PCPI. During 1980-2006, PCPI for the Basin increased by 157%, while PCPI for the State of Oregon increased by 229%. As it is shown in Figure 3, the Basin's PCPI lagged behind in 1980s. For the duration of 1995-2006, the annual rates of PCPI growth for the Basin was 3.5% (Table 3). At the same time, Oregon's PCPI has increased by 3.9% annually. During 2000-2006, the Basin and the State's PCPI grew at the same rate (2.9%).

Table 3: Summary of PCPI Trends for the Basin and Oregon, 1980-2006

		Basin	Oregon
PCPI			
	1980	$9,818	$10,113
	990	$14,675	$18,010
	2000	$21,297	$28,096
	2006	$25,254	$33,299
% Change in PCPI			
	from 1980 to 2006	157	229
	from 1980 to 1990	49	78
	from 1990 to 2000	45	56
	from 2000 to 2006	19	19
Compounded Annual Growth Rate			
	from 1980 to 2006	3.7	4.7
	from 1995 to 2006	3.5%	3.9%
	from 2000 to 2006	2.9%	2.9%

***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Table 4 presents total personal income, PCPI, labor income, transfer payments and investment income in 2006 for the Basin, selected counties in Oregon, and the State. Three major conclusions can be drawn from the information presented in Tables 2 and 3.

1. There exists a substantial income disparity between the eastern and western counties of the State. For example, in 2006, the PCPI of the Basin and Sherman County represented only 61% and 47% of Clackamas County's PCPI, respectively; while in 1980 their PCPIs represented 79% and 171% of Clackamas. In 2006, Morrow, Umatilla and Sherman Counties' PCPI ranked 30th, 31th and 36th, respectively, among Oregon's 36 counties.
2. As a result of recent economic development initiatives, the Basin's PCPI has fared much better in 1990s and 2000s. Nevertheless, these counties have not been able to overcome the persistent gap in per capita personal income with the State and western counties of the State.

3. There is a large variation in shares of sources of income among counties in Oregon. In general, smaller regions are more dependent on transfer payment and to a lesser degree on investment income as sources of income. However, about 65% of the Basin's personal income comes from labor income, which is at the same level as the State's. This implies that the Basin is more dependent on employment for their source of income, thus, could be more susceptible to economic downturn.[1/]

Table 4: Total Personal Income, PCPI, and Sources of Income for Selected Counties in Oregon, 2006

Selected Counties	Total Personal Income ($mil)	(PCPI ($)	PCPI, % of State	Labor Income, % of Total	Transfer Payment, % of Total Income	Dividends, Interest & Rent, % of Total Income
Clackamas*	$15,371	$41,378	124%	70%	11%	19%
Columbia*	$1,455	$30,174	91%	69%	17%	14%
Multnomah*	$26,483	$38,529	116%	68%	13%	19%
Washington*	$18,608	$36,259	109%	74%	10%	16%
Wallowa	$189	$28,112	84%	50%	24%	26%
Sherman	$32	$19,550	59%	28%	40%	31%
Gilliam	$41	$23,889	72%	37%	27%	37%
Basin	**$2,135**	**$25,254**	**76%**	**65%**	**20%**	**16%**
Oregon	**$122,909**	**$33,299**	**100%**	**65%**	**15%**	**20%**

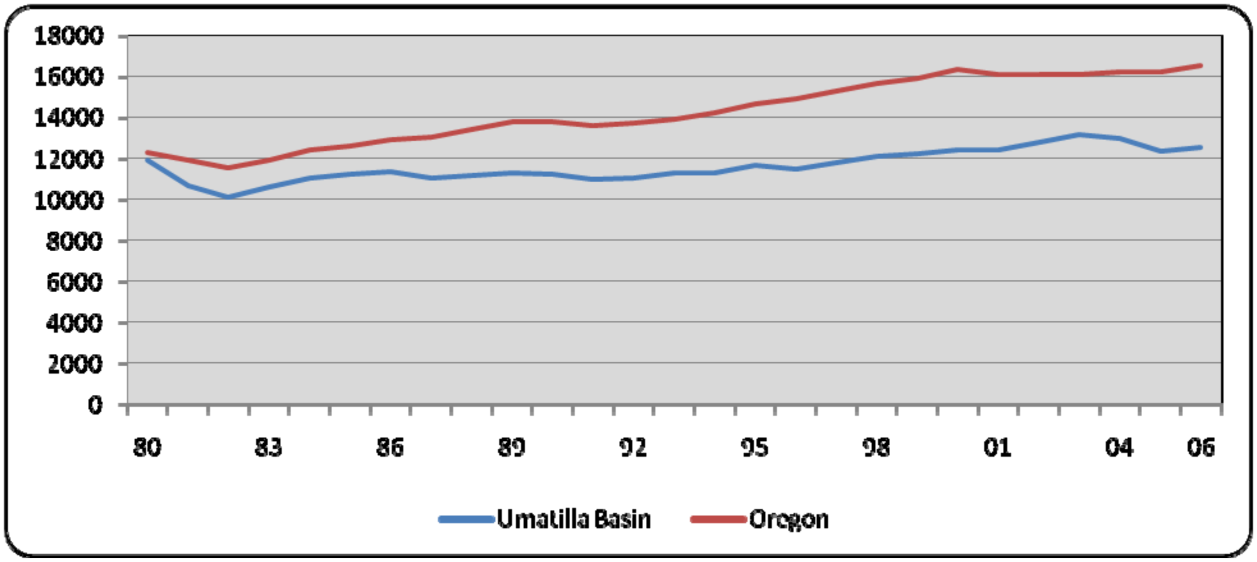
* Identifies the counties located in western parts of Oregon, mainly the counties around Portland, OR. Other counties are located in eastern half of Oregon along the Columbia River.

[1/] Transfer payments and investment income can have a stabilizing effect on the economy and could be considered counter-cyclical to an economic downturn. It should also be noted that high transfer payments in a region may imply presence of a poor economic condition.

***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Figures 3 and 4 show the PCPI trends and the annual percentage changes in real terms[2/] for the Basin and Oregon, from 1980 to 2006, respectively. From 1980 to 2006, the real PCPI in the Basin and Oregon changed by 5% and 35%, respectively. Furthermore, during the same periods, the average real PCPI in the Basin and Oregon changed by -0.1% and 1.7%, respectively. It implies that as the rest of the State has enjoyed an increase in their standard of living in terms of their purchasing power, the purchasing power of residents of the Basin has declined.

Figure 3: Real PCPI Trends in the Basin and Oregon, 1980-2006

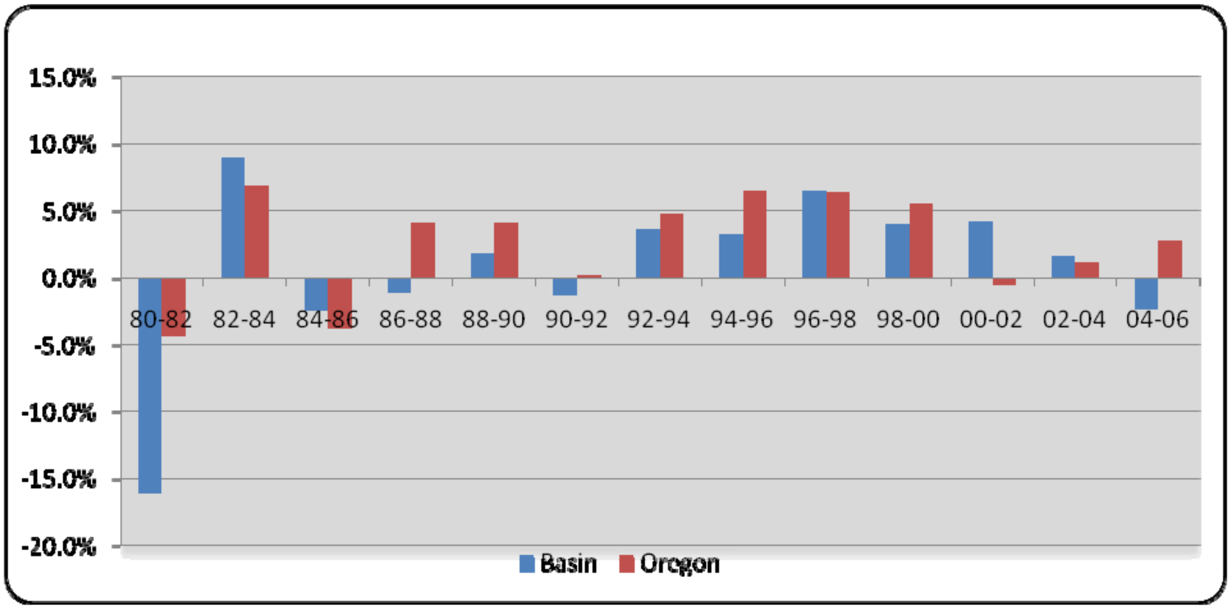


***Source:** U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

When analyzing the trend from 1980 to 2006, Figure 4 also reveals that the economy of the Basin has generally been more exposed to economic variations than the State economy as a whole. This is due to the heavy reliance of the region in 1980s on dryland farming, which is inherently more unstable than other economic sectors. However, as Figure 4 shows, the extent of variations in income has declined in 1990s and 2000s. As will be discussed later in this report, this can be attributed to less reliance of the economy on agriculture production sector and more on food processing and transportation manufacturing and power generation sectors.

[2/] Real per capita personal income is based on a constant 1995 dollar. It represents the PCPI after removing the effects of inflation.

Figure 4: Annual Percentage Changes in Real PCPI in the Basin and Oregon, 1980-2006



Source: *U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

4.2.2 Employment Trends

Employment is one of the most important economic variables in determining the health of an economy. Wages earned by employees are engines of economic growth. In 2006, total employment (consisting of wage and salary employees and proprietors) for the Basin was at 45,355 (Table 4). Between 1980 and 2006, the total employment in the Basin and Oregon changed by 34% and 70%, respectively. It implies that during 1980-2006, the Basin's employment growth lagged significantly behind the statewide employment growth.

The employment trends for the Basin between 1990 and 2006 shows a strong turnaround in growth (Table 5 and Figure 5). Between 1990 and 2006, total employment in the Basin and Oregon increased by 1.7% and 2.2%, respectively. The employment growth rates in the 1990s' and 2000s' indicate that the Basin fared better compared with the rest of the State. Between 1995 and 2006, the Basin had an annual employment growth rate of 0.6%, while the State had experienced a 1.5% annual growth rate (Table 5).

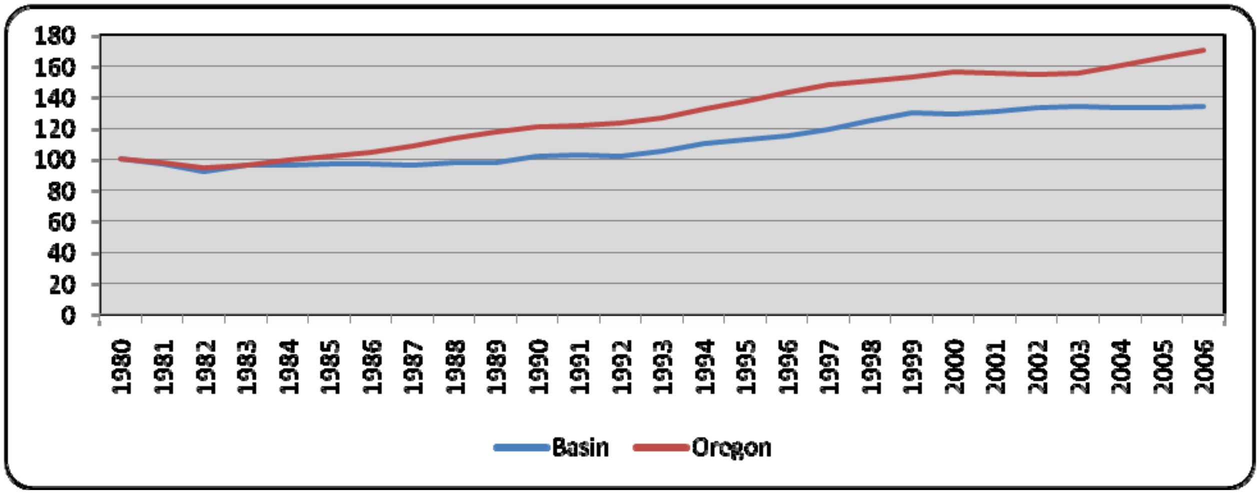
Figure 6 shows the changes in relative importance of farm, nonfarm private and government (or public) sectors' employment to the overall economy of the Basin from 1980 to 2006. It shows that farm employment from 1980 to 1992 declined, but in later parts of 1990s and early 2000s, farm employment stabilized its role throughout. As Figure 6 reveals, the employment in public and non-farm private sectors had significant up-trends in 1990s. However, in 2000s, the non-farm private employment growth leveled off and grew at a much lower rate. During the same period, employment in public sector grew at a faster rate than non-farm private sector but at a much slower rate compared to 1990s.

Table 5: Summary of Employment Trends in the Basin and Oregon, 1980-2006

		Basin	Oregon
Total Employment			
	1980	33,837	1,353,361
	1990	34,499	1,638,149
	2000	43,750	2,110,915
	2006	45,355	2,232,693
% Change in Employment			
	from 1980 to 2006	34%	70%
	from 1985 to 1996	2%	17%
	from 1995 to 2006	27%	29%
	from 2000 to 2006	4%	9%
Annual Rate of Growth			
	from 1980 to 2006	1.1%	2.1%
	from 1990 to 2006	1.7%	2.2%
	from 2000 to 2006	0.6%	1.5%

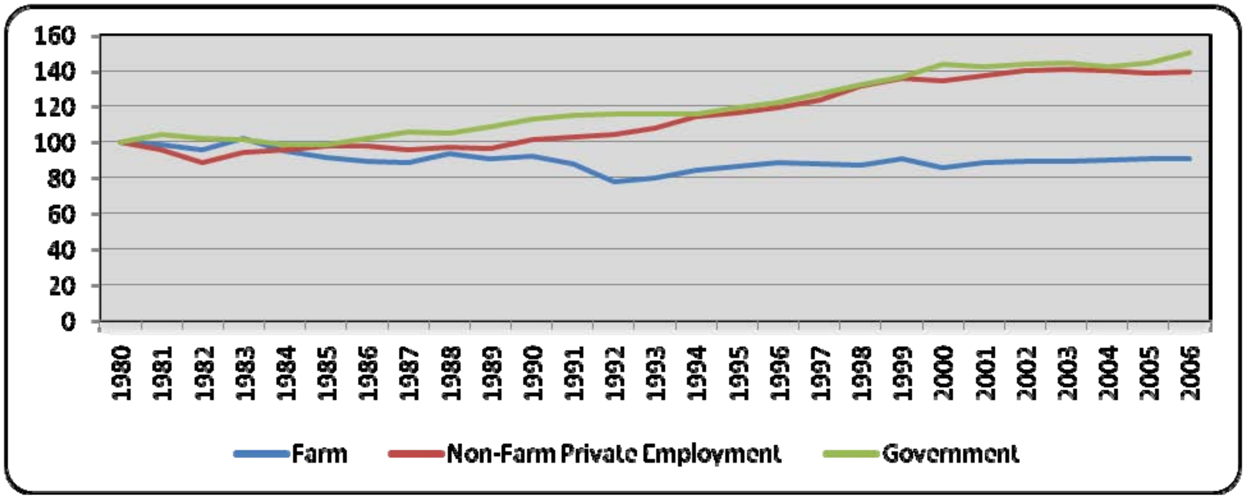
***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Figure 5: Employment Trends in the Basin and Oregon, 1980-2006



***Source**: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)*

Figure 6: Farm, Non-Farm Private and Government Employment Trends in the Basin, 1980-2006



Source: *.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS*

Table 6 shows the share of total employment among selected industries in the Basin in 1995 and 2006. In 2006, Services, Government, Trade, Agriculture, Manufacturing and Trade sectors accounted for 33%, 17%, 16%, 13%, and 11% of the total employment in the Basin. Compared to 1995, the total employment in the Basin increased by 17.4% (6,821 jobs). Significant gains in the share of employment in the Basin occurred in Services sector (by 47.4% or 6,340 jobs), Agriculture sector (by 12.7% or 1,741 jobs), and Government sector (by 3.9% or 1,389 jobs), whereas major losses in the share of employment occurred in Construction sector (by -73.0% or -1,235 jobs) and Trade sector (by -40.5% or -2,262 jobs).

Table 6: Percent of Employment by Industry in the Basin, in 1995 and 2006

	1995	2006	%Change	Change
Agriculture	13.7%	15.5%	12.7%	1,741
Mining	0.0%	1.0%	100.0%	460
Construction	4.6%	1.2%	-73.0%	(1,235)
Manufacturing	15.4%	12.5%	-18.7%	(274)
Trade	19.1%	11.4%	-40.5%	(2,262)
Transportation, Communications & Utilities	5.0%	4.4%	-12.6%	52
Finance, Insurance and Real Estate	3.8%	3.8%	0.0%	256
Services	22.2%	32.6%	47.4%	6,340
Government	16.1%	16.8%	3.9%	1,389
TOTAL	**39,180**	**46,001**	**17.4%**	**6,821**

Source: *Minnesota Implan Group, Inc. 1995 and 2006*

4.3 Economic Description of the Basin

Earlier sections of this report examined population, income and employment trends in the Basin. This section discusses the economic condition of the Basin in 2006 and identifies the important industries within the region in terms of total output, direct employment, etc.

Table 7 describes the economic condition of the Basin in 2006 in terms of industry's direct output (sale or business activities), direct employment, direct earned income, direct labor income and [direct] indirect business taxes.[3/]

4.3.1 Direct Economic Output [4/]

In 2006, the output sales from all economic activities in the Basin totaled $6.6 billion (Table 7).

- The Manufacturing sector was the largest sector in terms of its contribution to the Basin's direct economic output and accounted for about 45% ($2,989 million) of the region's total 2006 economic output. Within the Manufacturing sector, Transportation Equipment subsector (mainly automobile and light truck manufacturing, and travel trailer and camper manufacturing) accounted for 64% of the total output of Manufacturing sector and 29% ($1,915 million) of the region's total economic output. Food Processing (mainly its Vegetable Processing, Fruit and Vegetable Canning and Drying, and Cheese Manufacturing subsectors) accounted for 28% of the total output of Manufacturing sector and 13% ($833 million) of the region's total economic output.
- The second largest economic sector was Government sector which accounted for 9% ($577 million) of total 2006 economic output. State and local government accounted for 88% of the 2006 Government output and 8% of the region's total economic output.
- The third largest contributor to the Basin's total output was the Agriculture sector, which includes Farm Production, Forestry and Agricultural Services. In 2006, Agriculture sector accounted for 8% ($516 million) of the region's total business activity. The Farm Production sector, however, accounted for 62% (or $318 million) of Agricultural output value. Within the Farm Production sector, Vegetables, Livestock and Food Grains were the most important subsectors and accounted for 2% ($122 million), 1% ($77 million) and 1% ($71 million) of the region's total output, respectively.
- Utility sector was the fourth largest economic sector in terms of its contribution to the region's total output. However, the power generation subsector of the Utility sector accounted for 98% of Utility sector's total output.

[3/] Direct output or employment or earned income is defined as the output or employment or earned income generated by a specific industry. These are the direct contribution of industries to the economy; it excludes indirect and induced impacts (or secondary impacts) which will be discussed later in this report.

[4/] Due to potential double counting problem, the use of output (sales) as an economic indicator of the importance of a sector to overall economy should be interpreted with caution.

- Retail trade sector was the next important sector in the region and accounted for 4% (or $252 million) of the region's 2006 total output (Table 7).

4.3.2 Direct Employment

Employment in the Basin totaled 46,002 in 2006, which includes wage and salary earners plus proprietors.

- The Government sector was the largest employer in the region and accounted for 17% (or 7,885 jobs) of region's 2006 total employment.
- Agriculture sector was the second largest employer in the region. It accounted for 15% of total direct employment in the region (over 7,022 jobs) and 18% of non-government employment. Farm Production subsector, however, accounted for 60% of Agriculture sector's 2006 total employment. Agricultural and Forestry services accounted for 4% (or 1,772 jobs) of region's 2006 total employment.
- The third largest employer in the region was the Manufacturing sector, which accounted for 13% (5,823 jobs) of the region's 2006 total jobs. Nearly 43% of the employment in the Manufacturing sector was in Food Processing subsector, which accounted for 2,487 jobs. Transportation Equipment and Wood Product subsectors were the other large employers within the manufacturing sector.
- Retail trade sector accounted for 9% (or 4,184 jobs) of the region's employment and was the fourth largest employer in the County.

4.3.3 Direct Earned Income

The other economic indicator used to measure the importance of an industry to an economy is the earned income. Earned income is the sum of all wage and salary payments that are made to workers, plus the profits accruing to sole proprietors, plus payments made to investors in the forms of dividends, interests, or rents. Broadly speaking, the earned income, plus indirect business taxes (known as value-added account) represent the net addition an industry contributes to the economy.[5/]

If all of the earned income generated by an industry is paid to local residents, then the generated earned income represents the net wealth added to the local economy. However, if the majority of owners of capital (lenders, stockholders, partners, and proprietors) within a given industry, are not local residents (this is usually the case for capital-intensive industries such as utility industry), one can expect that a significant portion of the earned income (e.g., the profit component of the earned income) to leak out of the local economy. In an industry such as agriculture, where the majority of owners of capital and the workers are usually local residents, most of the earned income is expected to remain in the local economy. This is important since only the money that remains in the local economy stimulates the economy through spending and re-spending processes. Consequently, one should be cautious in interpreting the contribution of an industry based on the magnitude of its earned income. To get a good

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[5/] An industry's value-added is defined as the difference between the final value of products (or services) and the value of the materials and inputs used to produce (or render) them.

picture of an industry's relative contribution to the local economy based on earned income, it is necessary to have information concerning the residency of owners/operators and workers in the industry. For this reason, only the labor income component of the earned income is used in identifying the role of an economic sector to the general regional economy.

Table 7: The Economy of the Basin in 2006, in million $

	Total Output		Employment		Earned Income		Labor Income	Ind. Bus. Tax
Agriculture	**516**	**8%**	**7,022**	**15%**	**240**	**5%**	**106**	**8.3**
Farm Production	318	5%	4,190	9%	176	4%	58	4.8
Food Grains	71	1%	1,982	4%	33	1%	2	1.3
Vegetables	122	2%	1,089	2%	79	2%	28	1.2
Livestock	77	1%	894	2%	6	0%	9	1.6
Forestry & Logging &Fishing	70	1%	166	0%	22	0%	5	1.5
Agriculture and Forestry Serv.	52	1%	1,772	4%	36	1%	34	0.5
Mining	**62**	**1%**	**305**	**1%**	**28**	**1%**	**1**	**1.9**
Utilities	**301**	**5%**	**510**	**1%**	**206**	**4%**	**49**	**35.1**
Power Generation & Supply	294	4%	495	1%	204	4%	48	34.5
Construction	**169**	**3%**	**1,526**	**3%**	**69**	**1%**	**43**	**0.9**
Manufacturing	**2,989**	**45%**	**5,823**	**13%**	**424**	**9%**	**282**	**11.4**
Food Processing	833	13%	2,487	5%	171	3%	100	5.2
Frozen Food Mnf.	546	8%	1,895	4%	127	3%	72	3.5
Fruit & Veg. Canning & Drying	64	1%	142	0%	14	0%	7	0.4
Cheese Mnf.	90	1%	121	0%	7	0%	6	0.6
Wood Products	111	2%	561	1%	38	1%	23	0.6
Mobil Home Mnf.	54	1%	352	1%	20	0%	13	0.3
Transp. Equipment	1,915	29%	2,264	5%	179	4%	139	4.7
Light truck Mnf.	1,695	26%	1,225	3%	127	3%	88	4.0
Travel Trailers &Campers	194	3%	964	2%	48	1%	47	0.6
Wholesale Trade	**101**	**2%**	**906**	**2%**	**53**	**1%**	**37**	**14.8**
Transportation and Warehousing	**362**	**5%**	**2,946**	**6%**	**213**	**4%**	**140**	**7.8**
Rail Transportation	106	2%	325	1%	64	1%	38	2.0

Truck transportation	111	2%	754	2%	55	1%	41	1.3
Warehousing and storage	30	0%	446	1%	22	0%	18	0.2
Retail Trade	**251**	**4%**	**4,184**	**9%**	**127**	**3%**	**91**	**34.5**
Information	**62**	**1%**	**350**	**1%**	**22**	**0%**	**12**	**2.5**
Finance and Insurance	**130**	**2%**	**1,009**	**2%**	**78**	**2%**	**30**	**1.9**
Real Estate and rental	**100**	**2%**	**917**	**2%**	**51**	**1%**	**5**	**9.8**
Professional-scientific &tech	**88**	**1%**	**986**	**2%**	**38**	**1%**	**21**	**0.8**
Management of companies	**1**	**0%**	**8**	**0%**	**0**	**0%**	**0**	**0.0**
Administration & waste services	**220**	**3%**	**2,299**	**5%**	**123**	**2%**	**83**	**7.5**
Educational srvs	**6**	**0%**	**249**	**1%**	**2**	**0%**	**2**	**0.0**
Health & social services	**245**	**4%**	**4,045**	**9%**	**137**	**3%**	**102**	**1.9**
Arts-entertainment & recreation	**12**	**0%**	**410**	**1%**	**5**	**0%**	**3**	**0.7**
Accommodation & food services	**116**	**2%**	**2,456**	**5%**	**49**	**1%**	**33**	**6.4**
Other services	**143**	**2%**	**2,166**	**5%**	**68**	**1%**	**34**	**3.3**
Government	**577**	**9%**	**7,885**	**17%**	**517**	**10%**	**459**	**0.1**
Federal	68	1%	1,001	2%	58	1%	50	0.0
State & Local	510	8%	6,884	15%	459	9%	409	0.1
Other	**186**	**3%**	**-**	**0%**	**139**	**3%**	**0**	**25.1**
TOTAL	**6,638**	**100%**	**46,002**	**100%**	**4,962**	**100%**	**3,157**	**244**

Source: *Minnesota Implan Group, Inc., 2006 IMPLAN Database. Some numbers may not add due to rounding.*

Table 7 shows the earned income, labor income[6/] and indirect business taxes[7/] generated by the Basin's economic sectors in 2006. The total earned income, labor income, and indirect business tax in the Basin was estimated to be around $4,962 million, $3,157 million and $244 million, respectively.

- Government (federal, and state and local) sector had the largest earned income in the Basin, it accounted for 10% (or $517 million) of the Basin's 2006 total earned income. State and local sector accounted for more than 97% (or $459 million) of government sector's earned income.

[6/] The labor income includes the wages and salaries paid by employers, as well as benefits, such as health and life insurance, retirement payments, and non-cash compensation.

[7/] Indirect business taxes include property and other taxes and fees, except taxes on profits or income.

- Manufacturing sector generated the second largest earned income ($424 million or 9% of the region's total earned income), while its contribution to labor income and indirect business taxes were $282 million (or 9% of the Basin's total labor income) and $2.2 million (or 5% of the Basin's 2006 total indirect business taxes), respectively.
- The Agriculture sector was the third largest contributor, accounted for $240 million or 5% of the Basin's total earned income. It generated $106 million of labor income (or 3% of the Basin's total labor income) and contributed $8.3 million to the Basin's indirect business taxes (more than 3% of the region's total indirect business taxes).
- The Utility sector was the fourth largest contributor to the region's earned income and accounted for $206 million or 4% of the Basin's total 2006 earned income. Its contribution to labor income and indirect business taxes were $49 million (or 2% of the region's total labor income) and $35million (14% of the Basin's indirect business taxes), respectively. Utility sector was by far the largest contributor to the Basin's 2006 indirect business tax.

4.3.4 Economic Base of Basin

Direct economic output, employment, earned income and labor income are important in identifying the role of an economic sector in the general regional economy. Frequently, these measures cannot be used in identifying the sectors that constitute the engine or economic base of the economy. For this reason, regional economists use other economic measures to identify sectors that are the prime sources of regional economic growth and development.

Regional economic theory states that a regional economic growth and development is driven by economic activities that import money into the region through the sales of goods and services to firms and/or households outside of local region. An economic sector that brings money into the economy, through export activities, would initiate spending and re-spending process in the economy which would contribute to the region employment, income and growth. Hence, the sectors that bring money to the region are considered engines or the economic bases of the economy.[8/]

In general, an economy can be divided into "basic or primal or export activities" and "non-basic or non-primal" sectors. Basic sectors are the industries that sell outside the region (domestic and/or foreign) a large portion of their goods and services. By emphasizing export, these industries bring "new wealth" to the local economy. Non-basic sectors sell goods and services to the region's basic industries and local residents. The spending and re-spending of dollars generated in a basic sector create multiplier effects, which in turn support the non-basic sectors of the economy.

Several methods have been used to identify the basic and non-basic sectors of an economy. However, the location quotient (LQ) approach is the most popular and frequently used technique in economic base analysis (Crone, et. al.).

The location quotients identify the basic and non-basic sectors of a local economy by comparing the economic structure of that economy with a reference economy (usually state and/or nation). If the local economy has relatively less economic activity in a particular sector compared to the reference economy, that suggests the good or service is being imported from other regions. If the local economy has

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relatively more economic activity in a particular sector compared to the reference economy, that suggests the good or service is being exported to other communities.[9/] This comparison can be done using various measures of economic activity, such as employment, income, or retail sales. However, the standard unit of measurement used in LQ is employment for which the data is readily available.

LQ compares the share of total employment in a particular industry or sector in a local economy to its share at the national or state level. In other words, LQ compares the relative importance of an industry in a region to its relative importance at the national or state level. The quotient is determined by dividing the region industry's share of total employment by the same industry's share of total employment at the national or state level. If the location quotient exceeds one, then exports are indicated. Industries with location quotients less than or equal to one are assumed to be industries serving local markets only. The greater the LQ value above or below 1.0, the stronger the suggestion of exporting or importing becomes. For example, a location quotient of 1.50 indicates that 50% percent of the employment in the sector is related to the export activities. In general, all employment of sectors with location quotients greater than 2 is attributed to export activities. The sectors having LQs less than 0.75[10/] imply that the current level of economic activities in these sectors are not sufficient to meet local demands and thus goods and services from these sectors must be imported. This could indicate either a comparative disadvantage in these sectors compared to a reference economy or that these might be industries to consider for future expansion.

Table 8 shows the 2006 location quotients of major economic sectors in the Basin. It shows that based on North American Industry Classification System (NAICS) 2 digit aggregation level, only agriculture, mining, utilities, transportation and warehousing sectors constitute the economic base of Basin (Using LQ score of 1.50 as a cut off). However, at a lower level of aggregation, in addition to the above sectors, a few of manufacturing subsectors (frozen food manufacturing, fruit and vegetable canning and drying, cheese manufacturing, wood products, and transportation truck manufacturing) also make up the economic base of the Basin's economy (all with LQ > 2). In general, goods-producing sectors constitute the economic base of the Basin's economy. The construction, wholesale trade, retail trade, finance and insurance, government and a few other sectors have LQ <1, are largely non-export sectors (non-basic sectors). As noted above, the employment and income of non-basic sectors largely depend on the ability of basic sectors exporting activities (this is largely true if an economy has small transfer payments relative to size of the economy).

[7/] The importance of an industry can also be measured by the extent its goods and services are used as inputs in the production of other locally produced goods and services, and/or used as final goods and services by the local residence. The greater a basic sector's reliance is on locally produced goods and services, the greater its impact on the local economy. A decrease in imports (or import substitution expansion) has the same stimulative effect as an increase in exports. Increased exports increase the flow of money into the economy and decreased imports decreases the flow of money out of the economy.

[9/] http://www.epa.gov/greenkit/pdfs/howto.pdf

[10/] Due to potential errors with LQ analysis, it is difficult to make a broad conclusion on a sector with LQ between 0.75 and 1.25 without a more detailed study.

Estimating the contribution of economic base to the whole economy is beyond the scope of this report (see Waters et. al for a detailed description of economic base analysis). However, in this report, two other measures, net-trade balance and export-dependent employment, are used to highlight the importance of the major sectors that constitute the economic base of the Basin as identified in Table 8 (for sectors having LQ >2). The net-trade balance identifies how much "new money" an economic base sector brought to an economy. The net-trade balance for a sector reflects the difference between the value of goods and services exported (domestic and foreign) and the value of goods and services purchased by the sector from outside the region (Ziari et. al).[11/] The export-dependent employment is the number of jobs created, directly and indirectly, resulting from the export activities. The export-dependent employment was calculated by noting the employment impact of a sector's export activities using Basin's input-output model.[12/] The export values, net-trade balances, and export-dependent employment for major economic base sectors are presented in Table 8. Following summarizes the findings:

- The economic base sectors as identified in Table 8 accounted for $2,655 million of Basin's total export (81% of total), $671 million of net-trade balance, and 15,000 jobs (33% of total employment).
- In 2006, light truck manufacturing, frozen food manufacturing, power generation, travel trailer and campers manufacturing, and vegetables sectors exported $1,232 million, $522 million, $250 million, $149 million, and $101 million, respectively. These sectors accounted for 69% of 2006 total Basin export.
- In 2006, frozen food manufacturing, power generation, rail transportation, vegetable sectors and food grains sectors had net-trade balances of $246 million, $210 million, $82 million, $74 million, and $38 million, respectively. These sectors together brought more than $650 million of "new money" into the Basin's economy.
- Export activities by frozen food manufacturing, light truck manufacturing, food grains, vegetables, and travel trailers and campers manufacturing sectors accounted for 3,831, 2,501, 2,036, 1,385, and 1,235 jobs, respectively.[13/]
- Low export activities of livestock and agricultural services sectors (both having LQs > 2) indicate that most of their production are used in support of other goods produced locally (for example, the region's livestock activities support the local cheese manufacturing sector, this accounts for a large employment contribution of cheese manufacturing sector).

[11/] In addressing the relative importance of basic sector, a comparison between the percent of the export money that would be spent on local goods and services, and the percent of proprietors' income that would remain in local economy, should also be incorporated into the analysis. This kind of economic analysis can be performed using input-output and Social Accounting Modeling techniques.

[12/] Next section provides a brief discussion of input-output modeling technique.

[13/] The export-dependent employment estimations as presented in Table 8 ignore the induced economic activities (e.g., transportation, wholesaling activities, etc) beyond the farm gate and/or factory plant and hence they should be considered as conservative estimates (next section discusses this issue).

- The analyses of net-trade balances and export-dependent employment indicate that the farm production and food processing sectors exhibit healthy inter-industry linkages that allow less import of goods and services and higher regional job creation opportunities.

The above analysis identified the Basin's competitive strengths with respect to the state's economy and driver industries that constitute the engines of the Basin. It also estimated the extent of their direct and indirect contributions to their respective economies. From an economic development perspective, these are sectors that regional policy makers are to focus and be apprehensive that any policy change that adversely affects these sectors would also negatively impact the employment and income in other sectors of the economy. Therefore, retention and/or expanding these sectors should be the priority of the regional policymakers.

Table 8: Location Quotients, the Basin vs. Oregon

	% of Total Employment		Location Quotient	Export ($mil)	Net Trade Balance ($mil)	Export Dependent Employment (# of jobs)
	Basin	OR				
Agriculture	15.3%	4.5%	3.4			
Farm Production	9.1%	2.9%	3.2			
Food Grains	4.3%	0.2%	18.9	64	38	2,036
Vegetables	2.4%	0.2%	15.0	101	74	1,385
Livestock	1.9%	0.7%	2.7	0.3	(40)	
Forestry & Logging &Fishing	0.4%	0.7%	0.5			
Agriculture and Forestry Serv.	3.9%	1.0%	4.0	9	(3)	361
Mining	0.7%	0.3%	2.0	45	30	382
Utilities	1.1%	0.2%	4.9			
Power Generation & Supply	1.1%	0.1%	7.4	250	210	800
Construction	3.3%	6.2%	0.5			
Manufacturing	12.7%	9.6%	1.3			
Food Processing	5.4%	1.0%	5.4			
Frozen Food Mnf.	4.1%	0.3%	15.1	522	246	3,831
Fruit & Veg. Canning & Drying	0.3%	0.2%	2.0	72	36	384
Cheese Mnf.	0.3%	0.0%	10.1	42	19	564
Wood Products	1.2%	1.5%	0.8			

Sawmill	0.4%	0.4%	1.1			
Mobil Home Mnf.	0.8%	0.1%	7.1	53	26	478
Transp. Equipment	4.9%	0.8%	6.0			
Light truck Mnf.	2.7%	0.1%	24.2	1,232	(175)	2,501
Travel Trailers &Campers	2.1%	0.1%	17.4	149	48	1,235
Wholesale Trade	2.0%	3.9%	0.5			
Transportation/Warehousing	6.4%	3.3%	1.9			
Rail Transportation	0.7%	0.1%	6.1	88	82	614
Truck transportation	1.6%	1.1%	1.5	18	18	214
Warehousing and storage	1.0%	0.3%	2.8	10	10	198
Retail Trade	9.1%	10.8%	0.8			
Information	0.8%	1.8%	0.4			
Finance and Insurance	2.2%	3.7%	0.6			
Real Estate and rental	2.0%	3.9%	0.5			
Professional-scientific &tech	2.1%	5.7%	0.4			
Management of companies	0.0%	1.3%	0.0			
Administration & waste services	5.0%	5.5%	0.9			
Educational srvs	0.5%	2.1%	0.3			
Health & social services	8.8%	10.4%	0.8			
Accommodation & food services	5.3%	6.8%	0.8			
Other services	4.7%	5.6%	0.8			
Government	17.1%	12.1%	1.4			
TOTAL	**46,002**	**2,264,537**	**NA**	**2,655**	**671**	**14,983**

Source: *Minnesota Implan Group, Inc., 2006 IMPLAN Database*

5.0 AGRICULTURAL ECONOMY IN THE BASIN AND OREGON

The preceding analysis shows that the farm production, food processing (mainly frozen food manufacturing, vegetable canning manufacturing, and cheese manufacturing), transportation and warehousing, and public utility sectors constitute the economic bases of the Basin. Furthermore, a large portion of food processing activities is dependent on farm products produced in the Basin. A significant portion of transportation and warehousing activities in the region can also be attributed to the agriculture sector and its value-added industries (food processing). For the purpose of this report, the farm production, food processing, and agricultural services sectors are lumped together and presented as an agriculture industry. In this section, a detailed description of the agriculture industry will be provided.

5.1 Farm Production

Harvested crop acreage and gross farm values and their respective share of Basin's total crop acreage and farm values for 2006 are presented in Table 9. In 2006, harvested crop acreage (irrigated and dryland) in the Basin was 617,920 acres accounting for about 21% of Oregon's total harvested crop acreage. The Basin has approximately 200,000 acres of irrigated cropland. Most of the irrigated land is located in northern parts of Umatilla and Morrow Counties near the Columbia River.

As is shown in Figure 7 and Table 9, the region hosts a variety of high value crops. However, the southern part of Morrow and Umatilla Counties is still almost exclusively dryland farming and livestock production.[14/] In 2006, approximately, 73% of the Basin's harvested cropland (or 435,700 acres) was allocated to wheat production. From 435,700 wheat acres, around 40,000 acres of it was irrigated (Oregon Agricultural Information Network). Irrigated wheat is usually used as a crop rotation for high value crops (i.e. potatoes)

Crop acreage in the Basin is focused primarily on the production of high value crops. The majority of the region's potatoes, field corn, alfalfa, vegetables and tree fruits are irrigated. High value crops grown are potatoes (23,000 acres), alfalfa hay (58,000 acres), and onions (8,300 acres). Other vegetable crops grown in the Basin are watermelon, carrots, green peas, sweet corn and asparagus. The Basin also has the world's largest hybrid poplar plantation.

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[14] In recent years, a large cattle operation in Northern portion of Morrow County was established, which provides the necessary raw materials for a cheese plant located in the Port of Morrow industrial park.

5.2 Trends in Gross Farm Sales and Crop Acreage, the Basin

Figure 8 shows that the crop acreages in the Basin and the State have been decreasing since 1997. From 1997 to 2006, the crop acreages in Basin and State have decreased by 10% and 19%, respectively. Excluding the grain crops, the crop acreage in Umatilla Basin, however, increased by 3%. Examination of the acreages in the Basin shows there has been a shift from grain production (mainly wheat) to higher value crops and hay crops.

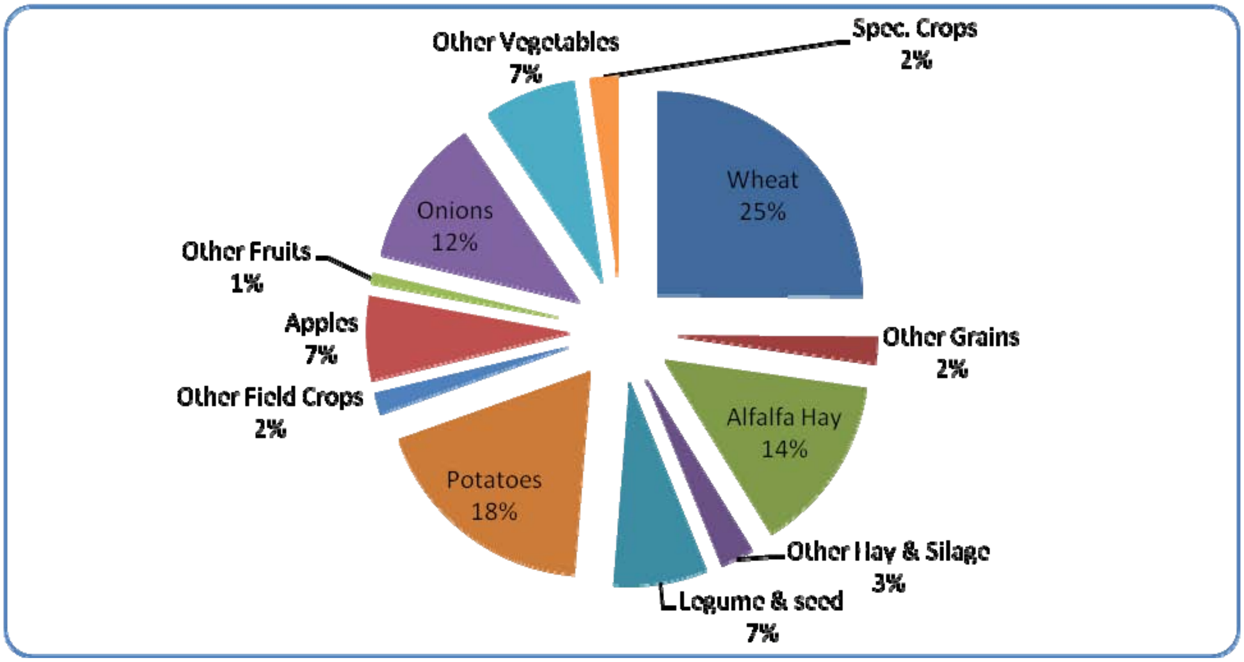
Table 9: Crop Acreage and Value of Agricultural Production in the Basin, 2006

	Crop Acreage	% of Region	Value of Production ($000)	% of Region
CROP PRODUCTION	617,920	100%	$ 540,811	100%
CROP GRAIN	449,050	73%	$ 102,582	29%
Wheat	435,700	71%	$ 94,684	26%
Barley	2,700	0%	$ 204	0%
Oats	650	0%	$ 44	0%
Corn for Grain	10,000	2%	$ 7,650	2%
HAY & FORAGE	75,150	12%	$ 62,503	17%
Alfalfa Hay	58,000	9%	$ 52,800	15%
GRASS & LEGUMES	18,378	3%	$ 24,989	7%
Kentucky Bluegrass	7,620	1%	$ 9,055	3%
Tall Fescue	4,290	1%	$ 7,079	2%
Perennial Ryegrass	4,320	1%	$ 7,386	2%
FIELD CROPS	32,542	5%	$ 74,716	21%
Potatoes	23,000	4%	$ 69,000	19%

Peppermint for Oil	4,000	1%	$	3,825	1%
TREE FRUIT & NUTS	3,762	1%	$	28,373	8%
Apples	2,386	0%	$	25,053	7%
Wine Grapes	836	0%	$	1,876	1%
VEGETABLES	12,460	2%	$	57,547	16%
Onions	8,300	1%	$	44,403	12%
Sweet Corn	1,930	0%	$	1,467	0%
Lima Beans	1,685	0%	$	1,515	0%
Other Vegetables	545	0%	$	10,161	3%
SPECIALTY PROD.	NA		$	8,820	2%
LIVESTOCK			$	98,426	27%
Cattle & Calves			$	95,415	27%
Others			$	3,011	1%
NOT DISCLOSED	26,573	4%	$	82,856	23%

Source: *2006 Oregon County and State Agricultural Estimates.*

Figure 7: Relative Share of the Basin's Value of Crop Production, 2006



Source: *2006 Oregon County and State Agricultural Estimates.*

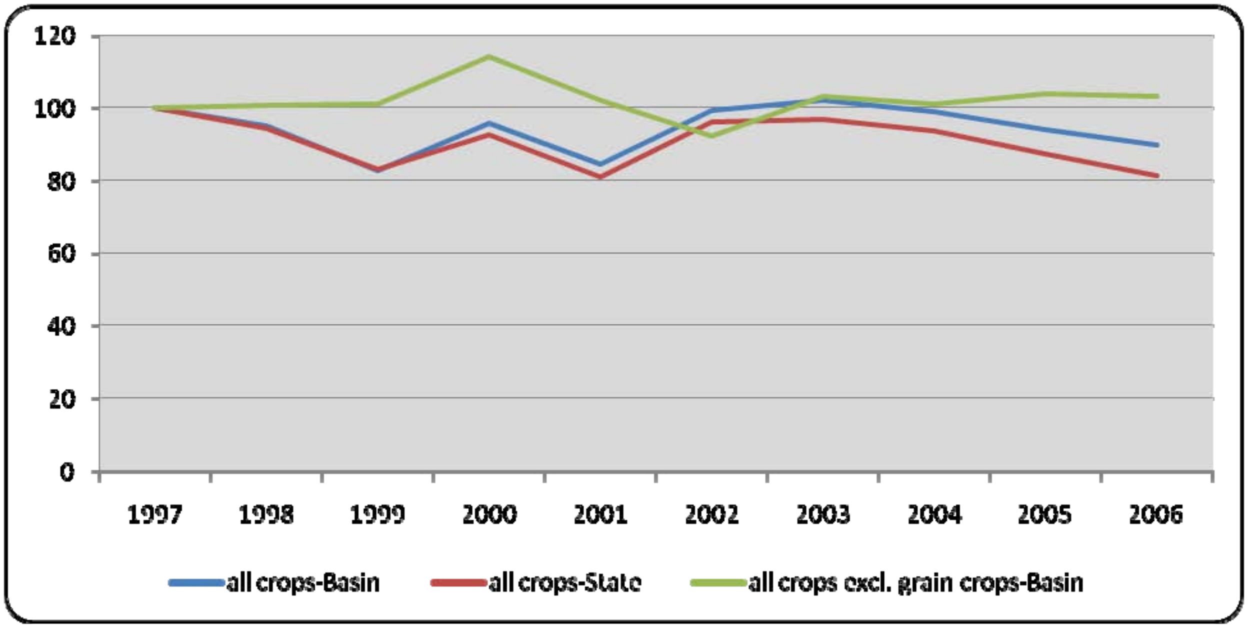
The trends overtime in the value of the Basin for grain crops, all crops excluding grain crops, all crops, and livestock production are presented in Figure 9. It shows that there been a significant variability in production value of grain crops, while excluding grain crops, the variability in total production value of other crops was significantly lower. Given the decline in grain acreages in recent years (Figure 8), the increase in production value of grain crops can be attributed to dramatic increases in grain prices in recent years. The value of production for grain crops, all crops excluding grain crops, and all crops, compared to 1997, increased by 131%, 124%, and 117%, respectively.

Livestock production has shown a dramatic increase in production in the last few years, increasing from $44 million in 1997 to $159 million in 2006, an increase of over 257 percent. The increase in livestock production can be directly attributed to an opening of a new cheese manufacturing.

5.3 Importance of the Basin Agriculture to Oregon Agriculture

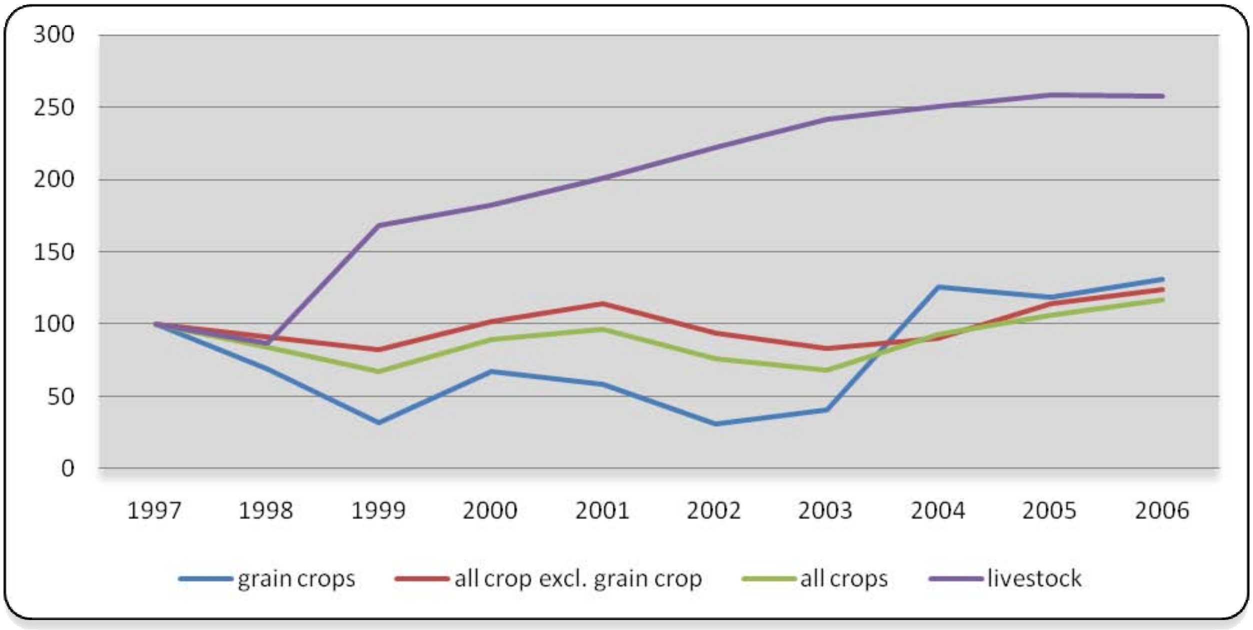
Table 10 presents the 2006 gross farm sales, percent of State's sales and State ranking by commodity group for the Basin. As is shown in Table 10, Basin's agriculture is very important to Oregon's agriculture and the State's economy. In 2006, the Basin's gross farm sales accounted for 12% of the State's total gross farm sales (or $536 million), which ranked second after Marion County. From $536 million, crop and livestock farm sales accounted for $377 million (or 12% of State's total crop sales) and $159 million (14% of all animal products sold in the State), respectively.

Figure 8: Trends in Crop Acreage, the Basin and Oregon, 1997-2006



Source: *Oregon County and State Agricultural Estimate, various years. Oregon Agricultural Information Network (ONIA), http://oregonstate.edu/oain/.*

Figure 9: Trends in Value of Production, the Basin, 1997-2006



Source: *Oregon County and State Agricultural Estimate, various years. Oregon Agricultural Information Network (ONIA), http://oregonstate.edu/oain/.*

In 2006, the Basin's grain production was valued at $102 million which accounted for 48% of state's total value of grain production. The Basin's field crop production accounted for 35% ($75 million) of the State's 2006 field crop production. In the same year, the vegetable crops production in the Basin accounted for 17% ($58 million) of total State's vegetable sales. Hay and silage, grass and legume seeds, tree fruits and nuts, and specialty products production in the Basin accounted for 20% ($62 million), 5% ($25 million), 10% ($29 million), and 1% ($9 million) respectively, of the State total gross farm sales. Cattle and Calves value was at $95 million, representing 15% of cattle and calves sales of the State.

Table 10: Gross Farm Sales, the Basin and Oregon – 2006

	Sales ($ mil)	% of State	Rank	Total State Sales ($ mil)
Grains	102	48%	1	214
Hays & Silage	62	20%	1	313

Grass & Legume Seeds	25	5%	7	483
Field Crops	75	35%	1	214
Tree Fruits & Nuts	29	10%	5	277
Vegetable Crops	58	17%	1	333
Specialty Products	9	1%	15	1,309
ALL CROPS	377	12%	2	3,269
Cattles and Calves	95	15%	1	636
All ANIMAL PRODUCTS	159	14%	1	1,163
TOTAL GROSS SALES	536	12%	2	4,432

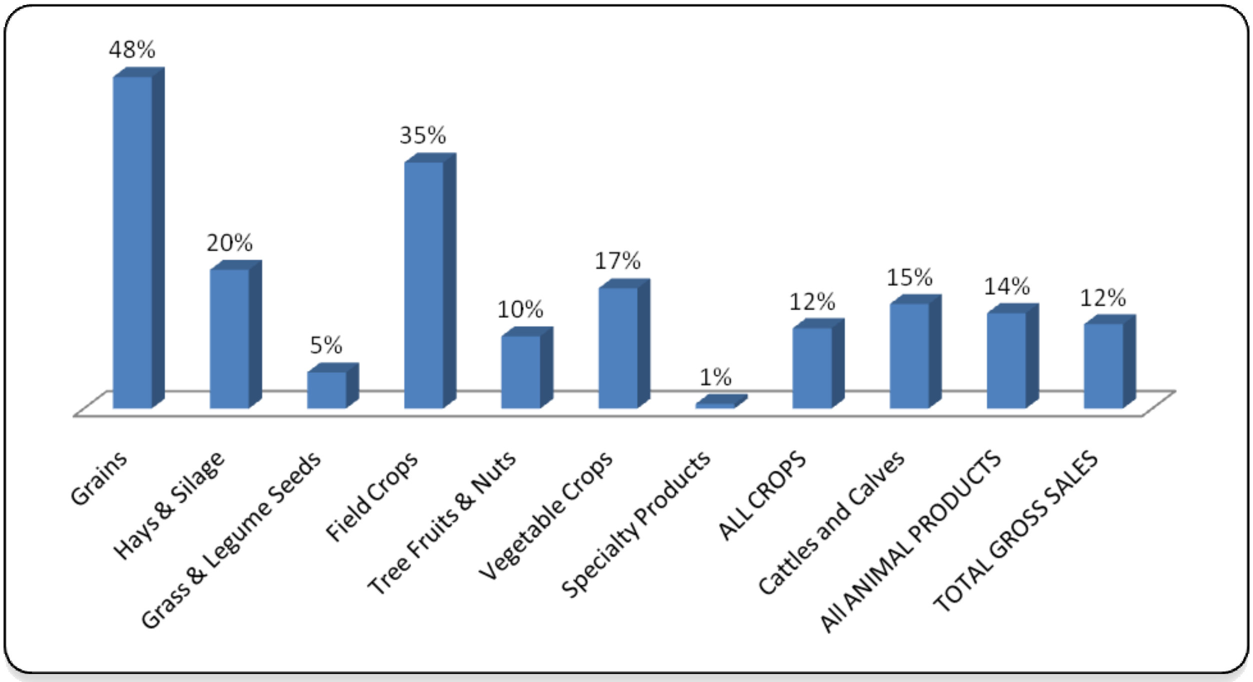
***Source**: 2006 Oregon County and State Agricultural Estimates.*

Table 10 also shows that the Basin's grain production, hay and silage, field crops, vegetable crops, cattle and calves sectors ranked first in the State in terms of 2006 gross farm sales. The Basin's gross farm sales of tree fruits and nuts, and specialty products ranked 5 and 15 in the State, respectively.

5.4 Basin Farm Production and Its Related Value-added Activities

In addition to the direct impact of farm production on the region's industrial output, income and employment, a vast network of support infrastructure has been built around the production of high-value crops (e.g. potatoes, green peas, alfalfa, carrots, onions, etc.). The increased production of high-value crops has stimulated the development of food processing plants in western Umatilla County and northern end of Morrow County. Food processing has become a major industry, producing frozen, canned, dehydrated fruits and vegetables. In 2006, the vegetable processing sector alone, which is highly dependent on locally produced farm products, accounted for 9% (or $610 million) of the Basin's industrial output and 5% (or 2,037 jobs) of the Basin's private employment (Table 7). French fries, dehydrated potatoes, dehydrated onions, frozen peas, frozen sweet corn, frozen carrots, etc. are the major food products produced in the Basin. As a result of a new cheese manufacturing plant, the livestock production in the Basin increased drastically. The value of cheese production in the Basin in 2006 accounted for 20% of the State's cheese production.

Figure 10: Relative Share of the Basin in State Gross Farm Sales, 2006.



Source: *1996 Oregon County and State Agricultural Estimates*

The role of agriculture industry (farm production, agricultural services and food processing) is significant and constitute a major component of the Basin's economy. The combined value of direct output from farm production, agricultural services and food processing sectors accounted for more than 20% (or $1.35 billion) of the Basin's 2006 total economic output (Table 7). In 2006, 9,509 jobs were directly employed in agricultural industry, representing roughly 21% of total employment (25% total private employment, excluding government) in the Basin (Table 7). The agriculture industry directly accounted for $411 million income (or 8% of the Basin 2006 earned income).

In order to fully capture the role of agricultural industry in the economy, the additional forward linkages (induced direct business activities beyond the farm and/or factory gate as a result of agricultural industry's production) should also be taken into account. Major forward linkages for agricultural industry within the Basin are transportation, warehousing, and wholesale trade sectors. However, specific data on economic relationship between these sectors to agricultural industry are not readily available. In the next section, this report uses IMPLAN database to estimate the linkages between agricultural industries and transportation, warehousing, and wholesale trade sectors.

The primary direct economic impacts that are generated by agriculture industry also create additional business activities through secondary or multiplier effects--stemming from the impacts of spending and re-spending of the new money (export activities). The resulting business activities further contribute to personal income, business income, federal tax revenue, State tax revenue, property tax revenue and saving. So, in determining the role of agriculture in the regional economy, it is necessary to consider both the direct and indirect (secondary) impacts. This is accomplished in next section.

5.5 Economic Impacts of the Agricultural Industry on Economy of the Basin [15/]

In this section, the economic impact of agriculture industry on the Basin's economy will be discussed. The economic impacts are estimated using the economic measures that include the changes in business output (sales), employment, and value-added. These are the economic indicators that are conventionally utilized within standard regional economic impact analysis.

In regional economic impact analysis, the economic impacts are categorized into three types: direct, indirect, and induced.[16/] In case of agriculture industry,

- Direct or Primary Impacts are the jobs, sales, and incomes generated by local businesses operating within agriculture sectors of the Basin.
- Indirect Impacts are the additional jobs, sales, and incomes generated in the economy as a result of local firms selling goods and services to the local businesses operating within agriculture sectors.
- Induced Impacts are additional jobs, sales, and incomes generated as individuals employed (directly or indirectly) by businesses operating within the agriculture sectors buy goods and services from local firms.

The total economic impact for each economic measure is the sum of the combined direct, indirect, and induced impacts.

Total economic impact estimates are compiled using Input-Output (I-O) models of Basin provided by Minnesota Implan Group, Inc (IMPLAN).

The direct economic contributions of farm production, food processing and agricultural services and transportation and warehousing are presented in Table 11. The direct impacts for farm production, food processing and agricultural services are directly derived from Table 7. However, as pointed out in the previous section, additional activities within the local economy are made beyond the farm gate and food processing factory gate that should be taken into account in impact analysis. Additionally, the extent to which wholesale trade, transportation, and warehousing sectors' businesses are directly tied

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[15/] Agriculture industry generally includes as farm production, food processing, and agricultural services (Ziari, H and D. Olsen, Tanjunkio, et al.). In other studies agricultural industry also includes transportation, warehousing, wholesale trade (Sorte and Weber).

[16/] The indirect and induced effects are also called the secondary or multiplier effects.

to agriculture industry beyond the farm gate and food processing factory gate are not directly available. However, in a recent study of economic impact of agriculture on Oregon, Sorte and Webber suggested using retail margins, as provided in IMPLAN database, to estimate the direct induced impacts of agricultural industry, beyond the farm gate and processing factory gate, on transportation and warehousing, and wholesale trade activities. Since the marketing margins, as provided by the IMPLAN database, are the same at the State and the County levels, the approach makes sense at the State level or for a larger economic area, but it might overestimate at the County level. For this reason, only 50% of total impacts of the value added activities beyond the farm gate and processing factory gate associated with the agricultural industry were considered in this report.

Table 11: Direct Economic Impacts of Agriculture on Economy of Basin, 2006$

	Output ($mil)	Employment (# of jobs)	Value-added ($mil.)
Farm Production	465	5,250	212
Agricultural Services	52	1,772	37
Food Processing	833	2,487	176
Trans.& Warehousing	17	103	9
Wholesale Trade	70	626	49
TOTAL AGRICULTURE	1,437	10,238	483

Source: *Minnesota Implan Group, Inc. 2006 IMPLAN Database*

The total economic impacts of agricultural industry, in terms of sales, employment and value-added, on overall economy of the Basin are presented in Table 12.[17/] The 2006 estimates show that the agricultural industry generated $1.44 billion in direct business activity. The total regional impact of this output was estimated to be $1.872 billion, which accounted for 28% of Basin's total business activity. Ripple or secondary effects represent an additional $401 million in sales that was distributed throughout the Basin's economy. This implies that many other local establishments are heavily dependent on income and jobs generated by agricultural industry.

[17/] To avoid the double counting problem, the backward linkage between food processing and farm production sectors was eliminated prior to the estimation. The double counting problem stems from the fact that a large portion of food processing outputs accounts for the purchase of locally produced agricultural raw materials. Hence, adding the outputs from these two sectors would grossly overestimate the direct output impact on total economy. It should be noted that employment and income figures are free of problem of double counting.

Table 12: Total Economic Impacts of Agricultural Industry on Economy of the Basin, 2006$

	Agriculture Industry				
	Basin Total	Direct Impact	Total Impact	% of Total Economy	% of Total Private Sectors*
Sales (Output) ($million)	6,638	1,420	1,821	27%	30%
Employment (# of jobs)	46,000	10,090	14,326	31%	38%
Value-added ($million)	4,962	483	697	14%	16%

** Private sectors include all sectors excluding Federal, State and Local government sector.*

The same $1.420 billion direct output, directly and indirectly, generated $4.962 billion of value-added in the form of wages, salaries, profits and indirect business taxes and created 14,326 jobs (10,090 jobs directly and 4,236 jobs indirectly). In 2006, the Basin's agriculture industry provided 31% of Basin's jobs and 14% of Basin's total value-added. Excluding the government sector, Basin's agricultural industry accounted for 30% of the total business activities of the Basin and 38% of its total jobs (Table 12).

5.6 Economic Impacts of the Basin Agricultural Industry on Economy of Oregon

The direct economic impacts as presented in Table 11 were used to estimate the total economic impact of the Basin's agricultural industry on Oregon's economy. Prior to estimating the economic impacts, two adjustments of IMPLAN database were made. The first adjustment accounted for sectoral differences in output and earning per worker in the Basin and the State. So as to get the same output per worker, the IMPLAN model for the State was modified to reflect the same worker productivity as the Basin. The second adjustment was related to the direct induced impacts of agricultural industry, beyond the farm gate and processing factory gate, on transportation and warehousing, and wholesale trade activities. The direct impacts of transportation and warehousing, and wholesale trade were estimated using the method as discussed in the previous section. Furthermore, as discussed before, to avoid double counting, regional purchasing coefficients for agricultural sectors are set to zero so as to eliminate the backward linkages among agriculture sectors.

Table 13 shows the total economic impacts of Basin's agricultural industry on Oregon's economy. As shown in this table, the Basin's agricultural industry contribution to the State's 2006 economy included $2.6 billion in economic activities, 18,853 jobs, and $1.1 billion in value-added.

Table 13: Total Economic Impacts of the Basin Agricultural Industry on Economy of Oregon, 2006$

	Agriculture Industry			
	Total Oregon	Direct Impact	Total Impact	% of Total Economy
Sales Output ($million)	$ 92,350,597	$1,489	$2,559	0.0%
Employment (# of jobs)	$ 2,264,537	10,323	18,853	0.8%
Value-added ($million)	$ 48,818,936	513	1,083	0.0%

6.0 ECONOMIC BENEFITS

Ideally, in calculating the economic benefits of a project, both positive and negative impacts of a project from direct and indirect sources should be included in the analysis. This provides a complete picture of the net contribution of the project to the region's social welfare.

The Economic and Environmental Principals for Water and Related Land Resources Implementation Studies, commonly known as the P&G, is the government's principal planning document for water resource projects and lays out the factors the government must consider when calculating the benefits and costs of water resource projects. The P&G require that a project should be undertaken if the water diverted for the project has a positive direct net value. For the aquifer recharge project, it implies that the direct contribution to the national economy of the water diverted for irrigation, enhancing stream flows for fish migration and spawning in the Umatilla River, municipal, and groundwater replenishment should be weighed against the cost of construction and the opportunity costs of the Columbia River water for hydropower production, fish enhancement program, recreational activities and other uses.

For evaluation from the national perspective, the Federal P&G mandate that secondary (or regional) benefits are to be excluded in deriving the economic benefits. However, state and regional decision makers typically want to know how the proposed project can affect their state and county economics. It is therefore important to determine the economic impact of the project on regional economy in terms of regional income and employment from direct and indirect sources.

For the above reasons, the economic impacts of the aquifer recharge project are evaluated from both the national and regional perspectives. The first analysis is known as National Economic Development (NED) or economic efficiency analysis, and the second is known as Regional Economic Development (RED) or regional economic impact analysis.

6.1 National Economic Development (NED) Analysis

To date the detailed information about the scale of operation, timing of construction, sources of funds and temporal allocation of artificially stored water among potential water users have not been fully determined yet. This prevents us from a detailed cost and benefits analysis in this project. Hence, the economic analysis of the proposed project from a national prospective will be conducted based on the direct net economic value[18/] of the diverted water from the Columbia River. The direct net economic value can be estimated for alternative uses of water. The direct net value is a measure of net contribution to national economic development (social welfare) and is calculated by subtracting total costs from total benefits. By estimating the value of water for alternative uses in a standard unit (i.e., in per acre foot of water) it provides the necessary information for decision maker to compare the relative benefits of alternative uses of water. Furthermore, all values are expressed as annual values in 2006$, for equivalent comparison.

For the purpose of this study, the procedure first calls for identifying the direct impacts (positive and negative impacts) of the proposed project, and then estimating the direct economic value for each impact.

The potential direct impacts of the aquifer recharge project are as follow:

1) It would increase the production of agricultural products;
2) It has potential to decrease fish population in the Columbia River;
3) It has potential to increase fish population in the Umatilla River;
4) It would increase water supply for cities/residential in the Basin;
5) It could decrease the regional hydropower production capacity;
6) It has potential to reduce/increase the water flow in the Columbia River during months of October-March/ (April-September);
7) It has potential to reduce the recreational activities in the Columbia River;
8) It has potential to reduce the navigational activities in the Columbia River;
9) It has potential to increase recreation and fishery in the Umatilla River.

In the next sections, the potential direct impacts of the aquifer recharge project will be discussed.

6.1.1 Direct Economic Value of Irrigation Water

Water is used as one of the several inputs in production of agricultural outputs. Where water is sold in well functioning markets, market price would reflect the value of water. The market price would then reflect the maximum amount individuals are willing to pay for the water. However, water transactions for surface water supplies are rare in the many parts of country. In the absence of market prices, economists use various economic techniques, such as production function, farm crop budget, land price differential between dryland and irrigated lands, mathematical programming, and hedonic property

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[18/] In economic literature also referred to as “economic benefit,” “economic value,” or “net economic benefit”.

value to estimate the economic value of irrigation water indirectly; see Young (1996) for a description of the valuation methods and Gibbons (1986) for a summary of the resulting value estimates. In this study, the farm crop budget technique, also known as a residual imputation technique, is used to estimate the economic value of irrigation water for the Basin. This method is widely used for valuing irrigation water and is consistent with NED Principles and Guidelines for evaluating federal water project that ask for use of farm crop budgets as the basis of evaluation.

Based on the farm crop budget technique, the difference between the revenue (crop price multiplied by crop yield) and total crop production cost, divided by actual water use is recognized as economic value of irrigation water. This approach can be used to estimate the value of irrigation water for short run, long-run, and for an individual crop, or for multiple crops.[19/] The total production crop cost, from a long-run irrigation water valuation perspective, includes the cost of all inputs, other than raw water, which are used in the production of a specific crop. To correctly estimate the value of irrigation water from NED prospective, the opportunity costs of all resources including land, labor and management should also be included in the calculation of crop production cost.

Table 14 presents the data used to estimate the economic value of irrigation water for the Basin. Following discusses the procedures used in developing the data:

- Crop mix: The proposed crop mix presented in Table 14 is the average of actual crop mixes from 2004-2008 that was used by local farmers. Crop mixes were provided by IRZ Consulting, Hermiston, OR. It is based on 46,000 irrigated acres within CGA area and reflects the cropping pattern we can expect on newly developed irrigated lands, if the aquifer recharge project is implemented.[20/]
- Crop Prices: The crop prices are average crop prices from 2000 to 2007 in the Basin. The crop prices were obtained from Oregon State University (OSU) database. The prices were brought forward to 2006$ using consumer price index as provided by Bureau of Labor Statistics (BLS). Green peas price was not available on OSU database, thus, it was developed with consultation with growers in the Basin. Yield and crop price for carrot were obtained from Washington State University Agricultural Extension Services.
- Crop Yields: The crop yields for all crops, except wheat, green peas and carrots, were obtained from OSU database. The crop yields are crop average yields from 2000 to 2007. Crop yield for irrigated wheat was provided by IRZ Consulting. Crop yield for irrigated wheat crop, as provided by OSU and NASSA, reflected the average yield with partial and full irrigation practices and not reflective of fully irrigated wheat yield in the Basin.
- Crop Production Costs: Data for crop production costs were obtained from crop enterprise budgets developed by Washington State University Cooperative Extension

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[19/] To compute the short run value, only the variable costs are subtracted; for the long run value, fixed costs are also subtracted. Long run values are appropriate for long run planning such as the aquifer recharge project.

[20/] Because of a large disclosed acres in OSU database (more than 26,000 acres in 2006; most of them irrigated croplands), IRZ data seemed to be more appropriate.

Services for Columbia Basin Project for various years.[21/] The costs were brought forward to 2006$ by producer price index for farm crops as provided by Bureau of Labor Statistics.[22/]

- Crop Water Use: These are the actual average crop water use in the area. They were obtained from historical data maintained by IRZ Consulting.

Based on the data presented in Table 13, the economic value of irrigation water in the Basin was estimated to be around $84/AF. This estimate is higher than estimates provided by Huppert et al. for the Columbia River Initiative (CRI) Project. They estimated $11/AF for irrigation water diverted from the Columbia River for the Columbia Basin Project (CBP) and $45-$60/AF for non-CBP area. The higher estimate in this report is attributed to the higher value crops grown within the Basin, the higher crop yields and the lower crop water usage. The higher crop yields and the lower crop water use are due to a combination of high efficiency irrigation systems and state of the art water conservation management practices in the Basin. However, our estimate is consistent with a recent study by Olsen and White. Based on irrigated versus non-irrigated land values and available water marketing information, they estimated the annual direct net value for irrigation to be about $90/AF., with a range of about $56-124/AF.

Table 14: Crop Mix, Crop Prices, Crop Yields, Total Production Cost, and Crop Water Use, Basin

Proposed Crop Mix	Crop Mix (%/ac)	Unit	Crop Yields (/ac)	Crop Prices ($/unit)	Crop Revenue $/ac	Total Cost $/ac	Crop Water Use AF
Alfalfa hay	24%	ton	7.5	117	878	1,065	3.03
Field Corn	12%	bu	230	2.92	672	835	2.9
Potatoes	16%	cwt	611	5.1	3,116	3,038	3.2
Onions	12%	cwt	639	7.8	4,984	2,695	2.8
Wheat	11%	bu	125	4.13	516	597	2.4
Sweet Corn, proc.	6%	ton	9	83	747	700	1.75
Green Peas, proc.	6%	ton	3.85	225	866	683	1.75
Peppermint for Oil	8%	lb	130	9	1,170	*	3.3

[21/] The crop budgets developed for Umatilla Basin by OSU are out of date.

[22/] The negative values that will result from the difference between crop revenue and total production cost (Table 14) do not imply that growing these crops is not profitable. Two factors should be considered. First, because of crop rotation requirements, the profitability of the whole farming is relevant not the individual crop. Second, the crop returns above the costs are economic returns not the accounting return; the opportunity cost of land, labor, and management are included in the total cost calculation (these costs are not out of pocket expenses).

Grass Seed	7%	lb	0.91	1,775	1,615	**	2.4
Other Veg. Crops –carrots	12%	ton	23	51.0	1,174	1,083	2.1
Wheat/fallow-dryland	0%	bu	50.06	4.13	207	255	0

* Crop budget for grass seed was not available, for calculation of economic value of irrigation water it was added to alfalfa hay acreage.

** Crop budget was not available for peppermint for oil, in calculation it was added to other vegetable crops.

In measuring NED benefits as defined in the P&Gs, the benefits comparison should be “with versus without” project. Hence, the economic value of irrigation water should reflect the difference between economic return with the project and without the project. Currently, the curtailed lands in CGAs are mostly in dryland wheat/fallow or low-value crop production. Based on the difference between “with” and “without” project, the economic value of irrigation water for the aquifer recharge project was estimated to be around $95/AF. [23/]

6.1.2 Economic Impact on Fish Enhancement Program and Recreation Activities

As planned, the aquifer recharge project would divert water from the Columbia River’s McNary and John Day pools- during high-flow winter months and store the water in the aquifers for later use for irrigation, municipalities/domestic, stream flows for fish migration and spawning in the Umatilla River. The change in water flow in Columbia River can affect the level of downstream pools. Levels in streams and lakes can directly affect the quality of boating experiences, success at sport fishing, scenic beauty, and suitability for swimming and wading; they have long term effects on the viability of fish and wildlife habits (Loomis, 1998).[24/] Furthermore, some biologists argue that inadequate flows shorten the angling season and impede the reproduction of fish (especially, smolt survival rate). Thus, the project has potential to impact the recreational activities and fish resources in Umatilla River and the Columbia River. Potential economic impacts of the UBARG Project on recreational activities and fish resources on the Columbia River and Umatilla River are discussed below.

6.1.2.1 Impacts on the Columbia River

Water diversion from the Columbia River can have potential adverse impacts on fishing and non-fishing recreational activities[25/]. However, a measurable adverse economic impact depends on the timing of diversion and the quantity of water diverted. In this section, we discuss whether the water diversion has a measurable economic impact on the recreational activities, so as to include it into the economic analysis.

[23/] Since, the potential impact of aquifer replenishment program on water tables has not yet been quantified, the estimate for irrigation value does not include the potential savings to irrigators to the gradual decline in pumping lifts.

[25/] Non-fishing recreational activities include boating, picnicking, swimming, etc.

The impact of the proposed project on the non-fishing recreational activities depends on its impact on the reservoir level on the affected pools, mainly McNary Pool and John Day Pool, and the flow rate. The aquifer recharge project intends to divert at most 100,000 +/- AF of water from Columbia River during winter periods (Table 1). Table 15 shows the monthly minimum, mean and maximum water flows from 1960-1999 in John Day Dam. It also shows the current monthly water withdrawals (withdrawals w/o project column). When the water diversion proposed for aquifer recharge project is added to the existing water diversions during January, February and March months, the flow rates do not show significant changes on those months. The increase in withdrawals as a result of aquifer recharge project would increase January, February and March withdrawals from 0.2%, 0.17%, and 1.8% to 0.8%, 0.7% and 2.2% of Columbia River minimum flows, respectively. It implies that 100,000+/- acre-ft of water withdrawal is too small to have a measurable effect on the flow rate and reservoir levels on the affected pools. Hence, the aquifer recharge project cannot adversely affect the non-fishing recreational activities on John Day and upstream pools.

Table 15: Water Flows and Water Withdrawals, Columbia River, 1960-1999

Month	Water Flows, 1960-1999			Withdrawals			Percent of		
	Maximum	Mean	Minimum	w/o UBAGR project	w/ aquifer recharge project	Total	max.	mean	Min.
Jan	16,200	9,690	5,430	10.8	33	44	0.3%	0.5%	0.8%
Feb	18,200	9,500	5,740	10	33	43	0.2%	0.5%	0.7%
Mar	20,400	11,100	6,200	110	34	144	0.7%	1.3%	2.3%
Apr	19,800	12,100	5,920	597	0	597	3.0%	4.9%	10.1%
May	29,400	17,200	8,110	765	0	765	2.6%	4.4%	9.4%
Jun	34,700	19,000	7,120	792	0	792	2.3%	4.2%	11.1%
Jul	21,400	12,500	5,110	850	0	850	4.0%	6.8%	16.6%
Aug	13,400	8,390	5,420	793	0	793	5.9%	9.5%	14.6%
Sep	9,260	6,420	4,280	498	0	498	5.4%	7.8%	11.6%
Oct	10,400	6,910	5,430	274	0	274	2.6%	4.0%	5.0%
Nov	9,280	7,340	5,170	12.3	0	12	0.1%	0.2%	0.2%
Dec	15,100	8,870	5,210	11.7	0	12	0.1%	0.1%	0.2%

***Source:** Water flows and withdrawals are obtained from National Research Center: Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival.*

The level of fishing recreational activities depends on the fish population, which in turn is a function of smolt-adult survival rate throughout the river system. Many studies have focused on identifying the relationship between river flow rate, survival of out-migration smolts, and smolt-adult survival rate.[26/] These studies show that the reduced flows could adversely affect survival rates of salmon and steelhead populations that are listed as threatened or endangered species under the Endangered Species Act.[27/] To protect and enhance the survival of out-migration smolts, federal agencies set monthly target flow rates in Columbia River system.

Table 16 shows the monthly 50% exceedance flows[28/], monthly target flows and monthly water availability, and proposed monthly water diversion in AF for aquifer recharge project. As it is shown in Table 15, the Columbia River has sufficient water available to meet the aquifer recharge project of 100,000 AF withdrawals and target flows for fish enhancement programs. The 100,000 AF diversion accounts for 1.3% of total water availability as presented in Table 15. The proposed water diversion during Jan, Feb, and Mar would account for 5%, 3%, and 3% of water availabilities net of target flows during Jan, Feb, and Mar, respectively. Furthermore, as presented in Table 16, there is a small amount of water withdrawals by other users during Jan, Feb, and Mar. In a technical review of the aquifer recharge project by HDR, it was concluded that it is unlikely that the proposed diversions would interfere with the fisheries migration times in the Columbia River when flows are in the order of >416,000 AF during the periods when diversion is proposed.

Another important factor that should be considered is that the system operation of the Columbia River also minimizes any cumulative impact of water withdrawal on seasonal flow requirements for fish migration and recreational activities. This is because the system planners typically retain enough water in the reservoirs through the seasons to provide flows necessary for fish migration, irrigation, municipal and industrial water use, and flood control. Once water requirements by users other than power are met, the water will then be allocated to optimize the power production. The large amount of annual runoff of the Columbia River, coupled with flexibility, in scheduling water releases from storage and

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[26/] Flow rate influences both the travel time for migrant fish and the water temperature. Both of them can affect the survival rate and the fish population.

[27/] In a recent study of the Columbia River, a panel of scientists concluded that "within the body of scientific literature reviewed as part of this study, the relative importance of various environmental variables on smolt survival is not clearly established. When river flows become critically low or water temperatures excessively high, however, pronounced changes in salmon migratory behavior and lower survival rates are expected." (National Research Center). Based on their conclusion, the relationship between flow rate and smolt-adult survival rate might not be strong on an average year.

[28/] 50% exceedance flow is the stream flow rate derived statistically from flow records that represents the monthly-averaged flow value with a 50 percent probability of being exceeded in any given year; Oregon Water Resource Department (2002) uses the 50% exceedance natural flow values to evaluate the availability of water for appropriation for storage projects in Oregon.

filling reservoirs, allow the system planners to meet the flow requirements. We believe that the potential cumulative adverse economic and environmental impacts of the proposed project on the fish enhancement programs and recreational activities in the Columbia River, on average, would be too small to be measurable. Therefore, the diversion from the Columbia River would not have any measurable economic impact on recreational activities needs to be incorporated into the economic analysis.

6.1.2.2 Impacts on Umatilla River

Based on the current proposed plan, the aquifer recharge project would allocate some of the artificially stored water to instream flow augmentation in Umatilla River. In this section, the economic benefits of flow augmentation will be discussed.

Table 16: Monthly 50% Exceedance Flows, Target Flows and Water Availability, Proposed Monthly Water Diversions, AF

Month	50% Exceedance Flows (AF)	Target Flows* (AF)		Water Availability (AF)	Proposed Water Diversion** (AF)
		Bonneville	McNary		
Jan	6,486,480	6,652,800	None	624,324	33,000
Feb	6,860,700	6,652,800	None	999,167	33,000
Mar	6,943,860	6,652,800	None	1,028,856	34,000
Apr	7,858,620	6,652,800	10,810,800	N/A	None
May	10,353,420	None	10,810,800	N/A	None
Jun	10,769,220	None	10,810,800	N/A	None
Jul	6,943,860	None	8,316,000	N/A	None
Aug	5,322,240	None	8,316,000	N/A	None
Sep	4,490,640	None	None	4,490,640	None
Oct	4,615,380	None	None	457,380	None
Nov	5,239,080	6,652,800	None	N/A	None
Dec	6,070,680	6,652,800	None	3,742	None

[*] Target flows are the level identified in the NOAA Fisheries FCRPS BA and Biological Opinion;

** The 100,000 AF water withdrawal is the maximum amount that is considered, and the monthly diversion rate is the potential pumping schedule so as to minimize the adverse impact on the flow rate in the Columbia River.

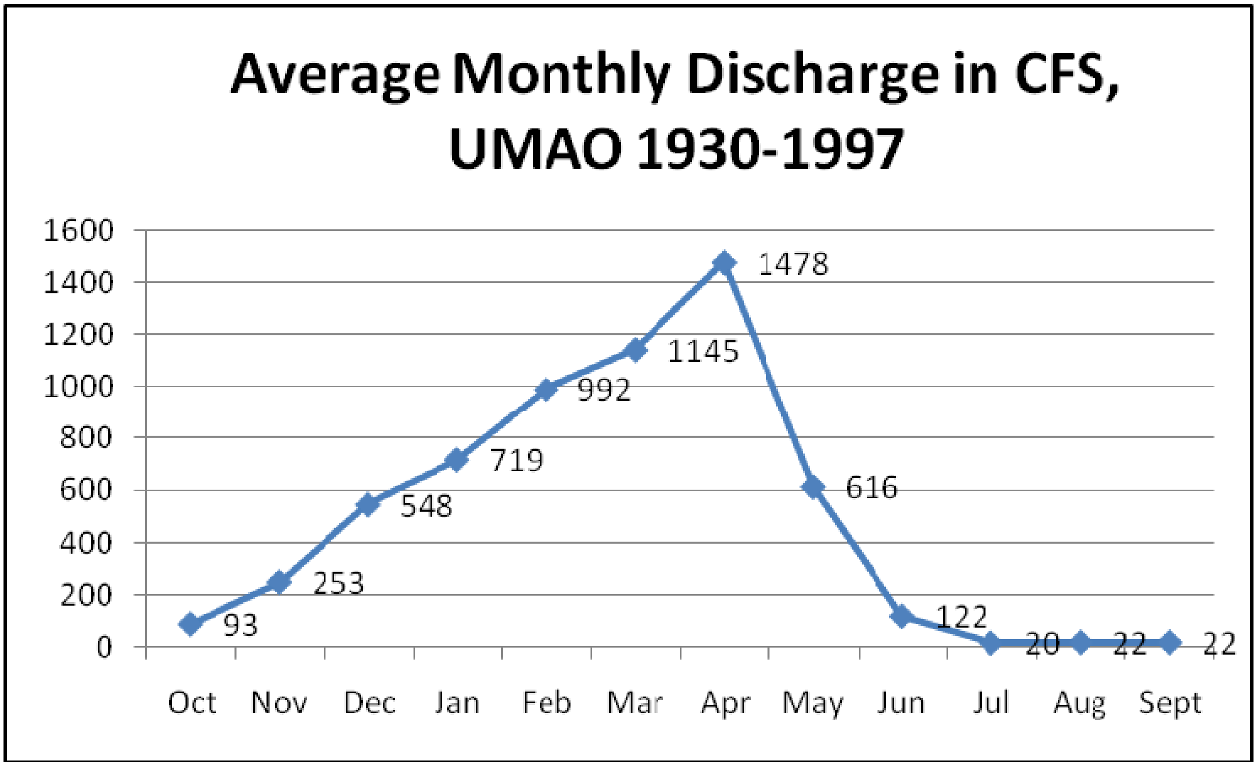
***Source**: OWRD December 2007. Water availability is estimated by subtracting the target stream flows from the 50% exceedance stream flow.*

<u>*Background Information -*</u> The Umatilla River is a tributary of the Columbia River, joining the Columbia just below McNary Dam. It originates on the slopes of the Blue Mountains at nearly 5,500 ft in elevation and its drainage basin is 3,714 square miles.

Water development for irrigation using Umatilla River water has a long history. The first large irrigation canal was constructed in 1903. In 1905, Bureau of Reclamation (BOR) undertook the Umatilla Project, for purpose of irrigating 60,000 acres of land. Four irrigation districts are supported by six diversion dams and two reservoirs, Cold Springs and McKay Reservoirs. The reservoirs were designed to store spring run-off for use during the crop growing season.

Figure 11 shows the average monthly discharge for the period 1930-1997 for USGS gauging station at UMAO, which is located near the mouth of the Umatilla River (river mile 2.1) or confluence with the Columbia River. Flows in the Umatilla River are heavily dependent on winter snowpack, as characterized by high peaks during the early spring and often extremely low flows in the summer. Average monthly discharge at UMAO varies from 1,478 cubic feet per second (cfs) in April to 20 (cfs) in July for the period of record of 1930-1997. The average annual discharge of 474 cfs is, however, lower than the natural discharge due to summer diversions for irrigation. (Umatilla County Critical Groundwater Task Force, p.24).

Figure 11: Average Monthly Discharge in CFS, Umatilla River



Source: *Umatilla County Critical Groundwater Task Force. 2008. Umatilla Sub-Basin 2050 Water Management Plan. Prepared for Umatilla County, Oregon.*

Historically, inadequate flow during the summer months and migration conditions were contributor to the extirpation of salmon and decline of summer steelhead trout populations in the Umatilla River. To address the inadequate migration conditions, Umatilla Basin Project (UB Project) was authorized and funded by the U.S. Congress in 1988. The project includes the diversion and conveyance infrastructure needed to deliver Columbia River water to irrigation districts in exchange for an equivalent amount of Umatilla River water left instream.

In addition to the water exchange program, the UB Project also incorporated fish passage improvements, habitat restoration, trapping and transportation of adults and juveniles. Phase I of the project involves pumping water, up to 5,821 AF (140 cfc), from the Columbia River into the West Extension Irrigation District system, to offset diversion of Umatilla River water when flows in that river drop below target values. Phase II of the project involves exchanging up to 9,980 AF (or 240 cfs) of Umatilla River and McKay Reservoir water for Columbia River water for use by the Stanfield and Hermiston Irrigation Districts. This results in water, which had historically been diverted from live flow and from McKay Reservoir releases, being retained for instream uses. As a result, in 2003, approximately 65,000 AF of water were used to maintain instream flow in the Umatilla River below McKay Creek (Umatilla County Critical Groundwater Task Force). Phase III of the UB Project, which would involve a complete exchange of water in the Umatilla River used by Westland Irrigation District with Columbia River has not been funded yet.

The Umatilla Basin Project has partially restored Umatilla River stream flows and allowed three stocks of salmon to be reintroduced and partially recovered (Umatilla County Critical Groundwater Task Force). Currently, the Umatilla River supports populations of spring and fall Chinook salmon, resident rainbow, and anadromous rainbow trout (steelhead) among other species. Coho salmon were extirpated, but have been reintroduced. The river supports tribal and sport fisheries for spring Chinook and steelhead.

Although, the UB Project has restored some of the instream flow conditions in the Umatilla River, still the instream flow may not be adequate during summer months and especially in low-flow years. There will be years in which there is simply not enough water available to meet recommended flows. As discussed before, the decrease in flow is due partly to natural reduction in snow pack and runoff and partly to summer irrigation withdrawals. Significant flow augmentation occurs from McKay Reservoir. However, during parts of the summer this flow augmentation is largely withdrawn from the Umatilla River before it reaches the Columbia River. Observed summer flows increase dramatically downstream of the McKay Creek confluence, where nearly 200 cfs of McKay Reservoir water enters the Umatilla River (Oregon Department of Environmental Quality 2001). Umatilla River flows then decrease dramatically due to irrigation diversions (IRZ Consulting Technical Memorandum, 2008). As a result, the allocation of water for fish enhancement program under the aquifer recharge project can have the potential to improve aquatic habitat, through an increase in instream water and lower stream temperature on average-flow years, especially during the low-flow years when there might not be enough water available to meet recommended flows.

Economic Value of River Flow Augmentation – The value of instream use in maintaining habitat for aquatic organisms could be large, but it is a very difficult problem to estimate. This problem is summarized by xx, "Economists attempting to evaluate the economics of fish and wildlife programs are faced with some of the most difficult of economic analyses. One is trying to address the benefits of the various program measures. ….., the effects of measures on fish and wildlife are often unknown. Ecological systems are complex, poorly understood, and difficult to predict. Even if biologists could predict the effects of measures on salmon, valuing the increased numbers of fish would be a difficult economic problem. Commercial harvest values of salmon are not too difficult to determine. However, valuing the recreational harvest involves indirect measurement of value through surveys based on contingent value or travel cost methods to determine willingness to pay or willingness to be compensated. Even more difficult to quantify, are existence values of natural resources like fish and wildlife or the religious and ceremonial value of salmon for northwest Indian tribes."[29/] Although, it is difficult to estimate directly the value of allocating the artificially stored water for instream use, this report uses other alternatives (discussed below) to compare the cost of achieving the same flow augmentation effects using different water delivery systems. This would give us some sense of magnitude of the economic contribution of the aquifer recharge project.

[29/] Economists characterize the values placed by society on environmental and natural resources as *use value*, where a natural resource is directly used or experiences by individuals, and *nonuse value or passive use*, where individuals may place a value on the current or potential existence of an environmental service, even though they may not directly use or consume it. There is also *option value* which reflects the values some individuals who currently are non-users but are willing to pay now for probable future use. Option value lies between use and non-use values. It should be noted that there is considerable controversy among economists on how to measure the nonuse and option values.

Impact on Recreational Activities: If we assume the fish in stream would benefit if instream flows were increased by selected amounts, then we can estimate the value of instream water by its impact on recreational activities across the Columbia River system using the procedures as described by Huppert et. al. or Economic Technical Report for the Yakima River Basin. Unfortunately, the potential impact on fish population as a result of increase in Umatilla River's instream flows is not yet known, so we do not provide a number. However, to get a sense of magnitude of its impact, the values of fish for various recreational activities within Columbia River System are presented in Table 17.

Table 17: Values of Recreational Activities in Columbia River Basin

Study	Site Description	Recreational Activity	Value/fish
Economic Technical Report for the Yakima River Basin (2008)*	Pacific Ocean	Commercial:	
		Coho Salmon	$ 8.07
		Spring Chinook Salmon	$ 25.57
	Pacific Ocean	Fall Chinook Salmon	$ 25.57
		Sport:	
		Coho Salmon	$118.54
		Spring Chinook Salmon	$101.49
		Fall Chinook Salmon	$101.49
	Yakima River	Ceremonial & Subsistence:	
		Coho Salmon	$ 3.89
		Spring Chinook Salmon	$ 28.20
		Fall Chinook Salmon	$ 10.97
Olsen, Richards, Scott (1991)**	Columbia River Basin	Salmon & Steelhead	$ 78.58
Layton, Brown, & Plummer (1999)**	Columbia River Basin	Salmon & Steelhead	$144.43

* Use Value only. ** Total Value (use and non-use values).

***Source**: adopted from "Economics Technical Report for the Yakima River Basin." Bureau of Reclamation, Technical Series No. TS-YSS-23, January 2008.*

Water Acquisition for Instream Use: Water acquisition involves the purchase or lease of irrigated land or water rights for instream water use. For the purpose of this report, one can use the water acquisition cost for instream use as a proxy for valuing water for flow augmentation in Umatilla River. Jeager and Mikesell documented water acquisitions for instream use in Oregon and Washington (Table 18). But, due to a) small number of the transactions, b) small quantity of water involved and c) lack of comparability to the site, their water market transactions has a limited use for this report. Because of dominance of high value crops in the Basin, the irrigated land values and hence water right values in the Basin are many times greater than the values Jaeger and Mikesell documented in their report for Oregon.[30/] However, interestingly the average water rights value for Washington locations as presented in Table 18 ($72.86 in 2000$ or $84.50 in 2006$) is comparable to the irrigation value estimated for the Basin in previous section of this report. Nevertheless, the number of transactions documented in report for Washington was small (Table 18), but the volume of water traded was significant to support $84.50 as a potential value of instream use.

Table 18: Water Rights Transaction to Augment Streamflows (in 2000 $)

Selected Locations	Current Use	Contract Type	Consumptive Use (AF/year)	Price Paid	Cost/AF
Oregon Locations					
Deschutes River, Squaw Creek	Pasture	Purchase	417.19	$ 42,900	$ 6.17
Deschutes River, Squaw Creek	Pasture	Purchase	308.08	$ 44,352	$ 8.64
Hood River, Fifteenmile Creek	Wheat	Purchase	71.76	$ 26,307	$ 22.00
				Average:	**$ 9.16**
Umatilla River, E. Birch Creek	Hay	one-year lease	238.5	$ 2,500	$ 10.48
John Day River, Hay Creek	Hay	one-year lease	248.8	$ 14,500	$ 58.28
Umatilla River, Couse Creek	Wheat/Pea	one-year lease	1065.9	$ 23,800	$ 22.33
				Average:	**$23.19**
Washington Locations					
Teanaway River, Kittitas County	na	Purchase	302	$ 300,000	$ 59.60
Teanaway River, Kittitas County	na	Purchase	121	$ 160,000	$ 79.34
Big Creek, Kittitas County	na	Purchase	113	$ 150,000	$ 79.64
				Average:**	**$ 72.86**

*A 6% discount rate was used by the authors to compute annualized cost of permanent acquisitions.
** Other water transactions in Washington State reported by Jaeger & Mikesell were in order of 2 AF, hence, was not reported here.

Source: *Jaeger and Mikesell.*

Cost of Alternative Sources of Water: In this approach, the value of instream water is estimated by identifying the cost of providing the same amount of instream water using different methods of

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[30/] Due to time constraints, this report did not look at new water right transactions in Umatilla Basin.

delivery. The cost of alternative sources of water can be utilized in context of instream valuation in two ways. Under assumption of a benefit/cost ratio equal or greater than one, the cost of alternative delivery reflects the present value of future benefits of the project. Or, in benefit-cost analysis, one can deduct the cost of alternative delivery of water from the cost of the proposed project and assign a zero value for instream use value.

Since it is costly to develop an engineering design for alternative way of obtaining the water for instream use in Umatilla River, this report uses secondary data for this purpose. For the purpose of this report, we considered the UB Project and Salmon Creek Project in Washington.

The mission of UB Project (UBP) was discussed briefly in the previous section. It appears that the UB Project may be the best alternative to estimate the cost of alternative sources of water for instream use. But the project is convoluted with economics, politics, tribal water rights, and cultural value of restoring the salmon run in the Umatilla River. These made it very difficult to analyze the project features in totality, given the time and budgetary constraint, to achieve the goal of estimating the cost of alternative sources of water. Nevertheless, some cost estimates, provided below, can provide insights into the value that the society, through political process, has assigned to the instream value of water in the Umatilla River.

- First nine years of Phase I and II is estimated to cost $56 million.
- The cost of pumping water from the Columbia River for Phase I and II is estimated at $1.5 million per year.
- Phase III originally was estimated to cost $65 million, but, presently some estimate the cost to be around $220 million.

Salmon Creek Project was initiated with collaboration between the Okanogan Irrigation District and the Colville Confederated Tribes to restore anadromous fish to Salmon Creek, a tributary of the Okanogan River in Northern Washington. Salmon Creek drains about 167 square miles on the eastern slopes of the North Cascade Range in Okanogan County. Conconully Reservoir and Salmon Lake, about 15 miles upstream of the Okanogan River, together provide 23,500 AF of storage space. Long term historical average runoff above Conconully dam is estimated to be 21,700 AF, ranging from 1,500 to 67,000 AF. Controlled releases from Conconully Reservoir are diverted 4.3 miles above the Okanogan confluence for irrigation of about 5,000 acres within the Okanogan Irrigation District. Primary crops are apples, pears, alfalfa, pasture, and urban yards and gardens. It was estimated that 7,122 to 9,737 AF of water, in addition to what the watershed naturally provides would be required to meet the seasonal needs of irrigators and the year-round life cycles of steelhead and spring Chinook in the creek.[31/]

Okanogan River water exchange project costs are presented in Table 19. The $1,716/per AF (in 2000 dollar) presents the cost of exchange project from regional perspective. From national perspective, the total cost of the Salmon Creek exchange project is estimated to be $2,032/AF (in 2000 dollar), which includes costs of Salmon Lake dam and feeder canal improvements paid by U.S. taxpayers (Northwest Power Planning Council, 2000).

[31/] The information on Salmon Creek Project was obtained from Northwest Power Planning Council, 2000.

Table 19: Per AF Cost Estimate for Salmon Creek Project, 2000$

Acre-Feet	Capital Cost	O&M Cost	Present Value of Total Cost	$/AF
7,234	$6,825,000	$298,845	$12,415,515	$1,716

***** The present value of total cost includes the capital cost plus the present value of O&M cost discounted at 4% (assuming a planning horizon of 50 years).

***Source**: Northwest Power Planning Council, 2000*

According to the analysis made by Independent Economic Analysis Board (IEAB), the Salmon Creek Project appears to be cost-effective relative to water acquisition. In other words, it would cost the project $2,032/ per AF to achieve the same objective if the water was purchased from irrigators or other sources. In economics, the market value reflects the annualized values of capital (purchased price of water). The annualized value of $2,032, using a 4% discount rate and 50 years planning horizon, is $110/AF (or $128 AF in 2006 dollar).

Based on the above analysis, the allocation of artificially stored water for instream use in Umatilla River is estimated to be within a range between $84.50/AF and $128/AF. However, these values do not imply the economic value of recreational activities as a result of increase instream flows for fisheries. It simply states that, without the aquifer recharge project, it would cost a range between $84.50/AF and $128/AF to achieve the same flow augmentation objective. If the cost is incurred by the U.S. tax payers, then the range between $84.50/AF and $128/AF for instream use is consistent with the NED account and could be considered the economic value of allocation of artificially stored water for instream use in Umatilla River.

6.1.3 Direct Impact on Hydropower Production

Water withdrawal from the John Day pool for the aquifer recharge project reduces hydroelectric power generation capacity in downstream hydroelectric projects. The reduction in power output can be measured by calculating the net water withdrawals and assigning a power cost to the foregone energy. As discussed before, as planned, the artificially stored water in aquifers will be used for irrigation, municipal/domestic uses, and Umatilla River flow augmentation program. So, some of the water withdrawals from John Day pool will be returned to the Columbia River through Umatilla River. Table 20 shows the water withdrawal, water return and hydropower lost for three alternative project options.

The annual value of the foregone hydropower generation attributed to the aquifer recharge project for SSRD 1 Option 2&3, SSRD 1 Option 1, and Full-Project options were estimated to be $227,050 ($4.13/AF), $421,530 ($4.22/AF), and $703,469 ($4.44/AF) of diverted water, respectively.

Table 20: Water Withdrawals, Expected Return Flows, and Expected Net Energy Lost

	Proposed Diversion (AF)	Return Flows to John Day Pool			Net Diversion (AF)	Cost ($/AF)*	Lost Hydro-power
		Irrigation (1.8%)*	River Flow Augmentation (100%)	Municipal & Domestic (90%)*			

SSRD 1 Option 2&3	54,900	666	14,000	540	39,694	$5.72	$227,050
SSRD 1 Option 1	99,830	1,236	24,000	900	73,694	$5.72	$421,530
Full-Project	158,330	2,046	27,000	6300	122,984	$5.72	$703,469

* These information were obtained from Huppert. et al. The energy cost per acre foot is based on average price forecast for 2004-2024. This is a cumulative cost through the Columbia River system.

6.1.4 Direct Impact on Aquifer Replenishment

A major impetus for the aquifer recharge project is to replenish the aquifer and reverse ground water declines in existing domestic and municipal, and irrigator wells in CGWAs. As planned, under SSRD 1 Option 2&3, SSRD 1 Option 1, and Full-Project options, annually 3,300, 6,166, and 10,666 AF of artificially stored water would be allocated for aquifer replenishment. The aquifer replenishment would also have other positive impacts:

- It would reduce the pumping lifts and hence pumping costs for irrigators, municipalities and domestic users.
- It is possible that if the aquifer recharge project is implemented, it would not be necessary to deepen existing wells.
- It has potential to improve ground water quality.

The specific wells within CGWAs that might be positively affected by an increase in water level are not yet determined. Hence, the economic benefit of decline in pumping lifts and other potential indirect benefits are not included in the analysis. Studies by Richard and Bredehoeft, and also by Donovan, et al. however show that the lower energy cost for pumping, as a result of increase in water level can be economically significant.

Traditionally, techniques for quantifying the economic value of ground water resources include:[32/]

- Contingent valuation, which essentially involves asking people how much they would pay to maintain the resources or services dependent on it under carefully specified conditions.
- Hedonic pricing, e.g. obtaining a measure of the value of groundwater through differences in the value of lands with and without access to it.
- Loss analysis, estimating the value of groundwater as equivalent to the total social costs incurred when drought or depletion constrain economic activity.
- Averting behavior in which the value of groundwater is estimated by the investments made to avoid water shortage.

[32/] http://www.fao.org/docrep/005/y4502e/y4502e00.HTM, visited Feb 12, 2009.

- Substitution, the value of groundwater as equivalent to the least cost alternative source of supply for meeting the same set of services.
- Derived demand and production cost analysis, essentially estimating the contribution of water to profits within a given set of economic activities.

The last technique is the most appropriate for evaluating the value of allocating artificially stored water for the aquifer replenishment. For the purpose of this analysis, the relevant alternative use of water is for irrigation. Based on this assumption, the value of water for aquifer replenishment is set at $95/AF (this is the value of irrigation water that was estimated earlier). Since other direct and indirect benefits that may result from aquifer replenishment plan were not included in the analysis, the $95/AF should be considered as the lower limit of the range.

6.1.5 Direct Impact on Municipal and Domestic Uses

The alluvial and shallowest basalt aquifers are the main sources of domestic water for rural residents in the area. As planned, some of artificially stored water will be tapped for allocating to municipal/domestic uses. Depending on engineering design options, between 0 to 7,000 AF of stored water is planned to be allocated for municipal/domestic uses.

Estimating the economic value of water for the municipal/domestic use is a difficult task. The difficulty mainly arises due to the role of water in human life and the lack of substitution for the water. Compared to the other users of water, many municipalities, facing a severe water supply constraint, are willing and also able to pay significantly higher prices for the water. In general, the economic value of water for municipal use can be obtained through a) use of demand elasticity[33/], b) analysis of regional water market transactions, c) the opportunity costs of the alternative uses of the water, and e) the cost of obtaining additional water through alternative sources of supply. Additionally, the value of water for a city needs to be estimated within overall context of alternative water supply sources, capital and maintenance costs associated with alternative water supplies, expected water demand and supply conditions, and availability of alternative sources of financing.

A direct estimation of value of the water allocated for the municipal/domestic uses under the aquifer recharge project is beyond the scope and budget constraint. Nevertheless, for the purpose of this report, the value of artificially stored water allocated for municipal/domestic use was assumed to be the value of municipal water used by the Bureau of Reclamation for Yakima Storage Project (Bureau of Reclamation, 2008).

In a recent study of Yakima Storage Project, the Bureau of Reclamation used a $235.66 per acre-foot wholesale price of municipal water to value the annual supply of municipal water (obtained from 2006 M&I Water Rate Survey Data, Bureau of Reclamation, Contract Services Office, 2006). The report assumed that the municipalities in search of municipal water could obtain the water at wholesale rates which was estimated to be $235.66.

[33/] It is mainly used for estimating the value of potable water rather than raw or untreated water in a river or groundwater.

Based upon records of water transactions in the Pacific Northwest, Huppert, et. al. valued municipal and industrial (M&I) water at between 0 and $452 per acre-foot.[34] As noted in their report, the marginal value of water for M&I use is higher than the marginal value for irrigation. So, the water for M&I should be valued between $95 and $452 per acre-foot ($95 is the value of irrigation water estimated earlier in this report). To this end, $235.66 for valuing water for municipalities used in this report seems to be reasonable.

6.1.6 Direct Impact on Navigation

Based on discussion in section 5.1.2.1, the UBGAR Project would be unlikely to have a measurable impact on hydrology of the Columbia River system to affect the navigation system. Thus, no economic analysis of impact on navigation was performed.

6.1.7 Values of Alternative Uses of Columbia River Diversion Water ($/AF)

As discussed previously, the aquifer recharge project is still in appraisal-level investigation phase and some of the relevant information for a detailed cost-benefit analysis is not currently available. The focal point of the report, however, is to provide an approximation of the total costs and benefits from the aquifer recharge project, without making an exact conclusion. To accomplish this task, this section provides the costs associated with the project and summarizes the project benefits as estimated in previous sectors (see Table 21).

Initial capital costs, and annual operation and maintenance costs (O&M) for alternative project options are estimated by IRZ Consulting. The initial capital costs for SSRD 1 Option 2&3, SSRD 1 Option 1, and Full-Project options were estimated to be $42, $100, and $156 million, respectively.

The annual operation and maintenance costs (including the annual energy cost) for SSRD 1 Option 2&3, SSRD 1 Option 1, and Full-Project options were estimated to be around $5.2, $9.0 and $14.0 million, respectively. Since the sources of funding and terms of financing are not yet known, the project capital cost for alternative options were annualized using two planning horizons (30 and 50 years) and three alternative discounting rates (0%, 2.44%, and 4.88%). The discount rate, 4.88%, is the rate used by BOR in 2008 study of Yakima Project (BOR, 2008), 2.44% is U.S. Treasury Real Long-Term Rates on March 15 2009[35/]. Capital costs, annualized capital costs for alternative planning periods and discount rates, and total annual costs per acre-foot for SSRD 1 Option 2&3, SSRD 1 Option 1, and Full-Project options are presented in Table 21. All per acre-foot costs are in 2006$.

Table 21: Initial Capital, O&M, and Total Annual Project Cost for Various Planning Horizons and Discount Rates

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[34/] The value of $0/AF reflects a 2002 transaction in Washington when a private individual donated 25 AF of water to the Town of Granger.

[35/] http://www.ustreas.gov/offices/domestic-finance/debt-management/interest-rate/real_ltcompositeindex.shtml

	SSRD 1 Option 2&3 **Capital Cost:** $42 mil **Annual O&M Cost** $5.2 mil			**SSRD 1 Option 1** **Capital Cost:** $100 mil **Annual O&M Cost:**$9 mil			**Full Project** **Capital Cost:** $156 mil **Annual O&M Cost:** $14 mil		
	Annualized Cost (2006$)		Total Annual Costs*	Annualized Cost (2006$)		Total Annual Costs*	Annualized Cost (2006$)		Total Annual Costs*
	$	$/AF	$/AF	$	$/AF	$/AF	$	$/AF	$/AF
30 years									
0%	1,340,996	24	115	3,192,848	32	118	4,980,843	31	116
2.44%	1,906,745	35	125	4,539,869	45	132	7,082,196	45	129
4.88%	2,581,323	47	138	6,146,007	62	148	9,587,771	61	145
50 years									
0%	804,598	15	105	1,915,709	19	106	2,988,506	19	104
2.44%	1,401,470	26	116	3,336,833	33	120	5,205,460	33	118
4.88%	2,162,933	39	130	5,149,840	52	138	8,033,750	51	135

* Total annual cost includes the annualized capital cost plus annual O&M cost

Table 22 summarizes the benefits and costs of the aquifer recharge project in $/AF. The economic values of the aquifer recharge project were estimated to be $**99**, $**99**, and $**103**, depending on the project options.

It should be noted that the economic analysis provided in this section is based on NED account which ignores the regional economic benefits of the project (will be discussed in next section). Furthermore, NED account as presented in Table 22, does not include other benefits such as lower energy costs for pumping due to a decrease in pumping lift for municipalities and irrigators, and a decreased need to deepen wells, and improvement in water quality.

Table 22: NED Project Benefits, Project Costs under Varying Planning Horizons and Discount Rates ($/AF, 2006$)

	SSRD 1 Options 2&3	**SSRD 1 Option 1**	**Full-Project**
PROJECT BENEFITS			
Regional Value of Irrigation Water	$ 95	$ 95	$ 95

Instream Value-Umatilla River*	$104	$104	$104
Municipal/Domestic Use	$236	$236	$236
Value of Water for Aquifer Replenishment	$ 95	$ 95	$ 95
NED Benefit	$ 99	$ 99	$103
<u>PROJECT COSTS</u>			
Total Annual Direct Cost			
		<u>30 years</u>	
0% discount rate	$115	$118	$116
2.44% discount rate	$125	$132	$129
4.88% discount rate	$138	$148	$145
		<u>50 years</u>	
0% discount rate	$105	$106	$104
2.44% discount rate	$116	$120	$118
4.88% discount rate	$130	$138	$135
Hydropower Lost	$4.15	$4.22	$4.22

* $104 for instream use is the mid-range estimates of value of water for instream use based on “water exchange for instream use” and “alternative water delivery system” methods as discussed in previous section.

As revealed in Table 22, total project costs for three project options, for varying planning horizon and discount rates, exceed their respective total benefits.

There are few points that have to be considered before drawing a conclusion regarding economic the feasibility of the project from NED perspective.

- There are other direct benefits of the proposed project that were not included in the NED benefit estimates such as:[36/]
  a) Potential lower pumping costs as a result of an increase in aquifer water table.
  b) Savings by irrigators, municipalities and residential users as a result of a decreased need to deepen wells.
  c) Improvement in ground water quality.

[36/] As previously mentioned in this report, studies have shown that the economic value of some of these benefits can be significant.

    d) Potential increase in fishery and non-fishery recreation activities in the Umatilla River.
    e) Potential economic benefits of the accumulated stored water as a result of proposed aquifer replenishment program (in drought years, the accumulated stored water could be used for irrigation, municipalities/domestic uses, and flow augmentation program in the Umatilla River).

- The cultural and religious value of potential improved fish population, as a result of an increase in flow augmentation in Umatilla River, as planned by the aquifer recharge project.
- Given that the project would contribute a significant portion of stored water for non-commercial use such as flow augmentation and aquifer replenishment; it is desirable to evaluate the project using a lower discount rate and/or longer planning horizon as argued by Platt (2008).
- NED account emphasizes on economic efficiency and is neutral to distributional impact of a project. However, economic efficiency, although an important objective, is not the sole objective of a county's or state's policymakers. How a project would contribute to a region's economy in terms of output, employment, and income might be as important as economic efficiency, per se.

In the next section, the aquifer recharge project will be evaluated from RED perspective.

6.2 Regional Economic Development (RED) Analysis

In the previous section, the economic analysis of the aquifer recharge project was performed from a National Economic Development (NED) (or economic efficiency) perspective. However, economic efficiency, although an important objective, is not the sole objective of a County or State policymakers. In this section, the contribution of the aquifer recharge project is examined from a RED perspective. Focus of this section is on how the proposed project would contribute to the region's economy in terms of output, employment and labor income.

The regional economic impact analysis of a project requires identifying the economic impacts the project would have in the region. The regional impacts are sum of NED impacts that accrue to the region, plus transfer of income from outside the region resulting from implementation of the proposed project. The measurable income transfers for the proposed project are as follow:

1. Increase in regional economic activities beyond the farm gate such as transportation, packaging, processing, wholesale trade, etc.
2. Transfer of money to the region for construction, operation, and maintenance, depending on who will finance the project.
3. Secondary or ripple effects as a result of NED benefits, 1 and 2.

The regional economic impact of the aquifer recharge project on the Basin was performed using an input-output modeling technique. The input-output model or inter-industry model is the most commonly used method of quantifying regional economic impacts. The input-output model is a mathematical tool that traces the linkages of inter-industry purchases and sales of an economy (with or without household economic behavior). The input-output model then uses the economic linkages to estimate the total economic impact (direct, indirect and induced) on a regional economy resulting from a direct impact in a particular sector. Input-output analysis can provide not only an accounting of direct impacts but also provides estimates of indirect effects and induced changes throughout the regional economy. The inclusion of indirect and induced effects in the economic analysis recognizes the potential social and economic impacts as a result of changes in economic activity.

In this report, the economic impact analysis was performed using a non-survey economic input-output model called IMPLAN (IMpact analysis for PLANning). IMPLAN was originally developed by the U.S. Forestry Service. It was further developed at the University of Minnesota, and is currently being maintained by the Minnesota Implan Group (MIG). A detailed discussion of the IMPLAN regional model is provided in MIG. IMPLAN is designed to establish input-output models for a state, a county, or group of states/counties in the United States. IMPLAN estimates the local production, local consumption, export, import and local inter-industry trade data using the available regional and national data sources.

IMPLAN is a “demand-driven” input-output model. In other words, to analyze economic impacts of a particular economic impact scenario, it is necessary to determine what the net changes would be in upstream sectors (e.g. changes in upstream sectors’ final demands: increase in exports of the product and/or increase in personal income) or expenditures made within a regional economy. Then, IMPLAN traces back their impacts to downstream sectors through their backward linkages. So, the first step in impact analysis using an input-output methodology is to identify the positive and negative direct impacts of a policy change on the affected resources. The next step is to quantify the direct economic impacts on affected economic sectors. The third step is to convert the direct economic impacts into net change in “final demand” or purchases made within a regional economy. IMPLAN then uses the changes in the final demand on affected economic sectors or purchases made within the regional economy to measure the total impact of an economic impact scenario on a local economy.

Among NED benefits, only farm production has a measurable impact on the Basin’s economy. Majority of the economic impacts of hydropower production and fish resources, resulting from the proposed project, will occur outside the Basin. Hence, the regional impact analysis in this report focuses on farm production, regional value-added agricultural activities induced by the increase in farm production, and construction, and operation and maintenance costs.

6.2.1 Direct Economic Impact of Farm Production

As stated above, the first step in regional economic impact analysis is to identify the direct impacts of the proposed project on the local economy. In estimating the farm impact, it is important to identify the expected crop mix on newly irrigated lands. Table 23 shows the engineering designs currently under investigation and their respective potential water withdrawal and water allocation for irrigation. To limit the scope of analysis, this report only considers the SSRD 1 Option 2&3, SSRD 1 Option 1, and Full Project.

Table 23: System Design, Water Withdrawal, and Irrigation Water

SSRD[*] System	System Option	Total Withdrawal (AF)	Water Allocated for Irrigation (AF)
1	1	100,000	68,664

1	2&3	55,000	37,000
1	4&5	45,000	30,000
1	6&7	25,000	19,610
2		25,000	20,000
3		33,500	25,000
Full-Project[**]		160,000	113,664

[*] SSRD denotes Supply, Storage, Recovery, and Distribution systems envisioned for the project.

** Full Project denotes the restoration of full water right allocations to the irrigators in the CGAs. It consists of the SSRD 1 system for Ordnance Gravel and Butter Creek CGAs, SSRD 2 system for the Stage Gulch CGA south of the Umatilla River, and SSRD 3 system east of the Umatilla River.

Based on average crop water use, as specified in Table 14, impacted irrigated lands under SSRD 1 Option 2&3, SSRD 1 Option 1, and Full Project options, will be 12,701, 23,563, and 39,007 acres, respectively. Based on discussions with the growers in the Basin, the historical crop mix, as presented in Table 14, deemed to be appropriate for SSRD 1 system Options 2&3; and they believe that the local food processors can absorb the additional farm production under SSRD 1 system Options 2&3. However, they argue that the market demand might not exist for sweet corn, green peas, peppermint for oil, and grass seed, if newly irrigated lands are significantly greater than 12,701 acres. Hence, for SSRD 1 system Option 1 and Full Project options, the historical crop mix is adjusted in the following way. The current acreage allocated to sweet corn, green peas, peppermint for oil, and grass seed under SSRD 1 system Options 2&3 were maintained, but the remaining irrigated lands under SSRD 1 system Option 1 and Full Project options were allocated to other crops included in the historical regional crop mix. The demand for alfalfa hay, potato, onion and wheat are large enough so that the additional acres proposed in this project would not affect their respective demand conditions.

Expected crop mix and the farm-gate production values for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full-Project options are presented in Table 24.[37/] The total annual farm-gate production value for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full-Project options are estimated to be $22.5, $43.1, and $71.3 million, respectively. They represent the direct regional contribution of the aquifer recharge project at the farm gate.

Table 24: Farm Gate Production Values

	SSRD 1 Option 2&3 12,701 acres	SSRD 1 Option 1 23,561 acres	Full-Project 39,006 acres

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[37/] Farm-gate production value refers to receipts by growers for sales of raw commodities at their farm gates prior to any additional handling or processing.

	Proposed Crop Mix (%/ac)	Farm Gate Production Value $	Proposed Crop Mix (%/ac)	Farm Gate Production Value ($)	Proposed Crop Mix (%/ac)	Farm Gate Production Value ($)
Alfalfa hay	24%	$2,514,760	28%	$5,382,433	28%	$8,909,893
Field Corn	12%	$1,023,584	14%	$2,190,813	14%	$3,626,596
Potatoes	16%	$6,332,319	18%	$13,553,293	18%	$22,435,650
Onions	12%	$7,596,405	14%	$16,258,862	14%	$26,914,356
Wheat-full irrigation	11%	$721,247	13%	$1,543,712	13%	$2,555,407
Sweet corn, pro.	6%	$569,250	3%	$569,279	3%	$942,364
Green Peas, proc.	6%	$377,214	3%	$373,244	3%	$617,855
Peppermint for Oil	8%	$1,188,796	4%	$1,188,855	4%	$1,967,989
Grass seed	7%	$1,436,049	4%	$1,436,120	4%	$2,377,304
Other Veg. crops	4%	$595,922	2%	$595,952	2%	$986,518
TOTAL	106%	**$22,355,547**	**103%**	**$43,092,562**	**103%**	**$71,333,930**

* The crop yields and crop prices are used in the calculation of farm gate production values are presented in Table 14.

6.2.2 Direct Economic Impact of Value-added Activities beyond the Farm Gate

The contribution of the aquifer recharge project to the local economy does not, however, stop at the farm-gate. Additional marketing activities (i.e., processing, transportation, drying, storage, wholesaling, and so on) occur before the farm products are shipped out of the region. The study of historical marketing patterns of regional crop production indicates that a large portion of the high-value crops grown in the Basin are used as intermediate inputs in other locally produced goods (e.g., frozen and dehydrated vegetable products, alfalfa cubes, distilled oil, etc.).

Incorporating the forward linkages into the economic impact analysis requires information concerning the extent to which the increased crop production would stimulate economic activities in other sectors of local economy. The extent of induced activity beyond farm gate is difficult to quantify. To limit the scope of the analysis, this report assumes that market demand is not a limiting factor for crops included in the crop mix, and the local food processors have the capacity to expand and hence import substitution effect is ruled out.

The direct regional impacts of farm production, as a result of the aquifer recharge project, are estimated based on the following procedures:

- Distributions of additional farm production among various outlets are made based on the historical marketing patterns of crop production in the region and growers inputs and previous studies. Specifically,

  - Based on a study by Holland and Jun Ho Yeo, this report assumes 12% of potato production will be used for fresh potato market and the remaining will be absorbed by local food processors.
  - Based on a study by Ziari, et. al., it is assumed that 25% of onion production is exported for fresh onion market and remaining will be shipped to local food processors.
  - Sweet corn, green peas and other vegetable crops is assumed to be utilized by local food processors.
  - It is assumed all other crop production will be absorbed by domestic and/or foreign markets.

- The value of processed product at the factory gate was calculated based on gross absorption coefficient (GAC) value used by Huppert et.al. The GAC is the value of a farm product (e.g. potato) for each dollar value of processed food (i.e., french fries).
- Value-added activities beyond the farm gate and factory gate, such as transportation and wholesaling, were estimated using the procedure discussed in section 4.4.
- It was assumed that the newly irrigated lands are currently in dryland wheat-fallow production.

Tables 25, 26, and 27 present the direct impact of farm production for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full-Project options, respectively. Each table shows how each farm product affects different economic sectors of the local economy. For example, under CL5-6 option, farm gate production value of potato is estimated to be $6.3 million. Out of $6.3 million, $0.76 million is exported to fresh potato market (identified in IMPLAN as Vegetable sector) and the remaining are shipped to local food processors (identified in IMPLAN as Frozen and Dehydrated food product sector). The value of potato before leaving the factory gate is $29.6 million. The additional economic activities beyond farm gate and factory gate were estimated to be $0.31 for transportation sector and $1.29 million for wholesaling sector.

The total direct economic impacts of the aquifer recharge project are estimated to be $81, $145, and $239 million annually for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full-Project options, respectively.

Table 25: Direct Impact of Farm Production, 2006$ (SSRD 1 Options 2&3, 12,701 acres)

Crops\Economic sectors	Grain Farming*	Vegetable *	All Other Crops Farming*	Frozen & Dehydrated *,**	Transportation *	Wholesale trade*
Alfalfa hay			2,514,760		69,299	115,868
Field Corn	1,023,584				28,207	47,162
Wheat	721,247				19,875	33,231
Potatoes		759,878		29,640,643	309,696	1,290,722
Onions		1,899,101		30,304,808	347,560	1,371,349

Sweet corn, proc.				3,027,927	29,498	128,277
Green Peas, proc.				2,006,458	19,547	85,003
Peppermint for Oil			1,188,796		32,760	54,774
Grass seed			1,436,049		39,573	66,166
Other Veg. crops				3,169,798	30,880	134,287
Wheat-dryland***	(1,311,359)				(36,137)	(60.421)
TOTAL, $	**433,472**	**2,658,980**	**5,139,605**	**68,149,634**	**926,895**	**3,326,838**

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* Indicate the economic sectors as identified in IMPLAN.

**Due to the lack of information, we allocated vegetable crop production to a combined sector of frozen food manufacturing, and vegetable canning and drying manufacturing sectors.

***It represents the crop production value without the aquifer recharge project.

Table 26: Direct Impact of Farm Production, 2006$ (SSRD 1 Option 1, 23,563 acres)

Crops\Economic Sectors	Grain Farming*	Vegetable *	All Other Crops Farming*	Frozen & Dehydrated *,**	Transportation*	Wholesale Trade*
Alfalfa hay			5,382,433		148,324	247,996
Field Corn	2,190,813				60,372	100,942
Wheat	1,543,712				42,540	71,127
Potatoes		1,626,395		63,440,944	662,854	2,762,580
Onions		4,064,716		50,471,154	603,696	2,325,467
Sweet corn, proc.				3,028,078	29,499	128,283
Green Peas, proc.				1,985,339	19,341	84,108
Peppermint for Oil			1,188,855		6,038	54,776
Grass seed			1,436,120		39,575	66,169
Other Veg. crops				3,169,798	87,350	134,287
Wheat-dryland***	(2,432,917)				(67,044)	(112,097)
TOTAL, $	1,301,608	5,691,111	8,007,408	122,095,313	1,699,590	5,975,734

[*] Indicate the economic sectors as identified in IMPLAN.

[**] Due to the lack of information, we allocated vegetable crop production to a combined sector of frozen food manufacturing, and vegetable canning and drying manufacturing sectors.

[***] It represents the crop production value without the aquifer recharge project.

Table 27: Direct Impact of Farm Production, 2006$ (Full Project, 39,006 acres)

Crops\Economic Sectors	Grain Farming[1]	Vegetable *	All Other Crops Farming *	Frozen & Dehydrated *,**	Transportation *	Wholesale Trade*
Alfalfa hay			8,909,893		245,530	410,523
Field Corn	3,626,596				99,938	167,095
Wheat	2,555,407				70,419	117,740
Potatoes		2,692,278		105,017,934	1,097,265	4,573,079
Onions		6,728,589		83,548,195	999,338	3,849,497
Sweet corn, proc.				5,012,575	48,832	212,355
Green Peas, proc.				3,286,461	32,016	139,229
Peppermint for Oil			1,967,989		9,995	90,675
Grass seed			2,377,304		65,511	109,534
Other Veg. crops				3,169,798	87,350	134,287
Wheat-dryland***	(2,432,917)				(67,044)	(112,097)
TOTAL, $	3,749,086	9,420,867	13,255,186	200,034,963	2,756,195	9,804,016

*Indicate the economic sectors as identified in IMPLAN.

** Due to the lack of information, we allocated vegetable crop production to a combined sector of frozen food manufacturing, and vegetable canning and drying manufacturing sectors.

*** It represents the crop production value without the aquifer recharge project.

6.2.3 Regional Economic Impacts

To estimate the regional economic impacts for each project option, the direct regional economic impact estimates (final demand estimates) from Tables 25, 26, and 27 were entered into the Umatilla Basin Input-Output model. Table 28 presents the direct and indirect regional economic impacts of the aquifer recharge project in terms of economic activities (output), labor income and employment (# of jobs) for different project options.[38/]

[38/] The regional economic impacts were estimated based on the following assumptions: a) no induced activities in regional livestock sector; b) local food processors have the capacity to absorb additional farm production; c) increase in farm production would not affect the local farm prices; d) financing arrangement has not yet been

SSRD 1 Option 2&3:

Under this project option, the aquifer recharge project would stimulate regional economic activities by $116 million. Of this, $81 million is direct impact and $36 million is indirect impact. The $116 million additional economic activities would create 679 jobs (330 jobs directly and 349 jobs indirectly). The project would increase the labor income by $24 million (13 million directly and $11 million indirectly). Using a 7% marginal tax rate, State tax revenue could increase by $1.7 million annually.

SSRD 1 Option 1:

Under this project option, the aquifer recharge project would stimulate regional economic activities by $209 million. Of this, $145 million is direct impact and $64 million is indirect impact. The $209 million additional economic activities (sales of all products,) would create 1,233 jobs (606 jobs directly and 627 jobs indirectly). The project would increase the labor income by $43 million (23 million directly and $21 million indirectly). Using a 7% marginal tax rate, State annual tax revenue could increase by $3 million annually.

Full- Project:

Under this project option, the aquifer recharge project would stimulate regional economic activities by $344 million. Of this, $239 million is direct impact and $105 million is indirect impact. The $344 million additional economic activities would create 2,074 jobs (1,040 jobs directly and 1,034 jobs indirectly). The project would increase the labor income by $72 million (37 million directly and 34 million indirectly). Using a 7% marginal tax rate, State tax revenue could increase by $5 million annually.

6.2.4 Regional Direct Economic Benefits of Irrigation Water

Regional value of irrigation water can be calculated using value-added or labor-income (personal income) measures. Both measures provide the net contribution of a regional resource to the region's social welfare. Value-added is calculated by adding the labor income, other property income (interest, dividend, rent, etc) and indirect business taxes. Since it is difficult to estimate what percentage of other property income remain in the local economy, labor income is a better measure of how the welfare of the Basin's citizens is affected by the change in availability of irrigation water. To this end, this report used the labor income to measure the regional value of irrigation water.

Table 28 displays the change in direct and secondary regional labor income as a result of implementing the aquifer recharge project. The regional direct value for irrigation water, for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full Project options were estimated to be around $340/AF, $330/AF, and $328/AF, respectively. The regional total value of irrigation water (including the secondary impact) for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full Project options were estimated to be around $652/AF, $633/AF, and $629/AF, respectively.

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determined, hence was not included in the analysis; and e) impacts on regional recreational activities and hydropower production are assumed to be small, thus not included in the analysis.

Table 28: Regional Economic Impacts of the aquifer recharge project, 2006$

Project Options	Output		Labor Income*		Employment (# of jobs)	
	Direct	Total	Direct	Total	Direct	Total
SSRD 1 Options 2&3	$80,635,422	$116,265,246	$12,573,426	$24,150,857	330	679
SSRD 1 Option 1	$144,770,763	$208,720,310	$ 22,656,434	$ 43,452,201	606	1,233
Full Project	$239,020,310	$344,264,806	$37,346,288	$71,600,591	1,040	2,074

***** Labor income consists of employee compensation plus proprietor's income.

Economists usually use the change in labor income including the secondary impact to measure the regional value of irrigation water. However, the secondary impact usually takes more than a year to have its impact be fully absorbed by the economy. Since, this report presents all costs and benefits in annual basis, then including the secondary impact would overstate the potential value of irrigation water. To this end, the report uses the midrange of the change in direct and total labor income as presented above, to estimate the regional value of irrigation water for equivalent comparison. Using the Mid-range value, the regional value of irrigation water, for SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full Project options were estimated to be around $496/AF, $481/AF, and $478/AF, respectively.

Summary of regional project benefits, projects costs under varying planning horizons and discount rates are presented in Table 29. Due to the lack of information, the same discount rates and planning horizons were used. The regional benefits of diverted water for a combination of irrigation, fishery, municipal/domestic and aquifer replenishment for County-Line#5&6, County-Line#7, and Full-Project were estimated to be around $383/AF, $373/AF, and $371/AF, respectively.[39/]

[39/] The potential regional economic impacts of instream use for recreation and fishing, municipal/residential, and aquifer replenishment

Table 29: Summary of Regional Project Benefits, Project Costs under Varying Planning Horizons and Discount Rates, for Alternative Project Options, ($/AF, 2006$)

	SSRD 1 Options 2&3	SSRD 1 Option 1	Full-Project
PROJECT BENEFITS			
Regional Value of Irrigation Water	$ 496	$ 481	$ 478
Instream Value-Umatilla River*	$ 104	$ 104	$ 104
Municipal/Domestic Use	$ 236	$ 236	$ 236
Value of Water for Aquifer Replenishment	$ 95	$ 95	$ 95
Regional Benefit	**$ 383**	**$ 373**	**$ 371**
PROJECT COSTS			
Total Annual Cost			
		30 years	
0% discount rate	$ 115	$ 118	$ 116
2.44% discount rate	$ 125	$ 132	$ 129
4.88% discount rate	$ 138	$ 148	$ 145
		50 years	
0% discount rate	$ 105	$ 106	$ 104
2.44% discount rate	$ 116	$ 120	$ 118
4.88% discount rate	$ 130	$ 138	$ 135
Hydropower Lost	$ 4.15	$ 4.22	$ 4.22

* $104 for instream use is the mid-range estimates of value of water for instream use based on "water exchange for instream use" and "alternative water delivery system" methods as discussed in previous section.

Based on information given in Table 29, net RED benefits of the aquifer recharge project are summarized in Table 30. It indicates that for all three options, the total annual benefits significantly outweigh the total annual cost. Based on the assumed discount rate and planning horizon, the aquifer recharge project has potential to become economically feasible from regional economic development perspective.

6.2.5 Regional Economic Impacts of Construction, Operation and Maintenance Cost

Since the financing aspects of initial capital requirements and annual O&M and energy costs are not yet determined, the regional economic impacts of construction and O&M costs are not estimated at this time.

Table 30: Net RED for Aquifer Recharge Project, ($/AF, 2006$)

	Discount Rate		
	0%	**2.44%**	**4.88%**
30 years			
SSRD 1 system Option 3	$ 268	$ 258	$ 245
SSRD 1 system Option 1	$ 255	$ 241	$ 225
Full Project	$ 255	$ 242	$ 226
50 years			
SSRD 1 system Option 3	$ 278	$ 267	$ 253
SSRD 1 system Option 1	$ 267	$ 253	$ 235
Full Project	$ 267	$ 253	$ 236

7.0 SUMMARY AND CONCLUSIONS

The main objective of this report was to assess the economic benefits of the aquifer recharge project for three alternative engineering options, namely SSRD 1 system Options 2&3, SSRD 1 system Option 1, and Full-Project (all three Critical Ground Water Areas). Each project option identifies the annual total water withdrawals from the Columbia River, the annual allocation of stored water for irrigation, river flow augmentation, municipalities & domestic use, and basalt aquifer replenishment.

The economic benefits analysis for the project was performed from National Economic Development (NED) and Regional Economic Development (RED) perspectives.

NED analysis shows that the alternative uses of the water, as proposed by the aquifer recharge project, compared to the instream uses of the Columbia River water, provides a significant direct net gain to the society (in range of $95-$99 AF) . However, when taking into account the project cost, the total cost exceeds the economic benefits of the project. As explained in the report, there are additional potential benefits that need to be incorporated into NED analysis before drawing a conclusion regarding the economic feasibility of the project. A complete NED analysis, which includes these potential benefits, requires additional data that are not yet developed at an appraisal-level engineering investigation phase.

From RED prospective, the economic benefits of the aquifer recharge project were evaluated based on its direct and indirect contribution to the Basin's economy in terms of output (or business activities), employment, and labor income. The direct impacts included in the analysis are the increase in farm production and induced regional direct value-added activities beyond the farm gate. The regional economic impacts were estimated using the IMPLAN input-output model of the Basin. If the aquifer recharge project is implemented, the project would increase regional business activities by \$116-\$344 million, would add 679-2,074 jobs, and would increase annual regional labor income (employee compensation plus proprietor's income) by \$24-\$72 million, depending on the project options. The RED analysis shows that the total annual benefits significantly outweigh the total annual project costs, for all three project options. Based on the assumed discount rate and planning horizon, the aquifer recharge project has potential to become economically feasible from regional economic development perspective.

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TECHNICAL MEMORANDUM

TO:	Barry Norris - OWRD	DATE:	27 January 2009
FROM:	Said Amali, Ph.D., PE	PROJECT:	Umatilla Basin Regional Aquifer Recovery Assessment
SUBJECT:	Task 1.F – Review Regulatory and Permitting Challenges and Opportunities		IRZ Project No.: 08-016

The Oregon Water Resources Department (OWRD) has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

This technical memorandum includes an outline of regulatory steps to develop applications and secure the needed permits for project implementation. Figure 1 depicts the boundary of the CGAs.

1.0 EXECUTIVE SUMMARY

IRZ conducted a review of Oregon rules and regulations to identify permitting and other requirements which must be met for implementation of three conceptual engineering Supply, Storage, Recovery, and Distribution (SSRD) systems identified in this project. No federal permitting requirements are triggered by the SSRD systems. Our evaluation indicates that as long as the final design of the SSRD systems do not deviate significantly from the conceptual systems, the regulatory pathway to implement the selected engineering design is mostly clear. Although some uncertainty exists regarding how best to accommodate certain project permitting needs, we expect that OWRD, and other agencies, will be able to process the needed permits and within normal time frames (months). We intend for this memorandum to be a vehicle to initiate discussion amongst stakeholders and solicit comments at an early stage to minimize what regulatory uncertainty exists and eliminate or minimize potential legal issues. The regulatory steps to obtain the needed State permits are summarized in the attached Table 1.

2.0 INTRODUCTION

The conceptual SSRD systems are designed to provide water to certain Sub-Areas within the CGAs. The Sub-Areas which will potentially receive recharge water and the rationale for their selection are described in IRZ (2008) and IRZ (2009). The SSRD1 system is designed to pump Columbia River water for eventual use in the Ordnance Gravel and Butter Creek CGAs. The SSRD2 system is designed to provide water to the Stage Gulch CGA Sub-Areas west of Umatilla River. And the SSRD3 system is designed to provide water to Stage Gulch CGA Sub-Areas east of the Umatilla River.

The SSRD systems will require a number of permits and licenses to secure the necessary water rights, to divert water from Columbia River for storage in alluvial and/or basalt aquifers, and to pump the stored water. In addition, the permits and licenses require agency approvals regarding compliance with water quality and treatment standards.

An initial evaluation of Oregon rules and regulations was performed early on to identify the regulatory steps necessary to allow implementation of the SSRDs. This initial evaluation indicated that Oregon Administrative Rules (OAR) 690-350 govern permitting for aquifer storage and recovery (ASR) and aquifer recharge (AR) facilities, administrated by OWRD. These rules incorporate certain sections of OAR 340-040 and OAR 333-061 by reference. These sections govern the treatment of waters to be used as potable water or stored in an aquifer which acts as a source of drinking water. They are administered by Oregon Department of Environmental Quality (DEQ), and Oregon Department of Human Services (DHS) Drinking Water Program, respectively. Several ASR and AR facilities are operational in Oregon and provide examples of regulatory processes, and challenges, for this type of system. For example, the cities of Pendleton, Baker City, Beaverton, and Salem use ASR systems to increase their potable water supply. Only a few ASR systems operate in eastern Oregon for the purpose of providing stored water for agricultural irrigation. Finally, several AR systems have been permitted in Oregon to store winter high flows to provide water for a variety of uses during the other times of the year.

3.0 OBJECTIVES

This task has the following specific objectives:

- Clarify permitting requirements under Oregon rules and regulations relating to testing and implementation of AR and ASR projects.
- Clarify regulatory requirements under Oregon rules and regulations relating to water treatment, impacts to native water quality, impacts to drinking water supplies, and impacts to existing water rights.

- Suggest steps to resolve permitting uncertainties.
- Identify a Water Rights Strategy for AR and ASR Source Waters.
- Determine if existing water rights may be suitable for the project.

4.0 SCOPE OF ASSESSMENT

Oregon developed the current ASR/AR regulatory framework to primarily meet the needs of municipal and public water systems. These systems are regulated to ensure that their water supplies meet drinking water standards through stringent and extensive monitoring and reporting as well as treatment requirements. The SSRD systems proposed in this project have several significant differences with typical public water systems, as follows:

- A great portion of the imported water is designed to reside in the aquifers to provide for curtailed irrigation groundwater rights and not for municipal drinking water use.
- A portion of the imported water is targeted to increase aquifer sources of water supply to domestic and municipal water supplies and not to be directly tied to any potable water distribution system.
- The system will be operated in areas where the distance to existing municipal systems is much greater than the groundwater 2-year time of travel.
- The system is at a large scale in terms of volumes of water to divert and store, geographical extent of system distribution, use of existing pumping infrastructure, the size of the groundwater aquifers utilized, and finally its great importance to local and State economies.

It appears that the current regulatory framework can be used to permit and operate the proposed SSRD systems. However, there are specific items which need further clarification and discussion with OWRD, DEQ, and DHS. The data and information generated in this project are expected to provide significant assistance in reaching clarifications and agreements on the final regulatory steps. It is certainly preferred by the stakeholders that any permitting complexities that arise can be addressed within the current rules and regulations, without the need for new rule making.

The following rules and regulations were deemed applicable and reviewed for this task:

- OAR 690-350 AQUIFER STORAGE AND RECOVERY (ASR) AND ARTIFICIAL GROUNDWATER RECHARGE (AR)
- ORS 537.135 & 143 APPROPRIATION OF WATER GENERALLY
- OAR 333-061 PUBLIC WATER SYSTEMS
- OAR 340-040 GROUNDWATER QUALITY PROTECTION
- OAR 690-033 ADDITIONAL PUBLIC INTEREST STANDARDS FOR NEW APPROPRIATIONS

- OAR 690-310 WATER RIGHT APPLICATION PROCESSING
- OAR 690-507 UMATILLA BASIN PROGRAM
- OAR 690-009 GROUNDWATER INTERFERENCE WITH SURFACE WATER
- OAR 340-044 UNDERGROUND INJECTION CONTROL

The above rules and regulations were reviewed to identify sections which are relevant to construction of the SSRD systems and their operation and maintenance. They include provisions required to begin pilot testing, and to obtain system permits and final water right certificates. They additionally include provisions dealing with monitoring and reporting of system, aquifer, and water quality data which will have to be part of the initial pilot testing and future system operations. This evaluation did not intend to include those aspects involving fiscal responsibilities related to system ownership and operation.

5.0 FINDINGS

The steps required to obtain the OWRD limited licenses and permits, and to comply with other regulatory requirements are summarized in Table 1. Table 1 provides a pathway for the stakeholders to begin project construction, and for its continued operation and maintenance. It should be noted that the information included in Table 1 covers the permitting needs of SSRD1 and SSRD2 systems. The SSRD3 system, intended for the Stage Gulch Sub-Area east of Umatilla River, has not been designed due to lack of suitable alluvial recharge and treatment options. Therefore, permitting needs for this system are not included in Table 1.

5.0 REFERENCES

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TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
SSRD 1 – "COUNTY LINE SYSTEM" SERVING ORDNANCE GRAVEL AND BUTTER CREEK CGAs				
	Supply	**Secure Columbia River Winter Water**	OAR 690-350-0110 and subsequent sections, ORS 537.143..	Apply to OWRD through a limited license or permit to divert winter flow from the Columbia River.
			Water is available during September through March excluding November according to OWRD availability study (OWRD September 2005).	Discuss with OWRD whether withdrawals may be allowed in November, or in December at greater rates than allowed, to be credited toward non-consumptive, fisheries flow augmentation in Umatilla River. It is likely that additional aquifer and system data will be needed to support these discussions.
			OAR 690-033-0000(c) – Allows appropriation of water for groundwater recharge.	None
			OAR 690-033-0120(2)(a)does not allow withdrawal between April 15th and September 30th – however may be exempted by OWRD if there is a net benefit for fish recovery 0140(2) or for multipurpose storage projects with net	Discuss with OWRD & ODF&W whether withdrawal during September can be allowed based on potential for enhancement of Umatilla River fisheries.

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			public benefit 0140(5).	
	Storage	**Recharge Ordnance Gravel Aquifer**	OAR 690-350-0110(1) allows use of diverted water for aquifer recharge. The permit obligates the recharged water to the applicant as the water right holder.	Apply to OWRD for an AR testing Limited License under ORS 537.143 (also Listed above). Discuss with OWRD the requirements for fulfillment of its goals.
			Diversion of water for AR testing under a Limited License is subordinate to any other water rights irrespective of their priority date, except other licenses, per ORS 537.143. ORS 537.143(1) prohibits the use of stored water during the Limited License testing unless as allowed under subsection (9).	Discuss with OWRD to retain ownership of AR water for irrigation during the irrigation season pursuant to subsection (9) and for use of the AR water for ASR testing.
			DEQ's approval of recharge water quality is required per 690-350-0120(3)(b).	Discuss approval process and requirements with DEQ as part of Limited License.
			Additional AR Permit information required by OWRD per OAR 690-310-0040.	Include in Permit submittal package.
			Recharge Permit can become a "Recharge	Requires annual reports. Discuss reporting

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			Certificate” per 0120(6) – a water right.	requirements and goals with OWRD to obtain water right. Certificate won’t be issued until a complete monitoring plan is approved. A final monitoring plan will become a condition of the permit and certificate.
			AR testing operations continue during Permit application review times.	Continue recharge under the Limited License through the permit application review period.
	Recovery	**Recover AR Water for ASR and Direct Irrigation**	An ASR Limited License will be needed to recover the AR water for the purpose of ASR pilot testing OAR 690-350.	Apply to OWRD to obtain AR Limited License per ORS 537.534 for ASR testing using the AR water as source water.
			A secondary groundwater permit will be needed for continued recovery of AR water per 690-350-0130.	Discuss with OWRD whether the Limited Licenses for AR and ASR testing can be applied concurrently.
			The permit issued to the applicant obligates the water to the applicant as the water right holder.	
			Recovery of AR water is limited to 85% of recharged water for the first 5 years per 350-0130(3).	Discuss with OWRD during the limited License phase the information needed for a decision on final allowed withdrawal amount.

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			Disposition of current CLWID recharge water right after SSRD 1 AR begins.	To be decided through an agreement between owner and user. Options include leasing, transfer of place of use, etc. Will require a change application.
			Water conservation measures will likely need to be proposed in the Permit application for the use of AR water per OAR 690-507-0020(4)	Propose measures as part of Permit application.
			Permit can become a "Secondary Groundwater Certificate" per 350-0130(5) – a water right.	Requires annual reports. Discuss reporting requirements and goals with OWRD to obtain the water right. Requires an approved monitoring plan.
	Distribution	**ASR Water Injection And Recovery**	Injection/recovery to be accomplished under ASR Rules OAR 690-350. Rule 0010(1)(a) contemplates secondary use of the injected water for beneficial uses. The AR Secondary Groundwater Permit or Certificate acts as the water right for ASR source water - right to ASR inherent in "every" water right per 0010(3), 0020(3)(a)(F).	Apply for Limited License for ASR aquifer testing per 0010(2) and 0020. The License can be issued for up to 5 years 0020(3). Apply to OWRD for ASR test concurrently with AR testing. Discuss with OWRD the status of the original basalt groundwater rights. Access to ASR source water and recovery of water

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
				is subject to being junior to other existing users and may be subject to restrictions during the limited license testing period if other users can prove injury.
			"Only after completion of an ASR testing program under a limited license may an applicant apply for a permanent ASR permit." 0030(1)	Apply for permit following completion of ASR testing.
			Injection source water quality criteria – Under OAR 690-350-0010(6)(a) the ASR injection water must meet drinking water standards in OAR 333-061-0030.	Data has been collected from alluvial wells for drinking water quality analysis. Discuss with OWRD & DEQ regarding any additional sampling and analysis.
			Minimize presence of constituents not naturally present per OAR 690-350-0010(6)(b).	Discuss with OWRD & DEQ regarding additional sampling for pesticides and other agricultural chemicals.
			Presence of nitrate in alluvial groundwater at levels greater than 50% of its established level of 10 mg/L 690-350-0010(6)(d).	Discuss with OWRD and DEQ to design the AR system to dilute nitrate concentrations to less than 5 mg/L in ASR source water and develop appropriate monitoring points.
			OAR 333-0032 discusses groundwater versus GWUDI.	The SSRDs are not "Public Water Systems". Finalize with DHS that Groundwater" doesn't

TABLE 1
Regulatory Framework and Steps

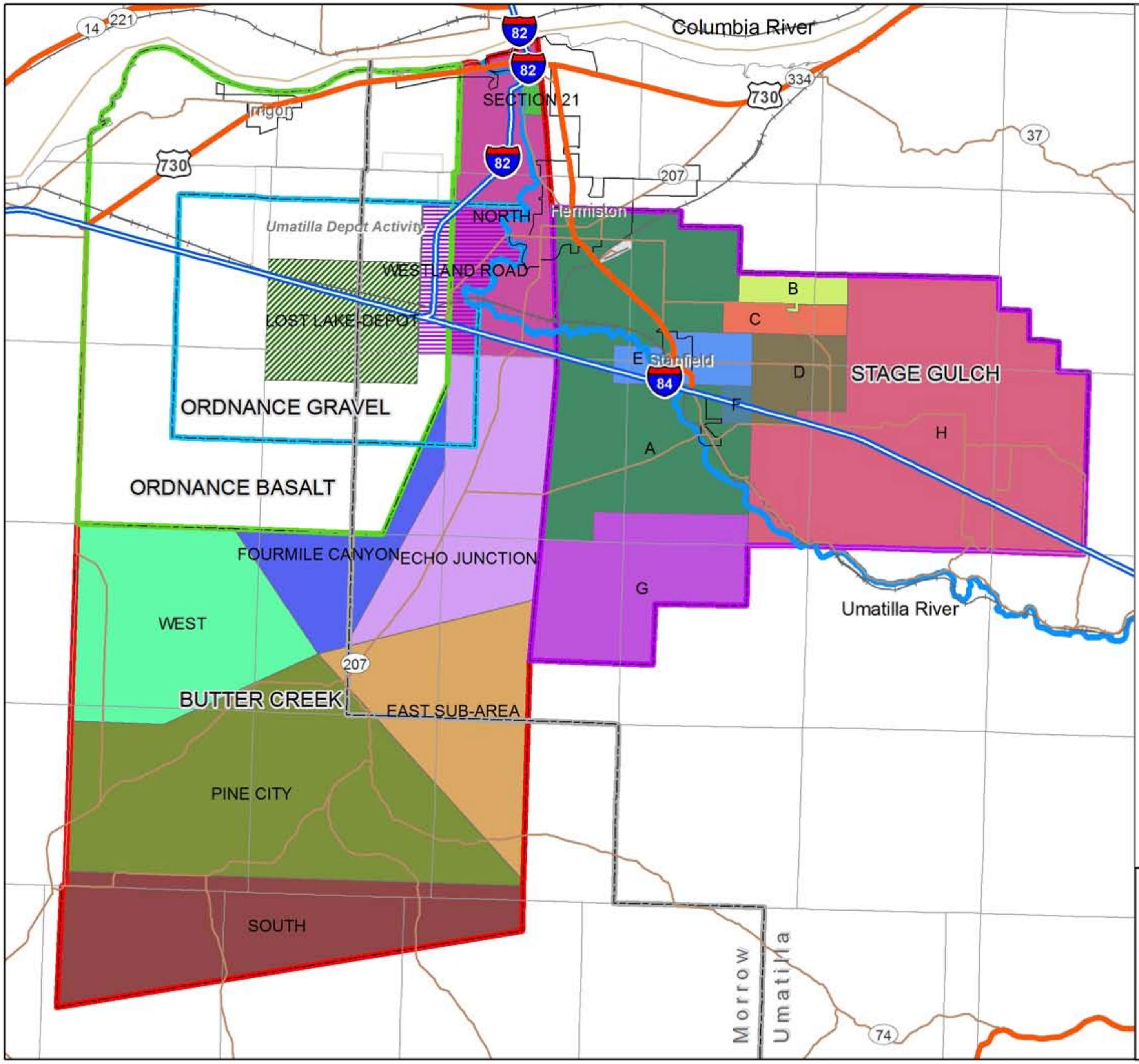
SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			Based on OAR 0031(7) 200 ft criteria, County Line and Echo Meadows groundwater are classifies as "groundwater". Compliance with OAR 333 in this context is similar to complying with Drinking Water Stds OAR 340-040.	require filtration, but only disinfection. Monitor for presence/absence of total coliforms based on OAR 061-0030(4)(a). Discuss with DEQ/DHS on the required monitoring frequency and what defines "consistent" hit before disinfection is considered.
			Injection source water quality criteria – Under OAR 690-350-0010(6)(a) the ASR injection water must meet treatment requirements in OAR 333-061-0032.	No treatment may be necessary. If points of AR water withdrawals (wells) are designed to be more than 200 feet away from injection locations, the provisions of OAR 333-061-0032(7)(a) apply which classify AR groundwater as "groundwater" and not as groundwater under the direct influence of surface water (GWUID).
			Recovered ASR testing water to be tested for disposal options per 0010(7)(c).	Discuss with OWRD and DEQ on requirements.
			Injection locations should be located beyond the 2-year time of travel zones for public water systems.	Discuss with DHS, DEQ to design the system accordingly.
			ASR injection must meet DEQ's Underground Injection Control (UIC)	Submit an Underground Injection Control (UIC) registration with DEQ.

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			Following successful ASR testing, an ASR Permit will be issued by OWRD per OAR 690-350-0030.	Develop permit application package for submittal to OWRD.
		ASR Water Recovery	ASR water recovery is not subject to the 5-mile radius restriction around cities 690-507-0070(3)(d)(D). Only wells producing native groundwater from a basalt aquifer apply.	None.
			Groundwater from Butter Creek CGA shall be pumped March 15th to November 1st - 231 days - per OAR 690-507-0630(3) – and March 1st to November 30th - 275 days - in Stage Gulch CGA per 690-507-0770(3).	This applies to native groundwater only, although a permit for use of ASR water may include "season of use" restrictions consistent with other agricultural uses in the basin. Discuss with OWRD and include in system design.
			Metering and reporting for injection and recovery systems for Butter Creek CGA in OAR 690-507-0640 and for Stage Gulch CGA in OAR 690-507-0780 and sections referenced therein.	These regulations apply to pumping native groundwater. But similar conditions may apply to this project. Clarify with OWRD.
SSRD 2 – "ECHO MEADOWS SYSTEM" SERVING STAGE GULCH SUB-AREA G AND SUB-AREA A SOUTH OF THE UMATILLA RIVER				
	Groundwater Recovery For ASR Injection	**Water Right Availability**	Appropriation/transfer of Echo Meadows groundwater as source water for ASR testing and permitting requires a water right. Applicable regulations to be clarified as to the	Discuss with OWRD the steps to possibly use CLWID's recharge water right. Formal agreement with CLWID under ASR rules

TABLE 1
Regulatory Framework and Steps

SYSTEM	COMPONENT	ISSUE	RELATED RULES/REGULATIONS	PERMIT/ACTION/RESOLUTION
			exact mechanism.	690-350-0020(3)(a)(G) is required for ASR testing.
			The use of Echo Meadows groundwater as ASR source water is potentially subject to OAR 690-507-0070(3)(e) and OAR 690-033-0000(b), 0120(2)(a)&(b)&(4) requirements.	Discuss with OWRD the nature and extent of any mitigation that may be necessary.
			Groundwater withdrawals are subject to the 1-mile rule per OAR 690-009-0040, and controlled on a CGA basis per 009-0050(b).	Discuss with OWRD and include in system design.
			OAR 690-507-0070(2)(d)(A)requires that diverted water is applied only to lands with existing water rights and sub-section (B) requires only 2.25 acre feet per acre of duty.	Clarify with OWRD whether this applies to new applications or use of CLWID water right in Echo Meadows is exempt from sub-section (B).
		ASR Injection And Recovery	Entries listed for SSRD 1 are applicable.	Entries listed for SSRD 1 are applicable.



Legend

CGA Boundaries

- 🟥 Butter Creek
- 🟩 Ordnance Basalt
- 🟦 Ordnance Gravel
- 🟪 Stage Gulch

Notes:

CGA = Critical Groundwater Area
Colored areas denote Sub-Areas within CGAs.
CGA boundaries from Umatilla County.

Critical Groundwater Areas
Figure 1

Umatilla Basin Recharge Project

IRZ

TECHNICAL MEMORANDUM

TO:	Barry Norris - OWRD	DATE:	30 June 2009
FROM:	Said Amali, Ph.D., PE	PROJECT:	Umatilla Basin Regional Aquifer Recovery Assessment
SUBJECT:	Task 2.A – Aquifer Recharge Permit Process	IRZ Project No.: 08-016	

The Oregon Water Resources Department (OWRD) has designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits.

This technical memorandum includes a summary of information and findings regarding the permitting steps needed to allow alluvial aquifer recharge (AR) with imported Columbia River water.

1.0 OBJECTIVES

The specific objectives of this technical memorandum are as follows:

- Clarify the information and data needed to complete an OWRD "Application for a Permit to Use Surface Water" for AR.
- Clarify the Supplemental Information Requirements and Permit Conditions, as stipulated in OAR 690-350-0120 to accompany the above AR permit application.

2.0 FINDINGS

The conceptual design of a Supply, Storage, Recovery, and Distribution (SSRD) system 1 begins with diversion of water from Columbia River and its conveyance to the County Line aquifer for storage (IRZ 2009). This step requires obtaining a water right permit from OWRD. Additionally, water to be used in SSRD 2 system is envisioned to be available through a temporary transfer of the water right with the County Line Water Improvement District (CLWID). The CLWID currently receives water from the Umatilla

River via the Hunt Canal. The temporary transfer, if approved could allow this diversion to be left in the canal for recharge of the Echo Meadows aquifer.

A meeting was held between Donn Miller, Mike Ladd, and Timothy Wallin of OWRD, Phil Richerson of Oregon Department of Environmental Quality (DEQ), Tom Pattee and Russell Kazmierczak of Oregon Department of Human Services, J.R. Cook of the Umatilla County Planning Department, and Said Amali of IRZ Consulting LLC on Friday 26 June 2009 to discuss the details of these permitting steps. The results of the meeting are provided below.

2.1 AR Water Right Permit

The recharge of the County Line aquifer with imported Columbia River water will be permitted as required by OAR 690-350-0120. The regulations require submission of an AR application to secure a "Permit to Use Surface Water". The permit is similar to other water right permits in that once proven, it can result in issuance of a water right certificate by OWRD. The permit will only cover diversion of river water for AR and not secondary beneficial uses of the stored water.

A partially filled permit application is enclosed in Appendix A based on the meeting discussions. The items that will need further discussion include the following:

- The diversion from the Columbia River was assumed to occur over 90 days within the months of October, January, February, and March. There are certain advantages to be gained in system cost and ease of operation if diversion period could be extended into other months, especially the early irrigation season months (April, May, June). If such requests are to be made, mitigation of the impacts to Columbia River flow must be proposed for OWRD considerations.
- The application is to be submitted to OWRD as soon as funds for the next phase (implementation) of this project become available. As a result, certain technical information may not be available or management decisions not be finalized at the time of submission. The meeting participants recognized that additional information will be provided to OWRD over time as part of completing the application. This process will allow much information to be available for review and comment by OWRD and other agencies early on.
- Much of the technical information and data on alluvial aquifers and existing water supply infrastructure developed during this project can be referenced in the application with appropriate short summaries to address specific application questions.

Other requirements of OAR 690-350-0120 are listed below:

- *0120(3)(a) – Minimum Perennial Stream Flow or Instream Water Right*. An instream water right (ISWR) certificate will soon be issued as a result of the approval of conserved water application CW-58. Additionally, OWRD has conducted an assessment of water flow availability for

Columbia River based on the target flows listed in the draft 2000 biological opinion (OWRD 2005 and 2007)

- *0120(3)(b) – Water Quality Permit*. DEQ's primary concern is the quality of the source water and it's compatibility with the water in the receiving aquifer. DEQ staff stated no separate permits will be required. DEQ's approval will require that 1) the groundwater system in the vicinity of the AR location be adequately understood, 2) water quality of the imported Columbia River water be analyzed for potential contaminants of concern at the same time of year and location proposed for AR, 3) information on the land use (specifically chemicals historically applied to that land) be provided, and 3) site characteristics at the planned AR location be defined.
- *0120(3)(e) – Financial Capability*. The applicant must demonstrate its capabilities in constructing the system proposed in the application.
- *0120(3)(F) – Hydrogeological Feasibility Report*. The documents prepared as part of this project (GSI 2009) and IRZ (2009a) will provide the required details. A summary of the findings of these documents will be presented in the permit application. Additional information obtained during the implementation phase of the project will be used to augment the application information.
- *0120(3)(G) – Project Description Report*. The information and findings included in IRZ (2009b) will provide the required details. A summary of the findings of these documents will be presented in the permit application. Additionally, a clarification was made by OWRD that the phrase "surplus surface waters" is equivalent to "available" water, as discussed in OWRD (2005, 2007). Finally, the report must propose a groundwater quality monitoring plan to include an analyte list and sampling plan commensurate with the characteristics of the project. DEQ will comment on its completeness and applicability.

2.2 Use of the CLWID Water Right

The process to recharge the Echo Meadows aquifer and subsequently use the stored water in Stage Gulch CGA sub-areas west of the Umatilla River is dependent on approval of a temporary transfer of CLWID aquifer recharge water right as well as other authorizations to allow use of the stored groundwater. The options and associated points to address, as discussed in the meeting, are as follows:

- A formal exchange of CLWID water right may occur under ORS. 540.533. In this case, since instream flow augmentation is a beneficial use, along with irrigation and others, the requirement of this statute may be considered fulfilled.
- An application for temporary transfer of CLWID can be filed to request use of CLWID water right at Echo Meadows. A Temporary transfer could be requested not to exceed five years (OAR 690-380-8000) based on a set duration or a condition in the temporary transfer that unwinds the transfer. However, you could not unwind the transfer for a particular year in mid-season and

then expect CLWID to use the water at their location in the same year after Echo Meadows had used it in their location earlier in the same year. There is no limit on the number of times a temporary transfer could be filed CLWID will retain ownership of the water right while both SSRD 1 and 2 systems are tested and implemented.

- AR may proceed at Echo Meadows through a limited license process for the purpose of testing SSRD2 system until CLWID water right becomes available once SSRD1 system is operational.

3.0 REFERENCES

GSI Water Solutions, Inc. February 2009. *Report: ASR Feasibility, Umatilla Basin Regional Aquifer Recovery Assessment*. Prepared for IRZ Consulting LLC as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

IRZ Consulting LLC. June 2009a. *Final Report: Conceptual Hydrogeology of Alluvial Aquifers and Echo Meadows Aquifer Recharge Report, Umatilla Basin Aquifer Recharge Project*. Prepared for Oregon Water Resources Department as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

IRZ Consulting LLC. 18 June 2009. *Technical Memorandum, Tasks 1.J & 3.D – Conceptual Engineering Designs.* Prepared for Oregon Water Resources Department as a deliverable for the Umatilla Basin Regional Aquifer Recovery Assessment project and included in this report.

Oregon Water Resources Department, 3 April 2003. *Ground Water Supplies In The Umatilla Basin*. OWRD Ground Water Section, Pendleton, Oregon.

Oregon Water Resources Department, 30 September 2005. *Memorandum: Columbia River Water Availability.*

Oregon Water Resources Department, 19 April 2007. *Memorandum: Columbia River Water Availability.*

Oregon Water Resources
Department725 Summer Street NE,
Suite A, Salem Oregon 97301-1266(503)
986-0900www.wrd.state.or.us

Application for a Permit to Use
Surface Water

Please type or print in dark ink. If your application is found to be incomplete or inaccurate, we will return it to you. If any requested information does not apply to your application, insert "n/a." Please read and refer to the instructions when completing your application. A summary of review criteria and procedures that are generally applicable to these applications is available at www.wrd.state.or.us/OWRD/PUBS/forms.shtml.

1. APPLICANT INFORMATION

A. Applicants NOT APPLICABLE

Applicant:
First Last

Mailing Address:

City State Zip

Phone:
Home Work Other

*Fax: *Email Address:

B. Organizations

(Corporations, associations, firms, partnerships, joint stock companies, cooperatives, public and municipal corporations)

Name of Organization: FORMATION OF A NEW ORGANIZATION IS IN PROGRESS.

Name and Title of Person Applying:

Mailing Address or Organization:

City State Zip

Phone :
Day Evening

*Fax: *Email Address:

**Optional*

For Department Use

App. No. Permit No. Date

2. SOURCE AND PROPERTYOWNERSHIP

A. The Proposed Source of Water Provide the commonly used name of the water body from which water will be diverted, and the name of the stream or lake it flows into. If unnamed, say so:

Source 1: COLUMBIA RIVER	Tributary to:
Source 2:	Tributary to:
Source 3:	Tributary to:
Source 4:	Tributary to:

If any source listed above is stored water that is authorized under a water right permit, certificate, or decree, attach a copy of the document or list the document number (for decrees, list the volume, page and/or decree name).

B. Applications to Use Stored Water **NOT APPLICABLE**
Complete this section if any source listed in item 2A above is stored water. Do you, or will you, own the reservoir(s) described in item 2A above?

Yes

No. (Please enclose a copy of your written notification to the operator of the reservoir of your intent to file this application, which you should have already mailed or delivered to the operator.)

If *all* sources listed in item 2A are stored water, the Department will review your application using the expedited process provided in ORS 537.147, unless you check the box below. Please see the instruction booklet for more information.

By checking this box, you are requesting that the Department process your application under the standard process outlined in ORS 537.150 and 537.153, rather than the expedited process provided by ORS 537.147. To file an application under the standard process, you must enclose the following:
☐

❺ A copy of a signed non-expired contract or other agreement with the owner of the reservoir (if not you) to impound the volume of water you propose to use in this application.

❺ A copy of your written agreement with the party (if any) delivering the water from the reservoir to you.

C. Property Ownership

Do you own all the land where you propose to divert, transport, and use water?

Yes *(Please check appropriate box below then skip to section 3 'Water Use')*

There are no encumbrances☐

This land is encumbered by easements, rights of way, roads or other encumbrances*(please provide a copy of the recorded deed(s))*☐

√ No *(Please check the appropriate box below)*

I have a recorded easement or written authorization permitting access.☐

√ I do not currently have written authorization or easement permitting access.☐

Written authorization or an easement is not necessary, because the only affected lands I do not own are state-owned submersible lands, and this application is for irrigated and/or domestic use only (ORS 274.040).☐

You must provide the legal description of: (1) the property from which the water is to be diverted, (2) any property crossed by the proposed ditch, canal or other work, and (3) any property on which the water is to be used as depicted on the map. List the names and mailing addresses of all affected landowners.

INCLUDE LEGAL DESCRIPION OF THE AQUIFER RECHARGE SITE(S).

INCLUDE STATEMENT THAT THE EASEMENT(S) WILL BE OBTAINED BY THE SYSTEM CONSTRUCTION TIME.

3. WATER USE

Please read the instruction booklet for more details on "type of use" definitions, how to express how much water you need and how to identify the water source you propose to use. You must fill out a supplemental form for some uses as they require specific information for that type of use.

A. Type(s) of Use(s)

See list of beneficial uses provided in the instructions.
PROVIDE A NARRATIVE TO DESCRIBE THAT THE TYPE OF USE IS GROUNDWATER RECHARGE AND INCLUDE A DESCRIPTION OF THE NATURE OF THE SECONDARY BENEFICIAL USES.

- If your proposed use is **domestic**, indicate the number of households to be supplied with water:
- If your proposed use is **irrigation**, please attach **Form I**
- If your proposed use is **mining**, attach **Form R**
- If your proposed use is **municipal or quasi-municipal**, attach **Form M**
- If your proposed use is **commercial/industrial**, attach **Form Q**

B. Amount of Water

Provide the amount of water you propose to use from each source, for each use, in cubic feet-per-second (cfs) orgallons-per-minute (gpm). If the proposed use is from storage, provide the amount in acre-feet (af):
(1 cfs equals 448.8 gpm. 1 acre-foot equals 325,851 gallons or 43,560 cubic feet)

Source	Type of use	Amount			
COLUMBIA RIVER	AQUIFER RECHARGE	100,000	cfs	gpm	√ af
			cfs	gpm	af
			cfs	gpm	af
			cfs	gpm	af

C. Period of Use

Indicate the time of year you propose to use the water:
(For seasonal uses like irrigation give dates when water use would begin and end, e.g. March 1-October 31.)
SEPTEMBER THROUGH JUNE, WITH MITIGATION DURING TIMES PROHIBITED BY OWRD “WATER AVAILABILITY” MONTHS OR DIVISOIN 33 RULES. DESCRIBE THE NATURE OF THE MITIGATIONS.

If you will be applying water to land, indicate the total number of acres where water will be applied or used:
(This number should be consistent with your application map.)

4. WATER MANAGEMENT

A NARRATIVE WILL DESCRIBE THE PROPOSED WATER MANAGEMENT COMPONENTS, MONITORING SYSTEM AND PROTOCOL, AND CONSERVATION ASPECTS. IT IS UNDERSTOOD THAT THIS DESCRIPTION WILL BE REFINED AS THE SYSTEM DESIGN IS FINALIZED.

A. Diversion

What method will you use to divert water from the source?

Pump (give horsepower and pump type):☐

Head-gate (give dimensions):☐

other means (describe):☐

B. Monitoring

How will you monitor your diversion to be sure you are within the limits of your water right (allowed rate andduty) and you are not wasting water?

Weir☐ Meter☐ Periodic Sampling☐

other means (describe):☐

C. Transport

How will you transport water to your place of use?

Ditch or canal (give average width and depth):☐

Width Depth

Is the ditch or canal to be lined? Yes No

Pipe (give diameter and total length):☐

Diameter Length

other, describe:☐

D. Application/Distribution Method

What equipment will you use to apply water to your place of use?

Irrigation or land application method (check all that apply):

Flood☐
Drip☐
Hand Lines☐

High pressure sprinkler☐
Water Cannons☐
Wheel Lines☐

Low pressure sprinkler☐
Center pivot system☐

Siphon tubes or gated pipe with furrows☐

other, describe:☐

Distribution method

Direct pipe from source☐ In-line storage (tank or pond)☐ Open Canal☐

E. Conservation

What methods will you use to conserve water? Why did you choose this distribution or application method? Have you considered other methods to transport, apply, distribute or use water? For example, if you are using sprinkler irrigation rather than drip irrigation, explain. If you need additional space, attach a separate sheet.

INCLUDE ITEMS SUCH AS UNDERGROUND STORAGE, CONVEYANCE IN PIPES, AND WINTER DIVERSION ALL REDUCE EVAPORATION.

5. RESOURCE PROTECTION

PROVIDE DESCRIPTION OF EXISTING RIVER PUMP STATION RESOURCE PROTECTION MECHANISMS. NO ADDITIONAL MECHANISMS WILL BE NEEDED.

A. Protection Practices
In granting permission to use water from a stream or lake, the state encourages, and in some instances requires, careful control of activities that may affect the waterway or streamside area. See instruction guide for a list of possible permit requirements from other agencies. Please indicate any of the practices you plan to undertake to protect water resources.

Diversion will be screened to prevent uptake of fish and other aquatic life. Describe planned actions:☐

Excavation or clearing of banks will be kept to a minimum to protect riparian or streamside areas. Describe planned actions:☐

Operating equipment in a water body will be managed and timed to prevent damage to aquatic life. Describe:☐

Water quality will be protected by preventing erosion and run-off of waste or chemical products. Describe:☐

Other:☐

6. PROJECT SCHEDULE

Indicate the anticipated dates that the following construction tasks should begin. If construction has already begun, or is completed, please indicate that date.

Proposed date construction will begin:

Proposed date construction will be completed:

Proposed date beneficial water use will begin:

Is this project fully or partially funded by the American Recovery and Reinvestment Act? (Federal stimulus dollars) Yes No

7. REMARKS

If you would like to clarify any information you have provided in the application, please do so here and reference the specific application question you are addressing.

8. MAP REQUIREMENTS

The Department cannot process your application without accurate information showing the source of water and location of water use. You must include a map with this application form that clearly indicates the township, range, section, and quarter/quarter section of the proposed points of diversion and place of use. The map must provide tax lot numbers. See the map guidelines sheet for detailed map specifications.

9. SIGNATURE

By my signature below I confirm that I understand:

- I am asking to use water specifically as described in this application.
- Evaluation of this application will be based on information provided in the application packet.
- I cannot legally use water until the Water Resources Department issues a permit to me.
- If I get a permit, I must not waste water.
- If development of the water use is not according to the terms of the permit, the permit can be canceled.
- The water use must be compatible with local comprehensive land use plans.
- Even if the Department issues a permit, I may have to stop using water to allow senior water right holders to get water to which they are entitled.

I swear that all information provided in this application is true and correct to the best of my knowledge:

Signature of Applicant *(If more than one applicant, all must sign.)*
Date

Before you submit your application be sure you have:

- Answered each question completely.
- Attached a legible map which includes township, range, section, quarter/quarter and tax lot number.
- Included a Land Use Information Form or receipt stub signed by a local official.
- Included the legal description of all the property involved with this application. You may supply a copy of the deed, land sales contract, or title insurance policy, to meet this requirement.
- Included a check payable to the Oregon Water Resources Department for the appropriate amount. The Department's fee schedule can be found at www.wrd.state.or.us or call (503) 986-0900.

WRD on the web:*www.wrd.state.or.us*

Standard Application Completeness Checklist

Minimum Requirements (OAR 690-310-0040)(ORS 537.400)

This is the checklist used by WRD staff Application

Application ______________________ Township ___________________________

Priority Date______________________ Range _____________________________

Use(s) ___________________________ Section ____________________________

Rate ____________________________ POD Loc ___________________________

County __________________________ POU Loc ___________________________

W.M. ___________________________ Caseworker _________________________

☐ Applicant/Organization Name, Mailing Address and Telephone Number.

☐ Source of water.

If stored water, is the stored water component filed out, including a non-expired agreement for stored water must be included. (ORS 537.400)

NOTE: *A surface water application cannot be filled at the same time as a Reservoir or Alt Reservoir if it will be for the use of the stored water under the PROPOSED Reservoir application (E2).*

☐ The proposed source **is** or **is not** (circle one) withdrawn from further appropriation, or Division 538.

If it is return application and fees.

☐ Property ownership indicated.

☐ If applicant does not own all the land, the affected landowners name and mailing address must be listed.

☐ If applicant does not own all the land, a statement declaring the existence of either written authorization or an easement permitting access to land crossed by the proposed ditch canal or other work must be submitted.

☐ Groundwater development section (Page 3 and 4, Section B) or a well log report.

☐ Proposed use of water. If supplemental, list primary water right acreage if applicable.

☐ Enclosed Supplemental Form for each proposed use.

☐ Form I (Irrigation) ☐ Form M (Municipal or Quasi-Municipal)

☐ Form R (Mining) ☐ Form Q (Commercial or Industrial)

☐ Spring Description Sheet

☐ Amount of water from *each* source in gallons per minute (GPM), cubic feet per second (CFS), or acre feet (AF)

☐ Period of use

☐ Water management section (Please estimate if the water system has not been designed).

- ☐ Resource Protection Section (Page 6, Section 5).
- ☐ Project schedule (If system is already completed, indicate "existing").
- ☐ For reservoir applications storing more than 9.2 acre feet, and a dam height of more than 10 feet, preliminary plans and specifications for dam and impoundment are required.
  - ☐ If the above is statement is checked, the map must be prepared by a CWRE.
- ☐ **All** applicants (or the authorized agent with title or authority if for an organization or corporation), must sign the application in ink. *Signature must be an original "wet" signature.*
- ☐ You must include a Legal description of the property involved that includes a metes and bounds, or other government survey description. A copy of the deed, land sales contract or title insurance policy can provide this information, or you may submit a lot book report prepared by a title company. The Department will not accept a copy of the tax bill.
- ☐ A completed Land-Use Form or receipt signed and dated by the appropriate planning department officials. *Date of signature must be within the past 12 months. Signature must be an original "wet" signature.*
- ☐ The map must meet all the minimum requirements of OAR 690-310-0050.
  - ☐ Township, Range, Section
  - ☐ Place of use, 1/4, 1/4s and tax lot clearly identified
  - ☐ Location of each diversion point well or dam by reference to a recognized public land survey corner
  - ☐ Number of acres per 1/4, 1/4, if irrigation, nursery, or agriculture
  - ☐ Reference corner on map
  - ☐ Each point of diversion coordinate
  - ☐ Location of main canals, ditches, pipelines or flumes (if POA/POD is outside of POU)
  - ☐ Even map scale not less than 4" = 1 mile (example: 1" = 100 ft, 1" = 200 ft, etc.)
  - ☐ North Directional Symbol
  - ☐ Other _____________________________
    ____
- ☐ Fees: Amount of water requested ________________

Base Fee $________________ Additional Use @ ______= ______

1st CFS/AF ______________Total Exam Fees $ ________________

Addtn'l CFS/ AF @ _____ = ______Total Paid $______________________

Addtn' POD @ _____ = ______ Amount Due $_______________ __

Reviewed by: _____________________ Date :__________________________

1859

Oregon

Theodore R. Kulongoski, Governor

Water Resources Department
North Mall Office Building
725 Summer Street NE, Suite A
Salem, OR 97301-1266
503-986-0900
FAX 503-986-0904

NOTE TO APPLICANTS

In order for your application to be processed by the Water Resources Department (WRD), this Land Use Information Form must be completed by a local government planning official in the jurisdictions where your water right will be used and developed. The planning official may choose to complete the form while you wait, or return the receipt stub to you. Applications received by WRD without the Land Use Form or the receipt stub will be returned to you.

NOTE TO LOCAL GOVERNMENTS

The person presenting the attached Land Use Information Form is applying for a water right. The Water Resources Department (WRD) requires its applicants to obtain land-use information to be sure the water rights do not result in land uses that are incompatible with your comprehensive plan.   Please complete the form or detach the receipt stub and return it to the applicant for inclusion in their water right application. You will receive notice once the applicant formally submits his or her request to the WRD. The notice will give more information about WRD's water rights process and provide additional comment opportunities. You will have 30 days from the date of the notice to complete the land-use form and return it to the WRD. If no land-use information is received from you within that30-day period, the WRD may presume the land use associated with the proposed water right is compatible with your comprehensive plan.   Your attention to this request for information is greatly appreciated by the Water Resources Department. If you have any questions concerning this form, please contact the WRD's Customer Service Group at 503-986-0801.

Oregon Water Resources Department

Land Use Information Form

THIS FORM IS NOT REQUIRED IF: 1) water is to be diverted, conveyed, and/or used only on federal lands; or 2) the application is for a water-right transfer, allocation of conserved water, exchange, permit amendment, or ground water registration modification, and all of the following apply: a) only the place of use is proposed for change, b) there are no structural changes, c) the use of water is for irrigation, and d) the use is located in an irrigation district or exclusive farm-use zone.

Applicant Name:

Mailing Address:

City: State: Zip: Day Phone:

A. Land and Location

Please include the following information for all tax lots where water will be diverted (taken from its source), conveyed (transported), or used. Applicants for municipal use, or irrigation uses within irrigation districts may substitute existing and proposed service-area boundaries for the tax-lot information requested below.

Township	Range	Section	¼ ¼	Tax Lot #	Plan Designation (e.g. Rural Residential/RR-5)	Water to be:			Proposed Land Use:
						Diverted	Conveyed	Used	
						Diverted	Conveyed	Used	
						Diverted	Conveyed	Used	
						Diverted	Conveyed	Used	

List all counties and cities where water is proposed to be diverted, conveyed, or used.

B. Description of Proposed Use

Type of application to be filed with the Water Resources Department:

Permit to Use or Store Water
Water-Right Transfer
Exchange of Water
Allocation of Conserved Water
Limited Water Use License
Permit Amendment or Ground Water Registration Modification

Source of water: Reservoir/Pond Ground Water Surface Water (name)

Estimated quantity of water needed: ____________ cubic feet per second gallons per minute acre-feet

Intended use of water: Irrigation Commercial Industrial Domestic for ______ household(s)
Municipal Quasi-municipal Instream Other

Briefly describe:

Note to applicant: *If the Land Use Information Form cannot be completed while you wait, please have a local government representative sign the receipt below and include it with the application filed with the Water Resources Department.*

Receipt for Request for Land Use Information

State of Oregon
Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301-1266

For Local Government Use Only

The following section must be completed by a planning official from each county and city listed unless the project will be located entirely within the city limits. In that case, only the city planning agency must complete this form. This deals only with the local land-use plan. Do not include approval for activities such as building or grading permits.

Please check the appropriate box below and provide the requested information

Land uses to be served by proposed water uses (including proposed construction) are allowed outright or are not regulated by your comprehensive plan. Cite applicable ordinance section(s): ________________.

Land uses to be served by proposed water uses (including proposed construction) involve discretionary land-use approvals as listed in the table below. (Please attach documentation of applicable land-use approvals which have already been obtained. Record of Action/land-use decision and accompanying findings are sufficient.)**If approvals have been obtained but all appeal periods have not ended, check "Being pursued".**

Type of Land-Use Approval Needed(e.g. plan amendments, rezones, conditional-use permits, etc.)	Cite Most Significant, Applicable Plan Policies & Ordinance Section References	Land-Use Approval:	
		Obtained	Being pursued
		Denied	Not being pursued
		Obtained	Being pursued
		Denied	Not being pursued
		Obtained	Being pursued
		Denied	Not being pursued
		Obtained	Being pursued
		Denied	Not being pursued
		Obtained	Being pursued
		Denied	Not being pursued

Local governments are invited to express special land-use concerns or make recommendations to the Water Resources Department regarding this proposed use of water below, or on a separate sheet.

Name: Title:

Signature: Phone: Date:

Government Entity:

Note to local government representative: *Please complete this form or sign the receipt below and return it to the applicant. If you sign the receipt, you will have 30 days from the Water Resources Department's notice date to return the completed Land Use Information Form or WRD may presume the land use associated with the proposed use of water is compatible with local comprehensive plans.*

Receipt for Request for Land Use Information

Applicant name:

City or County: Staff contact:

Signature: Phone: Date:

GSI
Water Solutions, Inc.

Technical Memorandum

REGISTERED PROFESSIONAL
OREGON
JEFF BARRY
1206
GEOLOGIST
exp 6/2010

To: Said Amali, P.E./IRZ

From: Jeff Barry, R.G./GSI
Matt Kohlbecker, R.G./GSI

Date: August 6, 2009

Re: Umatilla Basin Regional Aquifer Recharge Project - Benefits and Uncertainties Evaluation, Task 3.C

1.0 Introduction

The Oregon Water Resources Department (OWRD) has designated four aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) due to their documented overdraft (OWRD 2003). As a result, use of additional groundwater for irrigation in these areas has been curtailed causing adverse impact to the economies of Umatilla and Morrow counties. Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability, an assessment is being completed to evaluate the feasibility of diverting water during high winter and spring flow periods from the Columbia and Umatilla Rivers and storing it in shallow sediment and deeper basalt aquifers. The stored water will be used for irrigation and to achieve environmental and other benefits. Figure 1 shows CGA boundaries.

This technical memorandum describes the methodology and results of our analysis of benefits and uncertainties associated with surface recharge projects in the Echo Meadows and County Line areas of Umatilla County, Oregon (Figure 1). This work fulfills Task 3.C of the scope of work for the Umatilla Basin Aquifer Recovery Assessment project. Previous work completed by IRZ Consulting, LLC (IRZ) identified Echo Meadows and County Line alluvial aquifers, where surface recharge may be conducted to achieve multiple benefits in the basin. At Echo Meadows, Umatilla River water would be conveyed through Hunt Ditch when water is available in the winter months and diverted into constructed infiltration basins that would recharge the underlying alluvial aquifer. IRZ (2009) estimates that up to 6,000 acre-feet per year may be infiltrated in this area based on available acreage for recharge and soil infiltration rates. In the County Line area, a surface recharge project has been ongoing since the 1970's whereby Columbia River water is conveyed in an irrigation canal operated by the County Line Water Improvement District (CLWID) and allowed to infiltrate and recharge the alluvial aquifer. IRZ (2009) has envisioned that this project would be expanded significantly to accommodate 10,000 to 50,000 acre-feet, and possibly as much as 100,000 acre-feet of recharge per year. Because of the uncertainty in the upper end of these figures, IRZ believes that the project should be developed in increments in order to better assess constraints.

Intended benefits of both projects include the following:

1. Additional alluvial groundwater can be pumped in the summer months for irrigation water supply that fulfills existing rights that have been curtailed in the critical groundwater areas.

2. Groundwater can be pumped from the alluvial aquifer downgradient of the recharge areas and used as source water for conducting ASR in the deep basalt aquifer.

3. Depleted groundwater levels can be restored.

4. Recharge water can be left in the alluvial aquifer for environmental benefits including increased discharge of cool groundwater to the Umatilla River.

2.0 Executive Summary

The timing and magnitude of potential benefits to the Umatilla River resulting from hypothetical groundwater recharge projects at Echo Meadows and County Line were simulated using simplified groundwater flow models. The ultimate project concept may change in scope and location; consequently, this modeling effort was performed to illustrate in general how the groundwater/surface water systems will be affected by artificial recharge. We want to emphasize that these models are highly simplified and uncalibrated; they are intended to help us understand what factors are most important for assessing benefits to the river, to help guide decision-making regarding how to design the recharge project to maximize benefits, and to help identify where we should focus future data collection efforts. We believe that the project can be designed to optimize benefits and minimize adverse impacts. Findings from the recharge simulations for each area are summarized as follows:

2.1 Echo Meadows

Recharge was simulated at Echo Meadows to evaluate the effect of artificial recharge on alluvial groundwater and the Umatilla River. Recharge was simulated at two locations in Echo Meadows—Field 1 (90 acres) and Field 6 (130 acres)—and simulation results indicate:

- Estimated recharge volumes for 90 acre (Field 1) and 130 acre (Field 6) recharge areas, assuming 75 percent of the water is pumped out, range from 1,500 to 4,650 acre-feet, respectively.
- Echo Meadows has limited storage potential for irrigation water supply during the irrigation season so the recovered water would have to be used primarily for deep basalt ASR source water.
- Artificial recharge causes a significant increase in groundwater discharge to the Umatilla River in August and September only if aquifer parameters have certain values. Specifically, the aquifer storage parameter, which is a measure of the volume of water taken into or released from the aquifer pore space, must be greater than 0.01. The aquifer storage parameter is a key variable that must be better defined by long-term aquifer testing.
  - Leaving 25% recharge water at Field 1 shows 20 – 30% increase in groundwater discharge in August to September relative to pre-recharge groundwater discharge.
  - Leaving 25% recharge water at Field 6 shows 50 – 75% increase in groundwater discharge in August to September relative to pre-recharge groundwater discharge.
- Benefits to the river increase when recharge occurs closer to river.
- Benefits to the river result from increased natural groundwater discharge to the river that is caused by an increase in the hydraulic gradient between the river and aquifer.
- Benefits to the river do not result from recharged water traveling to the river because the groundwater travel time is on the order of years, not months.
- Consideration should be given to specifically dedicating recharge sites for environmental benefits that are closer to the river and utilizing other recharge sites primarily for ASR source water.
- More acres are needed for surface recharge purposes than simulated in Echo Meadows in order to achieve measureable changes in river flow and to provide meaningful volumes for deep basalt ASR storage.

2.2 County Line

Recharge was simulated at County Line to evaluate the effect of artificial recharge on the Umatilla River flow and on groundwater levels at the Umatilla Army Depot. Two recharge options were evaluated (i.e., infiltrating 10,000 acre-feet and infiltrating 50,000 acre-feet), and simulation results indicate:

- The groundwater flux to the river is higher than pre-recharge conditions during most months of the year, including the critical months of August and September. The model results indicate that because of the long distance from the recharge area to the river, benefits to the river are relatively small on a percent basis (a few percent increase in groundwater discharge from pre-recharge conditions) and are spread out over a fairly large area. Additional data on groundwater flow direction and gradient are needed to better define the magnitude and location of the increased discharge to the river.

- The model indicates an increased benefit to the Umatilla River when an additional recharge basin is simulated near the river compared to recharge only at the simulated CLWID basin. In addition, locating the ASR source water wells and irrigation wells on the west (inferred upgradient) side of the CLWID recharge basin appears to increase discharge to the Umatilla River compared to wells located on the east (downgradient) side.

- Artificial recharge at County Line has a hydraulic effect on a groundwater plume at the Umatilla Army Depot. The maximum drawup (i.e., groundwater elevation increase) at the Umatilla Depot ranged from 1.1 to 5.3 feet (if water is not recovered), or 0.6 to 3.2 feet (if 75% of water is recovered). The scenarios in which recharge water is recovered are considered more appropriate to assessing hydraulic impacts to groundwater at the Umatilla Army Depot plume area. Pumping wells can be located so that groundwater level changes from recharge can be managed and impacts to the groundwater plumes are minimized.

2.3 Comparison Between Echo Meadows and County Line Simulations

The percent change in groundwater discharge to the Umatilla River is significantly lower at County Line, and is significantly higher at Echo Meadows. However, the total amount of groundwater flux to the river is substantially higher at County Line because substantially more water is being recharged. The significantly lower percent change in groundwater discharge at County Line is likely due to some combination of the following:

- Recharge basins at County Line (i.e., CLWID basin) are farther from the Umatilla River than recharge basins in Echo Meadows (i.e., Field 1 and Field 6). The greater distance between the river and recharge basin at County Line spreads out the effects of recharge and reduces the hydraulic impact of recharge on the River.

- The County Line simulations evaluate flux to the Umatilla River over a shorter length of the river relative to the Echo Meadows simulations.

2.4 Uncertainties and Data Gaps

The benefits evaluation has helped us to identify uncertainties and data gaps that should be addressed prior to moving forward with development of the project or with future groundwater modeling efforts:

- **Aquifer Characteristics.** Specifically, aquifer properties (i.e., the aquifer storage parameter), seasonal changes in groundwater gradient and flow direction, effects of the CLWID canal system, groundwater pumping (location and amount), and groundwater quality/variability.
- **Groundwater and Umatilla River Interaction.** Relationship of groundwater with the Umatilla River – where is the river gaining and losing and how much.
- **Soil Properties.** Specifically, soil infiltration rates and estimated recharge volumes in the area where future recharge projects may be located.
- **Relationship Between the Umatilla Army Depot and County Line Aquifer.** Groundwater conditions (e.g., aquifer properties, gradient, and flow direction) beneath the Umatilla Army Depot and its relationship to the County Line aquifer.

The recommended methodology and approach to addressing the data gaps in areas where future projects may be developed include the following:

- Multiple long-term aquifer tests (72 hours) to estimate aquifer transmissivity and storage parameter. Focus this work in areas where projects are likely to be constructed.
- Groundwater level monitoring network in County Line area and downgradient toward the Umatilla River.
- Paired stream and aquifer levels over time in areas downgradient of potential projects.
- Improved estimates of groundwater discharge to river (seepage run).
- Pumping rates and durations for existing wells.

- Soil infiltration tests in target areas.
- Groundwater quality sampling conducted in cooperation with Department of Environmental Quality (DEQ) Ground Water Management Area (GWMA) monitoring program in target recharge areas to assess areas impaired by agricultural activities.
- Continued long-term groundwater level and stream gauge monitoring.

3.0 Objectives

Our scope of work was intended to address the following objectives:

- Evaluate groundwater flow at the County Line and Echo Meadows alluvial aquifers and assess benefits and uncertainties associated with the artificial recharge (AR) projects.
- Develop preliminary groundwater flow models for the Echo Meadows and County Line alluvial aquifers and assess the effects of different recharge and extraction scenarios on the Umatilla River.
- Estimate the amount and timing of increased groundwater discharge to the Umatilla River resulting from groundwater recharge.
- Use the results to guide decisions about where recharge projects should be located to maximize benefits.
- Evaluate how recharge in the County Line area may affect groundwater levels near documented groundwater contamination at the Umatilla Army Depot.
- Identify uncertainties and data gaps in our analysis that can be addressed through additional data collection.

4.0 Approach

Our approach to the benefits and uncertainties analysis consisted of first developing a conceptual model of the groundwater systems in Echo Meadows and County Line areas using information developed by IRZ (2009) and the Oregon Water Resource Department (OWRD) (Grondin et al., 1995). We then developed a preliminary two dimensional numerical groundwater flow model for each area using the USGS modeling code MODFLOW (Echo Meadows) and WinFlow (County Line). These new models were developed because previous models (i.e., by IRZ and USGS) were either large scale or did not have the capability to simulate conditions necessary for this evaluation.

Models were used because we wanted to evaluate how changing aquifer parameters, boundary conditions, and recharge/pumping scenarios affected groundwater discharge to the Umatilla River. A groundwater flow model is well suited for this purpose because it can handle complex boundary conditions (e.g., Umatilla River) and offers significantly more flexibility for adjusting multiple parameters individually or simultaneously. We used a numerical groundwater flow model for Echo Meadows because we had a good understanding of groundwater flow direction, gradient, and boundary conditions. We used an analytical groundwater model for County Line because groundwater flow direction and gradient are not well understood. The analytical model is less sophisticated than MODFLOW and incorporates fewer site-specific details about the aquifer system; however, the analytical model can incorporate ambient groundwater flow, surface recharge features, and wells.

The Echo Meadows numerical groundwater model was used to simulate artificial recharge at two locations in Echo Meadows—Field 1 and Field 6. Field 6 was evaluated because it is located closer to the river, which allowed us to assess how relative distance from the river affects the timing of increased groundwater discharge. At each location, two recharge scenarios were evaluated. The first scenario simulated artificial recharge without recovery, and the second scenario simulated artificial recharge with 75% recovery of injected water. The second scenario showed that considerably more water could be recharged at Echo Meadows if groundwater pumping was conducted simultaneously. This is because groundwater levels are naturally high in Echo Meadows and pumping creates more “headroom” above the water table. Four model simulations were conducted for each scenario using a range of aquifer storage parameters reported for the area. Aquifer storage, also referred to as specific storage in confined aquifers, is the amount of water released by an aquifer for every 1 foot of water level change over a uniform cross sectional area. Aquifer storage was found to be a very sensitive aquifer parameter because it affects the timing and magnitude of recharge benefits to the river.

The simplified analytical two dimensional groundwater flow model for the County Line area was used to assess a range of possible flow directions, gradients, and effects from recharge. We used this model to calculate the magnitude and timing of groundwater discharge changes at the Umatilla River in response to infiltrating 10,000 acre-feet and 50,000 acre-feet of recharge water. We also used the model to assess how recharge might affect groundwater gradients in the vicinity of documented groundwater contamination at the Umatilla Army Depot, 2.5 miles to the north of the County Line recharge area (Figure 1). Changing groundwater gradients may affect groundwater flow direction and levels near these contaminant plumes and affect the plume movement. Consequently, we want to understand to what extent this could be a constraint on the project, and if it is, how might the project be designed to mitigate this.

We want to emphasize that both models are highly simplified and uncalibrated; they are intended to help us understand what factors are most important for assessing benefits to the river, to help guide decision-making regarding how to design the recharge project to maximize benefits, and to help identify where we should focus future data collection efforts.

Attachment A includes detailed descriptions of groundwater model setup, input parameters, assumptions, and model results for both the Echo Meadows and County

Line evaluations. Table 1 presents the recharge and pumping scenarios used in the model simulations at County Line and Echo Meadows.

Key assumptions made in the modeling exercises for both Echo Meadows and County Line include the following:

- The alluvial aquifer at Echo Meadows and County Line is horizontal and uniform in character.
- At County Line, the aquifer has infinite aerial extent and is not affected by irrigation ditches or the river.
- Assumed recharge water infiltration rates were estimated from available field testing data, which were limited. The maximum infiltration volumes calculated for Echo Meadows were determined by assuming a maximum water level rise of 10 feet due to the presence of shallow groundwater (otherwise flooding could occur). There was no maximum water level rise specified at County Line because flooding is not anticipated for the recharge rates tested.
- Regional irrigation pumping other than for recovery of recharged water is not included.
- Pumping wells used for recovery were assumed to be located at least 200 feet downgradient from the recharge areas. Pumping rates for individual wells were within the range of pumping rates that are typical for each area.
- In Echo Meadows, the recovery period was assumed to be at the same time as the recharge period because groundwater levels are typically high and there is insufficient room above the water table to store water. In this case, the recovered water is assumed to be used for ASR source water and not direct irrigation because pumping occurs prior to the irrigation season.
- At County Line, 50 percent of the pumped water was assumed to be directed to ASR storage between the months of March and April and 50 percent of the pumped water was assumed to be used for irrigation water supply during the irrigation season (May through September).

5.0 Findings and Results from Groundwater Modeling

Conceptually, infiltration and recharge of the shallow alluvial aquifer results in increased groundwater flow and discharge to the downgradient Umatilla River because the groundwater gradient has been increased by the recharge mound. Because the recharge areas are sufficiently far from the river and groundwater flow velocities are generally low, it is the increase in natural groundwater flow and not the discharge of stored water that creates the initial benefit to the river. With sufficient time, the recharge water would eventually discharge to the river. Benefits to the river and fish are maximized when the largest increase in groundwater discharge occurs between the months of August and September when river levels are at their lowest. Consequently, benefits to the Umatilla River in response to groundwater recharge are described in this memorandum in terms of the change in groundwater discharge to the river with time relative to natural (pre-recharge) conditions. Findings and results from groundwater modeling are discussed separately for Echo Meadows and County Line in the following sections.

5.1 Echo Meadows

The estimated percent change in groundwater discharge to the Umatilla River over time as a result of artificial recharge at Field 1 is shown in Figure 2 (recharge without recovery) and Figure 3 (recharge with 75% recovery) for several different aquifer storage parameters. Estimated percent change in groundwater discharge to the Umatilla River over time as a result of artificial recharge at Field 6 is shown in Figure 4 (recharge without recovery) and Figure 5 (recharge with 75% recovery) for several different aquifer storage parameters. The percent change in groundwater discharge is calculated by the following formula:

$$\text{Percent Change in Groundwater Discharge} = \frac{\text{Groundwater Discharge to River With Recharge}}{\text{Groundwater Discharge to River Prior to Recharge}}$$

The following conclusions are made based on the preliminary numerical groundwater model results for Echo Meadows:

- Estimated recharge volumes were two to three times higher when recovery occurred simultaneously with recharge. In addition, recharge volumes were higher when the storage parameter was higher because storage and head rise are inversely proportional (e.g., Driscoll, 1986). Significantly more recharge was able to occur at Field 6 (up to 3,000 acre feet for reasonably likely storage parameter values) relative to Field 1 (up to 750 acre feet for reasonably likely storage parameter values). This is primarily due to the larger area of Field 6 (130 acres) relative to the area of Field 1 (90 acres).

- Recharge volumes can be maximized by simultaneously extracting the recharged water. This water would be used for ASR source water because the water is being pumped outside of the irrigation season.

- Groundwater velocities in Echo Meadows alluvium are relatively low (on the order of a few feet per day), and water recharged near Hunt Ditch will not reach the Umatilla River for decades. The predicted increase in groundwater discharge to the river during artificial recharge is caused by an increase in the groundwater gradient between the recharge area and the river that is caused by mounding from artificial recharge.

- Because increased groundwater discharge to the Umatilla River is caused by the increased gradient between the recharge area and the river, recharge should occur as close to the river as possible, which would maximize the gradient between groundwater and the river and, therefore, would maximize benefit to the Umatilla River.

- Artificial recharge at Field 6 provides a larger increase in groundwater discharge to the river than artificial recharge at Field 1. This is primarily due to the greater recharge at Field 6, and the proximity of Field 6 to the river.

- The aquifer storage parameter is the most sensitive parameter affecting the magnitude and timing of recharge benefits to the river. Most recharge scenarios result in an increased groundwater discharge to the Umatilla River during the critical periods of August and September. Exceptions include scenarios with the aquifer storage value of 1×10^{-4} (considered to be too low and not representative of a semiconfined aquifer) and recharge simulations for Field 1 (located farthest from the river near Hunt Ditch) using a high aquifer storage value (0.22). Lower values for aquifer storage (less than 0.001) resulted in the maximum increase in groundwater discharge to the river during the months of January through April (and not during the ideal August – September timeframe that benefits fish).

- The simulations indicate that recharge results in increased groundwater discharge to the river; however, the resulting increase in river flow will likely be small and difficult to measure in the river because the total volume of water recharged in Echo Meadows is likely to be relatively small (less than 4,600 acre-feet in all simulations). Acreages dedicated to recharge and recharge volumes would have to be substantially greater (greater than 10,000 acre-feet) and closer to the river to cause measureable changes in river flow.

5.2 County Line

Various recharge/recovery scenarios were simulated with the model to estimate hydraulic impacts to the Umatilla River and groundwater at the Umatilla Army Depot. Each modeling scenario simulated aquifer response over a six year period with five yearly cycles of recharge/recovery. This allowed for evaluation of both annual impacts and longer term impacts to the aquifer and Umatilla River.

5.2.1 Umatilla River Simulations

A total of eight model simulations were conducted for the Umatilla River area by varying the recharge volume and recovery. In addition, the number of recharge basins was varied [i.e., recharge occurred only in the 162 acre CLWID basin, or in both the

CLWID basin in addition to the 18 acre Cottonwood basin (Figure 1)]. Hydraulic impact to the river was assessed by tracking the time at which the maximum drawup occurs at Cottonwood Bend. In addition, the increase in groundwater flux to the river was estimated on an annual basis and normalized to the baseline discharge to the river (i.e., discharge to the river prior to recharge). The annual flux increase is based on a six year simulation period with five years of recharge/recovery.

5.2.2 Hydraulic Impacts to Umatilla Army Depot Groundwater

A total of four simulations were conducted to evaluate the effect of artificial recharge on Umatilla Army Depot groundwater levels by varying the recharge and recovery volumes. Hydraulic impact to the Umatilla Army Depot groundwater levels was assessed by tracking the maximum increase in the water level (or drawup) and maximum change in the horizontal groundwater gradient. Table 2 summarizes the results from the Umatilla Depot model simulations.

Most model simulations located recovery wellfields (i.e., ASR and irrigation wells) on the downgradient (east) side of the CLWID basin. Two model scenarios (C′ and E′) relocate the ASR and irrigation wellfields on the west (upgradient) side of the CLWID basin away from the river. Table 3 summarizes the results from the river area model simulations.

The following conclusions are made based on the preliminary analytical groundwater model of the County Line Aquifer area:

- Hydraulic impacts to the Umatilla Army Depot groundwater were assessed by tracking the maximum water level increase (drawup) and maximum groundwater gradient increase at the Umatilla Army Depot plume area. On the basis of the preliminary modeling results, artificial recharge at County Line causes groundwater level changes at the Umatilla Army Depot plume area. Of the four model scenarios, the maximum water level increase (drawup) ranged from 1.1 to 5.3 feet (for recharge volumes of 10,000 and 50,000 acre-feet, respectively, with no recovery). When recharged water is recovered, the maximum water level increase was 0.6 and 3.2 feet for the 10,000 and 50,000 acre-feet recharge volumes, respectively. The scenarios in which recharge water is recovered are considered more appropriate to assessing hydraulic impacts to groundwater at the Umatilla Army Depot plume area. Simulation results indicate that pumping wells can be located between the Depot and recharge area so that groundwater gradient changes from recharge can be managed and impacts to the groundwater plumes are minimized.

- The groundwater flux to the river is higher relative to pre-recharge conditions during all months of the year, including the critical months of August and

September. The model results indicate that because of the long distance from the recharge area to the river, benefits to the river are relatively small on a percentage basis (a few percent increase in groundwater discharge) and are spread out over a fairly large area. Additional data on groundwater flow direction and gradient is needed to better define the magnitude and location of the increased discharge to the river.

- The model indicates an increased benefit to the Umatilla River when an additional recharge basin is simulated near the river compared to recharge only at the simulated CLWID basin. In addition, locating the ASR source water wells and irrigation wells on the west (inferred upgradient) side of the CLWID recharge basin appears to increase discharge to the Umatilla River compared to wells located on the east (downgradient) side.

- The percent change in groundwater discharge to the Umatilla River is significantly lower at County Line, and is significantly higher at Echo Meadows. However, the total amount of flux to the river is substantially higher at County Line because substantially more water is being recharged. The significantly lower percent change in groundwater discharge at County Line is likely due to some combination of the following:

    - Recharge basins at County Line (i.e., CLWID basin) are farther from the Umatilla River than recharge basins in Echo Meadows (i.e., Field 1 and Field 6). The greater distance between the river and recharge basin at County Line spreads out the effects of recharge and reduces the hydraulic impact of recharge on the River.

    - The County Line simulations evaluate flux to the Umatilla River over a shorter length ort river relative to the Echo Meadows simulations.

6.0 Uncertainties and Data Gaps

The benefits evaluation has helped us to identify uncertainties and data gaps that should be addressed prior to moving forward with development of the project or with future groundwater modeling efforts. Resolution of these uncertainties will enable us to optimize the design of the project, address constraints and impacts, and better evaluate and quantify environmental benefits. If funds from the state Water Development Fund are used for recharge projects in the basin, applicants will be required to dedicate 25 percent of the new stored water for the purpose of providing net environmental public benefit or in-stream benefits. Furthermore, within 6 years of issuance of permits, water returning in-stream will have to be identified and "protected". In our opinion, it is unlikely that water level or streamflow monitoring alone will be sufficient to identify the water that is to be "protected" instream. We anticipate that it will be necessary to develop a fully calibrated groundwater flow model to make this demonstration and that in order to do this, the data gaps identified below must be addressed.

Uncertainties and data gaps that have been identified as part of this project and discussed previously in this memorandum include the following:

- **Aquifer Characteristics.** Specifically, aquifer properties (i.e., the aquifer storage parameter), seasonal changes in groundwater gradient and flow direction, effects of the CLWID canal system, groundwater pumping (location and amount), and groundwater quality/variability.
- **Groundwater and Umatilla River Interaction.** Relationship of groundwater with the Umatilla River – where is the river gaining and losing and how much.
- **Soil Properties.** Specifically, soil infiltration rates and estimated recharge volumes in the area where future recharge projects may be located.
- **Relationship Between the Umatilla Army Depot and County Line Aquifer.** Groundwater conditions (e.g., aquifer properties, gradient, and flow direction) beneath the Umatilla Army Depot and its relationship to the County Line aquifer.

The recommended methodology and approach to addressing the data gaps in areas where future projects may be developed include the following:

- Multiple long-term aquifer tests (72 hours) to estimate aquifer transmissivity and storage parameter. Focus this work in areas where projects are likely to be constructed.
- Groundwater level monitoring network in County Line area and downgradient toward the Umatilla River.
- Paired stream and aquifer levels over time in areas downgradient of potential projects.
- Improved estimates of groundwater discharge to river (seepage run).
- Pumping rates and durations for existing wells.
- Soil infiltration tests in target areas.
- Groundwater quality sampling conducted in cooperation with DEQ's GWMA monitoring program in target recharge areas to assess areas impaired by agricultural activities.
- Continued long-term groundwater level and stream gauge monitoring.

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Table 1. Recharge and Pumping Scenarios Used in Recharge Simulations

Umatilla Basin Recharge Project

Location	Recharge			Pumping (75% of Recharge)			Environmental Benefit	
	Area (acres)	Volume (ac-ft)	Period	Number Wells	Total Rate (gpm)	Volume (ac-ft)	Percent of Recharge Water Vol. %	Volume (ac-ft)
Echo Meadows								
Field 1	90	600 to 1,500	Jan to April	3	850 to 2,100	450 to 1,125	25%	150 to 375
Field 6	130	1,800 to 4,650	Jan to April	4	2,500 to 6,600	1,350 to 3,488	25%	450 to 1,163
County Line								
Option 1	162 to 180	10,000	Jan to April	14	14,100	7,500	25%	2,500
Option 2	162 to 180	50,000	Jan to April	67	70,700	37,500	25%	12,500

Note:

ac-ft = acre feet

gpm = gallons per minute

Table 2. Umatilla Army Depot Simulations - County Line

Umatilla Basin Recharge Project

Model Simulation	Recharge Volume (ac-ft)	Recovery	Maximum Drawup (ft)	Maximum Change in Groundwater Gradient (ft/ft)
Plume - A	10,000	no	1.1	1.20E-04
Plume - B	50,000	no	5.3	5.80E-04
Plume - C	10,000	yes	0.6	9.00E-05
Plume - D	50,000	yes	3.2	4.50E-04

Note:

ac-ft=acre feet

cfs = cubic feet per second

Table 3. River Area Simulations - County Line
Umatilla Basin Recharge Project

Model Simulation	Recharge Volume (ac-ft)	Number of Basins	Recovery	Maximum Drawup (ft)	Time of Maximum Drawup	Maximum Percent Change in GW Flux to Umatilla River (%)
River – A	10,000	1	no	0.3	24-Aug	1.03%
River – B	10,000	2	no	1.3	1-May	2.63%
River – C	10,000	1	yes	0.2	26-May	0.07%
River – C’	10,000	1	yes	0.3	10-Jul	0.49%
River – D	50,000	1	yes	0.9	26-May	0.36%
River – E	10,000	2	yes	1.3	1-May	1.33%
River – E’	10,000	2	yes	1.4	1-May	2.10%
River – F	50,000	2	yes	6.6	1-May	6.67%

Note:
ac-ft = acre feet
ft = feet
Recovery wells located on west side of CLWID basin for scenarios C’ and E’

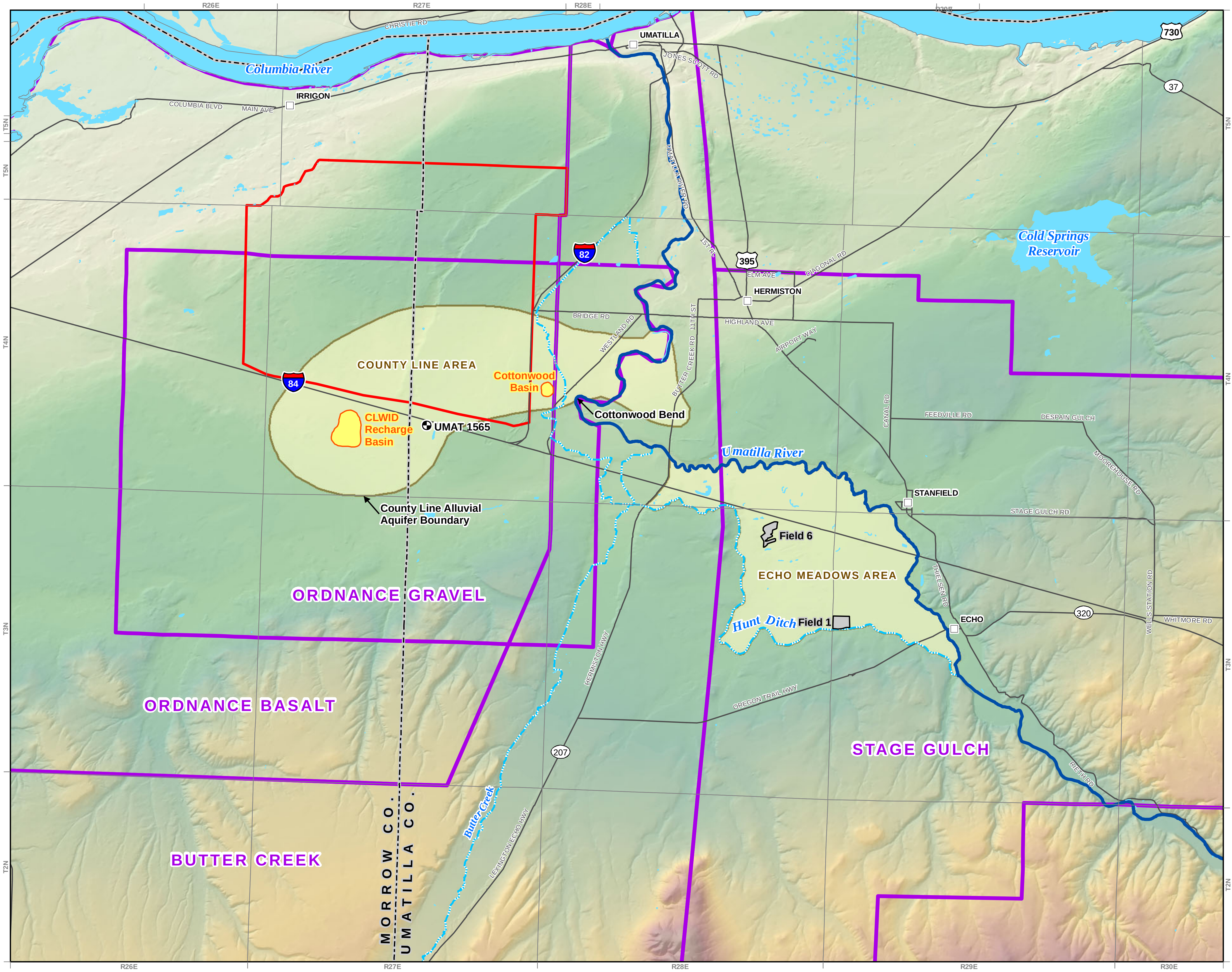


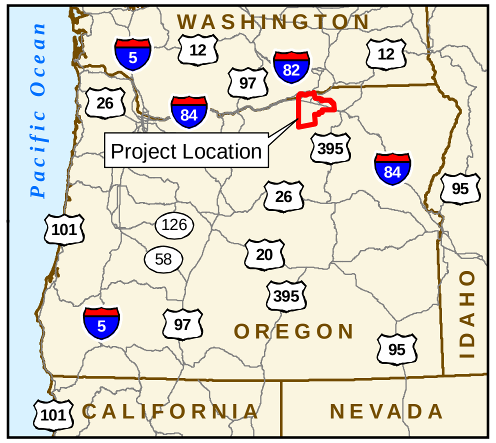
FIGURE 1

Project Area

Umatilla Basin Recharge Project

LEGEND

- ▭ Aquifer Recharge Opportunity Areas
- ▭ Potential Recharge Basins
- ▭ 2008 Recharge Fields
- ▭ Umatilla Army Depot
- ▭ Critical Groundwater Areas
- ◐ UMAT 1565
- ☐ Cities
- ⬚ Counties
- ☐ Township and Range
- ╱╲ Highways and Major Roads
- ∼ Umatilla River
- ∼ Major Watercourses
- ● Waterbodies



N

Scale
1:126,720

0 1 2 3 4
Miles

MAP NOTES:
Projection: Universal Transverse Mercator
Datum: North American Datum of 1983
Date: August 6, 2009
Data Sources: IRZ, Oregon Geospatial Data Clearinghouse, OWRD, USGS, ESRI

GSI Water Solutions, Inc.

File Path: \\pdx\Projects\290 - Umatilla\001 - Umatilla Basin Critical Area Recharge Project\Project_GIS\Project_mxds\Benefits_Analysis\Figure1_Project_Area.mxd, Date: August 6, 2009 9:30:55 AM

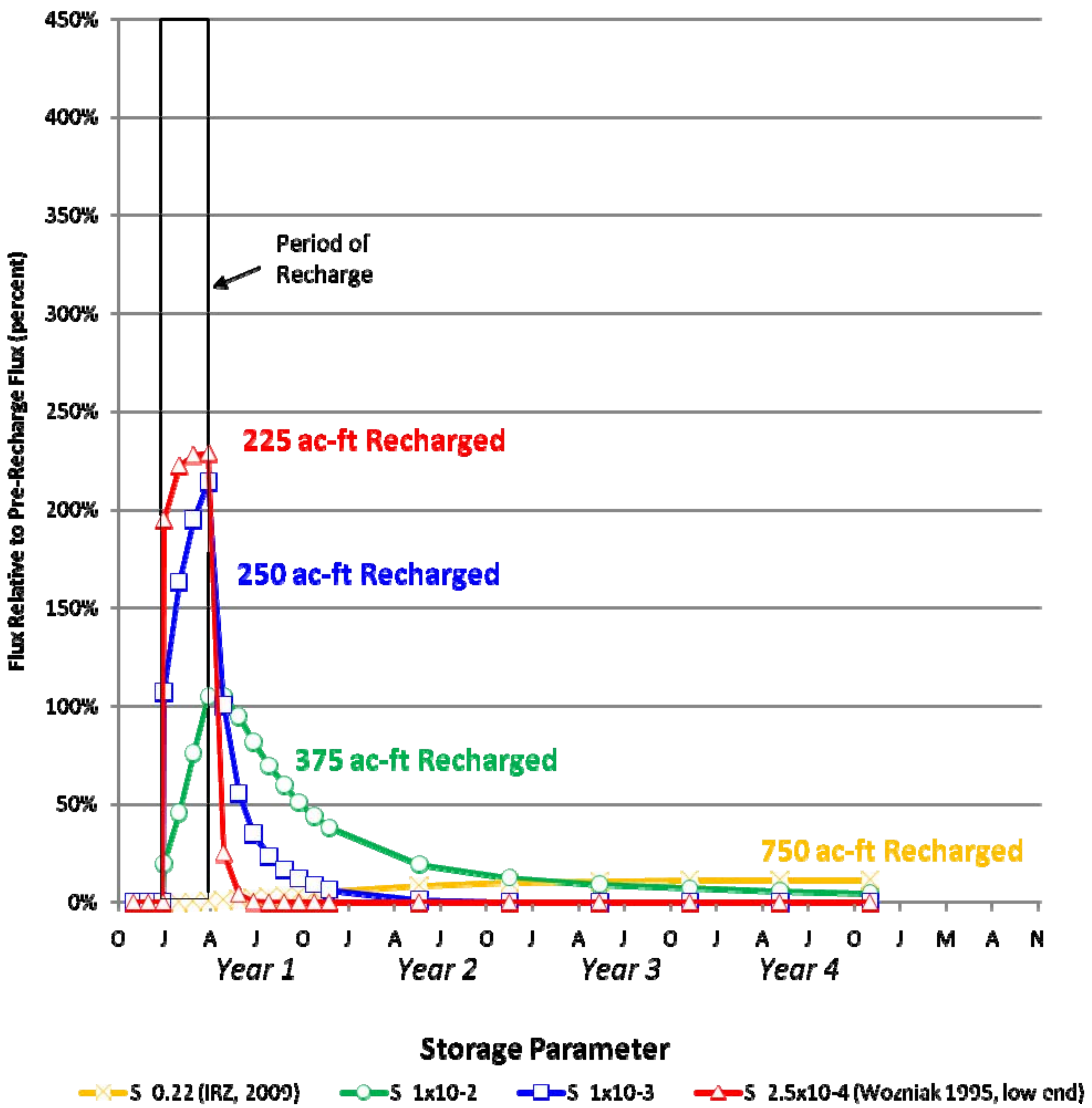


FIGURE 2

Percent Change in Groundwater Flux to the Umatilla River, Field 1, No Recovery

Umatilla Basin Recharge Project

Note:
Percent change is relative to pre-recharge groundwater discharge to Umatilla River

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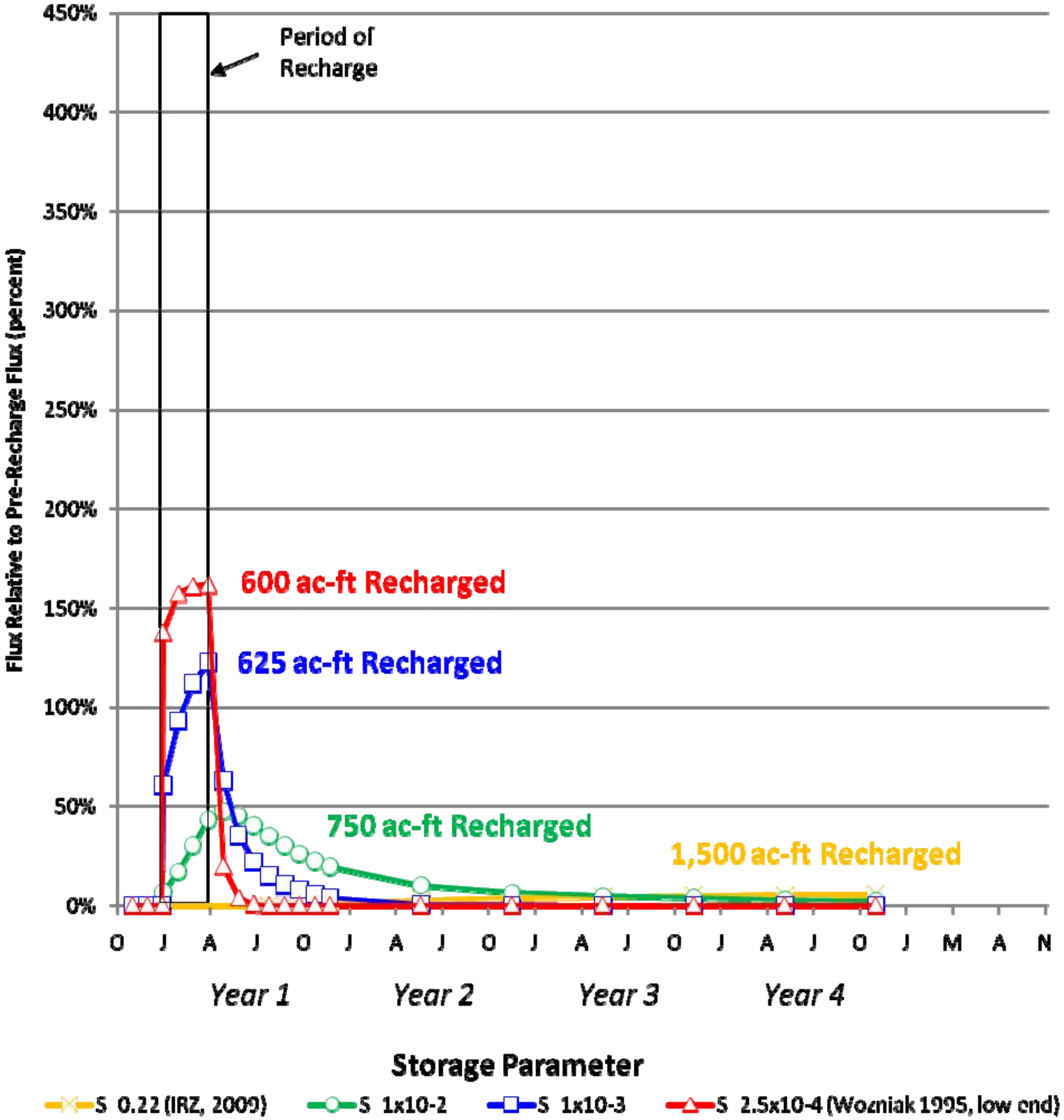

FIGURE 3

Percent Change in Groundwater Flux to the Umatilla River, Field 1, Recover of 75% of Recharge Water

Umatilla Basin
Recharge Project

Note:
Percent change is relative to pre-recharge groundwater discharge to Umatilla River

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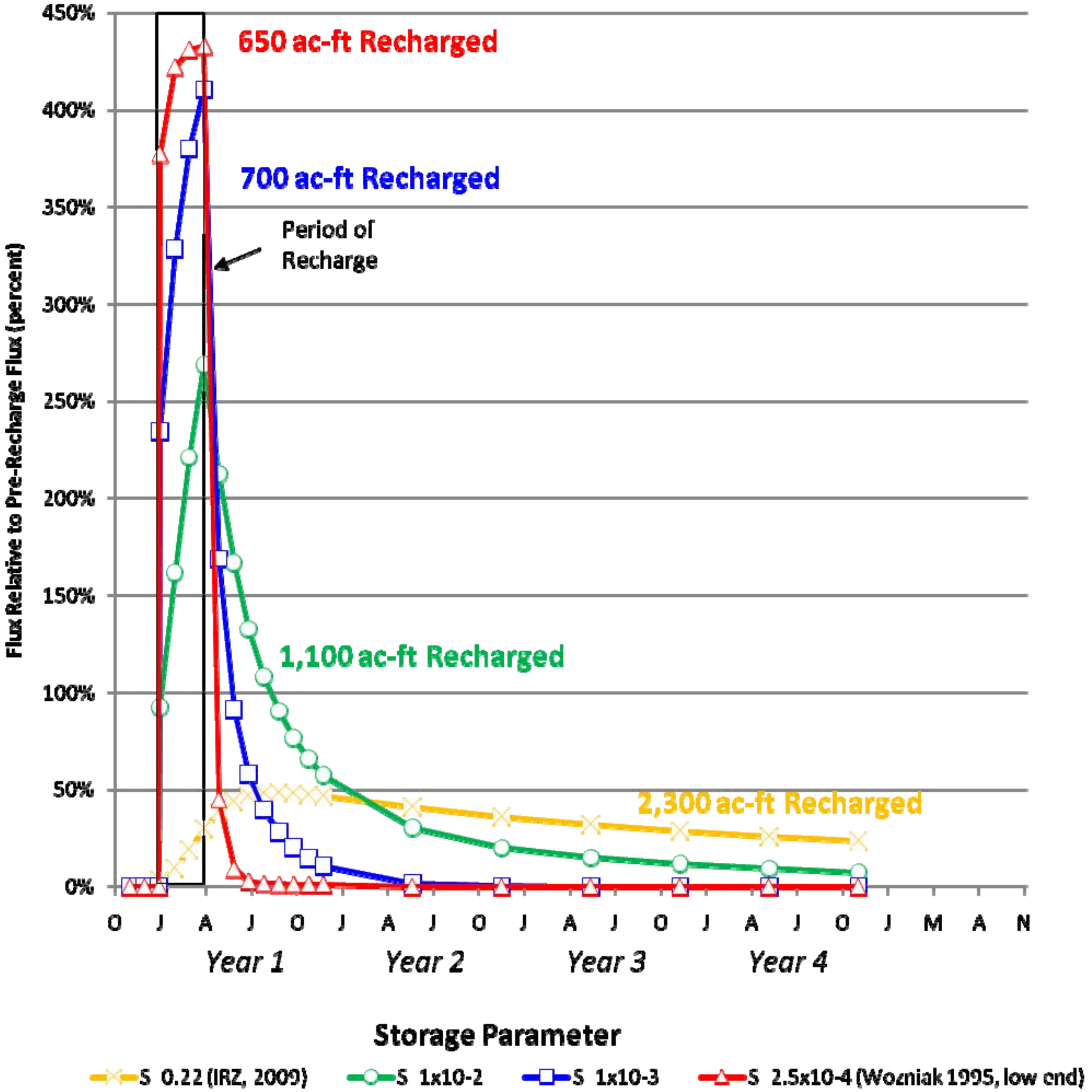

FIGURE 4

Percent Change in Groundwater Flux to the Umatilla River, Field 6, No Recovery

Umatilla Basin
Recharge Project

Note:
Percent change is relative to pre-recharge groundwater discharge to Umatilla River

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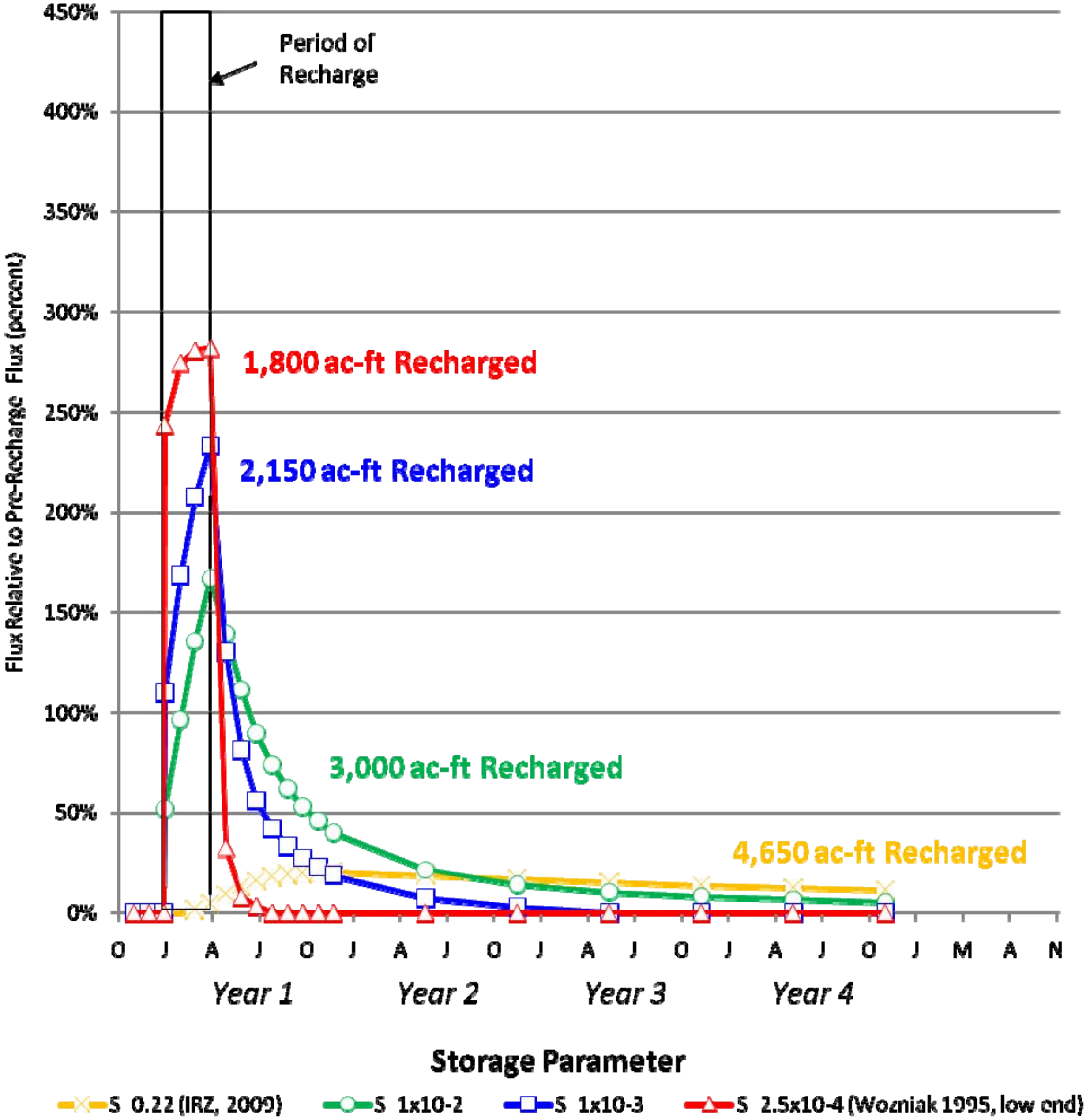

FIGURE 5

Percent Change in Groundwater Flux to the Umatilla River, Field 6, Recover of 75% of Recharge Water

Umatilla Basin
Recharge Project

Note:
Percent change is relative to pre-recharge groundwater discharge to Umatilla River

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Attachment A

Groundwater Modeling Methodology

Echo Meadows Groundwater Modeling

A preliminary numerical groundwater model was developed for evaluation of artificial recharge in Echo Meadows, Umatilla County, Oregon. The model simulates groundwater flow and groundwater-surface water interaction in the Echo Meadows alluvial aquifer, and was created with the United States Geological Survey (USGS) finite-difference groundwater flow code MODFLOW. The goals of developing a preliminary numerical groundwater model were to:

- Evaluate the affect of artificial recharge on groundwater flux to the Umatilla River,
- Evaluate the timing of artificial recharge benefit to the Umatilla River (specifically, does benefit occur from August to September, a critical time for fish migration),
- Estimate the volume of water that could feasibly recharge the alluvial aquifer at Echo Meadows, and
- Identify data gaps that need to be filled for finalization of the model.

Only a preliminary groundwater model was developed. Significant uncertainties exist in model parameters (specifically, storage and river flux parameters) and model design (specifically, whether the alluvium is homogeneous or should be split into a fine-grained and coarse grained facies). Moreover, the groundwater model has not been calibrated. Therefore, the goals of modeling discussed above cannot yet be fully realized. However, the preliminary groundwater model was used to simulate groundwater conditions in Echo Meadows in order to identify data gaps and to obtain a preliminary understanding of artificial recharge. This technical memorandum documents the preliminary groundwater model setup and preliminary results.

Geology and Hydrogeology

Echo Meadows geology and hydrogeology have been documented by IRZ (2009). This section briefly summarizes and expands upon portions of IRZ (2009) relevant to the model.

Geology

Geology in Echo Meadows is consists of basalt of the Columbia River Basalt Group overlain by Quaternary Alluvium. The basalt is covered by the alluvium except in the western portion of Echo Meadows, where basalt crops out at Emigrant Butte.

Generally, the alluvium is 30 to 35 feet thick in the southern portion of Echo Meadows, and is up to 150 feet thick in the northern portion of Echo Meadows.

Hydrogeology

Groundwater in Echo Meadows occurs in the Quaternary Alluvium and Basalt bedrock. The basalt bedrock and alluvium are considered separate aquifers because groundwater elevations in basalt and alluvium exhibit significant differences. Because artificial recharge will occur in the Alluvium of Echo Meadows, the model simulates groundwater flow in the Alluvium.

The Alluvium is saturated in the valley floor and is generally unsaturated south and west of Hunt Ditch (with the exception of Spike Gulch and Stage Gulch). Groundwater flows towards the north-northwest, from Echo towards the I-84 and Highway 207 intersection where groundwater exits Echo Meadows. Most groundwater flow in Echo Meadows Alluvium occurs in gravel lenses interbedded with sand. Because water levels in the gravel lenses rise above the tops of the gravel lenses, and because the sand allows water to slowly recharge the gravel lenses, the aquifer in Echo Meadows is considered semiconfined.

Figure A.1 shows sources of groundwater recharge and discharge to the Echo Meadows alluvial aquifer. The groundwater system is recharged by aerial precipitation, irrigation return, inflow from Spike Gulch and Stage Gulch, inflow from Hunt Ditch (an unlined irrigation canal), and the Umatilla River upstream of Stanfield. Groundwater discharges to the Umatilla River downstream of Stanfield, and flows out of Echo Meadows near the Highway 207 and I-84 intersection, where the alluvium is bounded by basalt bedrock. Groundwater also exits the Echo Meadows alluvial aquifer by domestic and irrigation pumping. The magnitudes of these fluxes are discussed in the "Initial Model Parameters" section.

Groundwater Flow Model

This section documents model boundaries, the model code, model discretization, and initial model parameters for the Echo Meadows numerical groundwater model.

Model Boundaries

Model boundaries are shown in Figure A.2, and are discussed below:

- According to Grondin et al. (1995), groundwater divides are present along the margins of Echo Meadows. Because groundwater cannot flow across a groundwater divide, these groundwater divides were simulated at no-flow boundaries.

- The contact between the alluvium and basalt aquifers was simulated as a no-flow boundary.

- Hunt Ditch was simulated as a specified flux boundary using the Well package.

- The Umatilla River was simulated as a head-dependent flux boundary using the River Package.

- The Emigrant Butte area, where groundwater exits Echo Meadows and flows westward and eventually northward towards Hermiston, was simulated as a constant head boundary. The constant head was based on December 2008 groundwater elevation measurements by IRZ (2009).

Model Code

Groundwater flow was simulated using MODFLOW-2000, the USGS block centered, finite-difference groundwater flow modeling code (McDonald and Harbaugh, 1988). The pre conditioned conjugate gradient (PCG2) solver was used to solve for the head field. This solver is able to minimize local mass balance errors more efficiently than other solvers commonly used with MODFLOW (e.g., SOR solver, SIP solver). Groundwater Vistas version 5.30 was used for pre and post processing of model data.

Model Discretization

MODFLOW simulates groundwater flow by discretizing an aquifer into cubes (i.e., cells), and balancing mass flux between the cubes. Spatial discretization of the numerical groundwater model is summarized in Table A.1.

Grid design is based on groundwater flow direction and alluvial aquifer geometry. The model grid was oriented so that the principle directions of groundwater flow are orthogonal to cell faces. In addition, because artificial recharge will occur on the Echo Meadows valley floor, the cell size was refined from 1,320 feet on a side on the model margins to 660 feet on a side in the Echo Meadows valley floor. This cell size was chosen because it matched the resolution of model data, and was an appropriate cell size for simulating the geometry of Hunt Ditch and the Umatilla River.

Because the numerical groundwater model simulated transient aquifer conditions, it was also necessary to use temporal discretization. Temporal discretization is summarized in Table A.2.

The model simulated groundwater flow for 5 years using 60 month-long stress periods. The pre-recharge period lasts one year, represents baseline conditions, and is used to evaluate changes to the Echo Meadows aquifer system after artificial recharge begins.

The recharge period lasts four months (January through April) and represents the time that artificial recharge occurs. The post-recharge period represents the time over which the effects of artificial recharge are observed.

MODFLOW allows aquifers to be simulated as unconfined or confined. The alluvial aquifer was simulated as unconfined (LAYCON=1), and semi-confined conditions were created by using a low specific yield value (see Initial Model Parameters). Flux between cells was calculated using harmonic mean averaging of hydraulic conductivities. If a cell became dry during the solving process, the dry cell was allowed to become wet again (IWDFLG not 0) if heads in the surrounding cells and the cell below the dry cell were greater than 0.1 feet above the dry cell bottom elevation (WETDRY>0).

Global mass balance error for all stress periods was lower than the acceptable level of 1% suggested by Anderson and Woessner (1992), and the acceptable level of 0.1% suggested by Konikow (1978).

Initial Model Parameters

A numerical groundwater model simulates groundwater flow based on aquifer properties (i.e., model parameters). Initial model parameters were based on references, including Echo Meadows hydrogeologic studies (IRZ, 2009), regional groundwater studies (Grondin et al., 1995), and references (e.g., Anderson and Woessner, 1992). These initial model parameters will likely be refined during model calibration. Table A.3 summarizes initial model parameters. These parameters are discussed in detail in the following text.

Because the numerical groundwater model is preliminary, all model parameters were constant for all stress periods. When the model is finalized, parameters such as recharge and flux from Hunt Ditch may be varied to replicate seasonal changes.

Ground Surface Elevation and Model Bottom Elevation

Ground surface elevations were taken from a 10 meter USGS Digital Elevation Model (DEM). Model bottom elevation (i.e., alluvial sediment bottom elevation) was based on two sources. Grondin et al. (1995) was used to define model bottom elevation distal from Echo Meadows, and drillers' logs obtained online from OWRD (2009) were used to define model bottom elevation in Echo Meadows.

Hydraulic Conductivity

Hydraulic conductivity is a coefficient of proportionality governing the permeability of a porous medium (Fetter, 1994). Hydraulic conductivity was isotropic in the x and y directions. A horizontal hydraulic conductivity of 180 feet per day was used in the numerical groundwater model (Table A.3). This hydraulic conductivity is in the range of 100 to 400 feet per day in IRZ (2009) for "most areas" of Echo Meadows, and is consistent with published hydraulic conductivities for the lithologies observed in Echo Meadows Alluvium [i.e., “well sorted sand (3 ft/day to 280 ft/day)” and “well sorted gravel (28 ft/day to 2,800 ft/d)” (Fetter, pg. 98, 1994)].

Porosity

Total porosity is the dimensionless ratio of void space volume in sediment to total sediment volume, and effective porosity is the dimensionless ratio of void space volume to total sediment volume that is available to fluid flow (Fetter, 1994). Effective porosity is less than total porosity, and is approximately the same as specific yield. It is only necessary to specify effective porosity for numerical modeling purposes. Effective porosity was assumed to be 0.22 (IRZ, 2009).

Storage Parameter

The storage parameter used in the numerical groundwater model depends on whether the aquifer is unconfined or confined. Specific storage is used when an aquifer is confined, and is the amount of water taken into or released from storage per unit volume per unit head change. Specific yield is used when an aquifer is unconfined, and is the volume of water in soil that is released from storage under gravity drainage (Fetter, 1994). When an aquifer is categorized by the confined or unconfined end-member conceptual model, the storage parameter can be taken from published value for the aquifer lithology (e.g., sand, gravel, silt, etc.). However, the Echo Meadows aquifer is semi-confined, and the storage parameter must be estimated with a site specific, long-duration (i.e., 72 hour) constant rate pumping test. Because no long-duration aquifer tests have been conducted in the Echo Meadows alluvial aquifer, the preliminary numerical groundwater model was run with several different storage parameters, as shown in Table A.4. The storage parameter will need to be estimated with a long-term aquifer test prior to finalization of the preliminary numerical groundwater flow model.

River Package Parameters

Recharge and discharge to the Umatilla River were simulated using the River Package. The river package simulates flow between groundwater and a river based on river stage and groundwater elevation. If groundwater elevation is greater than river stage, then groundwater discharges to the river (i.e., a gaining river). If river stage is greater than groundwater elevation, then river water discharges to groundwater (i.e., a losing river). Table A.5 summarizes river package input parameters. Many of these parameters are initial estimates from references that would be refined during model calibration. However, flux between groundwater and surface water along the Umatilla River must be measured before the model can be calibrated.

Recharge Package Parameters

Recharge from precipitation is the quantity of rainfall or snowmelt that reaches the groundwater table after the occurrence of runoff and evapotranspiration, and was simulated using the recharge package. The recharge package simulates a constant flux to a model cell. Recharge was applied to the Echo Meadows Alluvial aquifer at a rate of 0.54 inches per year (0.000125 feet/day). This is within the range of 0.2 to 0.6 inches/year in the Echo Meadows area used in the Davies-Smith (1988) numerical groundwater model, and below the maximum recharge rate of 2 inches/year in Grondin et al. (1995).

Canal Leakage

Canal leakage occurs where canal water leaks through the bottom of unlined canals and recharges groundwater. Hunt Ditch is the only irrigation canal in Echo Meadows, and is estimated to lose 691,000 ft^3/d [8 cfs (cubic feet per second)] along the length of the canal in the model domain (i.e., from Echo to the intersection between Highway 207 and I-84) (personal communication, 2009). Because this loss includes losses to groundwater and evaporation, losses to evaporation were subtracted out based on average pan evaporation rates from 1928 to 1997 in Hermiston, Oregon (DRI, 2009) and a pan evaporation- free surface evaporation correction factor of 0.75 (Linacre, 2002). Therefore, canal leakage in the numerical groundwater model (i.e., 671,000 ft^3/d or 7.77 cfs) was slightly lower than the IRZ-measured value.

Model Simulations

This numerical groundwater model is preliminary, and needs to be calibrated before it can be used to fulfill the goals discussed previously. However, the model was used to simulate artificial recharge in Echo Meadows in order to obtain a preliminary understanding of aquifer response to artificial recharge, and to identify data gaps that must be filled in order to finalize the model.

Verification Simulations

Prior to simulating artificial recharge scenarios in Echo Meadows, the numerical groundwater model was verified against observed groundwater flow conditions in Echo Meadows. Model verification is a precursor to model calibration, and is conducted in order to ensure that a numerical model simulation is reasonably realistic. Results of model verification are presented in Table A.6, and indicate that:

- Simulated and observed downgradient boundary fluxes are similar. The agreement between simulated and observed flux indicates that the numerical groundwater model results are reasonably realistic.
- Simulated and observed horizontal hydraulic gradients are similar. The agreement between simulated and observed gradients indicates that the numerical groundwater model results are reasonably realistic.

- Simulated groundwater velocity (about 2 feet/year) is lower than the range of observed groundwater velocities [3.5 to 11.5 feet/year in IRZ (2009)]. The difference between simulated and observed groundwater velocity will be addressed during model calibration.

Figure A.3 shows simulated and observed groundwater elevation contours. Simulated groundwater elevations closely follow observed groundwater elevations at the downgradient edge of the model, but are approximately 10 feet too high in portions of the upgradient edge of the model. This error could be due to real-world heterogeneity not simulated by the model, Hunt Ditch contributing too much water to the aquifer system, or hydraulic conductivity in the model being too low. The error should be addressed as a part of model calibration.

Artificial Recharge Simulations

The numerical groundwater model was used to simulate artificial recharge at two locations in Echo Meadows—Field 1 and Field 6. At each location, two recharge scenarios were evaluated. The first scenario simulated artificial recharge without recovery, and the second scenario simulated artificial recharge with 75% recovery of injected water. As shown in Table A.7, four model simulations were conducted for each scenario based on the four values for storage parameters presented in Table A.4. The $S=0.22$ and $S=2.5\text{x}10^{-4}$ storage parameter scenarios are representative of the end-member unconfined and confined aquifer models, respectively. These end-member models are considered unlikely to apply to Echo Meadows, which is semiconfined. Therefore, the most likely storage parameter scenarios are represented by the $S=1\text{x}10^{-2}$ and $S=1\text{x}10^{-3}$ scenarios, which are representative of a semiconfined aquifer.

Recharge was applied continuously from January through April at a rate that would create 10 feet of mounding in the aquifer below the recharge field.

Field 1 Simulations

Table A.8 shows Field 1 artificial recharge simulations. Recharge volumes were significantly higher when recovery occurred simultaneously with recharge. In addition, recharge volumes were higher when the storage parameter was higher because storage and head rise are inversely proportional (e.g., Driscoll, 1986).

Figure A.4 shows particle traces during and after artificial recharge at Field 1. Particle traces are simulated by MODPATH, and each arrow represents on year of travel time. The total simulation time is 4 years, at which time the particles had traveled approximately 2,750 feet (or at an average velocity of 2.0 feet/year).

Percent change in groundwater flux to the Umatilla River over time as a result of artificial recharge at Field 1 is shown in Figure 2 (recharge without recovery) and Figure

3 (recharge with 75% recovery) for several different storage parameters. The percent change is relative to baseline groundwater discharge.

Field 6 Simulations

Table A.9 shows Field 6 artificial recharge simulations. Recharge volumes were significantly higher when recovery occurred simultaneously with recharge. In addition, recharge volumes were higher when the storage parameter was higher because storage and head rise are inversely proportional (e.g., Driscoll, 1986).

Percent change in groundwater flux to the Umatilla River over time as a result of artificial recharge at Field 6 is shown in Figure 4 (recharge without recovery) and Figure 5 (recharge with 75% recovery) for several different storage parameters.

County Line Groundwater Modeling

A preliminary analytical groundwater model was developed for evaluation of artificial recharge in the County Line area of Umatilla County, Oregon. The model simulates groundwater flow and groundwater-surface water interaction in the County Line alluvial aquifer using WinFlow groundwater flow modeling software. The goals of developing a preliminary analytical groundwater model were to:

- Estimate relative change in groundwater discharge at the Umatilla River in response to different recharge and extraction scenarios
- Evaluate the timing of artificial recharge benefit to the Umatilla River (specifically, does benefit occur from August through September, a critical time for fish migration)
- Estimate the ranges of water level and gradient change at the Umatilla Army Depot plume area

Model calibration and verification using observed data were not performed during model development since limited aquifer and river stage data are available for the area. However, the model results are intended for preliminary planning purposes and can be used to identify data gaps for future phases of the project. This section describes model development and simulation results.

Geology and Hydrogeology

The geology and hydrogeology of the County Line aquifer area has been documented by IRZ (2009).

Geology

Geology in the County Line aquifer area consists of basalt of the Columbia River Basalt Group overlain by alluvium. The basalt surface regionally dips from north to south towards the Columbia River. Superimposed on this general trend, a basalt ridge exists in the middle of the Umatilla Army Depot. The sediments overlying the basalt include lenticular deposits of sand, gravel, silt, and clay. The trough in the basalt surface that is adjacent to the ridge contains a significant accumulation of Pleistocene coarse-grained sand and gravel sediments. The presence of the trough and the coarse sediments appears to be the result of main-channel scouring and deposition from the Missoula floods. The alluvium above the basalt varies in thickness from approximately 100 to 200 feet.

Hydrogeology

In the County Line aquifer area, groundwater occurs in the alluvium and Basalt bedrock. The basalt bedrock and alluvium are considered separate aquifers because groundwater elevations in basalt and alluvium exhibit significant differences. Because artificial recharge is planned in the alluvium, the model simulates groundwater flow in the alluvium.

The total thickness of the County Line aquifer sediments is variable due to the varying elevation of the top of basalt and thickness of overlying fine-grained sediments across the area. The thickness of sediments in the aquifer varies from a low of approximately 64 ft near the southern boundary of the aquifer to a high of approximately 191 ft in the center of the area. The thickness of the unsaturated sediments varies from approximately 30 to 90 ft within the County Line aquifer.

The direction of groundwater flow is principally to the northeast toward the Umatilla River with some component to the northwest. A regional horizontal groundwater gradient of 12 ft per mile has been estimated in the vicinity of County Line; however, there is uncertainty in the site-specific flow direction and gradient due to the limited availability of spatial water level data. Hydraulic conductivity of the coarse sediments ranges from 1,000 to 4,000 ft/day, and storage coefficients range from 0.15 to 0.25 (IRZ, 2009).

Groundwater Flow Model

This section discusses the model code and input model parameters for the County Line analytical groundwater model.

Model Code

WinFlow groundwater flow modeling software (Environmental Simulations, Inc. Ver. 3) was selected for the County Line model. WinFlow is an analytical model that simulates two-dimensional flow for both steady-state or transient flow conditions. The effects of multiple analytical functions (recharge basins, pumping wells, line sources or sinks) on a uniform regional flow field are computed based on the principle of superposition. WinFlow includes the following simplifying assumptions:

1. Groundwater flow is horizontal and occurs in an infinite aquifer.
2. The horizontal groundwater gradient is initially constant.
3. Water is released instantaneously from storage with decline of hydraulic head.
4. The aquifer hydraulic conductivity is isotropic and homogeneous.
5. The base of the aquifer is horizontal and fixed at a given elevation.
6. All wells fully penetrate the aquifer and are 100% efficient.

Input Model Parameters

Most of the model input parameter values were based on information provided in IRZ (2009). These parameter values are preliminary and will likely be modified when additional data is collected from the County Line area.

Aquifer Parameters

Table A.10 summarizes the input values used for the model simulations and the rationale for the values.

Umatilla River

The Umatilla River between Cottonwood Bend and Bridge Road lies within the eastern portion of the County Line Alluvial Aquifer, as shown in Figure 1 (IRZ 2009). Although the reach of the river is circuitous, the model represented the river as a simple straight line having a reach length of 12,000 feet. Flux between the Umatilla River and County Line Alluvial Aquifer were recorded at the midpoint of this line. Actual flux to the river in the upriver area is expected to be higher compared to the downriver area because the recharge basins are located closer to the upriver portion. However, for the purposes of the modeling, the averaging simplification is expected to provide reasonable approximations of groundwater flux increases.

Umatilla Army Depot Contaminant Plume

A groundwater contaminant plume consisting of munitions related contaminants is located in the alluvial aquifer at the Umatilla Army Depot (IRZ 2009). The plume is located approximately 2.5 miles north of the County Line Water Improvement District (CLWID) recharge basin. The model was used to assess hydraulic impacts in this area, including head and groundwater gradient changes, for various recharge/recovery scenarios.

Recharge Basins

Two options for recharge basins were evaluated in the modeling. Option one consists of recharge in the CLWID basin only, and option two consists of recharge in the CLWID basin and the Cottonwood basin. The CLWID basin is located in the current CLWID recharge overflow ponds and the Cottonwood Basin was located in the Cottonwood Bend area approximately one-half mile west of the Umatilla River. Figure 1 shows the locations of these basins. Table A.11 summarizes the model input values associated with the basins.

ASR Wells and Irrigation

After infiltration, recharge water was recovered with ASR source water recovery wells and irrigation wells. The total available recovery volume was assumed to be 75% of the recharge volume. Of this total recovery volume, half was recovered with ASR wells and the other half with irrigation wells. The ASR source water recovery wells initially were modeled along a circular arc with a setback distance of 500 feet from the CLWID basin. The wells were equally spaced within the northeast quarter of the arc. The irrigation wells were initially modeled on a grid with 1,000 foot spacing between wells in the U1565 well area (see Figure 1). Later model simulations considered locating the ASR and irrigation wells on the opposite side of the CLWID basin further away from the Umatilla River.

For each of the recovery wells, the maximum pumping rate was assumed to be 1,500 gpm. Table A.12 summarizes the model input values associated with the recovery wells.

Model Simulations

Various recharge/recovery scenarios were simulated with the model to estimate hydraulic impacts to the Umatilla Army Depot plume area and the Umatilla River. It is important to note that model calibration and verification are typically performed before proceeding with model simulations. However, because the model results are intended for preliminary planning purposes and to identify data gaps for future phases of the project, calibration and verification were not performed.

Each modeling scenario consisted of simulated aquifer response over a six year period with five yearly cycles of recharge/recovery. This allowed for evaluation of both annual impacts and longer term impacts to the aquifer and Umatilla River.

Umatilla Depot Plume Area Simulations

A total of four model simulations were conducted for the Umatilla Army Depot plume area by varying the recharge volume and recovery. Hydraulic impact to the Umatilla Depot groundwater was assessed by tracking the maximum increase in the water level (or drawup) and maximum change in the horizontal groundwater gradient at the Depot. Plume area Table A.13 summarizes the results from the Umatilla Army Depot model simulations.

Umatilla River Simulations

A total of eight model simulations were conducted for the Umatilla River area by varying the recharge volume, number of recharge basins, and amount and location of recovery. Hydraulic impact to the river was assessed by tracking the time at which the maximum drawup occurs at Cottonwood Bend. In addition, the increase in groundwater discharge to the river (flux) was estimated on an annual basis and normalized to the baseline discharge to the river (i.e., discharge to the river prior to recharge). The annual flux increase is based on a six year simulation period with five years of recharge/recovery.

Two model scenarios (C′ and E′) relocate the ASR and irrigation wellfields on the opposite side of the CLWID basin away from the river. Table A.14 summarizes the results from the river area model simulations.

Table A.1. Preliminary Numerical Model Spatial Discretization - Echo Meadows

Umatilla Basin Recharge Project

Number of Layers	1
Number of Rows (*y* -direction)	71
Number of Columns (*x* -direction)	78
Total Number of Cells (Active and Inactive)	5,538
Total Number of Active Cells	2,777
x-direction cell width	660 feet (minimum) to 1,320 feet (maximum)
y-direction cell width	660 feet (minimum) to 1,320 feet (maximum)
Grid Rotation	0 degrees
Coordinate System	NAD 1983, Oregon State Plane North Zone, International Feet
Vertical Datum	1929 NGVD
Length Units	Feet
Time Units	Days

Note:

NAD = North American Datum

NGVD = National Geodetic Vertical Datum

Table A.2. Preliminary Numerical Model Temporal Discretization - Echo Meadows

Umatilla Basin Recharge Project

Recharge Status	Time	Stress Period Numbers	Stress Period Length	Transient / Steady State
Pre-Recharge	January 2009 to December 2009	1 to 12	28 to 31 days (varies)	Steady State
Recharge	January 2010 to April 2010	13 to 16	28 to 31 days (varies)	Transient
Post-Recharge	May 2010 to December 2013	17 to 60	28 to 31 days (varies)	Transient

Table A.3. Initial Model Parameters - Echo Meadows

Umatilla Basin Recharge Project

Parameter	Value	Reference
Horizontal Hydraulic Conductivity	180 ft/day	IRZ (2009)
Effective Porosity	0.22	IRZ (2009)
Storage Parameter	0.22 to 1×10^{-4}	Varies based on model simulation, see Table 4
Aerial Recharge	0.54 in/yr	Davies Smith et al. (1988)

Note:

ft/day = feet per day
in/yr = inches per year

Table A.4. Preliminary Numerical Model Storage Parameters - Echo Meadows

Umatilla Basin Recharge Project

Storage Parameter (dimensionless)	Source	Comments
0.2	IRZ (2009)	Value based on effective porosity of alluvial sediments, represents end-member unconfined aquifer model
1×10^{-2}		Intermediate value
1×10^{-3}		Intermediate value
1×10^{-4}	Table 2.1, Grondin et al. (1995)	Value based on aquifer testing by OWRD, represents end-member confined aquifer model

Note:

OWRD = Oregon Water Resources Department

Table A.5. River Package Input Parameters - Echo Meadows

Umatilla Basin Recharge Project

Parameter	Value	Comments
River Stage	545.99 to 638.87 ft amsl	Stage Measurements presented in IRZ (2009)
River Bottom Elevation	3 feet below river stage	
Width of River	62.5 ft	Measured from aerial photographs
Length of River	660 ft	Based on cell size
Thickness of River Bed	10 ft	Preliminary Value
Vertical Hydraulic Conductivity	0.01 ft/day	10% of horizontal hydraulic conductivity for a silt (Anderson and Woessner, pg. 40, 1992)
Conductance	41.25 ft^2/day	Calculated

Note:

ft amsl = feet above mean sea level

ft = feet

ft/day = feet per day

ft^2/day = square feet per day

Table A.6. Preliminary Numerical Model Verification - Echo Meadows

Umatilla Basin Recharge Project

Parameter	Simulated	Observed
Flux out of Echo Meadows	835,000 ft^3/d	920,000 ft^3/d [a]
Horizontal Hydraulic Gradient	0.0025	0.003
Groundwater Velocity	2.0 ft/year	3.5 to 11.5 ft/year

Note:

[a] Flux through gravel lenses at the gap near the I-84 and Highway 207 intersection where groundwater leaves Echo Meadows, calculated by Darcy's law. Gravel lens thickness was estimated by constructing a cross section based on well logs available from OWRD (2009). Groundwater velocity was taken as the median of the range presented in IRZ (2009) (i.e., 7.5 ft/day), and porosity was estimated as 0.22 (IRZ, 2009).

ft/year = feet per year

ft^3/day = cubic feet per day

Table A.7. Echo Meadows Model Simulations

Umatilla Basin Recharge Project

Artificial Recharge Field	Recovery	Storage Parameter	Model Simulation
Field 1	No	0.22	UMAscnA1s0.22
		1.0×10^{-2}	UMAscnA1s10-2
		1.0×10^{-3}	UMAscnA1s10-3
		1.0×10^{-4}	UMAscnA1s10-4
	Yes	0.22	UMAscnA2s0.22
		1.0×10^{-2}	UMAscnA2s10-2
		1.0×10^{-3}	UMAscnA2s10-3
		1.0×10^{-4}	UMAscnA2s10-4
Field 6	No	0.22	UMAscnB1s0.22
		1.0×10^{-2}	UMAscnB1s10-2
		1.0×10^{-3}	UMAscnB1s10-3
		1.0×10^{-4}	UMAscnB1s10-4
	Yes	0.22	UMAscnB2s0.22
		1.0×10^{-2}	UMAscnB2s10-2
		1.0×10^{-3}	UMAscnB2s10-3
		1.0×10^{-4}	UMAscnB2s10-4

Table A.8. Field 1 Model Simulations - Echo Meadows

Umatilla Basin Recharge Project

Simulation	Storage Parameter (-)	Area (acres)	Recharge Volume (ac-ft)	Recharge Rate (cfs)
Recharge Without Recovery				
UMAscnA1s0.22	0.22	90	750	3.15
UMAscnA1s10-2	1.0 x 10^{-2}	90	375	1.56
UMAscnA1s10-3	1.0 x 10^{-3}	90	250	1.05
UMAscnA1s10-4	1.0 x 10^{-4}	90	225	0.95
Recharge With Recovery				
UMAscnA2s0.22	0.22	90	1,500	6.3
UMAscnA2s10-2	1.0 x 10^{-2}	90	750	3.15
UMAscnA2s10-3	1.0 x 10^{-3}	90	625	2.63
UMAscnA2s10-4	1.0 x 10^{-4}	90	600	2.52

Note:

ac-ft = acre feet

cfs = cubic feet per second

Table A.9. Field 6 Model Simulations - Echo Meadows

Umatilla Basin Recharge Project

Scenario	Storage Parameter (-)	Area (acres)	Recharge Volume (ac-ft)	Recharge Rate (cfs)
Recharge Without Recovery				
UMAscnB1s0.22	0.22	130	2,300	9.66
UMAscnB1s10-2	2-Oct	130	1,100	4.62
UMAscnB1s10-3	3-Oct	130	700	2.94
UMAscnB1s10-4	4-Oct	130	650	2.73
Recharge With Recovery				
UMAscnB2s0.22	0.22	130	4,650	19.54
UMAscnB2s10-2	2-Oct	130	3,000	12.6
UMAscnB2s10-3	3-Oct	130	2,150	9.03
UMAscnB2s10-4	4-Oct	130	1,800	7.56

Note:

ac-ft = acre feet

cfs = cubic feet per second

Table A.10. Model Parameters - County Line

Umatilla Basin Recharge Project

Parameter	**Value**	**Rationale**
Horizontal Hydraulic Conductivity	2,500 ft/day	Average value from reported range (1,000 and 4,000 ft/day, Grondin et al., 1995)
Horizontal Groundwater Gradient	0.0023 ft/ft	(McCall 1975)
Groundwater Flow Direction	N45E	Although local water level data indicates a seasonally variable flow direction, regional flow in the alluvial aquifer is generally toward the northeast (Grondin et al., 1995)
Storage Parameter	0.2	Average value from reported range (0.15 and 0.25, Grondin et al., 1995)
Aquifer Thickness	plume scenarios: 125 ft river scenarios: 80 ft	Average aquifer thicknesses from geologic cross-sections (IRZ 2009)

Note:

ft/day = feet per day

ft/ft = feet per foot

Table A.11. Recharge Basin Parameter Values - County Line

Umatilla Basin Recharge Project

Parameter	Value	Comments
CLWID Basin		
Basin Area	162 acres	Circular area with radius of 1,500 feet
Annual Recharge Volume (single basin option)	10,000 ac-ft 50,000 ac-ft	Range of recharge volumes simulated
Recharge Volume (two basin option)	7,500 ac-ft 37,500 ac-ft	75% of single basin option
Recharge Time Period	120 days	January through April
Cottonwood Basin		
Basin Area	18 acres	Circular area with radius of 500 feet
Annual Recharge Volume (two basin option)	2,500 ac-ft 12,500 ac-ft	25% of single basin option
Recharge Time Period	120 days	January through April

Note:

ac-ft = acre feet

Table A.12. Recovery Wells - County Line

Umatilla Basin Recharge Project

ASR Wells		
Pumping Time Period	60 days	March through April
Annual Recovery Volume	3,750 ac-ft (Option 1) 18,750 ac-ft (Option 2)	Half of the 75% of recharge volume that is available for recovery
Number of Wells	10 (Option 1) 48 (Option 2)	Based on maximum well capacity of 1,500 gpm
Pumping Rate per Well	1,414 gpm (Option 1) 1,473 gpm (Option 2)	Wellfield total = 14,144 gpm Wellfield total = 70,719 gpm
Irrigation Wells		
Pumping Time Period	150 days	May through September
Annual Recovery Volume	3,750 ac-ft (Option 1) 18,750 ac-ft (Option 2)	Half of the 75% of recharge volume that is available for recovery
Number of Wells	4 (Option 1) 19 (Option 2)	Based on maximum well capacity of 1,500 gpm
Pumping Rate per Well	1,414 gpm (Option 1) 1,489 gpm (Option 2)	Wellfield total = 5,658 gpm Wellfield total = 28,288 gpm

Note:

amsl = above mean sea level

ft/day = feet per day

ft^2/day = square feet per day

Table A.13. Umatilla Army Depot Simulations - County Line

Umatilla Basin Recharge Project

Model Simulation	Recharge Volume (ac-ft)	Recovery	Maximum Drawup (ft)	Maximum Change in Groundwater Gradient (ft/ft)
Plume - A	10,000	no	1.1	1.20E-04
Plume - B	50,000	no	5.3	5.80E-04
Plume - C	10,000	yes	0.6	9.00E-05
Plume - D	50,000	yes	3.2	4.50E-04

Note:
ac-ft = acre feet
ft = feet
ft/ft = feet per foot

Table A.14. River Area Simulations - County Line

Umatilla Basin Recharge Project

Model Scenario	Recharge Volume (ac-ft)	Number of Basins	Recovery	Maximum Drawup (ft)	Time of Maximum Drawup	Maximum Percent Change in GW Flux to Umatilla River (%)
River – A	10,000	1	no	0.3	24-Aug	1.03%
River – B	10,000	2	no	1.3	1-May	2.63%
River – C	10,000	1	yes	0.2	26-May	0.07%
River – C’	10,000	1	yes	0.3	10-Jul	0.49%
River – D	50,000	1	yes	0.9	26-May	0.36%
River – E	10,000	2	yes	1.3	1-May	1.33%
River – E’	10,000	2	yes	1.4	1-May	2.10%
River – F	50,000	2	yes	6.6	1-May	6.67%

Note:

ac-ft/yr = acre feet per year

Recovery wells located on west side of CLWID basin for scenarios C’ and E’

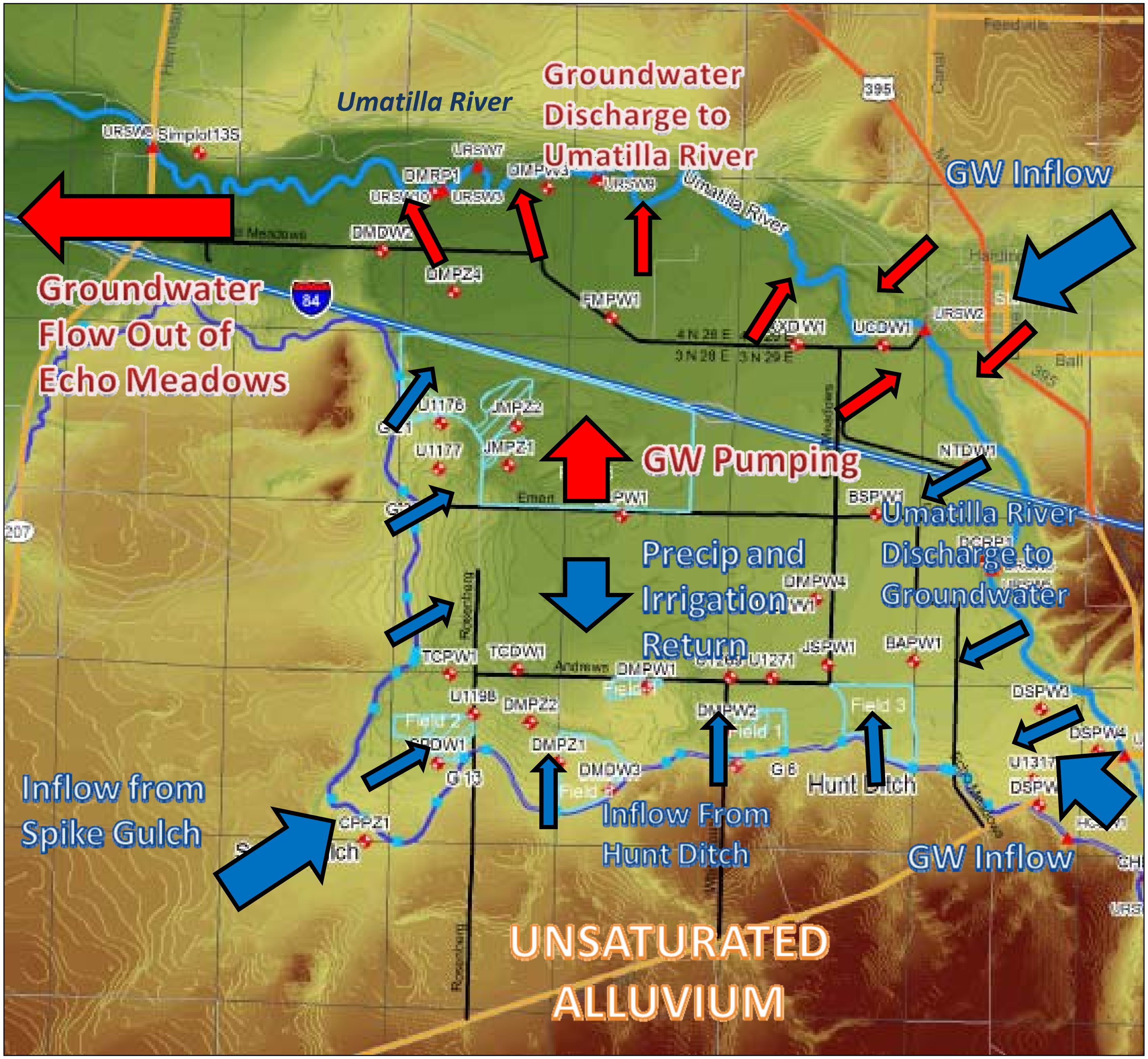


FIGURE A.1

Recharge and Discharge to Echo Meadows Alluvial Aquifer

Umatilla Basin Recharge Project

GSI Water Solutions, Inc.

P:\290 - Umatilla\001 - Umatilla Basin Critical Area Recharge Project\Report\Umatilla Benefits Memo\Figures

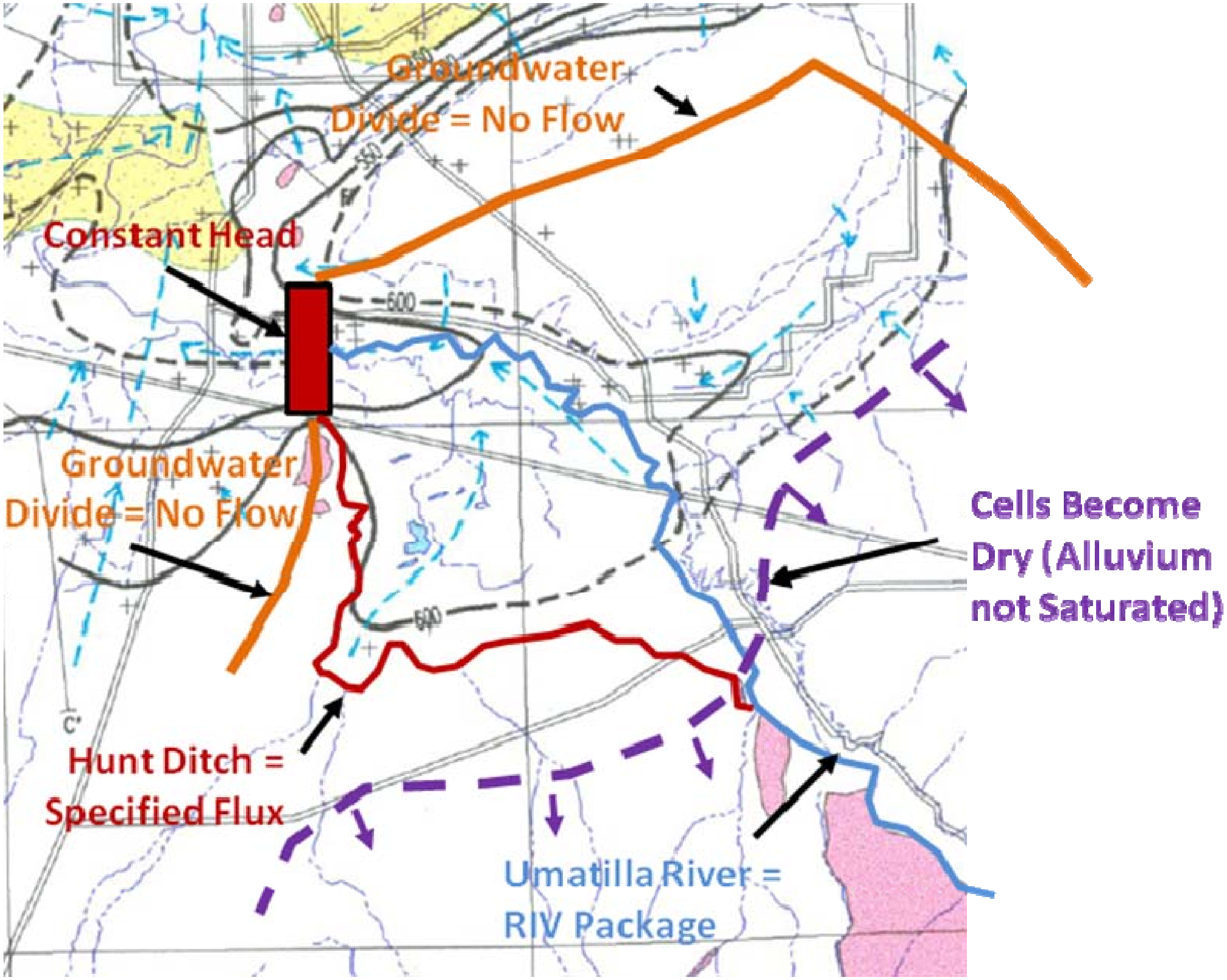


FIGURE A.2

Numerical Groundwater Model Boundaries

Umatilla Basin
Recharge Project

GSI Water Solutions, Inc.

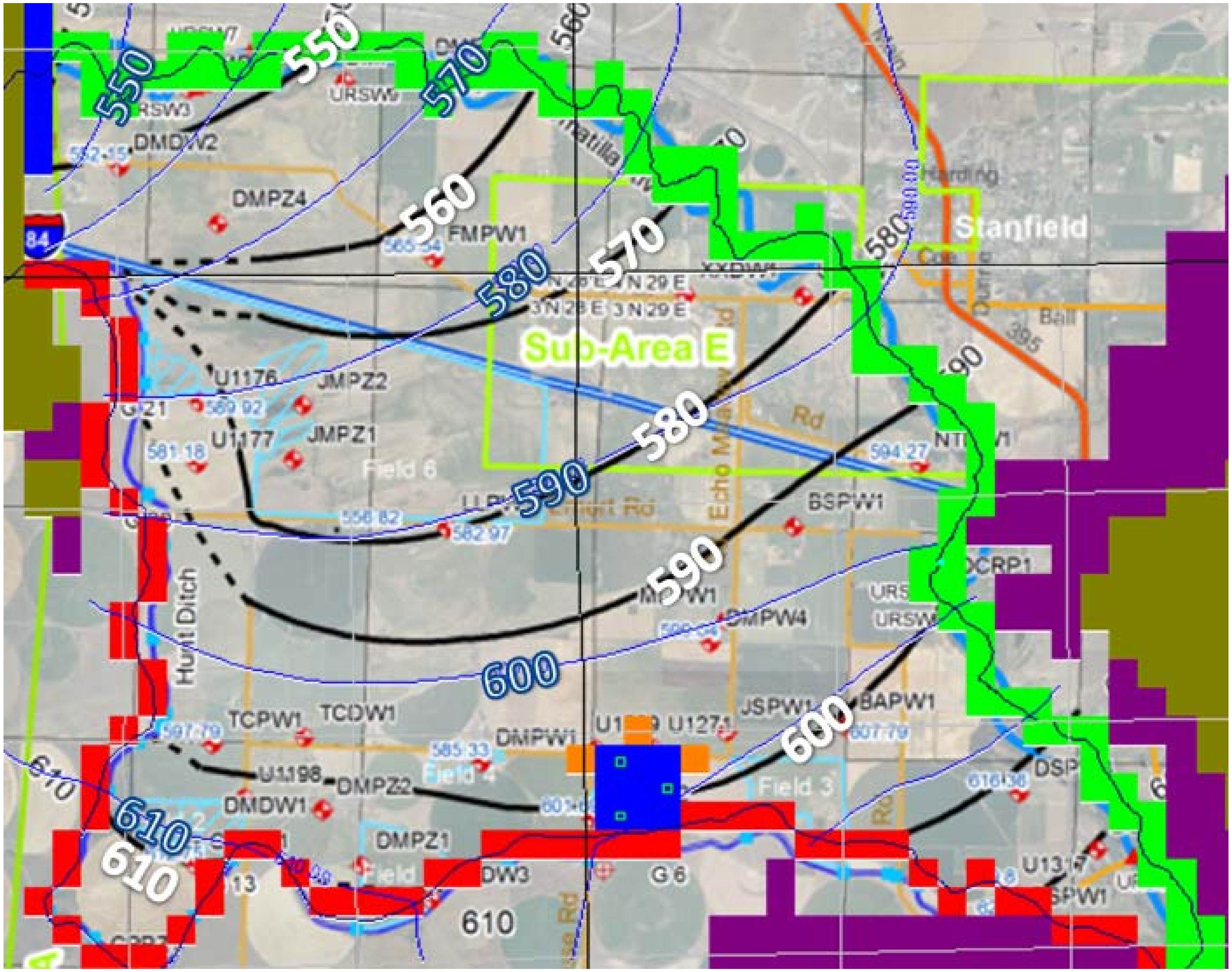


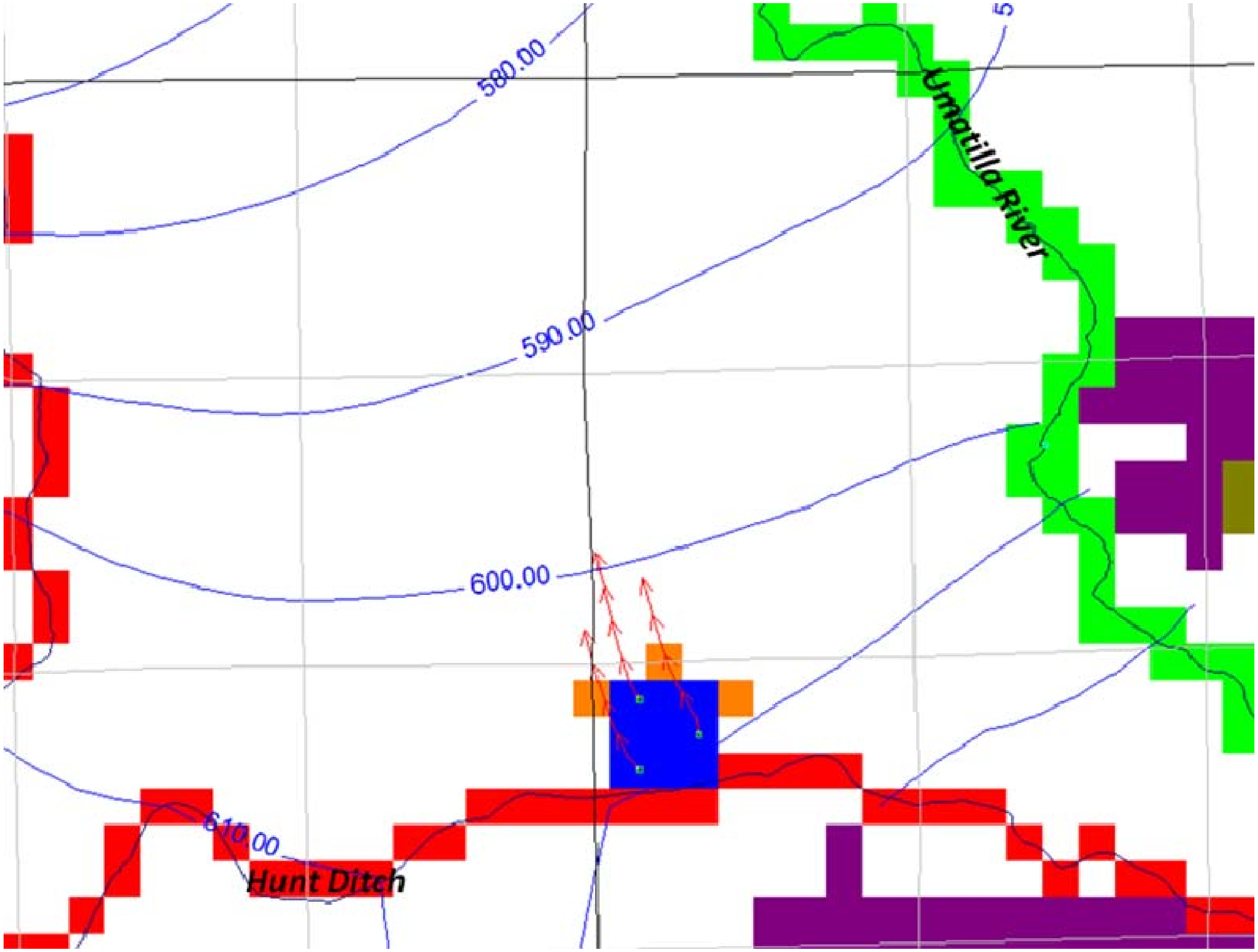
FIGURE A.3

Observed and Simulated Groundwater Elevation Contours

Umatilla Basin
Recharge Project

GSI Water Solutions, Inc.

Note:
Black = Measured Contours
Blue = Simulated Contours



Note:
Each arrow represents one year of travel time

FIGURE A.4

MODPATH Particle Tracks for Field 1

Umatilla Basin
Recharge Project

GSI Water Solutions, Inc.

U.S. ARMY UMATILLA CHEMICAL DEPOT
BASE REDEVELOPMENT PLAN

Planning the balance of
Economic Development
Environmental Protection
& Military Support

Umatilla Army Depot Reuse Authority

August 2010

Supported by the Dana Mission Support Team
"Solutions Planning for the Changing Environment of the Umatilla Chemical Depot"

"This study was prepared under contract with the Confederated Tribes of the Umatilla Indian Reservation, Oregon, on behalf of the Umatilla Army Depot Reuse Authority with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the UMADRA and does not necessarily reflect the views of the Office of Economic Adjustment."

ABSTRACT

For more than two decades county and regional leaders as organized by the State of Oregon and recognized by the Department of Defense (DoD) as the Umatilla Army Depot Reuse Authority (UMADRA – LRA), have been studying and preparing for the eventual closure of the Umatilla Army Depot. From August 2009 through August 2010 the LRA and its support contractor, Dana Mission Support Team, devoted over 10,000 hours to the development of a Redevelopment Plan, Implementation Strategy, and a Homeless Assistance Plan that fulfills the requirements of the DoD and Department of Housing and Urban Development (HUD) Base Realignment and Closure (BRAC) process.

Closure realignment of the Umatilla Army Depot represents a significant challenge due to a variety of factors. Much of the Depot's infrastructure and buildings are 70 years of age in generally poor condition. Moreover, many of the Depot's structures and land area has been developed for unique military applications not easily converted to civilian use, and in some circumstances represent continuing environmental liabilities. The Depot in 1941 was intentionally located in a remote, desert location and today remains isolated from any large metropolitan population."

The UMADRA - LRA recognized the inherent challenges and balanced three principle land-use categories in the Redevelopment Plan:

- A major training facility for the Oregon National Guard;
- Habitat protection through the creation of a U.S. Fish and Wildlife Refuge;
- And industrial zoning to aide in off-setting the economic impact of base closure to the community.

That *land-use plan*, presented within this document, represents a broad-based consensus among local, regional, and state interests. Upon DoD/HUD acceptance of the plan, the DoD would evaluate LRA recommendations for a variety of land conveyance mechanisms and determine the best utilization for the transfers of the property based on the approved uses for the land.

REPRESENTATION

Approved by the Umatilla Army Depot Reuse Authority on July 29, 2010

UMADRA - LOCAL REDEVELOPMENT AUTHORITY MEMBERS

William (Bill) Hansell,	*Chairman / Commissioner*
George Anderson,	*Attorney*
Terry Tallman,	*Vice-Chair / County Judge*
Carla McLane,	*County Planner*
Kim Puzey,	*Port Director*
John Turner,	*Port Commissioner / President BMCC*
Gary Neal,	*General Manager*
Lisa Mittelsdorf (alt),	*Director of Economic Development*
Joe Taylor,	*Port Commissioner / Agriculture*
Dr. Rodney Skeen, PhD, PE	*Manager CTUIR / DOSE-EMP*
Carl Scheeler,	*Wildlife Program Manager*
Rosenda Shippentower,	*Tribal Board of Trustees Treasurer*
William Quaempts,	*Tribal Board of Trustees, Member at Large*

EX-OFFICIO LRA BOARD MEMBERS

Scott Fairley,	*Governor's Office*
LTC. Christian Rees,	*Oregon National Guard*

LRA SUPPORT STAFF

DANA MISSION SUPPORT TEAM – LRA SUPPORT STAFF

William Dana, PE	*Program Manager / President*
Donald Chance, PhD	*Executive Director*
Kimberley Swentik	*Executive Administrator / MSE Project Manager*
Brian Cole	*Planning Specialist*
Dennis Walters	*Facilitator/Vice President*
Nancy Ness	*Homeless Assessment / Administrator*
Barry C.K. Moravek	*Communications Specialist / VP Western Operations*
Richard (Dick) Stone	*Communications Subject Matter Expert*
Jay Cornish	*Chief Environmental Scientist / Biologist*
Bernard Fineberg, EE/PE	*Electrical Engineer, PE*
Ross Dunfee, CE/PE	*Civil Engineer, PE*
Richard (Dick) Walker, EE/PE	*Electrical Engineer, PE*
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Ruthmeri Gleason	*Webmaster/Technical Editor*
Kathy Murray, CPPA	*Certified Personal Property Administrator*
Steve Antonioli	*Economic Analyst*
Kevin Bradford	*Graphics / Technical Expert*
John Hanson	*Assessor / Chemical Engineer*
Timothy McAnarney	*BRAC Technical Specialist*
Stephen Heck	*Air Quality, EPA Superfund Subject Matter Expert*
Steve Mallory, AIA, CSI	*Principal Architect*

BOOK GUIDE

MASTER ACRONYM KEY

Acronym	Definition	Document
A	Agriculture	Redevelopment/Implementation Strategy
AC	asbestos cement (pipe)	Infrastructure Ecosystem
ACM	asbestos containing material	Environmental Assessment
ADA	ammunition disposal area	Facilities Assessment Environmental Assessment Redevelopment/Implementation Strategy
ADSL	Asymmetric Digital Subscriber Line	Infrastructure
AOC	area of concern	Environmental Assessment
AQI	air quality index	Ecosystem
ATSDR	Agency for Toxic Substances and Disease Registry	Ecosystem
B.P.	before present	Ecosystem
BCP	Base Cleanup Plan (U.S. Army, 1995)	Environmental Assessment
BEA	Bureau of Economic Assessment	Market Assessment
bgs	below ground surface	Environmental Assessment
BLM	Bureau of Land Management	Economic Assessment Land Use Redevelopment/Implementation Strategy
BLS	US Bureau of Labor Statistics	Market Assessment
BMCC	Blue Mountain Community College	Economic Assessment
BR&E	Business Retention & Expansion	Economic Assessment
BRAC	Base Realignment and Closure	Economic Assessment Land Use Market Assessment Redevelopment Alternatives Environmental Assessment Homeless Redevelopment/Implementation Strategy Public Outreach Summary
BTEX	benzene, toluene, ethylbenzene, and xylene	Environmental Assessment
BTU	British thermal unit	Facilities Assessment Infrastructure
CAB	Cement Asbestos Board	Facilities Assessment
CAPECO	Community Action Program East Central Oregon	Homeless Redevelopment/Implementation Strategy
CAT	Category	Infrastructure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	Environmental Assessment Redevelopment/Implementation Strategy
CERFA	Community Environmental Response Facilitation Act	Environmental Assessment Ecosystem

Acronym	Definition	Document
CFR	Code of Federal Regulations	Environmental Assessment Ecosystem Homeless
cfs	Cubic feet per second	Land Use
CL	confidence limit(s)	Environmental Assessment
CMU	Concrete Masonry Unit	Facilities Assessment
COE	Corp of Engineers	Land Use
CSEPP	Chemical Stockpile Emergency Preparedness Program	Economic Assessment
CTUIR	Confederated Tribes of the Umatilla Indian Reservation	Economic Assessment Land Use Environmental Assessment Ecosystem Homeless Redevelopment/Implementation Strategy
D&D	Decontamination and Decommissioning	Redevelopment/Implementation Strategy
DBP	disinfection by-products	Ecosystem
DEQ	Oregon Department of Environmental Quality	Infrastructure
DMST	Dana Mission Support Team	Economic Assessment Facilities Assessment Market Assessment Redevelopment/Implementation Strategy Public Outreach Summary
DoD	Department of Defense	Redevelopment Alternatives Homeless
DPI	Disposable Personal Income	Market Assessment
DRMO	Defense Reutilization and Marketing Office	Facilities Assessment
ECF	Entry Control Facility	Infrastructure
ECP	Environmental Condition of Property (report)	Environmental Assessment
EFU	exclusive farm use	Land Use
ESD	explanation of significant differences	Environmental Assessment
FAA	Federal Aviation Administration	Economic Assessment
FEMA	Federal Emergency Management Agency	Redevelopment/Implementation Strategy
FICWD	Federal Interagency Committee for Wetlands Delineation	Ecosystem
FOSET	finding of suitability to early transfer	Environmental Assessment
FOSL	finding of suitability to lease	Environmental Assessment
FOST	finding of suitability to transfer	Environmental Assessment
FR2	Farm Residential	Land Use
ft	feet	Environmental Assessment Ecosystem
GAC	granular activated carbon	Environmental Assessment
GDP	Gross Domestic Product	Market Assessment

Acronym	Definition	Document
gpm	gallons per minute	Environmental Assessment Ecosystem
GIS	Geographic Information System	Redevelopment/Implementation Strategy
GWMA	Groundwater Management Area	Environmental Assessment Ecosystem
HC/I	Highway Commercial/Industrial	Redevelopment/Implementation Strategy
HQ/HI	hazard quotient/hazard index	Environmental Assessment
hr	hour	Ecosystem
HSP	Homeless Service Provider	Homeless
HUD	U.S. Department Of Housing And Urban Development	Homeless Redevelopment/Implementation Strategy
HVAC	Heating, ventilating, and air conditioning	Facilities Assessment
I	Industrial	Redevelopment/Implementation Strategy
ILRA	Implementation Local Reuse Authority	Redevelopment/Implementation Strategy
IMPLAN	IMpact Analysis for PLANning	Economic Assessment
INRMP	Integrated Natural Resources Management Plan	Ecosystem
IWW	Institute for Water and Watersheds (at Oregon State University)	Ecosystem
K	Thousand	Infrastructure
KSF	Key Success Factor	Economic Assessment
KVA	Kilovolt-Ampere	Infrastructure
LAN	Local Area Network	Infrastructure
LBA	Legally Binding Agreement	Homeless
LBP	Lead-based Paint	Environmental Assessment
LCDC	Land Conservation and Development Commission	Land Use
LEIC	lifetime excess incidence of cancer	Environmental Assessment
LRA	Local Redevelopment Authority	Market Assessment Redevelopment Alternatives Environmental Assessment Economic Assessment Land Use Homeless Redevelopment/Implementation Strategy Public Outreach Summary
LTC	Lieutenant Colonel	Public Outreach Summary
LTM	long-term monitoring	Environmental Assessment
LUB	Lower Umatilla Basin	Ecosystem
M-COFT	Mobile Conduct of Fire Trainer Pad	Redevelopment/Implementation Strategy
MCL	maximum contaminant level (in drinking water)	Environmental Assessment Ecosystem
MEC	munitions and explosives of concern	Environmental Assessment
mg/L	milligrams per liter (= parts per million)	Environmental Assessment Ecosystem

Acronym	Definition	Document
mph	miles per hour	Ecosystem
MPN	most probable number (of microbes)	Ecosystem
MT	Military Training	Redevelopment/Implementation Strategy
MVA	Million Volt-Amperes	Infrastructure
NAAQS	National Ambient Air Quality Standard	Ecosystem
NEC	National Electrical Code	Facilities Assessment
NEPA	National Environmental Policy Act	Environmental Assessment
NFPA 70	National Fire Protection Association	Facilities Assessment
NOI	Notice of Interest	Market Assessment Redevelopment Alternatives Homeless Redevelopment/Implementation Strategy
NPL	National Priorities List (under CERCLA)	Environmental Assessment
OAR	Oregon Administrative Rules	Environmental Assessment
OB/OD	open burning/open detonation	Environmental Assessment
ODEQ	Oregon Department of Environmental Quality	Environmental Assessment Ecosystem
ODGAMI	Oregon Department of Geology and Mineral Industries	Economic Assessment
ODHS/DWP	Oregon Department of Human Services/Drinking Water Program	Ecosystem
ODOT	Oregon Department of Transportation	Redevelopment Alternatives
OEA	Office of Economic Adjustment	Economic Assessment Homeless Redevelopment/Implementation Strategy
OEDA	Oregon Economic Development Association	Economic Assessment Market Assessment
OHTAC	Oregon Historic Trails Advisory Council	Ecosystem
OMD	Oregon Military Department	Redevelopment Alternatives
ORNG	Oregon National Guard	Land Use Redevelopment Alternatives Environmental Assessment Redevelopment/Implementation Strategy
ONHIC	Oregon Natural Heritage Information Center	Ecosystem
OSHA	Occupational Safety and Health Administration	Facilities Assessment
OSHA	Occupational Safety and Health Act	Redevelopment/Implementation Strategy
OU	operable unit	Environmental Assessment Ecosystem
P.L.	public law	Environmental Assessment
PAH	polyaromatic hydrocarbon	Environmental Assessment
PBC	Public Benefit Conveyance	Homeless
PBC	Public Benefit Conveyance	Redevelopment/Implementation Strategy
pCi/l	pico-Curie/liter	Environmental Assessment

Acronym	Definition	Document
pCi/l	pico-Curie/liter	Ecosystem
PILT	Payment in Lieu of Taxes	Redevelopment/Implementation Strategy
Plan	Redevelopment Plan and Implementation Strategy	Redevelopment/Implementation Strategy
PM10	particulate matter 10 – microns (or less) in diameter	Ecosystem
PM2.5	particulate matter 2.5 – microns (or less) in diameter	Ecosystem
PMB	Personnel and Maintenance Building	Infrastructure
PNNL	Pacific National Laboratory	Redevelopment Alternatives
ppb(m)	parts per billion (million)	Environmental Assessment Ecosystem
PRG	preliminary remediation goals	Environmental Assessment
PSB	Personal Support Building	Infrastructure
PVC	polyvinyl chloride (pipe)	Infrastructure Ecosystem
RA	risk assessment (human health or ecological)	Environmental Assessment
RAC	remedial action complete	Environmental Assessment
RCRA	Resource Conservation and Recovery Act (as amended)	Environmental Assessment Redevelopment/Implementation Strategy
RDX	Royal Demolition Explosive (hexahydro–1,3,5–trinitro–1,3,5–triazine)	Environmental Assessment Ecosystem
RI/FS	remedial investigation/feasibility study	Environmental Assessment
RNC	Remediation Not Complete	Environmental Assessment
RNS	Remediation Not Started	Environmental Assessment
RNU	Remediation Needs Unknown	Environmental Assessment
ROD	Record of Decision	Environmental Assessment Redevelopment/Implementation Strategy
RPIS	Redevelopment Plan and Implementation Strategy	Redevelopment/Implementation Strategy
RR1	Rural Residential	Land Use
RTE	rare, threatened, endangered (plant-animal species)	Ecosystem
RV	Recreational Vehicle	Facilities Assessment
S/S	solidification/stabilization	Environmental Assessment
SAIC	Science Applications International Corporation	Ecosystem
SETH		Facilities Assessment
Sq ft	Square feet	Facilities Assessment
ssp.	subspecies (of a particular species)	Ecosystem
SWRI	Southwest Research Institute	Facilities Assessment
TCLP	toxicity characteristic leach procedure	Environmental Assessment
TCP	Traditional Cultural Properties	Land Use
TCPC	Tank Crew Proficiency Course	Redevelopment/Implementation Strategy
TNT	2,4,6 – trinitrotoluene	Environmental Assessment
TNT 2,4,6 –	trinitrotoluene	Ecosystem
TSCA	Toxic Substances Control Act	Environmental Assessment

Acronym	Definition	Document
TCSA	Toxic Substances Control Act	Redevelopment/Implementation Strategy
TSDF	treatment, storage, or disposal facility	Environmental Assessment
U.S.C.	United States Code	Environmental Assessment Ecosystem
UADTZ	Umatilla Army Depot Transition Zone	Land Use
UEC	Umatilla Electrical Cooperative	Economic Assessment Infrastructure
UFSG	Unhealthy for Sensitive Groups	Ecosystem
UGB	Urban Growth Boundary	Land Use
UMADRA	Umatilla Army Depot Reuse Authority	Market Assessment Redevelopment Alternatives Homeless Redevelopment/Implementation Strategy Public Outreach Summary
UMCD	Umatilla Chemical Depot	Facilities Assessment Infrastructure Market Assessment Redevelopment Alternatives Environmental Assessment Economic Assessment Land Use Ecosystem Homeless Public Outreach Summary
UMCDF	Umatilla Chemical Disposal Facility or Umatilla Chemical Agent Disposal Facility	Facilities Assessment Infrastructure Redevelopment Alternatives Environmental Assessment Economic Assessment Ecosystem Redevelopment/Implementation Strategy
UPRR	Union Pacific Railroad	Infrastructure
USACE	United States Army Corp of Engineers	Land Use Environmental Assessment Ecosystem
USDoD	United States Department of Defense	Environmental Assessment
USEPA	United States Environmental Protection Agency	Land Use Environmental Assessment Ecosystem
USFS	United States Forest Service	Land Use Ecosystem
USFWS	United States Fish and Wildlife Service	Redevelopment Alternatives

Acronym	Definition	Document
		Ecosystem Redevelopment/Implementation Strategy
UXO	unexploded ordnance	Environmental Assessment Redevelopment/Implementation Strategy
V	Volt	Infrastructure
VA	Volt-Ampere	Infrastructure
VAT	Vinyl asbestos tile	Facilities Assessment
WDC-URS	Washington Demilitarization Company-URS Corp	Facilities Assessment
WGI	Washington Group International	Facilities Assessment
WR	Wildlife Refuge	Redevelopment/Implementation Strategy
µg/L	micrograms per liter (= parts per billion)	Environmental Assessment Ecosystem
$\mu g/m^3$	micrograms per dry standard cubic meter	Environmental Assessment Ecosystem

MASTER TABLE OF CONTENTS

SECTION A: REDEVELOPMENT PLAN

The purpose of Section A: The Umatilla Army Depot Reuse Authority (UMADRA or LRA) has developed this Redevelopment Plan for the U.S. Army Umatilla Chemical Depot (UMCD). The Depot, which is approximately 17,000 acres in size exclusive of restrictive easements, is located in Northern Morrow and Umatilla counties in northeastern Oregon. Originally listed in the 1988 Base Realignment and Closure (BRAC) process, the Department of Defense ultimately recommended closure of UMCD during the 2005 BRAC round of announcements. The chemical demilitarization operation at UMCD is anticipated to culminate in 2012 (or later).

Part I of the Redevelopment Plan identifies the planning process, land use, and implementation strategy used and developed by UMADRA for the UMCD.

Parts II - IIII of the Redevelopment Plan include supporting documentation and assessments used in assisting the UMADRA to develop the final plan. The reports provided in these sections were delivered to UMADRA by the LRA support contractor Dana Mission Support Team.

Section **Page**

A: Part I: Redevelopment Plan and Implementation Strategy Tab Section A_PI

The purpose of Part 1: **Redevelopment Plan and Implementation Strategy** - makes a series of recommendations to the US Department of the Army for the reuse of the Umatilla Chemical Depot in order to create jobs, preserve the environment, and foster the development of a training facility for the Oregon National Guard. It includes an *Overview of the Planning Process,* the *Redevelopment (Land Use) Plan,* and the *Implementation Strategy (Action Plan)*

SECTION A_PI: TABLES *Page*

SECTION A_PI: FIGURES *Page*

SECTION A_PI: EXHIBITS *Page*

Section **Page**

A: Part II: UMCD Assessment Results Tab Section A_PII

The Purpose of Part 2: **Assessment Results** - To identify and bring to attention the results of the individual assessments performed during the planning process. The reports included within this section are the results of on and off-site assessments performed by professional engineers, scientists, and Subject Matter Experts. The order is defined by the Professional Services Contract with the Dana Mission Support Team.

1.0: Market Assessment Tab Section A_PII: 1.0

2.1: Land Use and Cultural Resources Tab Section A_PII: 2.1

Section **Page**

2.2: Facilities Tab Section A_PII: 2.2

Section **Page**

2.3: Infrastructure — Tab Section A_PII: 2.3

2.4: Environmental — Tab Section A_PII: 2.4

Section **Page**

3.0: Market Assessment — Tab Section A_PII: 3.0

4.0: Homeless Assessment — See Section B: Homeless Assessment Plan

5.0: Redevelopment Alternatives — Tab Section A_PII: 5.0

Section **Page**

A: PII: TABLES PAGE

1.0: Tables Tab Section A_PII: 1.0

2.1: Tables Tab Section A_PII: 2.1

2.2: Tables Tab Section A_PII: 2.2

None

2.3: Tables Tab Section A_PII: 2.3

None

Section **Page**

2.4: Tables **Tab Section A_PII: 2.4**

3.0: Tables **Tab Section A_PII: 3.0**

4.0: Tables **See Section B: Homeless Assessment Plan**

5.0: Tables **Tab Section A_PII: 5.0**

A: PII: FIGURES — PAGE

1.0: Figures — Tab Section A_PII: 1.0

None

2.1: Figures — Tab Section A_PII: 2.1

2.2: Figures — Tab Section A_PII: 2.2

None

2.3: Figures — Tab Section A_PII: 2.3

2.4: Figures — Tab Section A_PII: 2.4

3.0: Figures — Tab Section A_PII: 3.0

4.0: Figures — See Section B: Homeless Assessment Plan

5.0: Figures — Tab Section A_PII: 5.0

Section **Page**

A: Part III: EcoSystem Status Tab Section A_PIII

The Purpose of Part III: **EcoSystem Status** - This section reflects current ecosystem conditions and resources for the site. Elements include: topography, atmospheric, geology, soil, vegetation, wildlife and groundwater.

A: PIII: FIGURES PAGE

A: PIII: TABLES PAGE

SECTION B: HUD APPLICATION

The purpose of Section B: In accordance with 24 CFR 586 the Umatilla Army Depot Reuse Authority (UMADRA or LRA) has developed this Homeless Assistance Plan for the U.S. Army Umatilla Chemical Depot (UMCD). The Base Closure Community Redevelopment and Homeless Assistance Act, as amended (10 U.S.C 2687 note) instituted a community-based process for addressing the needs of the homeless at BRAC sites. The UMADRA followed this process to identify how it could support the homeless needs in the communities surrounding the UMCD.

Section **Page**

B: Homeless Assistance Plan — Tab Section B

B: Tables — Page

B: Exhibits — Page

SECTION C: PUBLIC OUTREACH

The purpose of Section C: In accordance with both BRAC closure guidelines and HUD Homeless Assistance Plan guides, the UMADRA has summarized the Public Outreach used throughout the Umatilla Chemical Depot redevelopment planning process. In-depth details for the Homeless Outreach program are detailed in Section B: HUD Homeless Assistance Plan. This summary includes overview descriptions of:

Section **Page**

C: PUBLIC OUTREACH TAB SECTION C

C: Tables Page

REVISED ENVIRONMENTAL CONDITION OF PROPERTY ENVIRONMENTAL BASELINE SURVEY REPORT

7,421-Acre Oregon Military Department Parcel

Umatilla Chemical Depot

Umatilla and Morrow Counties, Oregon

Prepared for:

Oregon Military Department
1776 Militia Way SE
PO Box 14350
Salem, Oregon 97309-5047

Contract No. 109985A001

Prepared by:

AMEC Environment & Infrastructure, Inc.
7376 SW Durham Road
Portland, Oregon 97224
(503) 639-3400

September 2012

Project No. 0-61M-122750

amec

26 September 2012

Project No. 0-61M-122750

Mr. Jim Arnold
Oregon Military Department
1776 Militia Way SE
PO Box 14350
Salem, Oregon 97309-5047

Dear Mr. Arnold:

Re: Revised Environmental Condition of Property
Environmental Baseline Survey
7,421-Acre Oregon Military Department Parcel of the Umatilla Chemical Depot
Umatilla and Morrow Counties, Oregon

AMEC Environment & Infrastructure, Inc. (AMEC) is pleased to submit this revised Environmental Condition of Property (ECOP)/Environmental Baseline Survey (EBS) Report to the Oregon Military Department (OMD) for the 7,421 acre OMD Parcel of the Umatilla Chemical Depot (UCD), located near Hermiston, Oregon. The purpose of the ECOP Report is to document the potential environmental liabilities associated with transferring the Federally-owned Department of Defense (DOD) land to the OMD. The EBS satisfies the environmental due diligence and disclosure requirements of Army Regulation (AR) 200-1, 42 USC9620(h), and Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The work was conducted under the State of Oregon Standard Professional Services Contract Additional, contract number 109985A001 dated October 12, 2010.

Sincerely,

AMEC Environment & Infrastructure, Inc.	**Reviewed by:**
Jennifer C. Kuiper	Birte Kerstin-Wilson
Jennifer C. Kuiper, RG. CHMM	Birte Kerstin-Wilson, CHMM
Senior Project Manager	Associate/Environmental Group Leader
	Honolulu, Hawaii

Attachments

JCK/cw

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Fax+1 (503) 620-7892
www.amec.com

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

1,3,5-TNB	1,3,5-Trinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
°F	Degrees Fahrenheit
µCi	Microcuries
$\mu g/cm^2$	Micrograms per cubic meter
µg/g	Micrograms per gram
µg/L	Micrograms per liter
AAI	All Appropriate Inquiry
ACDP	Air Contaminant Discharge Permit
ACM	Asbestos-Containing Material
ACS	Agent Collection System
ADA	Ammunition Demolition Activity
AEC	Army Environmental Command
AMEC	AMEC Environment & Infrastructure, Inc.
APE	Ammunition Peculiar Equipment
AR	Army Regulation
ARAR	Applicable, or Relevant and Appropriate Requirement
Army	United States Army
ARNG	Army National Guard
AST	Above Ground Storage Tank
ASTM	ASTM International (American Society for Testing Materials)
BCC	Birds of Conservation Concern
BCP	Base Cleanup Plan
bgs	Below Ground Surface
BLM	Bureau of Land Management
BNA	Base-neutral and Acid Extractable Organics
BOD	Biochemical Oxygen Demand
BRA	Brine Reduction Area
BRAC	Base Realignment and Closure
BRP	Base Redevelopment Plan
BTEX	Benzene, Toluene, Ethyl-benzene, Xylenes

CAA	Clean Air Act
CAB	Cement Asbestos Board
CD	Compact Disc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CERFA	Community Environmental Response Facilitation Act
CEQ	Council on Environment Quality
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
CGA	Critical Groundwater Area
CMA	United States Army Chemical Materials Agency
COC	Contaminant of Concern
CORRACTS	Corrective Action Sites (Environmental Protection Agency)
CPE	Chemical Protective Equipment
CRL	Confirmed Release List
CTT	Closed, Transferring, and Transferred
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
CWC	Chemical Weapons Convention
DA	Department of the Army
DARP	Department of Army Radiation Permit
DATS	Drill and Transfer Site
DERP	Defense Environmental Restoration Program
DEQ	Department of Environmental Quality
DF	Deactivation Furnace
DFS	Deactivation Furnace System
DMM	Discarded Military Munitions
DNB	1,3-Dinitrobenzene
DOD	United States Department of Defense
DOI	United States Department of Interior
DRMO	Defense Reutilization Marketing Office
DUN	Dunnage Furnace

EA	Ecological Assessment
Earth Tech.	Earth Technology Corporation
EBS	Environmental Baseline Survey
ECOP	Environmental Condition of Property
ECSI	Environmental Cleanup Site Information System
EDR	Environmental Data Resources
EFU	Exclusive Farm Use
EIS	Environmental Impact Statement
EMPA	Ethyl methyl phosphonate
EPA	United States Environmental Protection Agency
EPAS	Environmental Performance Assessment System
ERNS	Emergency Response Notification System
ESD	Explanation of Significant Differences
EWL	Explosives Washout Lagoons
Fiber/cc	Fibers per cubic centimeter
FIFRA	Federal Insecticide Fungicide and Rodenticide Act
FINDS	Facility Index System
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	Feet or Foot
FTP	Fixed Transfer Protocol
GB	Nerve Agent (Sarin)
gpd	Gallons per day
GPS	Global Positioning System
GWMA	Groundwater Management Area
HCID	Hydrocarbon Identification
HD	Blister Agent
HHBRA	Human Health Baseline Risk Assessment
HHRA	Human Health Risk Assessment
HMX	Octahydro-1,3,5,7-tetranitrol-3,5,7-tetrazocine
HRS	Hazard Ranking System (Environmental Protection Agency)
HSWA	Hazardous and Solid Waste Amendments
HVAC	Heating, Ventilation, and Air-Conditioning
HWAD	Hawthorne Army Depot

HWS	Hazardous Waste Storage
ICAM	Improved Chemical Agent Monitor
ICRMP	Integrated Cultural Resources Management Plan
IIA	Initial Installation Assessment
IMPA	Isopropyl Methyl Phosphonic Acid
in.	Inch
INRMP	Integrated Natural Resources Management Plan
ITC	Intermediate Training Complex
IRP	Installation Restoration Program
JACADS	Johnson Atoll Chemical Agent Disposal System
LBP	Lead-Based Paint
LIS	Liquid Incinerator System
LRA	Land Reuse Authority
LQG	Large Quantity Generator
LSG	Small Quantity Generator
LUB	Lower Umatilla Basin
LUST	Leaking Underground Storage Tank Incident
MDB	Munitions Demilitarization Building
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MPF	Metals Part Furnace
MPPEH	Materials Potentially Presenting an Explosive Hazard
mg/cm^2	Milligrams per square centimeter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mm	Millimeter
NB	Nitrobenzene
NCP	National Contingency Plan
ND	Non-Detect
NEPA	National Environmental Policy Act
NFA	No Further Action
NGB	National Guard Bureau

NIL	Northern Inactive Landfill
NILE	Northern Inactive Landfill Extension
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	United States Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTNC	Non-transient Non-community
O&M	Operations and Maintenance
OAR	Oregon Administrative Rule
OB/OD	Open Burning/Open Detonation
ODFW	Oregon Department of Fish and Wildlife
OMD	Oregon Military Department
ORUM	Other Regulated Underground Material
OSHA	United States Occupational Safety & Health Administration
OU	Operable Unit
OWRD	Oregon Water Resources Department
PA	Preliminary Assessment
PAS	Pollution Abatement System
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PCS	Petroleum Contaminated Soil
pCi/L	picocuries per liter
pH	measure of the acidity or alkalinity of a solution
POL	Petroleum, Oil, and Lubricants
PPE	Personal Protective Equipment
ppm	Parts per million
PVC	Polyvinyl Chloride
PWS	Public Water System
QA	Quality Assurance

RAC	Risk Assessment Code
RCRA	Resource Conservation and Recovery Act
RCRA-LQG	Resource Conservation and Recovery Act Large Quantity Generator
RCRA-TSDF	Resource Conservation and Recovery Act Treatment, Storage, or Disposal Facility
RDC	Raytheon Demilitarization Company
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
REC	Recognized Environmental Conditions
RFA	Resource Conservation and Recovery Act Facility Assessment
RFNA	Red Fuming Nitric Acid
RI	Remedial Investigation
ROD	Record of Decision
ROW	Right of Way
RPO	Radiation Protection Officer
RR1	Rural Residential Area
RSO	Radiation Safety Officer
SARA	Superfund Amendment and Reauthorization Act
SBCCOM	Soldier Biological and Chemical Command
SHPO	State Historic Preservation Officer
SEIL	Southeastern Inactive Landfill
SIL	Southern Inactive Landfill
SILE	Southern Inactive Landfill Extension
SOP	Standard Operating Procedure
SPCC	Spill Prevention, Control, and Countermeasures
SRI	Supplemental Remedial Investigation
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
TIC	Tentatively Identified Compound
TOCDF	Tooele Chemical Agent Disposal Facility
TNT	2,4,6-Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
TPH-d	Total Petroleum Hydrocarbons-diesel
TPH-g	Total Petroleum Hydrocarbons-gasoline

TPH-HCID	Total Petroleum Hydrocarbons-Hydrocarbon Identification
TSCA	Toxic Substance Control Act
TSD	Treatment, Storage, and Disposal
TSS	Total Suspended Solids
TVHC	Total Volatile Hydrocarbons
UCD	Umatilla Chemical Depot
UCDF	Umatilla Chemical Agent Disposal Facility
UDMH	Unsymmetrical dimethyl hydrazine
UMADRA	Umatilla Army Depot Re-Use Authority
UMDA	Umatilla Depot Activity
UPRR	Union Pacific Rail Road
USACE	United States Army Corps of Engineers
USATHAMA	United States Army Toxic and Hazardous Material Agency
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound
VX	Nerve Agent S-2-(diisopropylamino)ethyl-O-ethyl-methylphosphonothioate
WIDS	Western Inactive Drum Site
WPCF	Water Pollution Control Facilities
WWTP	Wastewater Treatment Plant
XRF	X-ray Fluorescence

EXECUTIVE SUMMARY

AMEC Environment & Infrastructure, Inc. (AMEC) has completed this revised Environmental Condition of Property (ECOP)/Environmental Baseline Survey (EBS) Report to the Oregon Military Department (OMD) for the 7,421-acre OMD Parcel (Subject Site) of the Umatilla Chemical Depot (UCD), located near Hermiston, Oregon. The purpose of the ECOP/EBS Report is to document the potential environmental liabilities associated with transferring the Federally-owned Department of Defense (DOD) land to the OMD. The EBS satisfies the environmental due diligence and disclosure requirements of Army Regulation (AR) 200-1, Oregon Army National Guard (ORARNG) Regulation Number 200-1, 42 USC9620(h), and Section 120(h) of the Comprehensive Environmental Response, Compensation, and liability Act (CERCLA). The ECOP/EBS report was prepared following the Army National Guard (ARNG) ECOP Standard Operating Procedure (SOP), March 2007. The work was conducted under the State of Oregon Standard Professional Services Contract; contract number 109985A001, October 12, 2010.

This Executive Summary provides a brief description of the former and current uses of the UCD and areas of potential environmental concern evaluated during preparation of this ECOP/EBS report. Detailed information associated with the summary below is included in the main body of this report.

Site Description

The UCD is a 19,728-acre military installation located in northeastern Oregon, on the border of Umatilla and Morrow Counties. The installation is 3 miles south of the Columbia River and approximately 12 miles northwest of Hermiston, Oregon. The installation's main features consist of 1,001 concrete igloo storage structures, interspersed with bermed Y-site outdoor storage areas; active and inactive buildings; and miles of paved and unpaved roads constructed over large expanses of native shrub-steppe vegetation.

The Subject Site features include: an approximately 200-acre building complex identified as the Administrative Area; approximately 412 storage igloos (including igloos formerly containing blister agent [HD] in K-Block and igloos formerly containing agent-related secondary wastes in 14 J-Block Igloos); approximately 20 miscellaneous buildings associated with former ammunition maintenance, inspection, and repackaging; an ammunition demolition, detonation, and disposal area; and a railroad storage yard.

The UCD is divided into eight geographic areas, five of which comprise the Subject Site. The eight areas of the UCD are described as: Area I - ADA, Area II - Deactivation Furnace, Area III - West Central, Area IV - North Central, Area V - Cemtral/East Washout Lagoon, Area VI - South Central, Area VII - Administration Area, and Area VIII - East. The Subject Site is comprised of Areas I, III, IV, V, VI, and VII. Areas II and VIII are considered adjacent properties for purposes of this report.

Site History

During World War II, the UCD was one of the first Army ammunition supply depots created. The development of the UCD was initiated in 1941 after the acquisition of approximately 16,000 acres previously used for open range grazing. By the end of World War II, 1,268 of the installation's 1,411 structures had been constructed, including administration, maintenance, and housing facilities; ammunition storage igloos; and warehouses.

From the time the UCD commenced operations in 1941 until 1951, its primary function was to receive, store, and distribute various caliber ammunition and other conventional munitions. Over the next 10 years, UCD activities were expanded to include open burning/open detonation (OB/OD) of obsolete munitions; testing, maintenance, recycling and repackaging of munitions components; and storage and maintenance of missile and missile fuel components. In 1962, the Army began storing chemical munitions at the facility. No chemical weapons were ever used, manufactured, or tested at the UCD.

The Base Realignment and Closure (BRAC) Commission listed the facility for realignment in 1988. Subsequently, from 1990 to 1994, the facility reorganized in preparation for eventual closure, shipping all conventional ammunition and supplies to other installations. The Umatilla Chemical Agent Disposal Facility (UCDF) located adjacent to the northeast of the Subject Site, was completed in 2001, and incineration of chemicals began in 2004. As of 2009, the incineration campaigns for nerve agents, sarin (GB) and S-2 (VX) were completed. UCDF completed the HD incineration campaign in October 2011.

Environmental History

Environmental investigations began at the UCD as early as 1978, when the UCD was placed into the Army's Installation Restoration Program (IRP). Between 1978 and 1992, environmental assessments were conducted, resulting in the identification of over 83 locations or "Study Sites" of environmental interest. The UCD was placed on the National Priorities List (NPL) in 1987 due to the discovery of contamination at the Explosives Washout Lagoons (EWL) in the central area of the UCD (EWL/Area V - Central). The EWL/Central area is an area where conventional bombs were dismantled and washed out with water in the 1950s and early 1960s. Among the compounds washed out in the cleaning process were trinitrotoluene (TNT) and Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX).

In 1989, a Federal Facilities Agreement (FFA) was made among the Army, United States Environmental Protection Agency (EPA) and the Oregon Department of Environmental (DEQ) to facilitate cleanup of nine designated Operable Units (OUs) in accordance with EPA's CERLCA. These OUs were re-designated into eight OUs in a series of records of decision (RODs) in the mid-1990s that established cleanup goals and remediation strategies. Six of the eight OUs are within the boundaries of the Subject Site, with four of these having received a mutually-agreed upon no further action (NFA) designation among the parties to the FFA. Two of the OUs remain in the process of cleanup: Ammunition demolition activity (ADA) in Area I, and EWL-Groundwater in Area V.

Environmental Condition of Property

ECOP Categories were developed by comparing the results of AMEC's January 2011 field reconnaissance and research (including a review of previous environmental investigation reports from the 1990's) with the June 2010 ECOP report prepared for the UCD by the US Army Corps of Engineers. As a result of the additional research and field reconnaissance, some previously-designated ECOP categories were changed. As shown in Table ES-1 and Table 26, ECOP categories identified from the June 2010 ECOP report are shown in black text. ECOP categories determined from the results of AMEC's field reconnaissance and research are shown in red text, with previous ECOP categories shown in black strike-out mode. An expanded version of Table ES-1 and Table 26, which includes the rationale for each ECOP category, is included at the back of the report and is identified as "ECOP Summary Table". ECOP Parcel categories for Areas I-VI are shown on Figure 12. ECOP Parcel categories for Area VII are shown on Figure 13.

Classifications for property using ECOP category numbers are provided below, in accordance with Appendix B of the Army National Guard's ECOP Standard Operating Procedure (14 March 2007).

Category 1	Areas where no release or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).
Category 2	Areas where only release or disposal of petroleum products has occurred.
Category 3	Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial action.
Category 4	Areas where release, disposal, and/or migration of hazardous substances has occurred and where all remedial actions necessary to protect human health and the environment have been taken.

Category 5 Areas where release, disposal, and/or migration of hazardous substances has occurred and where removal or remedial actions are under way, but where all required remedial actions have not yet been taken.

Category 6 Areas where release, disposal, and/or migration of hazardous substances has occurred but where required actions have not yet been implemented.

Category 7 Areas that have not been evaluated or requiring additional evaluation.

Table ES-1 identifies each ECOP category using the definitions previously described. The ECOP Summary Table at the back of the report includes two additional columns: 1) a colum that identifies the ECOP category either as a recognized environmental condition (REC), a data gap, an historic REC, or a *"de minimis condition"*, in accordance with the EPA's All Appropriate Inquiry (AAI) Rule (40 code of federal regulations [CFR] Part 312); and 2) a column that describes the rationale for the ECOP category designation.

Table ES-1: Environmental Condition of Property Categories

Study Site Name	**Acreage**	**2010 ECOP Site Study Number(s)[1]**	**ECOP Condition**	**ECOP Parcel (Category)**
Area I - Ammunition Demolition Activity[2]				
All ADA grounds (not including ECOP Parcels 3, 8, 11, 14)	1,670	All ADA Grounds	~~6~~ 1	~~1(6)X~~ 1(1)X
Aniline Pit	40'x40' area	7	1	18(1)X
Acid Pit	Small Pit	8	3	19(3)HR,X
Borrow/Burn/Disposal Area	3.5	58	~~6~~ 1	~~2(6)HR,X~~ 2(1)HR,X
Open Burning Trenches	49.5	19	3	3(3)HR,X
Former Pit Area Locations	17.5	57	~~6~~ 3	~~4(6)HR, X~~ 4(3)HR,X
Dunnage Pits	6.3	18	~~6~~ 3	~~5(6)HR,X~~ 5(3) HR, X
Munitions Crate Burn Area	1.6	56	~~6~~ ~~3~~	~~6(6)HR,X~~ 6(3) HR,X
Sludge Burial/TNT Burn Area	4.6	15	5	7(5)HR,X
Trench/Burn Field	8.6	55	~~6~~ 3	~~8(6)HR,X~~ 8(3)HR,X

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Smoke Canister Disposal Area Above Ground Open Detonation Area	26.67 1.7	13 17	~~5~~ 3	~~9(5)HR,X~~ 9(3) HR, X
GB/VX Decontamination Solution Disposal Area	3.2	59 41	~~6~~ 3	~~10(6)HR,X~~ 10(3)HR,X
Open Burning Trays	1.4	32	~~5~~ 6	~~11(5)HR,X~~ 11(6)HR,X
Flare and Fuse Disposal Area Pit Field Area	55.5 77.24	14 38	~~6~~ 3	~~12(6)HR,X~~ 12(3)HR,X
Open Detonation Pits	61.0	16	~~6~~ 3	~~13(6)HR,X~~ 13(3)HR,X
Pesticide Pits	33.9	31	5	14(5)HR,X
Fuel Burning Area	2.5	28	6	15(6)HR,X
Missile Fuel Storage Area Disposal Pit and Graded Areas	39.3 7.5	21 80	~~6~~ 3	~~16(6)HR,X~~ 16(3)HR,X
Active Firing Range	17.7	60	~~6~~ 3	~~17(6)HR,X~~ 17(3)HR,X
Area II - Deactivation Furnace and 100/200 Warehouse Series				
Paint Spray and Shot Blast Area	1.2	34	~~4~~ 3	~~25(4)HR,PR~~ 25(3)HR, PR
Area III - West Central				
Buildings 601 - 606 and 623 GB Bomb Disassembly (aka remote munitions disassembly area)	0.6 23.0	No Study Site number was identified for this location in the 2010 ECOP Report. 9	~~6~~ 3	~~30(6)A,HR,PS,L(P)~~ 20(3)HR,PS,A, L(P)
Buildings 608-612 (Ammunition Maintenance and Disassembly)	2.7 0.5	45B 65	6	31(6)HR,PS,A,L(P)
Former Gravel Pit/Disposal Location	15.0	82	3	34(3)HR

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Northern fenced portion of Block-I Igloos & USTs and ASTs near NE corner	139.1	No Study Site number was identified for this location in the 2010 ECOP report.	7	32(7)A,PS,L(P)
Buildings 613, 618, and 621 (Water Tower and Well Houses)	14.09	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 1	~~100(2)PS,A(P),L(P)~~ 100(1), PS, A(P), L(P)
Building 619	0.02	No Study Site number was identified for this location in the 2010 ECOP report.	7	27(7)R,A(P),L(P)
Buildings 614 through 617 (Ammunition Disassembly and Renovation)	0.4	No Study Site number was identified for this location in the 2010 ECOP report.	6	28(6)A,HR,PS,L(P)
Building 270 and adjacent AST	0.02	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 1	~~29(2)PS~~ 29(1)PS
Concrete foundations	unknown	N/A[2]	7	116(7)HR(P), PR(P)
Building 457 Guard House	Uknown	N/A[2]	7	117(7)HR(P), PR(P)
Area IV - North Central				
Former Blister Agent HD Storage Area	8.6	10	3	41(3)HR
Drill and Transfer Site (DATS)	6.50	49	1	101(1)HS
All K-Block Igloos and associated former USTs and ASTs	514.5	No Study Site number was identified for this location in the 2010 ECOP report.	7	40(7)HS,HR,PS,PR,R,A, L(P)

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Building 655 Change House and Laundry	Area Not Accessible at time of January 2011 Field Reconnaissance	N/A[2]	7	102(7)HS,HR
Building 654 Toxic Chemical Munitions				
Building 656 Monitoring Building				
Building 659 Former HD Agent Storage				
Building 660 Security Building				
Area V - East Central				
Large Open Areas in Vicinity of Coyote Coulee	22.9	51	3	43(3)HR,CD
Paint and Solvent Disposal Area	1.3	62		
Former Gas Station/Possible UST Location	38.6	43	2	44(2)PS, PR,CD
Explosives Washout Lagoons	1.6 acres	4	5	45(5)HR, PS, PR, RAD, A,L,R
Explosives Washout Plant - Building 489	352.4 (total)	5		
Explosive Washout Lagoons - Groundwater Plume	Not listed	No Study Site number was identified for this location in the 2010 ECOP report.		
Building 486 Boiler/Laundry Effluent	0.08	47	3	103(3)HS,HR,L(P),A(P)
Building 493 – Paint Sludge Discharge Area	0.31	36	3	104(3)HS,HR,A(P),L(P)
Building 493 - Brass cleaning area		67		
~~Building 433 Collection Sump/Cistern and Disposal Area~~	~~0.09~~	~~53~~	~~4~~	~~46(6)A, PS~~ ~~105(4)HS,HR,A(P),L(P)~~

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Building 825	0.04	No Study Site number was identified for this location in the 2010 ECOP report.	~~6~~ 1	~~38(6)A,L(P)~~ 38(1)A,L(P)
Former ASTs near Building 825	1.28	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ ~~1~~	~~39(2)PS~~ 39(1)PS
Buildings 426, 455 and associated USTs	4.56	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 7	~~33(2)PS,A(P),L(P)~~ 33(7)PS, A(P),L(P)
All J Block Igloos (1797-#1810)	11.2	No Study Site number was identified for this location in the 2010 ECOP report.	~~7~~ 1	~~99(7)HS,A(P),L(P)~~ 99(1)HS, A(P), L(P)
Borrow Pit located northeast of Block J Igloos	14.6	No Study Site number was identified for this location in the 2010 ECOP report.	7	106(7)CD
Building 419 Former Laundry	Unknown	This location was not identified as a Study Site and was not given an ECOP category number in the report	~~7~~ 3	~~118(7)HR(P), PR(P)~~ 118(3)HR, PR(P)
Building 417 Renovation Building	Unknown	This location was not identified as a Study Site and was not given and ECOP category number in the report	~~7~~ 3	~~119(7)HR(P)~~ 119(3)HR

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
~~Building 431~~	~~Unknown~~	~~This location was not identified as a Study Site not was it given an ECOP category number, in the report~~	~~7~~	~~120(7)A, L HR (P)~~
~~Building 434~~	~~Unknown~~	~~This location was not identified as a Study Site not was it given an ECOP category number, in the report~~	~~7~~	~~121(7)HR (P)~~
Area VI - South Central				
Former Raw Material Storage Locations Brass, Copper, and Steel Storage Area	2.0 1.4	81 66	3	36(3)HR,HS,PS
Gravel Pit Disposal Area	2.6	33	3	49(3)HR,CD
Landfill Area	2.5	This location was not identified as a Study Site not was it given an ECOP category number, in the report	7	115(7)CD
Leaking Railcar Shipment Inspection Area	14.94	64	3	50(3)HR
Imhoff Wastewater Treatment Plant Storm Sewer Tile Field Pipe Discharge Area	17.6 total	6 30 48	~~3~~ 7	~~51(3)HR,PR~~ 51(7)HR,PR
Railroad Landfill Areas	53.4	50	~~3~~ 7	~~52(3)HR,PR~~ 52(7)HR,PR,A(P),L(P),CD
Inactive Landfills	36.33	12	7	107(7)A(P),L(P),CD
Former ASTs along Juniper Road	2.25	--	~~2~~ 1	~~37(2)PS~~ 37(1)PS

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Area VII - Administration Area				
Former DRMO Area Between Buildings 42 and 77	6.6	22	3	75(3)PS, PR, HS,HR
Wood Preserving Solution Spill Area	0.9	70	3	61(3)HR
Paint Storage and Disposal Area	0.1	77	3	62(3)HR,PS
Buildings 27 and 30A	0.1	--	3	63(3) HS, HR PS, PR
Building 31 Motor Pool Battery Acid Collection Sump	0.57	75	3	66(3)HS,PS
Former UST Locations Buildings 6,7, and 10	0.4	42	4	68(4)A,PS,PR
Former UST Locations Buildings 21, 24, 46	Admin Area - 3.0 Building 21 - 0.04 Building 24 - 0.03 Building 46 - 0.02	42A	~~3~~ 4	~~69(3)HR,HS,PS,PR~~ 69(4)HR,HS,PS,PR
Road Oil Application/Disposal Sites Building 54 Photographic Chemical Disposal Area	39.12	44 76	~~6~~ 4	~~79(6)A,PS,PR,HS,HR~~ 79(3)A,PS,PR,HS,HR
Former UST Near intersection of Fir Street and D Street	0.03	--	~~2~~ 1	~~70(2)PS~~ 70(1)PS
Building 29 Former Diesel Tank	0.07	--	2	71(2)PS, PR
Building 4 Public Works	0.34	--	4 7	~~72(4)A~~ 72(7)A, HR(P)
Building 18 Warehouse Office	0.36	--	~~4~~ 1	~~73(4)A,PS~~ 73(1)A, PS

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
UST NE of Building 17	0.03	--	~~2~~ 1	~~74(2)A, PS~~ 73(1)A, PS
Building 11 Dispensary	0.79	--	~~6~~ 7	~~76(6)A,HS~~ 76(7)A,HS
Building 36 and 53 N	0.32	--	~~6~~ 1	~~77(6)A,PS~~ 77(1)A,PS
Building 53S	0.16	--	~~6~~ 2	~~78(6)A,PS~~ 78(2)A,L,PS, PR
Building 30 Dunnage Shop	0.45	--	~~6~~ 3	~~*64(6),A,PS*~~ 64(3),A,PS,HR
Building 5 Vehicle Maintenance Shop Building 37 Boiler house Associated former USTs	1.09	--	~~6~~ 7	~~*67(6)A,HS,PS,PR*~~ *67(7)A,HS,PS,PR*
Building 42 Salvage and Surplus	0.52	--	2	*65(2)PS,PR*
Building 2 Fire Department	0.16	--	~~4~~ 1	~~*80(4)A,HS,HR,PS*~~ *80(1)A,HS,PS*
Building 41 USTs Standby Generator Plant	0.07	--	~~2~~ 1	~~81(2)PS~~ 81(1) PS
Building 57 Telephone communication building	0.09	--	~~7~~ 1	~~*82(7)A,R,PS*~~ 82(1)A,PS
Building 51 Commanders Quarters	0.08	--	~~4~~ 7	~~*83(4)A,PS*~~ *83(7)A,PS, PR(P)*
Building 73 Residence garage	0.03	--	~~7~~ 1	~~*84(7)R, A*~~ *84(1) A*
Building 55 Office space converted from residence	0.02	--	~~7~~ 1	~~*85(7)R, A*~~ *85(1) R,A*
Building 55G Identified twice	0.07	--	~~2~~ 1	~~*86(2)PS*~~ *86(1)PS*
Former PCB Transformer Vault	0.02	--	3	*87(3)HS,HR*
Building 1 UCD Headquarters	0.26	--	3	*88(3)R*
Building 35 Residence	0.06	--	~~7~~ 1	~~*89(7)R,PS, A*~~ *89(1)R, PS, A*

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Buildings 15 and 16 Building 14 - Former PCB Transformer Vault	0.1 0.37	--	3	*90(3)HR,PS*
Building 70 Residence garage	0.05	--	~~7~~ 1	~~*91(7)A,R*~~ 91(1)A,R
Building 32 Office and theater	0.19	--	~~6~~ 1	~~92(6)A,PS~~ 92(1)A,PS
Former PCB Transformer Vault	0.07	--	3	93(3)HR
Building 33 Community center	0.14	--	~~2~~ 7	~~94(2)PS~~ 94(7) PS
Building 34 Housing NCO	0.10	--	~~4~~ 2	~~95(4)A,PS~~ 95(2)A,PS
Building 71 Residence garage	0.06	--	~~7~~ 1	~~96(7)R~~ 96(1)R
Buildings 38 Bathhouse Building 40 Swimming Pool	0.26	--	~~2~~ 1	~~97(2)A, HR, PS~~ 97(1)A, HR, PS
Building 24 and adjacent UST Well house No. 1	0.03	--	~~3~~ 7	~~26(3)PS, R~~ 26(7) PS,R, A(P),L(P)
Former USTs along Birch Road	1.9	--	~~6~~ 1	~~46(6)A,PS~~ 46(1)A,PS
~~Former AST location East of Rim Road South~~	~~0.72~~	~~--~~	~~2~~	~~48(2)PS~~
Building 6 Service Station	0.03	--	~~3~~ 2	~~108(3)PS,PR,A(P),L(P)~~ 108(2)PS,PR,A(P),L(P)
Leaking Drum Storage Area	0.08	83	3	109(3)HS,HR
Vehicle Storage area		72	3	~~110(3)PS~~
Possible Fire Training Pits	0.33	71	7	111(7)HS,HR
Building 23 Oil Fuel transfer station	0.17	74	7	112(7) PS, HR
Building 39 Oil Storage Dock	0.02	--	7	113 (7) PS, PR(P), HS, HR(P)

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Diesel Fuel Spill	0.02	73	2	114 (2) PS, PR
Building 10 Locomotive House	--	--	7	122(7)HR(P), PR(P)

[1] Study Site Numbers referenced in this column are based on the USACE 2010 ECOP Report (March 2010). The Study Site numbers originally were developed to compile the extensive historical studies and activities into a standardized approach.

[2] The entire ADA - Area I is considered an Operable Unit by the EPA, where the cleanup was determined to be protective of human health and the environment in the short term because controls were put into place to prevent exposure. At this time, the entire ADA is surrounded by chain link fencing and is in accessible. The most recent 5-year report for ADA Operable Unit prepared in March 2010 acknowledged additional remedial actions would be required.

N/A = Not Applicable, since the March 2010 ECOP Report did not identify as a Study Site.

-- = Not identified as a “Study Site” in previous environmental reports.

Notes:

Buildings and/or structures with identified or suspected asbestos, radon, lead-based paint were not included in this table and were not designated with an ECOP Category, unless petroleum products or hazardous materials also were identified with an ECOP category of 2 or greater.

Buildings or structures determined to be located outside the Site boundaries are shown in strike-out mode.

The information provided below summarizes the investigation results from review of the June 2010 ECOP report (USACE, 2010), onsite file reviews, interviews with UCD staff and regulators, and a field reconnaissance conducted the week of 10 January 2011.

Site Wide Findings

Federal Facilities Agreement (FFA): The OMD Parcel is subject to an FFA signed in 1989 by the Army, EPA, and DEQ. In the FFA, the Army and all subsequent property owners are bound to cleanup requirements for nine designated cleanup locations, identified as OUs. The number of OUs was reduced to eight in a series of RODs in the mid-1990s, which established cleanup goals and remediation strategies for each of the OUs. Six of the eight OUs are within the boundaries of the Subject Site. The Army, EPA, and DEQ have agreed that remedial actions at four of the OUs are protective of human health and environment and that NFA is required at these four OUs. Two of the OUs remain in the process of cleanup: Area I - ADA and Area V - EWL/Central.

Igloo Blocks: Approximately 412 igloos are located within the Subject Site. At the time of AMEC's 10 January 2011 field reconnaissance, the majority of igloos were empty, with the exception of 14 igloos located in J-Block (#1797 - #1810). These igloos contained agent-related hazardous waste awaiting disposal at the UCDF. I-Block Igloos had contained HD agent prior to transfer of the material to K-Block. The I-Block Igloos were RCRA-closed and approved by the DEQ in December 2009. The Army also RCRA-closed J-Block and K-Block Igloos in a manner similar to I-Block. Based on the January 2011 field reconnaissance, igloos may have lead-containing paint and asbestos tar surfacing at the interface between the rooftops and vegetation. Note that no igloos were identified with ECOP categories in this report unless a petroleum or hazardous materials release was documented. It also should be noted that igloos were not included in previous lead paint surveys conducted at the UCD.

Miscellaneous Sites: Thirty-two separate locations throughout the Subject Site were included as one OU, identified "Miscellaneous Sites OU." These separate locations represent areas where past environmental investigations have identified potential contamination from historical operations. Remediation in the form of soil removal occurred at three of the 32 locations (Site 22: Defense Reutilization Marketing Office [DRMO] in Area VII; Site 26: Metal Ingot Pile in Area II; and Site 36: Building 493 Paint Sludge Discharge Area in Area V). According to a joint Record of Decision between the EPA and the Army (EPA ROD, 1994), subsurface soil and groundwater investigations indicated no need for further cleanup at the remaining 29 locations.

Septic Systems: Although most current and former septic systems reportedly have been identified, not all former septic systems may have been documented or properly investigated. As an example, foundations and a possible septic leach field were observed in Area III at the time of AMEC's January 2011 field reconnaissance.

Gravel Borrow Pits: Approximately 10 to 12 gravel borrow pits were observed throughout the Subject Site. Construction/demolition debris, metal, tires, and wood were observed in many former gravel borrow pits. Most gravel borrow pits were identified as Study Sites in previous investigations at the UCD. In the EPA ROD (1994) the Army, EPA, and DEQ determined that no environmental work was required at the gravel borrow pits. However, a gravel borrow pit located in J-Block, which was not identified as a previous Study Site, was observed to contain construction debris at the time of the January 201 field reconnaissance. Additionally, other gravel borrow pits determined to meet closure requirements as indicated in the ROD were observed to have construction debris, indicating a possibility that the gravel borrow pits may still be in use.

Petroleum Underground Storage Tanks (USTs): Several UST investigations have taken place since the 1980s to identify UST locations, remove USTs, and/or evaluate soil or groundwater quality around the USTs. However, USTs may remain in areas of the Subject Site that were not previously identified or documented.

Transformers: Comprehensive sampling, removal, and replacement surveys for transformers were completed in 1989 and 1993. During AMEC's field reconnaissance, out-of-service transformers were observed at several locations on the Subject Site. Materials associated with former transformers, such as electrical lines, insulators, metal transformer platforms, and utility poles were observed at several locations on the Subject Site.

Natural and Cultural Resources: At the time of AMEC's January 2011 ECOP/EBS, an Environmental Assessment was planned for the UCD once the Army approved of the Base Redevelopment Plan (BRP). The UCD was working with Oregon State Historic Preservation Office (SHPO) to obtain full compliance with Section 106. Additionally, UCD was in formal consultation with the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) regarding archaeological and cultural properties at UCD.

Animal Waste: During the January 2011 field reconnaissance, animal waste comprised of bird feces was observed in buildings located in Areas III and V. Bird feces are considered a health hazard when airborne and would need to be removed prior to conducting other removal actions.

Hazardous Building Materials

Suspect Asbestos-containing Material (ACM): Suspect ACMs were observed in many buildings throughout the Subject Site during AMEC's January 2011 field reconnaissance. Sampling will be required prior to any renovation or demolition of the buildings. Examples of suspect ACMs observed during the field reconnaissance include: cementitios ("transite") siding and piping, window glazing, window/doorframe sealant, electrical wire wrap, magnesium-block piping insulation, mastic dots associated with fiberglass ceiling insulation, and tar coating between the interface of the roofs and soil caps of igloos and safety shelters. Conditions of suspect ACM can be divided into: a) structures requiring immediate mitigation; and b) structures requiring mitigation based on planned future use:

Immediate Mitigation: Transite siding, roofing materials, window glazing, and numerous other confirmed ACMs were readily observed in pieces and scattered around the buildings due to weatherization and lack of building maintenance. Federal regulations require non-intact ACM to be immediately abated for proper disposal.

Future Mitigation: If renovation or demolition is performed at one or more buildings in the future, a site-specific pre-renovation or pre-demolition survey needs to be completed to identify materials to be abated prior to disturbance.

Lead-Containing Paint: Paint containing detectable concentrations of lead is present in many buildings and structures at the Subject Site. Historical lead paint chip surveys of the Subject Site were performed to identify paint suspected of containing greater than 1.0 milligrams per square centimeter (mg/cm^2) of lead. Historical lead paint chip surveys were not comprehensive and did not include the igloos or railroad transfer depots (which were confirmed to have painted surfaces during the field reconnaissance). Paint suspected of having detectable concentrations of lead was observed on many buildings throughout Areas I, III, IV, V, VI, and VII and may not have been previously identified and/or sampled. The United States Occupational Safety and Health Administration (OSHA) considers any detectable concentration of heavy metals to be a potential hazard during construction activities. Additional paint sampling would need to be conducted prior to any renovation or demolition.

Radon: Past radon surveys revealed radon concentrations between 0.5 picocuries per liter (pCi/L) and 3.8 pCi/L in 121 buildings at UCD. Buildings 1, 5, and 415, and seven igloos, had radon concentrations above 4.0 pCi/L. It was recommended that renovations be made to Buildings 1, 5, and 415 to reduce the accumulation of radon gas. Previous radon tests may not be representative of current conditions.

Universal Waste: Regulated materials potentially classified as universal hazardous wastes were observed in buildings located within all Areas of the Subject Site, including mercury-containing fluorescent light tubes; high-intensity discharge lighting and thermostats; and chlorofluorocarbons (CFC)-containing air conditioners. Polychlorinated biphenyl (PCB)-containing light ballasts were observed within all Areas of the Subject Site.

PCB Bulk-Waste Product: PCBs may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in many buildings built or renovated prior to 1978.

Wells and Underground Injection Controls

Potable Water Wells: The UCD's operational water needs have been supplied by seven potable water wells. These include five wells on the Subject Site (Wells 1, 2, 3, 6, and 7) and two in Area II (Wells 4 and 5) southwest of the Subject Site. Wells 1 and 2 are located in Area VII and are not in use at this time. Well 2 is housed by Building 25. Building 25 was not secured at the time of the January 2011 field reconnaissance. Additionally, the cover and pumping mechanism for Well 1 had been removed and replaced with a 5-gallon bucket, in violation of Oregon Water Resources Department (OWRD) regulation 690-215-0050 regarding well covers. Currently, water for Area VII is supplied by water wells outside the boundaries of the Subject Site. Unless the OWRD approves an application to transfer water rights to a different parcel of land, a water right may be exercised only on the specific land identified in the water right certificate and only for the uses recognized on that certificate.

Groundwater Monitoring Wells: Groundwater monitoring wells are located throughout the Subject Site. However, no map was identified during the January 2011 field reconnaissance or research that documented all groundwater monitoring wells at the UCD. Reportedly, there are approximately 116 groundwater monitoring wells at the Subject Site; however, observations made during the field reconnaissance suggest the number is higher. At least one groundwater monitoring well was installed adjacent to the wastewater treatment system in Area VI and reportedly, has never been sampled.

Drywells and Underground Injection Control (UICs) facilities: Historical UCD installation maps depicted drywells near Buildings 4, 10 and 608. Additionally, catch-basins were observed around buildings in Areas III and V and did not appear to be connected to a storm sewer system. Area VII-Administration Area is the only area of the Subject Site connected to a storm sewer system; therefore it is probable that catch-basins outside of Area VII are likely connected to drywells. Roof drains on buildings within Area VII direct precipitation directly to the ground surface. Roof drains and dry wells qualify as UICs per DEQ regulation 340-044-0005(24).

Area I - Ammunition Demolition Activity (ADA)

Area I is the location of the ADA, a 1,750-acre former ammunition demolition area on the western portion of the UCD. Over 20 individual sites where munitions were burned, detonated, buried, or otherwise disposed have been identified at the ADA. An active firing range, operated by OMD and UCDF contractors, is located near the southwest corner of the ADA, and includes a rifle range, machine gun range, and a pistol range. The BRP indicates a large caliber small arms range formerly was present at the active firing range; however, it was closed due to safety concerns. The surface danger zone for the active firing ranges covers a large extent of the ADA.

A ROD for this ADA OU was signed by the Army, EPA, and DEQ in June 1994. Cleanup operations are ongoing at the ADA and have included a surface unexploded ordnance (UXO) survey and a groundwater investigation to evaluate groundwater quality. A second survey is planned in the future. Twenty individual contamination sites within the ADA were identified from past investigations. These sites are discussed in this report.

Area II - Deactivation Furnace and 100/200 Series of Warehouses

Approximately 30 acres of Area II are included in the Subject Site. One Study Site was identified from past environmental investigations in Area II. Site 34 Paint Spray and Shot Blast area was investigated as part of the Miscellaneous Sites OU ROD. A determination of NFA was made for Site 34. No evidence of former disposal activities was observed in this area during AMEC's January 2011 field reconnaissance.

Area III - West Central

Catch-basins: Catch-basins were observed around Buildings 608 and 614. Area III is not connected to a storm sewer system and it is likely the catch-basins are connected to dry wells. Ponded water in one catch basin contained what appeared to be petroleum sheen at the time of the January 2011 field reconnaissance.

Buildings 608 and 614: Ethylene glycol reportedly remains in the cooling lines for Buildings 608 and 614. According to UCD personnel, Buildings 608 and 614 require remediation to remove explosives residues as well as the ethylene glycol in the cooling lines.

Concrete foundations: Concrete foundations for former restrooms were observed northeast of I-Block at Road A and North Juniper Road. A septic leach field was observed in the vicinity of the foundations.

Possible Air Pressure Tank: During the January 2011 field reconnaissance, what appeared to be a partially-buried air pressure tank was observed south of Building 608 and Building 612. Its use could not be identified from visual inspection during the field reconnaissance. A 4-inch pipe attached to the tank was directed downgradient to a topographically lower area to the north of Building 614 and appeared to follow a graded trench.

Possible Drainage from Building 614: At the time of the field reconnaissance, the area north of Building 614 and associated buildings appeared to have been purposely graded and bermed to a topographically lower area.

Area IV - North Central

K-Block Buildings: Buildings in K-Block (654, 655, 656, 659, and 660) were not accessible at the time of the field reconnaissance.

Septic systems: The septic system associated with the laundry building (Building 655) is subject to sampling under the UCD's Water Pollution Control Facility (WPCF) permit. No investigation around the septic leach field has been conducted. A septic system also is associated with Building 660.

Area V - Explosives Washout Lagoons (EWL)/Central

EWL-Groundwater OU: An explosives-contaminated groundwater plume extends over an approximate 350-acre area between Area V and adjoining Area VII. Groundwater cleanup currently is being conducted by the Army in accordance with the ROD and with oversight from EPA and DEQ.

Laundry Building 419: The field reconnaissance identified numerous vaults, manhole covers, washing station, and leach field associated with Building 419. Building 419 was not identified as a Study Site in previous investigations.

Area VI - South Central

Inactive Landfills OU: An NFA determination was made for the Inactive Landfills OU. During the January 2011 field reconnaissance; there was visible evidence of continued use of the landfills as a disposal area for construction/demolition debris, bales of tumbleweed, and potentially other waste. The regulatory status of the Inactive Landfill OU should be re-evaluated.

Railroad Yard and Storage: A 140-acre railcar storage area is located along the southern border of the UCD. The area contains approximately 8 miles of former railroad car classification/storage areas. Historically, this area had been leased to Union Pacific Railroad (UPRR), but is currently unused. Fill has been documented along the length of the rail yard and includes construction waste.

Small Arms Range: Evidence of a small arms range was observed among the rail spurs in the vicinity Inactive Landfills area. Evidence consisted of targets arranged at intervals, generally parallel to the rail lines.

Wastewater Treatment Plant (WWTP): The WWTP has received sanitary sewer wastes from Area VII since its construction in 1941. During this time, possible operations in Area VII such as disposal of photographic chemicals, petroleum products, solvents, pesticides and other materials, could have been discharged from floor and sink drains within Area VII buildings to the sanitary sewer system and ultimately to the WWTP. Only one groundwater monitoring well was observed around the WWTP leach field. This well was located near the WWTP Imhoff tanks, and reportedly has never been sampled.

Storm sewer discharge Pipe: Stormwater runoff is directed from Area VII to a single discharge pipe located approximately 500 yards southwest of the WWTP. The discharge pipe was located within a deep trench near the WWTP and could have discharged surface water runoff from Area VII that could contain concentrations of petroleum hydrocarbons and other constituents from storm drains and catch basins located in Area VII.

Area VII - Administrative Area

Drywells: The locations of drywells identified from historical installation maps were observed to the east of Building 10 and the north of Building 4.

Scrap yards/Storage yards: Two scrap yards were identified in Area VII during the January 2011 field reconnaissance. A storage yard located north of Building 77 is known as the DRMO storage yard and is identified as Study Site 22 from previous investigations. Materials observed in this area during AMEC's field reconnaissance included used motors, numerous used empty aboveground storage tanks (ASTs); commercial dryers, equipment, and used supplied-air gas cylinders. Many of these items were stored directly on the asphalt and gravel ground surface. Reportedly, at one time leaking transformers containing PCB-oil were stored temporarily in this area. Construction demolition debris was observed in an unfenced area west of Building 19 and east of Fir Street. Debris observed in this area included metal fence posts embedded in concrete foundations, bricks, telephone wiring, piles of asphalt rubble, fencing wire, and ceramic insulators.

Debris: Debris including asphalt shingle roofing, polyvinyl chloride (PVC) piping connections, steel piping, and scrap metal were observed at various locations around Area VII, generally in undeveloped areas and along rail lines.

Former foundations and Manhole Covers: Former foundations, manhole covers, and piping connections were observed over a large gravel and asphalt area to the south of South Street. In the past, used oil was sprayed in this area for dust control. This area was identified as Study Site 44 in previous reports.

Former Fire Training Pit: The area of a reported former fire training pit where solvents and other flammables were burned was observed in the grassy courtyard east of Building 57. No visible evidence of former fire training pits was noted during the January 2011 field reconnaissance. Additionally, no historical information regarding this activity was found during AMEC's document review or was documented in the June 2010 ECOP report (*USACE, 2010*).

Wood Treatment: Wood treatment using pentachlorophenol was reported to have occurred in the past in Building 11; however, no historical information regarding this activity was found during document review, nor was this activity confirmed in the June 2010 ECOP report (*USACE, 2010*). Treated wood had been stored in the DRMO area to the north of Building 11.

REVISED ENVIRONMENTAL CONDITION OF PROPERTY ENVIRONMENTAL BASELINE SURVEY REPORT

7,421-Acre Oregon Military Department Parcel
Umatilla Chemical Depot
Umatilla and Morrow Counties, Oregon

1.0 INTRODUCTION

AMEC Environment & Infrastructure, Inc. (AMEC) is pleased to submit this revised Environmental Condition of Property (ECOP)/Environmental Baseline Survey (EBS) Report to the Oregon Military Department (OMD) for the 7,421-acre OMD Parcel (Subject Site) of the Umatilla Chemical Depot (UCD), located near Hermiston, Oregon. The purpose of the ECOP Report was to document the potential environmental liabilities associated with transferring the Federally-owned Department of Defense (DOD) land to the OMD. Preparation of this EBS relied on information contained in the June 2010 EBS report prepared by the US Army Corps of Engineers - Seattle District (USACE - Seattle). This EBS satisfies the environmental due diligence and disclosure requirements of Army Regulation (AR) 200-1, Oregon Army National Guard (ORARNG) Regulation Number 200-1, 42 USC9620(h), and Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The ECOP/EBS report was prepared following the Army National Guard (ARNG) ECOP Standard Operating Procedure (SOP), March 2007. The scope of work was outlined in and conducted under is being conducted under the State of Oregon Standard Professional Services Contract; contract number 109985A001 (12 October 2010).

The UCD is 19,728-acre military facility located near Hermiston, Oregon, shown relative to surrounding land features in Figure 1, which has been closed by a 2005 Base Realignment and Closure (BRAC) action. The UCD Umatilla Land Reuse Authority (LRA) identified 7,421 acres for transfer to the OMD for development as an Intermediate Training Complex (ITC). Activities on the OMD Parcel include:

- Support facilities for individual and collective training;
- Training facilities focused on individual/platoon weapons proficiency and company maneuvers;
- Full-time personnel support and cantonment facilities;
- Small arms range and maneuver space; and
- Construction of facilities required to support training.

An ECOP/EBS comprises an investigation of historical activities and existing conditions at a property and adjacent properties affected by a proposed action. The purpose of the ECOP/EBS is to determine the presence or likely presence of a release, threat of release, or any hazardous substance or petroleum product, and to document those findings in a report. The intent of performing an ECOP/EBS is to reduce the possibility of unforeseen environmental issues and related un-programmed obligations prior to property acquisition. An ECOP/EBS also identifies restrictions on land use that may be necessary to protect human health and the environment and to prevent interference with existing or planned construction or environmental restoration activities.

1.1 LOCATION AND PROPERTY IDENTIFICATION

The UCD is a fence-enclosed, 19,728-acre military installation located in northeastern Oregon, on the border of Umatilla and Morrow Counties. The installation is 3 miles south of the Columbia River and approximately 12 miles northwest of Hermiston, Oregon. The UCD is located in all or parts of the following sections:

- Sections 1-28 in Township 4 North, Range 27 East, Willamette Meridian;
- Sections 31-36 in Township 5 North, Range 27 East, Willamette Meridian;
- Section 36 in Township 5 North, Range 26 East, Willamette Meridian; and
- Sections 1, 12, 13, and 24 in Township 4 North, Range 26 East, Willamette Meridian.

The installation’s main features consist of 1,001 concrete igloo storage structures, bermed Y-site outdoor storage areas; active and inactive buildings; and miles of paved and unpaved roads constructed over native shrub-steppe vegetation. OMD is conducting a due diligence review of the environmental condition of 7,421 of the 19,728-acre installation prior to taking ownership.

The UCD most recently supported the Army’s mission to complete the destruction of chemical weapons at the Umatilla Chemical Disposal Facility (UCDF), in accordance with the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction (Chemical Weapons Convention). The mission was completed in October 2011. The UCDF is located in U-Block in the northeast part of the UCD as shown in Figure 2. At the time of AMEC’s January 2011 field reconnaissance, igloos once used for the storage of conventional and chemical munitions were empty with the exception of: 1) the remaining mustard agent (HD) chemical stockpile located in igloos of the K-Block; 2) chemical-agent-related (agent-related) secondary wastes stored in 14 Igloos (#1797-#1810) within J-Block and; 3) and non-chemical-agent-related (non-agent-related) wastes located in Building 203 on the southwestern part of the UCD. Actively used buildings at the UCD are located predominantly in Area VII - Administration Area, in the south-central part of the UCD; in K-Block; and the UCDF. Unused buildings in various stages of disrepair are located in the central and northwest parts of the UCD *(UMADRA, 2010; USACE, June 2010; personal communication, Ferguson, 2010).*

1.1.1 OMD Parcel

The 19,718-acre UCD installation has been designated for transfer to OMD, United States Fish & Wildlife Service (USFWS), and others. The OMD Parcel includes 7,421 acres and is shown relative to the remainder of the UCD property in Figure 2. The main features of the OMD Parcel collectively referenced in this report as "Subject Site", consists of the following:

> **Administration Area:** An approximately 200-acre building complex consists of the administrative, facilities maintenance, and housing functions for the UCD. Approximately 57 buildings are located here including offices, security stations, maintenance shops, medical facilities, housing, mess hall, community center, fitness center and pool, warehouses, transportation service buildings, two potable water well houses, and a variety of ancillary buildings.
>
> **Storage Igloos:** The UCD contains 1,001 ammunition storage bunkers (igloos), of which approximately 412 are located on the Subject Site in Blocks F (100 igloos), G (95 igloos), I (80 igloos), J (90 igloos), and the west half of K (47 igloos). Standard igloo dimensions are 80 'x 26 'x 13' (2,147 square feet) or 60' x 26'x13' (1,608 square feet). At the time of the field reconnaissance, K-Block igloos contained HD agent awaiting disposal at the UCDF. With the exception of 14 igloos (#1797 through #1810 containing agent-related secondary hazardous waste awaiting disposal at the UCDF) in J-Block, the remaining igloos were empty at the time of the January 2011 field reconnaissance.
>
> **Ammunition Maintenance and Decommissioning:** There are approximately 20 miscellaneous buildings within the ammunition maintenance, inspection, supply, and storage areas of the UCD. These buildings include the munitions disassembly, maintenance, and repackaging buildings located in the northwest part of the Subject Site and the former munitions maintenance buildings located in the central part of the Subject Site. Ammunition maintenance and decommissioning activities no longer occur at the UCD.
>
> **Ammunition Demolition Activity (ADA):** The ADA is a 1,750-acre former ammunition demolition area located on the western part of the UCD. This area was used from the 1940s through the mid-1990s for demilitarizing conventional munitions by burial, burning, and/or by detonating defective or expired propellants. The ADA included two small arms ranges, currently operated by the OMD. The ADA presently is restricted due to safety

concerns and has undergone shallow surface clearing of unexploded ordnance *(UXO; UMADRA, 2010).* At the time of AMEC's January 2011 field reconnaissance, additional UXO clearance at the ADA was planned *(personal communication, Daugherty, 2010)*.

Railroad Yard and Storage: A 140-acre railcar storage area is located along the southern border of the UCD, in Area VI. The area contains approximately 8 miles of former railroad car classification/storage areas. Historically, this area was leased to the Union Pacific Railroad (UPRR), but is currently unused *(UMADRA, 2010).*

1.1.2 Study Area Designations

An ECOP was completed for the entire 19,728-acre UCD property in June 2010 by the Seattle District of the United States Army Corps of Engineers (*USACE-Seattle*). The UCD ECOP report summarized current and historical use and operations; environmental investigation and remedial action history; and permitting, compliance, and regulatory history. In the June 2010 ECOP report, the UCD was divided into eight sections to assist with data evaluation and to facilitate naming convention for locations of environmental interest. Two main factors were used to define study sections: a) boundaries around the study sections corresponded with sections of the UCD destined for transfer to OMD, USFWS, or Land Reuse Authority (LRA); and b) boundaries such as roadways and fence lines easily visible in the field. AMEC maintained this approach for consistency, with the exception that the term "study section" was replaced with "Study Area" and the Study Area identified as Explosives Washout Lagoons (EWL) was replaced by "EWL/Central." Table 1 identifies Study Areas comprising the OMD Parcel (i.e. Subject Site) and the UCD Study Areas considered adjacent to the OMD Parcel. The Study Areas are shown on Figure 2.

Table 1: UCD Study Areas

Study Area	Acreage*	Location	Area Description	Former Use
Subject Site				
Area I-ADA	1,750	Western Part of UCD	Ammunition Demolition Activity and the location of two current OMD firing ranges.	Conventional munitions detonation, burning, burial, and disposal. Other UCD materials burned and/or disposed at the ADA included pesticides and dunnage.
Area III-West Central	2,551	West Central Part of UCD (OMD Parcel includes only the northern 2/3)	Sparsely developed with inactive 600 series buildings, I-Block Igloos, gravel borrow pits, and a grid of roadways and temporary exterior storage pads.	600 series buildings used for munitions maintenance and renovation, remote munitions disassembly. Igloos #1699- #1722 in I-Block formerly stored HD chemical agent.

Study Area	Acreage*	Location	Area Description	Former Use
Area IV - North Central	670	North Central part of UCD (OMD Parcel includes west half of K-Block)	West half of K-Block consists of 47 HD-agent storage igloos and Buildings 656, 659, and 654.	K-Block formerly held VX V-type and GB Sarin agents, which were incinerated at UCDF. Mobile drill and transfer system (DATS) unit formerly located on the NW part of K-Block.
Area V - EWL/Central	1,990	Central part of UCD west of Coyote Coulee	Sparsely developed with inactive 400 series ammunition maintenance buildings, railroad piers, and igloo Blocks J and G.	400 series buildings and associated explosives washout plant, lagoons and ancillary buildings (including a laundry, munitions inspection buildings, fueling station, railroad lines and piers) and igloo Blocks J and G.
Area VI - South Central	1,261	South Central part of UCD	Area VI is the location of F-Block, the UCD wastewater treatment plant, 400 series storage magazines, six inactive landfills, and railroad classification yard.	400 series munitions storage magazines and F-Block munitions storage.
VII - Admin Area	~200	Administration Area	Area VII is the location of the UCDs Administrative and support buildings. Activities here include vehicle maintenance, carpentry and dunnage, equipment repair shops, and dry goods warehousing.	Diesel train engine maintenance.
Adjacent Parcels				
II - DF	1,022	Deactivation Furnace (DF)	Study Area II comprises the former Deactivation Furnace (DF) and the 100 and 200 series warehouses located to the south of Study Area I.	Location of the former DF, also known as the “popper” furnace, used for incinerating small arms munitions.
III - West Central	~750	Southern 1/3 of Area III, adjacent to East of Area III	This area contains H-Block storage igloos, now empty.	H-Block igloos formerly contained conventional munitions.
IV - North Central	~332	Eastern half of K-Block	Contains the eastern 43 HD-agent igloos of K-Block.	Formerly contained chemical agents VX and GB.
VIII - East	5,919	East of Coyote Coulee	Location of igloo Blocks A-E and the “Active Landfill”, which is now closed and is subject to groundwater monitoring. The Quality Assurance (QA) Function Range I.	QA Function Range, two areas used as a rifle range and for testing of flares, photoflash grenades, and mines.

* Acreage is approximate, based on calculations made from aerial photograph, Figure 2.

1.2 REFERENCES

Reports, memoranda, letters, websites, and personal communications were used to compile the information contained in this report. References are presented in Section 8.0.

1.3 METHODOLOGY

The Department of the Army (DA) promulgated Army Regulation (AR) 200-1, Environmental Protection and Enhancement, to help ensure Army compliance with applicable state, local, Federal, Department of Defense (DOD), and other environmental laws and regulations. Depending on the nature of the proposed Real Property transaction or action and in accordance with Army National Guard Directorate (ARNG) Standard Operating Procedures (SOPs) updated on 14 March 2007, the EBS/ECOP process also promotes compliance with:

- Section 102(h) of the CERCLA;
- ASTM International (ASTM) guideline ASTM 6008-96, which identifies liabilities and Recognized Environmental Conditions (RECs) on DOD Property and;
- EPA's All Appropriate Inquiry (AAI) rule, 40 Code of Federal Regulations (CFR) 312.21

In accordance with ARNG policy and guidance, ECOP categories are assigned to readily evaluate the current environmental conditions at a property. To establish the ECOP categories, an EBS is conducted that satisfies the due diligence and disclosure requirements of AR 200-1 and 42 US Code (USC) 9620(h) when transferring DOD land or when acquiring non-DOD land, and as such implements Section 102(h) of CERCLA. Requirements for records review, field reconnaissance, and personnel interviews conducted for an EBS/ECOP are described in several policy and guidance documents:

- AR 200-1 Environmental Protection and Enhancement (13 December 2007);
- National Guard Bureau (NGB) ARNG Environmental Condition of Property Standard Operating Procedure (*SOP, 14 March 2007*);
- ASTM Standard E1527-05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Practices; and
- ASTM D6008-96 Standard Practice for Conducting Environmental Baseline Surveys.

1.3.1 Scope of Work

The scope of work for the ECOP/EBS consisted of the following:

Historical and Environmental Records Review: The following documents and maps were reviewed, which were obtained from the UCD installation, USACE-Seattle, state and Federal regulatory offices, and from internet searches.

Specific records reviewed are listed in the References Section 8.0 of this report.

- The USACE-Seattle's June 2010 report titled, "*US Army BRAC 2010 Environmental Condition of Property Report, Umatilla Chemical Depot - Oregon"* was reviewed and formed the basis for preparation of this EBS report. The June 2010 ECOP report provided a foundation of understanding of the developmental, operational, environmental, and regulatory history of the UCD.
- AMEC supplemented its review of the June 2010 ECOP report by reviewing an additional 30 documents including site assessments and remedial investigation (RI) reports, groundwater monitoring reports, Records of Decision (RODs), Five-Year Review reports, BRAC plans and redevelopment documents and regulatory permits and letters. Many documents were provided by USACE-Seattle via a fixed transfer protocol (FTP) Site. Other documents were accessed from the www.missionumatilla.com website including a 2010 *US Army Umatilla Chemical Depot Base Redevelopment Plan* (BRP) prepared by the Umatilla Army Depot LRA, and a 1994 *Base Realignment and Closure Cleanup Plan*. Additional websites were accessed to obtain general and specific information regarding facility operations and use.
- As-built construction, plumbing, electrical, and operations maps were reviewed from hundreds of plans available at the UCD. Copies of selected maps and plans were provided by UCD personnel on compact disc (CD).
- Environmental Data Resources, Inc. (EDR) was contracted to prepare a GeoCheck® Report to identify listings for the UCD installation and for surrounding facilities reported on local, state, and/or Federal environmental databases. The GeoCheck® Report was derived from the search of Federal and state environmental database records for the Subject Site and adjacent properties, and meets the government records search requirements of ASTM Standard E1527-05 (*ASTM, 2005*).

Personnel Interviews: AMEC conducted interviews with twelve UCD personnel and 3 UCD contactors with knowledge of current and past operations. Additional interviews were completed with EPA and DEQ personnel. Interviews were conducted to obtain current information regarding environmental regulatory status of the UCD, historical operations, and any outstanding environmental concerns associated with Subject Site.

Review Soils, Geology, and Hydrogeology: Site-specific information was reviewed from previously prepared environmental reports regarding soils, geology, and hydrogeology.

Field Reconnaissance: A physical reconnaissance of the Subject Site and observation of adjoining properties was conducted the week of 10 January 2011. The purpose of the field reconnaissance was to identify visible indications of past or present waste handling or storage activities that may pose a hazard to the surface and subsurface environment.

During the field reconnaissance, the Army granted access to all OMD Parcels, with the exception of restricted-access Area I - ADA and the restricted-access K-Block section of Area IV. AMEC's field team was accompanied by Mr. Jim Arnold, OMD's Environmental Restoration Manager. Photographs of Study Areas III-VI were taken during the field reconnaissance using a camera equipped with an integrated global position system (GPS) receiver with embedded location coordinates and directional views.

Reconnaissance of Adjacent Properties: As appropriate during the field reconnaissance, the field team visually surveyed adjacent properties noting operations or activities in the area, evidence of aboveground or underground storage of chemical or petroleum products, stressed vegetation, and land use practices that might directly affect the Subject Site.

Report documenting the results of the ECOP/EBS: The results of the environmental and historical records review, interviews, and field reconnaissance are included in this report, along with conclusions with regard to the presence of RECs, historic RECs, data gaps, or de minimis conditions associated with the Subject Site.

1.3.2 Property Categorization

In accordance with ARNG guidelines, seven ECOP categories are established to define various types and degrees of environmental conditions. The categories are based on the presence or absence of hazardous substances as defined by CERCLA, and petroleum product releases or disposal. Areas on the Subject Site were classified into one of the following seven ECOP categories.

Category 1	Areas where no release or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).
Category 2	Areas where only release or disposal of petroleum products has occurred.
Category 3	Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial action.
Category 4	Areas where release, disposal, and/or migration of hazardous substances has occurred and where all remedial actions necessary to protect human health and the environment have been taken.
Category 5	Areas where release, disposal, and/or migration of hazardous substances has occurred and where removal or remedial actions are under way, but where all required remedial actions have not yet been taken.

Category 6 Areas where release, disposal, and/or migration of hazardous substances has occurred, but where required actions have not yet been implemented.

Category 7 Areas that have not been evaluated or require additional evaluation.

For purposes of this EBS, based on conversations with OMD and ARNG representatives, the following should be noted: 1) If related to the presence of hazardous substances or petroleum product releases or disposal, issues of asbestos, lead-based paint, radon, unexploded ordnance, polychlorinated biphenyls (PCBs), and radionucleides are included in the property categorization; 2) If not associated with a hazardous substance or petroleum product release, such considerations were included as a separate listing of "other environmental considerations."

1.3.3 Deviations

The standard sections suggested in Appendix E of the ARNG SOP were expanded in this report to accommodate the extremely large volume of environmental documentation describing the complex operational and land use history of the UCD. The outline presented in this report remains in compliance with the ARNG recommended outline.

2.0 PROPERTY DESCRIPTION AND ENVIRONMENTAL SETTING

The property description and environmental setting information was obtained from observations made during AMEC's January 2011 field reconnaissance; a review of available UCD maps and plans; a review of natural resources, planning, and geological documents; and interviews with UCD personnel and regulators knowledgeable about the Subject Site.

2.1 PROPERTY DESCRIPTION

The property was described previously in Section 1.1.1.

2.2 SURROUNDING LAND USE

Land use in the vicinity of the UCD is almost exclusively agricultural in both Morrow and Umatilla Counties. Properties west of the UCD in Morrow County have been zoned "exclusive farm use" (EFU) and most agricultural parcels are supported by center pivot irrigation. The rural-residential boundary of the town of Irrigon, Oregon is located northwest of the UCD and the zoning near Irrigon transitions from EFU to Rural Residential (RR1). In Umatilla County, the areas to the north, northeast, and south of the UCD are within the "North & South County Agricultural Plan Designation", which is zoned EFU, and is dominated by commercial farming operations using center pivot irrigation. Lands to the east of the UCD, in Umatilla County, are within the "West County Irrigation District", characterized by center pivot irrigation on agricultural parcels of 45 to 90 acres in size *(UMADRA, 2010).* As described in Section 1.1.2, Areas II and VIII, and parts of Areas III and IV are located on the UCD and are considered parcels adjacent to the Subject Site. Information and observations of adjoining properties and lands surrounding the UCD is presented in Section 6.0.

2.3 SURFACE WATER

There are no surface water bodies on the UCD. Little runoff occurs because of the minimal amount of precipitation (average annual precipitation of 8.13 inches) and very permeable soil. The minimal runoff that is generated is directed into shallow depressions found in the generally flat to gently rolling topography of the UCD. The most significant depression is located at the base of the west-facing bluff of Coyote Coulee, the dominant surface feature located centrally on the UCD. Surface runoff in the area east of Coyote Coulee is toward the southern boundary into a shallow, elongated depression running parallel to the UPRR rail line and Interstate Highway 84 *(Earth Tech., 1994)*. Surface water in Area VII - Administration Area flows into catch-basins, which direct stormwater runoff to an outfall located approximately 500 yards southwest of the wastewater treatment plant (WWTP) in Area VI. The nearest surface water sources are the Columbia River located 3 miles north of the UCD, and the Umatilla River located approximately 2 miles to the east.

2.4 TOPOGRAPHY

The UCD is located between two geomorphic regions, the Deschutes-Umatilla Plateau and the Blue Mountains. The north, west, and central part of the UCD generally is flat to gently rolling, with the exception of the most prominent surface feature, Coyote Coulee. Coyote Coulee is reported to have been created as a result of the prehistoric and catastrophic Missoula floods *(UMADRA, 2010*). The western edge of Coyote Coulee slopes at 5 to 10 percent, with the eastern edge being an escarpment that rises 60 to 90 feet at a 30 to 45 percent slope. Land to the west of Coyote Coulee (comprising the Subject Site), consists largely of gently rolling hills. Elevations at the UCD range from 400 feet (ft) to 677 ft above sea level *(UMADRA, 2010).* Topography of the Subject Site relative to surrounding topography and the remainder of the UCD is shown in Figure 1.

2.5 GEOLOGY

A veneer of wind-deposited silt and sand lies nearest to the surface at depths up to 10 feet thick, providing the parent material for the overlying soils. Soils at the UCD consist of sandy loam and coarse sand developed from these deposits. The three main soil series identified at the UCD are Burbank loamy fine sand, Quincy fine sand, and Quincy loamy fine sand. Burbank loamy fine sand is described by the United States Natural Resources Conservation (NRCS) as a very deep, excessively-drained soil that formed in gravelly deposits and wind-worked material. This soil is underlain by a dense, very cobbley and gravelly layer of the Pleistocene alluvial deposits. Permeability is rapid throughout this soil type and the water-holding capacity is low. Quincy fine sand also is described as a very deep, excessively drained soil that formed in mixed sand. Quincy loamy fine sand is very similar to the Quincy fine sand but occurs on slightly flatter slopes and has slightly more silt and clay in the upper layer, resulting in a higher water-holding capacity (*E&E, 2004; NRCS, 2010*). A soils map of the UCD is presented as Figure 3.

The surficial soil is underlain by as much as 200 feet of Pleistocene alluvial deposits. These surface deposits are known as the Ordnance Gravels and are comprised of permeable silts, sands, and gravels, with some cobbles to the west of Coyote Coulee. Much coarser permeable deposits containing considerable quantities of boulders occur along the east wall of the Coulee and toward the east side of the UCD *(Dames & Moore, 1992).*

Basaltic lava flows of the Columbia River Group are found beneath the alluvial gravels, forming the down-warped bedrock surface of the Dalles-Umatilla Syncline. The basalt is composed of many layers of separate basaltic lava flows, which vary in thickness by as much as 100 feet. The flows generally are characterized by dense, vertically-jointed centers and relatively porous top and bottom surfaces. The individual flows are often separated by sedimentary layers composed of gravel, sand, silt, and clay (*Wozniak, 1995*).

2.6 HYDROGEOLOGY

Groundwater characteristics at the UCD have been studied since at least 1978, particularly in Area I - ADA and Area V - EWL/Central. Groundwater occurs beneath the UCD in a number of distinct hydrogeologic settings, in a series of confined basalt aquifers and in a highly productive permeable unconfined aquifer to the south of the UCD. The unconfined aquifer beneath the UCD consists of alluvial deposits and the weathered surface of the Elephant Mountain Member of the Columbia River Basalt Group. This unit is overlain by approximately 20 to 125 feet of unsaturated alluvial sand and gravel. Depth to groundwater at the UCD ranges from 60 to 100 feet below ground surface (bgs). Groundwater flow in the unconfined aquifer generally is to the northwest (*Dames & Moore, 1992*). Two groundwater elevation maps showing the general direction of groundwater flow are presented in Figures 4A and 4B.

Three municipal water supply systems, the Cities of Hermiston, Umatilla, and Irrigon, withdraw groundwater and approximately 1,500 domestic and irrigation wells have been identified within a 4-mile radius of the UCD.

The UCD is located within the Oregon Water Resources Department (OWRD) Ordnance Gravel Critical Groundwater Area (CGA), which has restrictions on water allocation. The OWRD, working in conjunction with other state agencies and local planning groups, has proposed a project to increase water availability in the Ordnance Gravel CGA, as well as in two other nearby CGAs. The plan evaluates pumping water from the Columbia River during available months for storage in the CGA aquifer for later use during seasonal higher water demand (*IRZ, 2009*).

2.7 SENSITIVE ENVIRONMENTS/NATURAL AND CULTURAL RESOURCES

Natural and cultural resources at the UCD are actively managed to prevent adverse impacts. An Integrated Natural Resources Management Plan (INRMP) was completed for the UCD in 2007, and was completed in coordination with USFWS, Oregon Department of Fish and Wildlife (ODFW), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The Final Integrated Cultural Resources Management Plan (ICRMP), dated 4 January 2002 defined areas with potential cultural resources and inadvertent discovery requirements.

2.7.1 Biological Resources

The UCD supports large communities of shrublands, dominated by sagebrush and bitterbrush, with an understory of annual grasses and forbs; and grasslands, dominated by a mixture of native and exotic species such as Sandberg's bluegrass, cheatgrass (downy bromegrass), and crested wheatgrass. The shrublands are found primarily in the eastern and southwestern parts of the installation on soils with a higher silt content and higher moisture capacity. Reportedly, the UCD contains the largest remnants of bitterbrush habitat in the Columbia Basin, as well as high quality needle-and-thread sandy grasslands. The central region (Areas III, IV, V) of the UCD is dominated by grasslands, which are intermixed with the shrublands in the eastern parts as well. Mixed vegetative communities primarily are found in the northwestern (Areas I and III) and northeastern parts (Area VIII) of the UCD *(Tetra Tech, 2007; USACE, June 2010*).

No Federally-listed vascular plant species have been identified at the UCD. However, it is reported that crouching milkweed, or Columbia milk-vetch, an Oregon State (State) watch-list species, was discovered in several of the vegetative communities at the UCD. The species was found primarily in the less disturbed dry shrub and grassland communities in the eastern part of the UCD (Area VIII). It also was documented in a disturbed crested wheatgrass community and in a bitterbrush-dominated community in the southwestern part (Area II) of the UCD installation.

Four plant species of concern were listed by the USFWS as potentially occurring within the area: Northern wormwood, Laurence's milk-vetch, hepatic monkey flower, and Columbia yellow-cress. Habitat requirements for the four species indicate habitat potentially is present only for Laurence's milk-vetch (*USACE, 2010*). State-listed candidates potentially occurring within the UCD area include Laurence's milk-vetch and Douglas' milk-vetch.

In general, faunal species at the UCD are consistent with what one would expect in Columbia Basin native shrub-steppe and grassland habitats: pronghorn, coyote, American badger, jackrabbits and cottontail rabbits, Swainson's and redtail hawks, burrowing owl, long-billed curlew, and many other species common to this habitat. A pronghorn herd roams on the UCD and is not free-ranging as the UCD's perimeter fence ensures captivity. The lack of permanent surface water at UCD precludes the occurrence of native fish species; however, mosquito fish are stocked in a stormwater retention pond to control mosquito larvae (*USACE, 2010*).

The UCD hosts several bird species that are on the Birds of Conservation Concern (BCC) 2002 list and/or the USFWS Focal Species List. The sage sparrow and the long-billed curlew merit special mention due to their specialized living requirements or their declining numbers throughout their range *(Tetra Tech, 2007; UMADRA, 2010*).

2.7.1.1 Threatened and Endangered Species

There are no threatened or endangered species currently recorded at the UCD. There are several sensitive species potentially found at the UCD. Table 2 summarizes UCD's potential sensitive species as defined in the INRMP (*Gene Stout & Associates, 2002*).

Table 2: Faunal and Floral Species at UCD

Common Name	Scientific Name	Federal Status	BCCa FSb	State Status	Occurrence
Tricolored Blackbird	*Agelaius tricolor*	SoC	BCR 9, N FS	SP	Potential
Mammals					
Western Small-footed Myotis	*Myotis ciliolabrum*	SoC		SU	Potential
Long-eared Myotis	*Myotis evotis*	SoC		SU	Potential
Long-legged Myotis	*Myotis volans*	SoC		SU	Potential
Townsend's Big-eared Bat	*Corynorhinus townsendii*	SoC		SC	Potential
Pallid Bat	*Antrozous pallidus*	None		SV	Potential
White-tailed Jackrabbit	*Lepus townsendii*	None		SU	Potential
Washington Ground Squirrel	*Spermophilus washingtoni*	C		LE	Potential
Plants					
Laurence's Milk-vetch	*Astragalus collinus var. laurentii*	SoC		LT	Potential
Douglas' Milk-vetch	*Astragalus kentrophyta*	None		SC	Potential
Reptiles and Amphibians					
Northern Sagebrush Lizard	*Sceloporus graciosus graciosus*	SoC		SV	Present
Birds					
Long-billed Curlew	*Numenius americanus*	None	BCR 9, R1, N FS	SV	Present
Bald Eagle	*Haliaeetus leucocephalus*	None		LT	Transient
Swainson's Hawk	*Buteo swainsoni*	None	BCR 9, R1, N	SV	Present

Common Name	Scientific Name	Federal Status	BCCa FSb	State Status	Occurrence
Ferruginous Hawk	*Buteo regalis*	SoC	BCR 9, N FS	SC	Present
Peregrine Falcon	*Falco peregrinus*	None	BCR 9, R1, N FS	LE	Transient
Sage Grouse	*Centrocercus urophasianus*	None	BCR 9, R1, N	SV	Potential
Western Burrowing Owl	*Athene cunicularia hypugea*	SoC	BCR 9 FS	SC	Present
Lewis' Woodpecker	*Melanerpes lewis*	SoC	BCR 9	SC	Present
Bank Swallow	*Riparia riparia*	None		SU	Present
Loggerhead Shrike	*Lanius ludovincianus*	None	BCR 9 FS	SV	Present
Grasshopper Sparrow	*Ammodramus savannarum*	None		SV	Present
Black-throated Sparrow	*Amphispiza bilineata*	None		SP	Present
Sage Sparrow	*Amphispiza belli*	None	BCR 9	SC	Present
Bobolink	*Dolichonyx oryzivorus*	None	FS	SV	Present

Federal: **C**: Candidate species: category includes taxa for which the USFWS has sufficient biological information to support listing as endangered or threatened. **SoC**: Species of Concern: category includes taxa for which existing information may warrant listing, but for which substantial biological information to support a proposal rule is lacking. **BCC:** Birds of Conservation Concern. BCR 9 Bird Conservation Region 9 R1 USFWS Region 1 N National. **FS =** Focal Species**.**

State Protected: (State Protected List also includes the categories listed as State Sensitive). **LE** Listed as an Endangered Species. **LT** Listed as a Threatened Species. **PE** Proposed as an Endangered Species. **PT** Proposed as a Threatened Species. **SC** Sensitive - Critical. Those species for which state listing as threatened or endangered is pending, or for which state listing as threatened or endangered may be appropriate if immediate conservation efforts are not taken. **SV** Sensitive - Vulnerable. Those species for which state listing as threatened or endangered is not believed to be imminent and could be avoided through continued or expanded conservation measures or monitoring. **SP** Sensitive - Peripheral or Naturally Rare. Those species that occur in the state at the edge of their distribution. Naturally rare species are species that have been present in low numbers in Oregon historically due to natural limiting factors. **SU** Sensitive - Undetermined Status. Those species whose status is unclear. *Source: Gene Stout and Associates, 1997*

2.7.1.2 Wetlands

Wetlands are defined as those areas that are saturated or inundated by groundwater or surface water at a duration and frequency sufficient to support, and that at normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR Part 328.3). The National Wetlands Inventory indicates no permanent, naturally occurring wetlands were identified on the UCD (*Gene Stout & Associates, 1997*).

2.7.2 Cultural Resources

Several archaeological surveys and historic property inventories and plans have been prepared for UCD over the years; the most recent was documented in the integrated cultural resources management plan (ICRMP), dated 4 January 2002. The ICRMP identified the following key archeological and historical findings at UCD:

> **Large Bone:** An item identified as a "large bone" was discovered during construction of the UCD and was "turned over to an unknown natural history society". No other information was identified in the ICRMP report or in the report from which the original information came (*Boreson, 1993*). The large bone finding was discussed in the ICRMP under the subtitle of "paleontological" indicating that the bone likely was not human. Currently, the UCD has no identified significant paleontological sites (*USACE, 2010*).
>
> **Former Disposal Area:** An historic dump of debris spread over an approximate 16' x 23' area was documented in 1993 east of the Subject Site in Area VIII. The debris consisted of approximately 150 items of food cans such as oval fish tins, spice, and condensed milk containers; ceramics such as flower pots, bowls, and cups; and glass such as canning jars. Other items located in the area included enamelware pans, a baby stroller frame and car parts. Trademarks on the ceramics and glass jars indicated that the dump was pre-installation era, likely the 1920s or 1930s *(Boreson, 1993*).
>
> **Lithic Scatter:** The presence of "minor lithic scatter" and "isolated finds" at sites along the west rim of Coyote Coulee were identified and recorded in a 1983 survey. The report authors determined that the scatter likely represented a hunting area. A 1996 report also recorded two isolated finds - a mussel shell fragment and a basalt flake (*Boreson, 1996*). The report concluded that the artifacts were used in conjunction with hunting at this location. The lithic scatter did not meet the definition of prehistoric sites *(Earth Tech., 2002)*.
>
> **Remnants of the historic Oregon Trail:** According to a 1987 report prepared by the National Park Service (NPS), remnants of the historic Oregon Trail were identified in southeastern and northeastern parts of the UCD. These historic remnants are identified as field numbers 11-1 and 12-1. The 1861 and 1875 US General Land Survey maps show an "Old Emigrant Wagon Road" crossing the northeastern corner of the UCD in Area VIII. An analysis of 1993 aerial photography confirmed the location of the trail (*Dames and Moore, 1992b; Earth Tech., 2002*).

Canal: In 1915, the West Extension Irrigation Canal of the Umatilla Project was constructed across the northwest corner of the UCD and runs northeast/southwest through the area (*Earth Tech., 2002*).

Historically Significant Buildings: The Administration and Firehouse buildings were found to be eligible by the Oregon State Historic Preservation Office (SHPO) for inclusion on the National Register of Historic Places (NRHP), as they both represented examples of early WWII construction. These buildings were considered Category III properties of minor importance. Neither building has been listed *(UMADRA, 2010; Earth Tech., 2002).*

2.7.2.1 Prehistoric Resources and Archaeological Sites

The UCD is located within the Plateau Culture Area, an area drained by the Columbia River, which supports archaeological evidence of long-term occupation by ancestral Salishan, Sahaptian, Athabaskan, Kootenai, and Cayuse peoples. Plateau Culture is distinguished by a pattern of linear settlement along rivers and a diverse subsistence base which included the use of riverine and terrestrial resources. Permanent winter villages had semi-subterranean earth lodges and were located along the rivers or at the conjunctions of tributaries. Seasonal camps usually were made up of mat covered lodges and located at higher elevations *(USACE, 2010)*.

The UCD is within the traditional territory of the Cayuse, Umatilla, and Walla Walla peoples. The advent of horse culture in the 1700s served to expand both trading links and political perspective. The political arena changed from an inward focus on the band or village to a regional focus as trade expanded. The expansion of trade also shifted the political balances in the regions, resulting in social conflict and warfare. Social stratification developed; horses became wealth. The Plateau people maintained their traditionally strong trade relations with the Northwest Coast, adding to these relationships, new partnerships formed with the Plains peoples (*UMADRA, 2010*).

2.7.2.2 Historic Resources and Buildings

At the time of the January 2011 field reconnaissance, UCD had approximately 1,400 buildings and structures that are 50 years old or older. Reportedly, inventory data for the World War II and Cold War eras is complete, and provides adequate information to assess the eligibility of historic properties for listing in the NRHP. In 1984, the NPS conducted an historic buildings survey of the UCD (*Interior, 1984*). The Headquarters Building (Building 1) and the Firehouse (Building 2) in Area VII - Admin were considered to be historic properties of minor importance (*Earth Tech., 2002*). Both buildings represented examples of early WWII construction and were considered Category III properties. In 1988, Oregon SHPO confirmed that the two buildings were eligible for inclusion on the NRHP. Table 3 summarizes the historic era properties at UCD (*Tetra Tech, 1997; UMADRA, 2010*).

Table 3: Historic Era Properties at Umatilla Chemical Depot

Function	Age	Size	Condition	Report
Dump	Historic ca. 19301940	16.4’ x 23.0’	Good	Boreson, 1996
Wagon Road	Historic ca. 1874	14’ x 6,000’	Disturbed	Boreson, 1996
Wagon Road	Historic ca. 1861	26’ x 1,200’	Disturbed	Boreson, 1996
Administration Building	1941	NA	Good	Bldg. Tech., Inc., 1984
Firehouse	1941	NA	Good	Bldg. Tech., Inc., 1984

Notes: ca. = circa; NA = not applicable; Source: Tetra Tech, 1997

2.7.2.3 Current Status of Cultural Resources

The Army’s compliance with Section 106 of the National Historic Preservation Act (16 USC 470) plus implementing regulations (36 CFR 800) and appropriate National Register Bulletins (e.g., *Parker and King, 1998*) will occur during the final stages of UCD decommissioning (*Stein, 2009*). In an April 2010 letter to UCD, Oregon SHPO outlined the additional work necessary to obtain Section 106 compliance. A copy of this letter is presented in Appendix A.

In a conversation with AMEC personnel during the January 2011 field reconnaissance, Mr. Don Gillis reported that the UCD was addressing the requirements outlined in the letter and was working with Oregon SHPO to obtain full compliance with Section 106. Additionally, Mr. Gillis indicated that the UCD was in formal consultation with the CTUIR regarding archaeological and cultural properties. The USACE-Mobil/Savannah District planned to complete a UCD-wide tribal cultural properties/sacred sites survey.

According to the BRP (*UMADRA, 2010*), historical and archaeological clearance by Oregon SHPO may be needed during planning of any site-specific reuse activity on the UCD. Each survey’s level of effort would be determined by the degree of site disturbance and surface or subsurface cultural resources potentially affected by project implementation (*Pumphrey, 2002*).

2.7.3 National Environmental Policy Act

To comply with National Environmental Policy Act (NEPA) for disposal of installation property, the DOD must comply with regulations in 40 CFR 1500-1508, developed by the Council on Environmental Quality (CEQ) and service-specific NEPA regulations. These regulations define the examination process for potential impacts to the environment in the disposal of the BRAC property to the public or private parties. All NEPA-related decision-making is concerned with identification of environmentally significant direct or indirect impacts on a particular resource, actions resulting in uncertain or controversial effects on the human environment, plus those actions that may violate legal requirements for protection of the environment (40 CFR 1508.27). If such effects do not exceed pre-defined thresholds of concern, or the environmental consequences are easily mitigated

(40 CFR 1508.20), an EA level of analysis is usually sufficient (*UMADRA, 2010*). However, if the particular impact is so significant that it cannot be mitigated, or if the impact contributes to "cumulative effects" (40 CFR 1508.7) over time, an Environmental Impact Statement (EIS) is most appropriate. Generic actions taken by the Army that normally require an EIS include those leading to "significant changes in land use" (32 CFR 651.42(d)) or major changes in mission that affect environmentally sensitive resources (32 CFR 651.42(g)). Both events are relevant to the closure and transfer of the UCD to the OMD.

2.7.3.1 Current Status of NEPA Documentation

An EA will be prepared by the USACE-Seattle District, once the BRP is approved by the Army (*USACE, 2010*).

3.0 PAST AND CURRENT OPERATIONS

This section provides a summary of land use and facility and operations history as derived from review of the June 2010 USACE Report as well as selected environmental reports, historical UCD plans and maps, and interviews with UCD and regulatory personnel.

3.1 LAND USE HISTORY

During World War II, the UCD was one of the first Army ammunition supply depots created on the continental United States. The installation satisfied all location criteria: a reasonably safe distance from the Pacific Northwest coast, a sparsely settled location, low humidity, and dry climate ideal for the storage of ammunition, and excellent rail transportation links. The development of the UCD was initiated in 1941 after the acquisition of approximately 16,000 acres that had been used for open range grazing. By the end of World War II, 1,268 of the installation's 1,411 structures had been constructed. These included administration, maintenance, and housing facilities, ammunition storage igloos and warehouses (*UMADRA, 2010*).

From the time the UCD commenced operations in 1941 until 1951, its primary function was to receive, store, and distribute various caliber ammunition and other conventional munitions. Over the next 10 years, the UCD activities were expanded to include open burning/open detonation (OB/OD) of obsolete munitions; testing, maintenance, recycling and repackaging of munitions components; and the storage and maintenance of missile and missile fuel components. No chemical weapons were ever used, manufactured, or tested at the UCD (*USACE, 2010*). A brief summary of the operation type and period of time that the operation was conducted is presented in Table 4. A chronological history of land use, development, and operations at the UCD follows the table.

Table 4: UCD Operations Chronology

Period of Operation	Type of Operation
Pre-1940	Private, county, and Bureau of Land Management Land.
1941-1945	Conventional ordnance storage.
1945-1947	Conventional ordnance storage and demolition.
1947-1962	Conventional ordnance storage, demolition, renovation, and maintenance.
1962-1994	Conventional ordnance storage, demolition, renovation, and maintenance. Chemical ordnance storage.
Present	Depot realignment. Storage and incineration of chemical munitions only.

Pre-1940	In 1915, the Messner-Hinkle Cutoff rail line was constructed by the Oregon-Washington Railroad and Navigation Company. The Messner-Hinkle Cutoff is now the main line of UPRR and forms the southern boundary of the UCD. Lands at the location of the UCD were comprised of rangeland before acquisition by the Army in 1940.
1941	In accordance with the War Department's General Order No. 11, the UCD and its mission were established to store and issue ammunition, small arms and components, lend-lease quartermaster supplies, and store and process vehicles. A 16,000-acre area of undeveloped and agricultural land was designated a Military Reservation and construction began on shops, offices, warehouses, family housing barracks, miles of railroad siding, and 1,001 ammunition storage igloos. Additional acreage was acquired from various owners (8,800 acres) and from the Department of the Interior (DOI) and the Bureau of Land Management (BLM; 7,200 acres). Other operations conducted at the UCD beginning in 1941 included vehicle maintenance, fuel/oil storage, and waste disposal at landfills.
1945	In 1945, large stocks of ammunition were sent to the UCD for maintenance and storage or demilitarization. During this time the function of ammunition demolition was added at the UCD.
1947	In 1947 an ammunition renovation complex was constructed in Area V-EWL/Central.
1950	During the Korean War from 1950 to 1953, ammunition was shipped up the Columbia River by barge to Irrigon, Oregon and then transported by rail overland to the UCD.
1955, 1958	Two ammunition maintenance buildings were added in 1955 and 1958 in Area III - West Central (Buildings 608 and 614, plus ancillary buildings). The explosives washout plant (Building 489) in Area V - EWL/Central was active from the mid-1950s through the mid-1960s.
1957-1960	An additional 4,000 acres of adjoining land was added to UCD property as a safety precaution.
1962	The UCD was renamed the Umatilla Army Depot and was given the mission of receiving, storing, issuing, and maintaining toxic munitions. The Army began storing chemical agent-filled munitions and 1-ton containers of chemical agents at K-Block. Chemical munitions were received for storage at the installation from 1962 through 1969. In addition to chemical munitions, conventional munitions were stored in magazines and igloos in Blocks A through J. Missiles and missile fuel components, including

unsymmetrical dimethyl hydrazine (UDMH) and red fuming nitric acid (RFNA), were also stored at the UCD from the mid-1950s until the early 1960s.

1973	The UCD was renamed the Umatilla Depot Activity and became a reserve storage activity under the command of the Tooele Army Depot in Utah. Activities at UCD included conventional ordnance storage and demolition; chemical munitions storage and maintenance; vehicle maintenance; fuel and oil storage, and waste disposal at landfills.
1965-1973	During this time period the UCD shipped munitions to Vietnam.
1988	The UCD was recommended for realignment under BRAC and much of the conventional ordnance remaining at the UCD was either destroyed or moved to Hawthorne Army Depot (HWAD) in Nevada.
1993	The International Disarmament Treaty was signed by the United States, outlawing the development and stockpiling of chemical warfare materials. This agreement was developed at the Convention for the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction, otherwise known as the Chemical Weapons Convention (CWC). Under the terms of this agreement, the US was to destroy its entire inventory of chemical warfare materials by 2012.
1995	In October of 1995, the installation was re-named the Umatilla Chemical Depot (UCD) and was placed under the Soldier Biological and Chemical Command (SBCCOM).
1997	Construction began on the UCDF at U-Block. UCD’s original chemical agent stockpile included nerve agents GB and VX; and blister agent HD, which were stored igloo Blocks J, I, and K. The chemical agents were contained in a variety of munitions: M55 rockets; 155-millimeter and 8-inch artillery shells; 500, and 750-pound bombs; land mines; 1-ton containers; and aerial spray tanks.
2001	UCDF construction was completed in 2001. Trial burns using surrogate materials to test the incinerator’s ability to meet performance standards were conducted from 2003 to 2004.
2004-2007	In September 2004, UCDF began its disposal of chemical agent GB munitions. GB munitions disposal was completed on 8 July 2007.
2007-2008	Between October 2001 and November 2008, UCDF completed disposal of chemical agent VX.

June 2009 UCDF began its Chemical Agent HD disposal campaign.

October 2011 By October 2011, all remaining HD stockpile was destroyed.

At the time of AMEC's January 2011 field reconnaissance, the mission at the UCD supported the storage, handling, and disposal of chemical agent at the UCDF. Those areas of the Subject Site relevant to this mission consisted of the storage and handling of chemical agent in the west half of K-Block in Area IV, and the storage of agent-related hazardous materials stored in Igloos #1797-#1810 of J-Block in Area V. The chemical agent was destroyed at the UCDF, located in U-Block adjacent to the northeast of the Subject Site. All non-agent-related hazardous materials generated at the UCD were stored in Building 203 in Area II located adjacent to the southwest of the Subject Site.

3.1.1 Operational History

Past activities on the Subject Site consisted of chemical-agent and non-chemical agent materials storage; ammunition maintenance, renovation and demolition; general and vehicle maintenance activities; Defense Reutilization Marketing Office (DRMO) activities (surplus materials storage); waste disposal; land filling; and firing range operations. Historically, chemical weapons were stored on the Subject Site only in J-Block in Area V, I-Block in Area III and K-Block in Area IV. These igloos no longer contain chemical weapons. Chemical weapons storage activities have been documented in numerous environmental reports, which have identified known and suspected areas of environmental contamination in soils, groundwater, and infrastructure.

The following subsections describe industrial facilities associated with current or past operations at the UCD. Past environmental investigations of the industrial facilities and associated operations identified 83 locations of environmental interest at the UCD, with 65 of those located in the Subject Site. Previous environmental investigations are discussed in Section 4.0.

3.1.1.1 Materials and Munitions Storage Facilities

Four-hundred and twelve (412) earth-covered, reinforced-concrete storage igloos are located in Areas III, IV, V, and VI of the Subject Site, in igloo Blocks F, G, I, J, and K. The igloos originally were used for storage of various conventional and chemical agent munitions, and chemical agent-related secondary wastes. At the time of AMEC's January 2011 field reconnaissance, only HD blister agent was stored in igloos within K-Block, temporally stored until the chemical agent was incinerated. The adjacent UCDF completed GB and VX disposal and was processing the remaining HD blister agents stored in K-Block at the time of the field reconnaissance. Secondary agent-related hazardous wastes were stored in selected J-Block igloos #1797-#1810. Types of secondary wastes stored in the J-Block igloos include decontamination equipment, protective clothing, and carbon filters. Secondary wastes in the igloos were stored in 55-gallon drums, wood/cardboard containers, and metal containers.

In March 2002, chemical agent HD was moved from Building 659 to 24 I-Block igloos, #1699 through #1722. Six of the igloos were never placed into service. In 2006, all agents were transferred from the I-Block igloos to K-Block igloos. The I-Block igloos were permanently closed in accordance with RCRA and approved by DEQ in December 2009 *(pers. comm. Wenzl, 2010).* At the time of the January 2011 field reconnaissance, UCD was preparing a J-Block closure plan similar to the closure plan prepared and executed for I-Block igloo closure. A copy of the I-Block closure plan is presented in Appendix B.

3.1.1.2 Ammunition Demolition Activities (ADA)

Area I - ADA was used to burn, detonate, or dispose of ordnance and other solid wastes beginning in 1945. Currently, the ADA is no longer used for demilitarization of munitions. Two small firearms ranges are located in the southwest corner of the ADA. Locations where ADA activities occurred are listed below and are identified as “Study Sites” in Figure 6, as identified from the June 2010 ECOP Report (*USACE, 2010*) and from previous environmental reports. It should be noted that Study Site numbers were re-designated using a sequential numbering system in the June 2010 ECOP Report; therefore, Study Site numbers do not correlate with location numbers.

> **Aniline Pit, Study Site 7:** The aniline pit was a 40-foot x 40-foot area used to dispose of aniline, a missile fuel component. Previous limited soil sampling in this Aniline Pit did not identify contamination by aniline, nitrobenzene, or N,N-dimethylaniline (*USACE, 2010*). Study Site 7 was not specifically identified with an ECOP Category number in the June 2010 ECOP report; however it was included by inference as a Category 6 in the “All ADA Grounds” designation in Table 30 Non Condition Type I Property (*USACE, 2010*). A Category 6 designation for this Study Site, is not warranted since a previous soil sampling of this area identified no significant concentrations of inorganic compounds and no evidence of the analytes aniline, nitrobenzene, or N,N-dimethylaniline. Study Site 7 was identified as ECOP Category 1, with a property identification number of 18(1)X, as shown on Figures 6 and 12.
>
> **Acid Pit, Study Site 8:** The acid pit was a limestone-lined pit used to dispose of RFNA from 1955 to 1962. Approximately 300 to 400 20-gallon barrels of RFNA were disposed in the acid pit. In addition, a cyanide-containing brass cleaning solution from Building 493 in Area V-EWL/Central (Study Site 67) was disposed at the Acid Pit. High nitrate concentrations, heavy metals contamination, and low pH levels were detected in the soil of the former Acid Pit. Low concentrations of Hexahydro-1,3,5-trinitro-1,3,5-triazine

(RDX) were detected in a groundwater monitoring well believed to be hydraulically down-gradient of the former Acid Pit; however, a duplicate sample from the same well did not contain RDX above the laboratory detection limit *(USACE, 2010).* A 1994 ROD indicated that soil affected by these analytes was within or below the acceptable human health risk range. Given that concentrations of analytes were detected but at concentrations that do one exceed human health risk standards, Study Site 8 was identified as ECOP Category 3, with a property identification number of 19(3)HR,X, as shown on Figures 6 and 12.

Smoke Canister Disposal Area, Study Site 13: The Smoke Canister Disposal Area was located in the central part of the ADA and was used to dispose of burned waste from smoke canister burning operations. A review of aerial photographs indicated the possible existence of a burn trench prior to 1970. Low concentrations of heavy metals have been detected by previous sampling of the surface soil (*Dames & Moore, 1992*). Study Site 13 is identified as ECOP Category 3 and has a location identification number of 9(3) HR,X on Figures 6 and 12.

Flare and Fuse Disposal/Bird Cage Area, Study Site 14: The Flare and Fuse Disposal area, also known as the “Bird Cage”, was located in the west-central part of the ADA and was used to dispose of residue from flare and fuse burning. A 1970 aerial photograph showed the semicircular bird cage was replaced by a circular pit and a mound. Aerial photographs in subsequent years indicated no significant changes other than decreased activity and less definition (*Dames & Moore, 1992*). Previous sampling of the Study Site surface soil detected some heavy metals and nitrate at low concentrations (*USACE, 2010*). Study Site 14 is identified as ECOP Category 3 and has a location identification number of 12(3)HR,X on Figures 6 and 12.

Sludge Burial and Burn Area, Study Site 15: The Sludge Burial and Burn Area was used to dispose or burn wastes, including TNT sludge, paint sludge, shot blast waste, and deactivation furnace ash. In addition, a scrap metal pile was located in the vicinity of the Sludge Burial and Burn Area prior to October 1990. A prior investigation did not detect metals above naturally-occurring background concentrations; however, elevated concentrations of explosives constituents were detected. Two rounds of groundwater samples were collected. Reportedly, manganese was the only notable constituent detected at concentrations above background *(Earth Tech., 1994)*. Study Site 15 is identified as ECOP Category 5 and has a location identification number of 7(5)HR,X, as shown on Figures 6 and 12.

Open Detonation Pits, Study Site 16: Numerous Open Detonation pits were used to explode defective or unwanted ordnance. Previous soil and groundwater sampling investigations at this Study Site identified metals and explosives in soil samples. Explosives, volatile organic compounds (VOCs), or base-neutral acids (BNAs) were not detected in groundwater samples *(Earth Tech., 1994)*. Study Site 16 is identified as ECOP Category 3 and has a location identification number of 13(3)HR,X, as shown on Figures 6 and 12.

Aboveground Open Detonation Area, Study Site 17: The Aboveground Open Detonation Area was used for the detonation of M55 rockets and M23 land mines. The munitions were detonated in a steel tube running through the center of a metal-filled gravel bin. Chemical agents from the M55 rocket canister were drained and collected as part of operations at the Drill and Transfer Site (Study Site 49, K-Block) prior to detonation at Site 17 (*USACE, 2010*). Study Site 17 is identified as ECOP Category 3 and has the location identification number as Study Site 13, which is 9(3) HR, X, as shown on Figures 6 and 12.

Dunnage Pits, Study Site 18: Two Dunnage Pits, separated by a gravel road were used to burn or dispose of metal debris, waste solvents, waste oils, paint strippers, and other miscellaneous wastes. Interviews with UCD retirees and aerial photos indicate several dunnage pits were once located east of the existing pits (*1992 RI/FS of Dames and Moore*). An ash residue sample collected from one of the pits in 1981 was found to contain arsenic and chromium above RCRA toxicity limits. Surface soil sampling at the eastern pit in 1988 did not detect any nitrate/nitrite, volatile organic compounds (VOCs) or Base-neutral and Acid Extractable Organics (BNAs, *USACE, 2010*). Study Site 18 is identified as ECOP Category 5 and has a location identification number of 5(3)HR,X, as shown on Figures 6 and 12.

Open Burning Trenches/Pads, Study Site 19: Approximately 10 Open Burning Trenches/Pads and an adjoining burn field were located in the north-central part of the ADA. Sludges containing explosive constituents were burned in the northernmost trenches. Chemical analytical results from soil samples collected at the Open Burning Trenches indicated metals and explosives contamination was present, mainly in the shallow soil of the burn trenches. Occasional metals contamination was detected in samples from the burn field area. Groundwater samples from monitoring wells near the Open Burning Trenches/Pads indicated low concentrations of a few metals *(Earth Tech., 1994).* Study Site 19 is identified as ECOP Category 3 and has a location identification number of 3(3)HR,X as shown on Figures 6 and 12.

Missile Fuel Storage Areas, Study Site 21: The Missile Fuel Storage Areas previously had four sheds, located in a fenced area within the ADA. Presently, there are no storage of fuel components at the former missile fuel storage areas. Nine soil samples collected from the former missile fuel storage areas indicated no explosive contamination and low concentrations of nitrate/nitrite (*Earth Tech., 1994*). Study Site 21 is identified as ECOP Category 3 and has a location identification number of 16(3)HR,X, as shown on Figures 6 and 12.

Pesticide Pits, Study Site 31: A row of Pesticide Pits may have been used to dispose of or burn pesticide solutions and general debris, or to detonate munitions. The area to the north of the Pesticide Pits was identified as a torpedo burn area; however, no information concerning the activities in this area was provided by current or former UCD employees. Previous investigation reports indicate a large area once contained numerous Pesticide Pits that were then graded over (*USACE, 2010*). Previous soil sampling investigations identified metals and toluene contamination, and a low concentration of 2,4,6-TNT in a soil sampled collected from in one of the pits. Previous sampling of groundwater in a monitoring well believed to be hydraulically down-gradient of the Pesticide Pits detected a very low concentration of RDX. A duplicate water sample identified no RDX at concentrations above the laboratory method detection limit (*USACE, 2010*). Study Site 31 is identified as ECOP Category 5 and has a location identification number of 14(5)HR,X as shown on Figures 6 and 12.

Burning Trays, Study Site 32: Two Open Burning Trays, located on gravel pads within the ADA grounds were used to burn explosive propellant powder. The northern tray area previously included an operation in which cartridges were flashed with diesel fuel. UCD previously had a permit from Oregon DEQ to conduct burn operations. Both the northern tray and a related 150-gallon above ground fuel tank have since been removed (*USACE, 2010*). Study Site 32 is identified as ECOP Category 6 and has a location identification number of 11(6)HR,X, as shown on Figures 6 and 12.

Pit Field Area, Study Site 38: The Pit Field Area covers an area of approximately 50 acres and consists of numerous existing pits, 6 to 8 feet in diameter and 1 to 2 feet deep. The pits apparently were used to detonate or dispose of ordnance materials (based on their resemblance to other ADA pits and debris observed at the ADA). However, present and former UCD employees had no information on the use of the Pit Field Area (*USACE, 2010*). Study Site 38 is identified as ECOP Category 3 and has a location identification number of 12(3)HR,X, as shown on Figures 6 and 12.

GB/VX Decontamination Solution Burial Areas, Study Site 41: Former UCD employees indicated that decontamination solutions from a leaking GB bomb brought on-site in the early 1960s may have been disposed of in one of two areas in the northern part of the ADA grounds. Soil and groundwater samples obtained from this area were analyzed for Isopropyl Methyl Phosphonic Acid (IMPA), a degradation product of agent GB. However, none of the analytes were detected. Vanadium and manganese detected in groundwater were determined to be naturally occurring (*Earth Tech., 1994*). Study Site 41 is identified as ECOP Category 3 and has a location identification number of 10(3)HR,X, as shown on Figures 6 and 12.

Trench/Burn Field, Study Site 55: The Trench/Burn Field is located in the north-central part of the ADA grounds. The Trench/Burn Field was first noted in 1950 aerial photographs as several rows of trenches. The trenches appear in all of the aerial photographs reviewed through 1965 (*Dames and Moore, 1992b*). The eastern part of the Trench/Burn Field subsequently was covered by activities at Study Site 15 (*USACE, 2010*). Study Site 55 is identified as ECOP Category 3 and has a location identification number of 8(3)HR,X, as shown on Figures 6 and 12.

Munitions Crate Burn Area, Study Site 56: The Munitions Crate Burn Area is located in the north-central part of the ADA. The Munitions Crate Burn Area reportedly was used to burn empty wooden crates from munitions. Aerial photographs reviewed indicate the Munitions Crate Burn Area was active prior to 1950. A dark circular pit is evident in the aerial photographs in 1951 and 1956. In the 1958 photograph, the pit appears to have been partially filled in. The Munitions Crate Burn Area no longer is visible in the aerial photographs taken in 1972 or in following years (*Dames and Moore, 1992b*). Study Site 56 is identified as ECOP Category 3 and has a location identification number of 6(3)HR,X, as shown on Figures 6 and 12.

Former Pit Areas, Study Site 57: The Former Pit Areas consist of three areas located in the central and south-central parts of the ADA that were active prior to 1950 through the early 1970s. Soil in the former pit areas was disturbed and in the form of trenches or pits, based on a review of aerial photographs (*Dames and Moore, 1992b*). Study Site 57 is identified as ECOP Category 3 and has a location identification number of 4(3)HR,X, as shown on Figures 6 and 12.

Borrow/Burn/Disposal Area, Study Site 58: Located in the northeast comer of the ADA, the Borrow/Burn/Disposal Area was suspected to be a borrow site, as identified from a 1949 aerial photograph. In the early to mid-1950s, the Borrow/Burn/Disposal area is more distinguishable in the aerial photographs. The surface of the Borrow/Burn/Disposal Area is covered with orderly rows of soil, similar to crop rows. The ground appears to be dark-toned in the photographs during the mid-1950s, indicating burning activities may have taken place. Evidence of disturbed soil was observed in aerial photographs through 1968. By 1970, the defined boundaries of the Borrow/Burn/Disposal Areas had faded *(Dames and Moore, 1992b*). Study Site 58 is identified as ECOP Category 1 and has a location identification number of 2(1)HR,X, as shown on Figures 6 and 12.

GB/VX Decontamination Solution Disposal Areas, Study Site 59: The GB/VX Decontamination Solution Disposal Areas consist of two areas located in the central area of the ADA. Former UCD employees indicated that GB/VX decontamination solutions were disposed of on the ground in these areas in the early 1960s, on at least two separate occasions. The exact locations of the GB/VX Decontamination Solution Disposal Areas could not be determined (*USACE, 2010*). Study Site 59 is identified as ECOP Category 3 and has a location identification number of 10(3)HR,X, as shown on Figures 6 and 12.

Active Firing Range, Study Site 60: The Active Firing Range is located near the southwest corner of the ADA, and includes an active rifle range and machine gun range, and an active pistol range. The BRP indicates a large caliber small arms range was formally present, at the Active Firing Range, but was closed because of safety concerns. The surface danger zone for the Active Firing Range covers a large extent of the ADA, which has undergone shallow surface cleaning of unexploded ordnance (UXO; *UMADRA, 2010*). The remains of a former trench are located north the rifle and pistol range *(USACE, 2010).* Study Site 60 is identified as ECOP Category 3 and has a location identification number of 17(3)HR,X, as shown on Figures 6 and 12.

3.1.1.3 Maintenance Activities

Maintenance operations have taken place at Buildings 4, 5, 7, 10, 11, 31, and 75 in Area VII - Administrative Area. Building 4 is used as a machine shop in which the following activities are conducted: metal parts machining, welding, repair and cleaning of steam cleaning equipment, and brush painting. Building 5 is a vehicle maintenance garage, with typical activities consisting of: battery charging, steam cleaning, welding, engine maintenance and overhaul, and parts cleaning. Building 7 is a carpentry shop with activities consisting of wood cutting, spray painting, and brush painting. Building 10 was used as a diesel train engine repair shop with activities consisting of cleaning and maintaining diesel engines, brush painting, and battery charging. At the time of AMEC’s January 201 field reconnaissance, Building 10 was used only for vehicle storage. Building

11 houses the tool crib, offices, medical clinic, chemical protection equipment (CPE); protective mask fit area, and mail room. Prior to 2002, Building 31 was used as the motor pool where light maintenance and battery charging operations for vehicles was performed (*Earth Tech., 1994; USACE, 2010*).

3.1.1.4 Ammunition Renovation Activities

Building 131 located in Area II, adjacent to the Subject Site, was used for abrasive blasting, welding, cleaning of rocket cases, and spray painting of ammunition. Building 417 (Area V) housed spray painting and deep drill operations of 105-millimeter (mm) shells. Building 431 (Area VIII, outside Site boundary) was used for spray painting and stenciling of ammunition. Building 434 (Area VIII, outside Site boundary) operations included spray painting and removing 2,4,6-tetranitro-N-methyaniline (tetryl) charges from grenades. Building 489 housed the shell washout operations. Building 493 was used for spray painting, abrasive cleaning of shell bases, and ammunition demilitarization. Building 608 was used for spray painting and buffing of shell bands. Building 608 also was used for renovation of HD containers from 1978 to 1979 (*Earth Tech., 1994; UCD personal communication, Leep, 2010).*

3.1.1.5 Former Defense Reutilization Marketing Office Area Activities

Study Site 22 is the former DRMO storage area, which occupied approximately 1 acre in the southwestern part of Area VII – Administration Area, until the early 1990s. The former DRMO area includes warehouse Building 42 and both paved and bare-ground storage areas. The DRMO currently is used to store salvage material, such as scrap metals, wooden crates, and pallets prior to removal and disposal off-site. Rifles, empty projectiles, brass and lead bullets, scrap metals, vehicles, and furniture also are stored in this area prior to being sold. Leaking transformers containing PCB-contaminated oil reportedly were stored temporarily on the bare ground under the west end of a metal shelter located at the southwest end of the DRMO (*Earth Tech., 1994; DERP, 1994c*). Study Site 22 is identified as ECOP Category 3 and has a location identification number of 75(3)PS, PR, HS, HR on Figures 11 and 13.

3.1.1.6 Explosives Washout Plant Operations

From the mid-1950s until 1965, UCD operated an on-site Explosives Washout Plant located in Area V-EWL/Central on the Subject Site. The plant processed munitions to remove and recover explosives using a pressurized hot water system. The principal explosive constituents consisted of 2,4,6-trinitrotoluene (TNT), RDX, octahydro-l,3,5,7-tetranitrol-3,5,7-tetrazocine (HMX), and Tetryl. In addition, the munitions contained small quantities of 2,4-dinitrotoluene (2,4-DNT), 2,6-dinitrotoluene (2,6-DNT), 1,3,5-trinitrobenzene (1,3,5-TNB), 1,3-dinitrobenzene (DNB), and nitrobenzene (NB), occurring as either impurities or degradation products of TNT (*US Army, 1992*).

Operation of the plant included periodic flushing and draining of the explosives washout system. The wash water was discharged via an open metal trough to two infiltration lagoons located northwest of the plant. The lagoons were constructed in the 1950s and were used until 1965, when plant operations and all discharges to the lagoons ceased. The lagoons were known as the Explosives Washout Lagoons (EWL) and were two adjacent, unlined rectangular lagoons (North Lagoon and South Lagoon) constructed in the native sandy, gravelly soil. The north and south lagoons measured 80 feet by 39 feet, and 80 feet by 27 feet, respectively, and both were 6 feet deep. A 15-foot wide gravel berm separated the lagoons, and gravel berms encircled both lagoons as well. The depth from the bottom of the lagoons to groundwater generally varied from 45 to 50 feet. The lagoons typically were dry. Approximately 85 million gallons of effluent is estimated to have been discharged to the lagoons during the period of plant operation. The wastewater from the washout operation, also known as "pink water," contained high concentrations of explosive constituents, primarily TNT and RDX (*US Army, 1992; USACE, 2004*). The Explosives Washout Lagoons and Explosives Washout Plant are identified as ECOP Category 5 and have a location identification number of 45(5)HR, PS, PR, RAD, A,L,R as shown on Figures 9b and 12.

3.2 FEDERAL AND STATE REGULATORY RECORDS SEARCH

On 08 December 2010, AMEC subcontracted EDR to conduct a search of standard environmental record sources published by federal, state, tribal, and local regulatory agencies. The regulatory listings included only those facilities that were known to the regulatory agencies to be contaminated, in the process of evaluation for potential contamination, or were regulated at the time of publication. The results of the EDR Radius Map with GeoCheck® database search were reviewed to determine if the Subject Site or nearby properties are listed as having a past or present record of actual or potential environmental impact or are listed for regulated substances.

A summary of the records search is provided in Table 5, including the data source, search radius, and the number of properties identified. The Subject Site was identified on several of the databases reviewed, as indicated in Table 5 by an asterisk. The complete list of databases reviewed, based on EPA 40 CFR Part 312 and ASTM E 1527-05, are listed in the EDR report presented in Appendix C.

Table 5: Environmental Database Search Results Summary

Data Source	Search Radius1 (miles)	Number of Identified Facilities (Subject Site included)
Federal Records		
EPA National Priority List (NPL)	1.0	1*
EPA Delisted NPL	0.5	0
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)	0.5	1*
Resource Conservation and Recovery Act (RCRA) Corrective Action Sites (CORRACTS)	1.0	1*
RCRA non-CORRACTS Treatment, Storage, or Disposal (TSD) Facilities List	0.5	1*
RCRA Generators List	Site and adjoining properties	0
Institutional Control/Engineering Control Registries	Site Only	1*
Emergency Response Notification System (ERNS) List	Site Only	0
EPA Brownfields	0.5	0
State, Local, and Tribal Records		
Oregon DEQ Environmental Cleanup Site Information (ECSI) Database (State-equivalent NPL)	1.0	1*
Oregon DEQ Confirmed Release List (CRL) (State-equivalent CERCLIS)	0.5	1*
Oregon DEQ Leaking Underground Storage Tank (LUST) List	0.5	1
Oregon DEQ Underground Storage Tank (UST) Database	Site and adjoining properties	0
Oregon DEQ Aboveground Storage Tank (AST) Database	Site and adjoining properties	0
Voluntary Cleanup Program (VCP) List	0.5	0
Additional Environmental Records		
Solid Waste/Landfill Sites and Recycling Facilities	0.5	0
Lien Property List	Site Only	0
Facility Index System (FINDS)	Site Only	1*

[1] Minimum search distance for standard environmental record sources, as specified in ASTM Standard E 1527-05

* Indicates the UCD is included on the listed database

As shown in Table 5, the Subject Site was identified in nine federal and state environmental databases. No other facilities were identified within the respective search radii specified by ASTM E 1527-05. Each of the listings is discussed in the following sections.

3.2.1 Federal Listings

Federal environmental database listings identified within the search radii specified by ASTM E 1527-05 included listings on the CERCLIS, the EPA National Priorities List (NPL), the RCRA Corrective Action Sites (CORRACTS) list, the RCRA non-CORRACTS Treatment, Storage, or Disposal (TSD) Facilities List, and the US Engineering and Institutional Controls list.

3.2.1.1 CERCLIS List

The EPA maintains the CERCLIS list, which contains data on potentially hazardous waste sites that have been reported to the EPA, pursuant to Section 103 of CERCLA. The CERCLIS List includes sites which either are on the NPL or are in the assessment phase for inclusion on the NPL. The UCD is included on the CERCLIS list under Site ID number 1000546. Review of the CERCLIS list indicates the UCD was initially listed as a “Discovery” site in May 1980 and obtained a “Final Listing” in July 1987. The EPA maintains an administrative record for response actions at the UCD, which can be found by searching the EPA’s Superfund website: www.epa.gov/superfund.

3.2.1.2 EPA National Priorities List

The EPA maintains the NPL, also known as Superfund. The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund program. The UCD was included on the NPL list under EPA ID number OR6213820917. Review of the NPL list indicates the UCD was proposed for listing as an NPL site in 1987 for the Explosives Washout Lagoons, which were evaluated using EPA’s Hazard Ranking System (HRS), receiving a score of 28.5.

In October 1989, an FFA was executed by the UCD, the EPA, and the Oregon DEQ. Under the terms of the FFA, the Army was designated as the lead agency for initiating response actions under Superfund guidance and policy at the UCD, in accordance with CERCLA, the National Contingency Plan (NCP), and Superfund guidance and policy. The FFA is discussed further in Section 4.1.1.

3.2.1.3 RCRA CORRACTS Facilities List

The EPA maintains the RCRA CORRACTS facilities list, which is a list of hazardous waste generators and/or handlers with RCRA Corrective Action Activity. The UCD is included on the RCRA CORRACTS facilities list under EPA ID OR6213820917. The UCD initially was listed on the

RCRA CORRACTS list in July 1987 and corrective action at the facility was referred to CERCLA in October 1989.

3.2.1.4 RCRA non-CORRACTS TSD Facilities List

The EPA maintains the RCRA TSD facilities list, which provides access to data supporting the RCRA of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes information on sites that generate, transport, store, treat, and/or dispose of hazardous waste as defined by the RCRA. The UCD was included on the RCRA TSD facilities list under ID number OR6213820917, and is a large quantity generator (LQG) that handles both universal and hazardous waste. According to the RCRA TSD facilities list, the UCD has been listed as a LQG since 1994. The UCD was formerly listed as a small quantity generator (LSG) in 1992. Wastes handled by the UCD, as reported in 2009, include ignitable hazardous wastes, corrosive hazardous wastes, reactive hazardous wastes, chromium, lead, mercury, silver, benzene, chlorobenzene, methyl ethyl ketone, dichloromethane, and non-halogenated solvents. The Army maintains two RCRA permits: one for managing hazardous wastes generated by operational activities not involving chemical weapons (No.OR6213820917) and one jointly held with the Washington Demilitarization Company, LLC for operation of the UCDF (No. ORQ000009431). Additional information on the RCRA permits is discussed in Section 3.5.1.1.

3.2.1.5 FINDS

The FINDS is a database containing facility information and “pointers” to other databases that include more detail. The UCD is listed in the FINDS database under Registry ID 110025217307.

3.2.1.6 US Engineering and Institutional Controls Lists

The US Engineering and Institutional Controls list is a listing of sites with engineering controls in place. The EWL in Area V of the UCD (Study Site 4) is included in the US Engineering Controls list under EPA ID OR6213820917 and Site ID 1000546. Specified engineering controls include excavation, revegetation, solidification/stabilization, composting, disposal, flushing, and monitoring of soil; decontamination, capping, and disposal of debris; disposal of sediment; and carbon adsorption, extraction, reinjection, residuals disposal, discharge, and monitoring of groundwater. Specified institutional controls include water supply use restriction, access restriction, and land use restriction.

3.2.2 State Listings

Federal environmental database listings identified within the search radii specified by ASTM E 1527-05 including listings on the Oregon DEQ Environmental Cleanup Site Information (ECSI) database, the Oregon DEQ Confirmed Release List (CRL), the Oregon DEQ Leaking Underground Storage Tank (LUST) list, and the Oregon UST list.

3.2.2.1 Oregon DEQ ECSI Database

The Oregon DEQ maintains the ECSI database, which is considered a state-equivalent NPL. The UCD is included in the ECSI database as State ID Number 514. Review of the ECSI database indicates that 8 OUs were identified at the UCD for cleanup action and that cleanup is being conducted by the Army in accordance with DEQ requirements through the FFA. The DEQ maintains a website dedicated to the activities at the UCD and the UCDF at http://www.deq.state.or.us/umatilla/cdp.htm.

3.2.2.2 Oregon DEQ CRL

The Oregon DEQ maintains the CRL, which is considered a state-equivalent CERCLIS. The UCD is included in the CRL as Facility ID Number 514. The facility status is listed as “Remedial Action.”

3.2.2.3 Oregon DEQ LUST List

The Oregon DEQ maintains an inventory of reported leaking underground storage tank incidents. The UCD is listed on the DEQ LUST list. Review of the DEQ LUST list indicates the UCD was originally listed in January 2000 under Facility ID Number 30-00-0001 and received cleanup completion status in February 2001. Additional information regarding leaking USTs at the UCD is presented in Section 3.6.1.

3.2.2.4 Oregon UST List

The Oregon DEQ maintains an inventory of facilities with underground storage tanks (USTs). The UCD is listed on the DEQ UST list under Facility ID Number 4767. Review of the DEQ UST list indicates the UCD has decommissioned three USTs and has a total of six USTs in place at the facility. Additional information regarding USTs at the UCD is presented in Section 3.6.2 and 3.6.3.

3.3 AERIAL PHOTOGRAPHS

At least two comprehensive aerial photograph analyses have been conducted for the UCD: one completed in 1990 as part of an enhanced preliminary assessment (PA) completed by Dames & Moore, and one completed as part of a 2010 ECOP by the USACE-Seattle. The reviews were extensive, particularly the 1990 review, which included a comprehensive follow-up interviews and a field reconnaissance to ground-truth anomalies identified from the historic aerial photographs.

3.3.1 Aerial Photograph Review in 1990 Report

A review of aerial photographs reported in a 1990 Preliminary Assessment report prepared by Dames & Moore (*Dames & Moore*, *1990*), consisted of viewing stereographic pairs of aerial photographs obtained from several government sources for the following years: 1939, 1949, 1950, 1951, 1956, 1958, 1964, 1965, 1970, 1971, 1972, 1974, 1975, 1977, 1980, and 1988. The review consisted of a year-by-year, frame-by-frame search for locations of anomalies and potential contamination. Previously identified features such as landfills and gravel pits, and former buildings as identified from earlier reports also were located. Ground scars, pits and trenches, manmade structures, and visible anomalies were plotted on Mylar sheets that were overlaid onto individual photographic frames. A description of each location visible in a particular year was recorded.

Dames & Moore field personnel then conducted a visit to the UCD to field-verify as many of the photo-interpreted locations as time permitted. During the visit, present and former UCD employees were shown the historic aerial photographs and were questioned about potential sites of concern. Numerous areas of interest were identified and were given designated site numbers.

Further investigation was recommended at 55 Study Sites identified from the review of aerial photographs. Many of the sites that were previously sampled were recommended for additional investigation to support the previous sampling efforts and to provide more complete site characterization. For sites not previously sampled, investigation was recommended to substantiate or disaffirm reports of waste disposal activities that may have resulted in contamination to the physical environment. Anomalies were identified from the aerial photographs and only two anomalies, AX-2 and AX-10, later became part of Study Sites 59 and 68. A summary of the information compiled for each location identified from the 1990 aerial photograph review is summarized in Table 6-32 in the 1990 Enhanced PA (*Dames & Moore, 1990*).

3.3.2 2010 Aerial Photograph Review

The USACE-Seattle District reviewed forty aerial photographs obtained from in-house sources and from Google^{TM} Earth Pro. Photographs dated 1984, 1987, 1992, 1993, 1995, 1996, 1997, 2000, and 2005 were reviewed for evidence of excavation activities of unknown type; evidence of industrial operations; dumping or disposing of waste materials; or evidence of significant storage activities involving drums, tanks, or pipelines containing hazardous substances or petroleum products. Results of the aerial photograph review were presented in a table identifying the date of the aerial photograph along with the significant observations and study area where the area of interest was observed. The 2010 ECOP did not specify if the areas identified on the aerial photographs corroborated information identified from the 1990 Enhanced PA report.

Significant findings from USACE's aerial photograph review revealed the presence of disturbed soil in Igloo Blocks J and K, and the presence of vehicles in the inactive landfill areas to the west of Area VII in 1984 and 1987; construction of three buildings in the explosives washout plant area in 1995; and removal of several buildings in the same area in 1996.

3.3.3 AMEC Supplemental Review

AMEC personnel reviewed aerial photographs dated 1949, 1950, 1958, 1965, 1972, 1980, 1994, and 2005 to verify the findings discussed in the 1990 and 2010 reports, and to identify areas of potential contamination that may not have been addressed during previous investigations. The supplemental review consisted of an assessment of physical features, including evidence of ground disturbance, scarring, staining, and waste disposal practices, which would indicate potential environmental liabilities. Results of the aerial photograph review corroborated information provided in previous reports.

3.4 HISTORICAL RECORDS

Historical records reviewed for the Subject Site included a search of UCD installation maps, interviews with UCD personnel and contractors and regulators familiar with UCD operations and historical uses, a review of land use and water rights records, and general information obtained from the LRA's BRP report (UMADRA, 2010).

3.4.1 Depot Installation Maps

AMEC personnel reviewed hundreds of maps stored at the UCD to identify design drawings, and as-built plans for buildings, utilities, and UCD operational features. Selected maps and drawings were scanned and provided on a CD, which were reviewed in detail to evaluate building construction details for evidence of drywells, USTs, storage locations, sumps, and other building features. Maps and drawings of interested are presented in Appendix D. A discussion of map findings is presented in Table 6.

Table 6: Selected Depot Installation Maps Summary

Map Name	Date	Location	Significant Findings
Renovation Area Water System (Revisions)	14-Sep-1949	Area V - Building 486 area	Documented waste pile west of Building T-493; asbestos cement pipes throughout building area

Map Name	Date	Location	Significant Findings
General Utility Map (Water)	12-Dec-1950	Area VII - Admin	Fuel oil tanks: 25,000 gal; 8,000 gal; 10,000 gal near water tower in NW part of Admin Area; Gasoline storage tanks: 10,000 gal, 8,000 gal, 25,000 gal at motor fuel station (Building 6); 12,000 gal fuel oil storage tank and pump located near materials yard; Fuel oil storage tank at heating plant; Pumping stations Well No.1 and No.2 near D Street; Buildings include paint storage building, paint shop, locomotive house, transformer station, machine shop, garage and inert warehouses.
Chemical Stockpile Disposal Program Site Work Sanitary Sewer Details	Jan. 1997	Chemical Agent Disposal Facility	Spec. sheet for sanitary sewer construction including manhole, cleanouts, and plumbing design elements.
Storage Facility Upgrade-Key Plan	6-Mar-1980	Area IV - North Central	Proposed control center utility diagram on A and Main; railroad along Badger Road; water line from pump near Ironwood Road to site security control center at south end of K Block.
Storage Facility Upgrade-Site Security Control Center Water and Sewer Service	18-Apr-1978	Area IV - North Central	Installation specs for underground fuel oil tank, buried pump and enclosure at Road A and Main Road intersection; Building 455 water control design; septic tank design plan; sewer cleanout location at site security control center.
Pipeline from wells 6&7 to well 3	17-Sep-1986	Area III, Area IV, and Area V	Water supply piping along West Patrol Road between West Patrol Road and North Patrol Road. Septic tank is depicted west of Building 614. Well No. 7, elevated water tank and Well No. 6 located along North Patrol Road. A septic tank is depicted south of Well No. 6 and No. 7 near Building 608. Well Pump No. 3 located at building 455.
Quartermaster Garage Heating & Electrical Plans	5-Aug-1941	Area VII - Admin Building 5 area	Includes plans for floor drains in center of garage (Building 5), drains connect to catch basin at SE corner of garage and are plumbed to dry well outside of SE corner of garage; Shop has floor drain in center of building and sump in SW corner of building. Both are plumbed to dry well outside of SW corner; Boiler room has 2 floor drains plumbed to standard 4’ dry well 12’ north of boiler room.
Replacement of lubrication center Bldg. No-5 - Installation details	No Date	Area VII - Admin Building 5 area	Construction detail plans for new lubrication center; oil pump and tank at SW corner of building; Sewer pipe heading E-W at north end of building.

Map Name	Date	Location	Significant Findings
Installation details of 25,000-gal. corrugated steel tanks for gasoline & fuel oil	4-Nov-1942	Area VII - Admin Building 6 area	Cross section of tank installation specifications at motor fuel stations; Proposed 25,000-gal. and existing 10,000 gal and 8,000 gal tanks; includes piping, pumps, suction lines, and motor fuel station designs; Tanks south of gasoline pumps and crossing railroad tracks; Also shows proposed 25,000 gal. tank and existing tanks and fuel oil pumps and 15, 000 gal. water tank west of incinerator. Shows layout of fuel oil and gasoline storage.
Carpenter Shop Plans, Elevations and Sections	10-Sep-1941	Area VII - Admin Building 7 area	Construction design for carpenter shop. Shows asbestos shingles over 2" T&G solid Brdg.
Locomotive House Floor Plan	25-Jun-1968	Area VII - Admin Building 10	Diesel stalls in center of building; floor drain in toilet; repair pits adjacent to diesel stalls and steam locomotive.
Locomotive House Foundation Plan	01-Oct-1941	Area VII - Admin Building 10	A drywell is depicted outside the southeast corner of the building.
Depot Facilities Office and Shops Salvage Office Plans	No Date	Area VII - Admin Building 11	Drafting dark rooms in warehouse area.
Extension of Bldg. 14 Floor Plan, Elevations and Details	9-Sep-1953	Area VII - Admin Building 14	295 gallon fuel storage tank connected to engine base outside of NE corner of building. Spec. plans indicated copper fuel pipe connected to engine base. 1" oil drain connected to UST outside of SE corner of building.
Vehicle Wash Building Plot Plan	6-Apr-1959	Area VII - Admin Building 37	Existing transformer house Building # 14 and associated conduits; 15,000 gallon fuel oil tank located at SE corner of building near existing manhole. Existing drains in vehicle wash building are plumbed to manhole; propane tank located near fuel oil tank.
Loading Dock for Depot Property Page 1/4	31-Mar-1961	Area VII - Admin Building 39	Design specifications for loading dock.
Loading Dock for Depot Property Page 4/4 Oil Storage Siting Plan	14-Dec-1962	Area VII - Admin Building 39	Railroad tracks south of building and oil storage dock on west side of building.
Inspector's Workshop Boiler House	7-Feb-1942	Area V - EWL Building 416	Design Specifications of Inspector's workshop boiler house. Includes sump, vacuum pump and concrete conduits in boiler house plan view.
Washout Building-General Plan	No Date	Area V - EWL Building 417	Drawing includes 5 tanks of unidentified use in main floor plan. Possible water, separator and pelleting tanks for washout process.

Map Name	Date	Location	Significant Findings
Replace Laundry/Wastewater Drain Field, Bldg. 419	23-Mar-1973	Area V - EWL Building 419	Septic system drawings and drainage field plans. Shows sanitary sewer connecting to south end of building and a 1,000 gal septic tank installed outside of SE corner of asphalt parking lot.
Lunchroom for inspectors workshop sewage disposal	2-Nov-1953	Area V - EWL Building 420	275 gallon AST oil tank on west side of building 420; septic tank and drain field adjacent to AST. Septic tank located south of building 420 and drain field extending to the south.
Boiler Room & Wash Rooms Bldg. T-433	15-Oct-1952	Area VIII - East Building T-433	Design specifications for Building T-433; Cement Asbestos shingles, “coal bunker to be left as is” note in room at north end of building.
Replacement of Washout Plant Bldg. 489 Foundation and Floor Details	6-Apr-1962	Area V - EWL Building 489	Design specifications of Building 489; gutter heading E to W in concrete floor and plumbed to settling tank outside of building on west side.
Washout & Flaker Building # 489 Supply Operations	23-May-1952	Area V - EWL Building 489	Water tank system in center of building metal-lined concrete gutter connecting to sump at SE corner of 2 story building; settling tanks and drain on second floor.
Clean and Paint Building T-493 Floor Plan and Elevation	April, 1970	Area V - EWL Building 493	Two paint booths and drying ovens in center of building; blasting machine on north side.
Ammunition Disassembly Plant Typical Plot Plan	28-Mar-1949	Area III - West Central Bldg. 603	Explosives storehouse; facility is for disassembly of ammunition items containing high explosives charges up to 4,000 lbs in the course of surveillance inspection, renovation, salvage, or demilitarization at permanent installation.
Ammunition Normal Maintenance Facilities Ammunition Normal Maintenance Building Heating and Plumbing Details	28-May-1953	Area III - West Central Bldg. 608	4 drywells located on north and 3 on south side of building. Plumbed to drains throughout building and roof. Catch basin located at SE side of building; Includes typical dry well cross-section plan drawing.
Ammunition Renovation Facilities Increment No. 1 Bldg. No. 4-Ammunition Disassembly & Renovation Floor plan	25-Apr-1957	Area III - West Central Bldg. 614	Design specs for renovation of Building 614.
Change House at Ammunition Disposal Area No. 622 Plot Plan & Sewer Details	27-Jan-1961	Area III - West Central Building 622	500 gal UST fuel storage south of New Change House; Cement sewer line near UST heading west to septic tank and sub-soil disposal bed.

Map Name	Date	Location	Significant Findings
Protective Clothing Storage Bldg. Insulation & Heating Modification	20-Jan-1965	Area III - West Central Building 624	Floor drain in shower room on north side of building; dry well located west of shower room.
Chemical Maintenance Facility Electrical Supply Plan	14-Sep-1981	Area IV - North Central Building 654	Chemical maintenance facility location adjacent to railroad tracks; 1,000 gal. dosing tank across Ironwood Road. Oil-filled, pad-mounted transformer located SW of building along Ironwood Road.
Locomotive House Heating Plan	5-Nov-1941	Area VII - Admin Building 10	Diesel stalls in center of building, floor drains throughout and repair pits, fuel oil tank at NW corner plumbed to oil burner in heater room, "16"x18" ACC. tank" inside burner room
Paint Shop Plans & Details	19-Aug-1942	Area VII - Admin Building 8	Design specifications of paint shop; Asbestos shingle roof in plans.
Quartermaster Garage Floor Plan and Details	5-Aug-1941	Area VII - Admin Building 5	Standard grease pit and sump recessed in SW corner of shop building; battery room; storage space for forty vehicles; catch basin with metal grating in SE corner of storage space.
General Utility Map (Sewer)	1-Oct-1946	Site Wide	Gasoline & diesel fuel oil drum storage shed in Area II DF; 3,000 gal oil tank heating plant in Area V EWL
Boundary Survey Plot Plan for Miscellaneous Control & "K" Block	No Date	Area IV - North Central	Abandoned landfills, active landfill, test firing area, spoil area (gravel), firing range, airfield, facilities maintenance, chemical storage, ammo maintenance.

3.4.2 Interviews

Eleven UCD personnel and 3 regulatory personnel were formally interviewed to obtain information regarding current and past site operations, status of environmental permits and cleanup operations, and plans for UCD closure and transfer. Information obtained has been incorporated into appropriate sections of this report. Copies of interview records, which include contact information, are included in Appendix E.

Table 7: Interviewed UCD and Regulatory Personnel

Name	Position	Discussion Topic(s)
UCD Personnel		
Mark E. Daugherty	BRAC Environmental Coordinator	Status of cleanup at ADA and EWL, BRAC
Don Gillis	Environmental Protection Specialist	Natural and cultural resources, WWTP, drinking water wells

Name	Position	Discussion Topic(s)
Phil Ferguson	Base Transition Coordinator	Facility locations, general history of UCD
Jim Coates	Environmental Engineer	UCD maps and digital scanning
Jim Wenzl	RCRA Manager	RCRA permitting, storage igloos, Army auditing report, sampling records, universal waste
Rick Fuerstenberg	Building 4 Shop Manager	Shop operations
Russ Case	Building 5 Shop manager	Shop operations
Deborah S. Lopez	Environmental Protection Specialist RCRA Program Manager Risk Management Directorate	RCRA closure of I-Block igloos
Steve Martin	UCD Electrician	Electricity supply at UCD, sampling and removal of former transformers
George Newman	Chemical Operations Director	K-Block and former railcar classification operations
Doug Barnett	Public Works Director	Former operations in the 600 Block of buildings
Regulatory Personnel		
David Anderson	DEQ CERCLA Manager	Status of CERCLA response actions at UCD
Steve Potts	DEQ RCRA Manager	Status of RCRA response actions at UCD
Rich Duval	DEQ RCRA Pendleton Office Manager	Status of RCRA response actions at UCD

3.4.3 Land Use Records

Historical property acquisition and easements were reviewed from several sources including the June 2010 ECOP (*USACE, 2010*) and the BRP (*UMADRA, 2010*). Water rights records obtained from the OWRD, North Central Region State Watermaster.

3.4.3.1 Acquired Interests and Restrictive Easements

Of the initial approximately 16,000 acres of the UCD, the US Government acquired 8,774.55 acres in fee simple estate from private owners by direct purchase and condemnation. The remaining 7,159.86 acres were acquired through Executive Order from the public domain, managed by the BLM. A number of smaller land withdrawals from the BLM occurred by Executive Order between 1941 and 1972. By 1972, the total area of lands withdrawn from the BLM to the Army was

8,279.86 acres. Initial reversion rights existed for the original BLM lands should the Army close UCD. However, the October 28, 2004, Public Law 108-375, Section 2846, established that the nearly 8,300 acres of lands withdrawn from the BLM were no longer suitable for return to the public domain. The law established that withdrawn lands shall remain under the administrative jurisdiction of the Army for purposes of management and fee disposal pursuant to the Base Realignment and Closure Act of 1988 (*UMADRA, 2010*). In total, the UCD currently retains 17,054.41 acres in fee simple estate acquired either through purchase or Federal land transfer (*UMADRA, 2010*).

In addition to fee simple land acquisition and transfers from the Public Domain, the Army also acquired by direct purchase and condemnation a number of restrictive easements starting in 1956. The restrictive easements were for the establishment of safety areas north and east of the Depot boundaries. The majority of the restrictive easements were acquired between 1956 and 1958, but adjustments and transfers continued up to 1984. The net restrictive easement area is 2,673.61 acres (*UMADRA, 2010*). Significant additional detail on interests and easements associated with the UCD is provided in the BRP, Section A, Part II, Section 2.1.

3.4.3.2 OMD Parcel Tracts

The BRP identifies the OMD Parcel to include all or parts of Tract A and Tracts 4-13, 15, 16, and 18. A complete tract register of all acquired fees, easements, and withdrawn tracts, a legal description, a property acquisition summary table, and a real estate map reflecting all acquired interests are discussed in the BRP, Section A, Part II, 2.1 Land Use and Cultural Resources, Background Information and Analysis (*UMADRA, 2010*).

3.4.3.3 Property Leases and Easements

There are a number of grants of easements for: 1) significant facilities supporting or passing through the UCD, and 2) training by the OMD. These property leases and easements affecting the OMD Parcel are listed in Table 8.

Table 8: Property Leases and Easements

Easement Number	Description
DACA67-2-03-72	Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years from October 1, 2002 and ending September 30, 2052, over parts Sections 35 and 36, T5N, R27E, WM; and Section 1, T4N, R27E, WM.
DACA67-2-03-73,	Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years beginning October 1, 2002 and ending September 30, 2052, over parts Sections 12,13, 24, and 25, T4N, R27E, WM.

Easement Number	Description
DACA67-2-97-302	Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years beginning September 26, 1997 and ending September 25, 2047, over parts Sections 1, 12, 13, and 24, T4N, R27E, WM.
DACA67-2-97-302	Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years beginning September 26, 1997 and ending September 25, 2047, over parts Sections 1, 12, 13, and 24, T4N, R27E, WM.
DACA67-3-08-109	License for National Guard Purposes, to State of Oregon, term of 5 years beginning January 1, 2008 and ending December 31, 2012, for use of Buildings 115, 53, 36, 30, M1 SIMNET, rifle range, tank commander's proficiency course and the Mobile Conduct of Fire Trainer Pad and associated lands.
DACA67-9-03-71	Consent to Cross US Government Easement, to Umatilla Electric Cooperative, indefinite term beginning October 3, 2002, for construction of 115 kV electric transmission line over Tracts 26E and 27E.
DACA67-2-83-72	Easement for Communication Facility, to US West Communications, term of 50 years beginning May 27, 1983 and ending May 26, 2033, for buried cable lines.
DACA67-2-82-137	Easement and Relinquishment of Access rights for a Section of the National System of Interstates and Defense Highways, to State of Oregon, term indefinite beginning January 16, 1984, for right of way expansion of I-82 on east boundary of UCD.
DACA67-2-83-72	Easement for Right of Way for Electric Power Transmission or Communication Facilities, to Pacific Northwest Bell Telephone, term 50 years beginning May 27, 1983 and ending May 26, 2033, for "said facilities" in Section 25, T4N, R27E, WM, and Section 26, T4N, R27E, WN.
DACA67-9-99-62	Consent to Construct Gas Line Pending Grant of Easement, to Cascade Natural Gas, term of 2 years, beginning October 28, 1998, for natural gas line to Chemical Demilitarization Plant, in Section 34, T5N, R27E, WM (term expired, easement not granted yet).

The BRP indicates there are a number of expired leases, licenses, and permits to various entities that have not been renewed, such as the American Red Cross, Oregon State Police, and US West Communications. It is not known whether these or other entities are occupying building or land areas. In addition, there are other entities, such as the Oregon State Health Department, County Disaster Control, and Umatilla Fire Department that are occupying buildings or land areas for storage and other purposes with no documentation (*USACE, 2010; UMADRA, 2010*). There may be encroachments on the northwest corner of UCD from the adjacent farm operations. In addition, the BLM has granted Grazing Permits in Section 32 and three quarters (Tract C) of Section 34; T5NR27EWM.

3.4.3.4 Water Rights

The UCD's operational water is supplied by seven on-site wells, which extract water from a basalt aquifer with a minimum depth of approximately 200 feet. The following wells are located on the Subject Site: Well No. 1, Well No. 2, Well No. 3, Well No. 6, and Well No. 7. Groundwater in the immediate region exists in two separate aquifers; an upper aquifer and a lower aquifer. The upper aquifer, the Ordinance Gravel Aquifer, is unconfined and consists of overlying coarse alluvial deposits. Because the upper aquifer is relatively transmissive and shallow, the aquifer has been degraded by UCD activities and agricultural operations in the region. The lower aquifer, the Ordinance Basalt Aquifer, is a vertical sequence of confined aquifers in the Columbia River Basalt Group. The water rights of both aquifers have been over allocated, in an area of extensive irrigated agriculture (*UMADRA, 2010*).

As indicated previously in Section 2.6, significant drops in the water table of both aquifers obligated the OWRD to establish “critical ground water area” designations for both aquifers to protect senior water rights holders. New water rights permits will not be issued in the critical groundwater area. During the establishment of the UCD, the Army recorded Water Rights for seven wells with the State of Oregon. In Oregon, water rights are “appurtenant” or attached to the specific property where the water use is authorized. Unless the OWRD approves an application to transfer the water right to a different parcel of land, the water right may be exercised only on the specific land identified in the water right certificate and only for the uses recognized on that certificate. When a landowner sells or conveys land, the water right associated with the land is also conveyed unless specifically excluded (*UMADRA, 2010; USACE, 2010*). Water supply wells at the UCD are shown on Figure 5. Water Rights are described in Table 9. Copies of water rights including maps with illustrations of tract register, water right, and jurisdiction are presented in Appendix F.

Table 9: Water Rights

Water Right Permit/ Certificate #	Well No.	Certificate Date	Location of Well	Use	Well Status
G-2825 / #33778	Well 1	5 Jan 1965	Area VII (Admin)	Domestic	Inactive
G-2826 / #33779	Well 2	5 Jan 1965	Area VII (Admin)	Fire protection, Irrigation	Inactive
G-2827 / #33988	Well 3	5 Jan 1965	Area V (EWL)	Fire Protection, Irrigation	Active
G-2828 / #33765	Well 4	5 Jan 1965	Area II (DF)	Fire Protection	Active
G-2830 / #33989	Well 5	5 Jan 1965	Area II (DF)	Fire Protection	Active
T-6800	Well 6	11 Jan 1963	Area III (West Central)	domestic	Active
Permit U-522/ #30524 (canc.), transferred to T-6800	Identified as "ammunition normal maintenance well"	19 Dec 1952	Area III (West Central)	Fire Protection, Manufacturing	Rights transferred to Well 6

Water Right Permit/ Certificate #	Well No.	Certificate Date	Location of Well	Use	Well Status
Permit G-1017 #30525 (canc.), transferred to T-6800	Well 8	27 Jan 1958	*Never drilled*	Domestic (intended use)	*Never drilled*
Permit G-2829/ #33776 (canc.), transferred to T-6800	Well 7	5 Jan 1965	Area III (West Central)	Fire Protection	Active

Mr. Don Gillis, UCD Environmental Protection Specialist, provided information regarding the status of drinking water wells at UCD. Mr. Gillis indicated there are two water supply systems at UCD: one identified as the Admin System and one identified as the North System. Mr. Gillis indicated Wells 6 and 7 comprise the North System. He indicated that the UCDF used water rights for Well No. 8 (which was never drilled), to increase allowed water use for Wells 6 and 7. Both Wells 6 and 7 were upgraded approximately 5 years ago and outfitted with an emergency generator. Mr. Gillis indicated Well 3 is used as a back-up well, as needed.

Wells 4 and 5 are located in Area II, near the 100 and 200 series of warehouses. These wells supply water to Area VII-Admin and K-Block. Mr. Gillis indicated a booster pump was added to Well 4, providing more water pressure to K-Block. Mr. Gillis believed Wells 4 and 5 were permitted for domestic use and were being used consistent with their water rights. However, no information regarding change of water use from fire protection to domestic water use was identified in water rights information reviewed for this report.

Mr. Gillis stated Wells 1 and 2 are not currently active. A remote video camera inspection of Well 1 completed more than 1 year ago identified the well to be cased incorrectly. UCD attempted to re-drill the well into the targeted aquifer; however, the Oregon Health Department had required the contractor to case past the desired depth, resulting in a poorly producing well. Mr. Gillis indicated Well 2 tends to cavitate and has been shut down. He indicated the Army does not intend to perform any more upgrades to Wells 1 or 2.

3.5 HAZARDOUS MATERIALS GENERATION, USE, HANDLING, STORAGE

3.5.1 Environmental Permits and Licenses

This section discusses the following environmental permits and licenses held by UCD: two RCRA permits; NPDES permit; drinking water permit; air contaminant discharge permit; water pollution control facility permit; and Nuclear Regulatory Commission (NRC) licenses.

3.5.1.1 Resource Conservation and Recovery Act (RCRA) Permit

The UCD maintains two RCRA permits: one for hazardous waste storage at the UCD, which includes the Subject Site; and one for the incinerator operations at the adjacent UCDF. The UCD Permit (OR# 6213820917) was re-issued in 2005. A copy of this permit is included in Appendix G. Types of hazardous substances stored at UCD are discussed further in Section 3.5.2. UCD currently is permitted to store containerized hazardous wastes in storage units located in three specified facilities: K-Block, J-Block, and Building 203 in Area II. These storage locations along with former storage location I-Block and chemical lab Building 655 in K-Block, are discussed below.

<u>On Subject Site</u>

Area IV - K-Block: Chemical agent-filled munitions and bulk items are stored in K-Block, which is subject to the highest levels of security requirements, pending transfer to the UCDF for disposal. The western half of K-Block is located in Area IV of the Subject Site and includes 47 of the 90 storage igloos in K-Block. Currently, all GB and VX nerve agents have been destroyed at the UCDF and are no longer stored at UCD. At the time of the field reconnaissance, Blister agent HD remained stored in the K-Block igloos. The former blister agent storage area is identified as ECOP Category 3 and has a location identification number of 41(3)HR] on Figures 8 and 12. Also located on the Subject Site in K-Block are Buildings 654, 655 (laundry), 659 (storage warehouse) and 656 (laboratory). These buildings were identified as an ECOP Category 7 and were given a location identification number of 102(7)HS,HR on Figures 8 and 12.

Area IV - Building 656 - K-Block: Building 656 is a laboratory facility that supports K-Block activities. Hazardous wastes generated from Building 656 include agent-related decontamination and laboratory wastes, such as chemical agent standards, and personal protective equipment. Non-agent related laboratory wastes, such as solvents, acids and plastics, also are stored here in a satellite accumulation area (*USACE, 2010*). This building was identified as an ECOP Category 7 with a location identification number of 102(7)HS,HR on Figures 8 and 12.

Area V - J-Block: There are 90 igloos located in J-Block, with 58 designated as storage igloos for agent-related wastes generated from maintenance operations in K-Block, agent-related wastes once stored in I-Block, and from wastes generated by Building 656 (laboratory) in the west half of K-Block. At the time of the field reconnaissance, only 14 J-Block igloos, #1797 through #1810, stored agent-related secondary hazardous wastes. Agent-related items stored in J-Block included used filters from protective masks and storage units, spent decontamination solutions, and personal protective equipment. Wastes from Building 656 included those generated from chemical analysis and monitoring. At the time of the January 2011 field reconnaissance, wastes stored in the J-Block igloos were awaiting disposal at the UCDF. A list of secondary wastes stored in J-

Block Igloos #1797 through #1810 is included in Appendix H. Since final incineration of agent-related contaminated waste was completed in October 2011, the igloos were decontaminated through RCRA Closure, in a manner similar to the closure completed for I-Block Igloos located in Area V of the Subject Site. The J-Block Igloos are identified as ECOP Category 1 with a location identification number of 99(1)HS, A(P), L(P) on figures 9a and 12.

Area III - I-Block: There are 80 igloos located within I Block, with 30 of the 80 igloos previously permitted to store only HD chemical agent-filled bulk items. In March 2002, chemical agent HD was moved from Building 659 located in the west half of K-Block, to 24 I-Block igloos (#1699 through #1722). However, six of the igloos were never placed into service. In late 2006, the igloos were emptied and all agents were transferred to the K-Block igloos to increase storage security and operational efficiency. During its operational history, no HD liquids were ever discharged to the floor of the igloos (*Panamerican Consultants, 2002*). In March 2007, UCD submitted a RCRA closure plan for I-Block, which presented a methodology and schedule for completion of closure activities. In accordance with the closure plan UCD removed waste and cleaned all igloos and completed wipe sampling of all cleaned surfaces, and I Block igloos were RCRA-closed in December 2009. Currently, UCD is finalizing a work plan to complete RCRA closure of the J-Block igloos, utilizing the I-Block Storage Facility Project Closure Plan (2007), and updating/revising as appropriate to fit the closure requirements for J-Block. The northern I-Block igloos are identified as ECOP Category 7, with a location identification number of 32(7)A,PS,L(P) on Figures 7 and 12.

Adjacent to Subject Site

Area II - Building 203: Building 203 is located in Area II, adjacent to the southwest of the Subject Site. Building 203 stores containerized wastes generated from support activities that do not involve chemical agent operations. Support activities generally are conducted in Area VII - Admin where hazardous wastes are permitted to be stored in drums at 90-day accumulation points. Once full, or prior to the 90-day accumulation, the drums are transported to Building 203 to await transport offsite by a licensed hazardous waste contractor for disposal at Chemwaste Management's hazardous waste landfill in Arlington, Oregon.

The DEQ Office of Compliance and Enforcement monitors the current UCD and the UCDF permits to ensure that the installation is in compliance with all state and Federal environmental laws. The DEQ uses a variety of tools to monitor air, water, or solid waste permit compliance, such as inspections and investigation of complaints. To date, UCD has been issued three Notices of Noncompliance or Pre-Enforcement Notices to the UCD, with none resulting in a notice of violation or monetary penalties (*USACE, 2010*).

Mr. Steve Potts is the DEQ RCRA Permit Officer responsible for administering both the UCD and the UCDF RCRA permits. Mr. Potts indicated the UCD has maintained a positive compliance history at the UCD installation and indicated the UCD is working on obtaining RCRA closure at all of its facilities identified in its RCRA permit. Mr. Potts indicated once a clean closure is achieved and approved by the DEQ (i.e. DEQ has agreed with all data, objectives, and conclusions for closure) the installation will have met all of its permit requirements. At the time of AMEC's January 2011 research, he indicated that UCD intends to close its RCRA facilities using an industrial level of clean closure, and closure objectives currently are being discussed with UCD personnel.

3.5.1.2 National Pollutant Discharge Elimination System (NPDES) Permit

NPDES permits are required for "point source" discharges of pollutants to surface waters, according to the Federal Water Pollution Control Act (Clean Water Act) and Oregon law. UCD maintains one NPDES Waste Discharge Permit issued by the DEQ. NPDES Permit Number 200-J allows UCD to discharge to surface waters filter backwash, settling basin, and reservoir cleaning water that has been prepared to meet minimum dilution requirements as well as settleable solids and pH parameters. Other parameters stipulated in the permit pertain to the mixing zone limits, temperature management, and a treatment system for all reservoir cleaning water. Land application of filter backwash, settling basin, and reservoir cleaning water is also permitted when UCD obtains written approval from the DEQ and meets additional requirements outlined in the permit. In addition, flushing of raw water intakes after storm events and spring runoff also are allowed. UCD must monitor and report these activities to DEQ according to sampling and frequency requirements outlined in the permit. A copy of the NPDES permit and letter from DEQ granting an extension of the installation's existing NPDES permit is presented in Appendix I.

3.5.1.3 Drinking Water Permits

UCD maintains two public drinking water systems. Both are non-transient, non-community (NTNC) systems, which are public water systems that regularly serve at least 25 of the residential connections over 6 months per year. In both systems, water is obtained through groundwater wells and treated with gas chlorination. The Oregon Department of Human Services Drinking Water Program assigned Public Water System (PWS) Identification Number OR4101136 to the UCD Administration Area water system, which has the capacity to serve 25 residential connections and a population of 124. Currently there are no active potable wells in Area VII-Admin. Wells No. 1 and No. 2 were not in use at the time of the 10 January 2011 field reconnaissance and chlorination gas cylinders used for water treatment had been removed. PWS Identification Number OR4194664 refers to the northern UCD water system, which serves 10 residential connections and a population of 662 people. No other information regarding the connections was identified in the information reviewed. However, it is likely that the residential connections refer to the housing units located at the UCD, including several single-family residences and apartment units.

3.5.1.4 Air Discharge Permits

The UCD maintains an air discharge permit, which is primarily associated with the UCDF but contains a few air permit requirements for the UCD. Historically, the UCD held an air discharge permit, from 1974 through the mid-1990s, under Oregon's Air Contaminant Discharge Permit (ACDP) Number 25-0024. ACDP Number 25-0024 was renewed in 1997 and was significantly modified to incorporate the processes and activities associated with the UCDF. UCD renewed permit ACDP Number 25-0024 again in 2002. Significant changes to the permit included an increase in UCDF Plant Site Emission Limit. The ACDP was renewed again in 2005. A copy of UCD's ACDP is presented in Appendix J. In addition to the ACDP, The UCD maintains an Oregon Title V Operating Permit for the UCDF.

The UCD installation requirements include air emissions requirements for K-Block igloos and dust emissions from use of roads in J-Block and K-Block. The UCD boilers continue to be covered under the permit that was updated in 1997 and are operated in compliance with permit requirements. The updated permit primarily specified the requirements pertaining to emissions of the following criteria pollutants: particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and volatile organic compounds. The updated permit also required UCD to meet general testing, monitoring, recordkeeping, and reporting requirements.

3.5.1.5 Water Pollution Control Facility (WPCF) Permit

The UCD operates the WWTP in Area VI - South Central, in accordance with the DEQ WPCF Permit Number 102031. Domestic wastewaters and steam-cleaning wastes, after being filtered through an oil separator at Building 5, are routed to the WWTP. The WWTP consists of an Imhoff tank, standby Imhoff tank, sludge drying bed, and tile field percolation system. The WWTP is permitted to discharge an average daily flow of no more than 30,000 gallons per day (gpd). All wastewater must be distributed into on-site sewage disposal fields for dissipation by evapotranspiration and controlled seepage. No direct discharge to waters of the state is permitted. UCD is required to monitor the WWTP effluent and report to DEQ on a quarterly basis the following parameters: Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Nitrate and Nitrate, and Ammonia and Nitrogen. This permit expires in February 2015.

UCDF holds WPCF Permit Number 101456, which expires February 2013. The permit pertains to the disposal of domestic wastewaters through sewage treatment systems, including 2 septic tanks, 2 dosing tanks, and 2 drain fields (average flow 21,500 gpd) at the UCDF; a septic tank and drain field (average flow 210 gpd) at Building 402; a 1,500-gallon septic tank, dosing chamber, and 3 drain fields (average flow 5,100 gpd) at the Building 655 change house; a drain field (average flow 13,000 gpd per 10-hour shift) at the Building 655 laundry wastewater system; and at least 20 septic tank and drain field systems of various sizes throughout the facility.

Twenty-three other areas at UCD have septic tank-leach field systems. Only 15 of these tanks reportedly are active. The tanks are fed by concrete sanitary sewer pipes that range in size from 4-inch-diameter to 8-inch-diameter. The UCD operates the septic tank systems and leach fields in accordance with the DEQ WPCF Permit Number 104930 (*Earth Tech., 1994; NUS, 1987; DEQ 2006a*). The presence of septic tank leach fields at the UCD, where operations have included handling military-grade chemicals and munitions, represents a potential for contaminants to have been introduced to the subsurface.

Copies of the WPCF permit and the quarterly sampling results for the last quarter of 2010 are included in Appendix K.

3.5.1.6 Nuclear Regulatory Commission Licenses

Radioactive source materials at UCD consist of sealed sources of radiological materials, including 25 Improved Chemical Agent Monitor (ICAM) Chemical Agent Detectors with Ni-63 sources used by the UCDF. These devices are stored in Building 656 and will be turned in upon completion of chemical agent disposal. The detectors are used to inspect the K-Block igloos where the chemical agents are stored. No detector exceeds 300 microcuries, or 25 curies, total. The detectors are stored and used in compliance with Nuclear Regulatory Commission (NRC) license requirements.

Naturally Occurring Radioactive Material (NORM) is stored by the State of Oregon in Building 928 in the A-Block. Items stored include check counters of depleted uranium or radium (*UMADRA, 2010*).

The NRC license is to be terminated when sources are no longer required. Following closure of the chemical agent demilitarization operation, the detectors will be handled as specified in the NRC license and returned or destroyed according to the manufacturer’s instructions. There is no radioactive waste generated at UCD (*BRAC, 2005; MEDCOM Building List Radioactive Material Use; Earth Tech., 1995*).

3.5.1.7 Medical Waste

Over the history of UCD’s operation, a very small quantity of medical waste has been generated at the Occupational Health Clinic, which was sent to Fort Lewis, Washington for disposal.

Reportedly, no medical waste was sent to the former “Active Landfill” at UCD (*USACE, 2010*) in Area VIII of the UCD, adjacent to the Subject Site.

3.5.1.8 Solid Waste Permits

Currently, waste generated at UCD is transported off-post for disposal at a permitted facility. Six inactive landfills are located on the Subject Site in Area VI, located west of the Administration Area. A No Further Action (NFA) Record of Decision (ROD) has been issued for both the Inactive and the Active Landfill OUs. However, continued use of these landfill areas for disposal of construction debris was observed during the January 2011 field reconnaissance, which may compromise the NFA status of the inactive landfill. In addition, older fill material was observed at grade, indicating that the original closure of the landfill areas may not have met the DEQ requirements for appropriate cover of closed landfills.

3.5.1.9 Compliance Status

Mr. Jim Wenzel, UCD RCRA Manager, provided the results of an internal Environmental Performance Assessment System (EPAS) audit completed by the Army in Fall 2010. The audit was conducted to evaluate the UCD's compliance with air emissions permit, NEPA, hazardous materials and hazardous wastes, natural resources, petroleum product storage, water quality, wastewater and stormwater. EPAS audits are classified from one to four, according to seriousness of infraction ranging from housekeeping issues to violations of Federal law. EPAS findings for the UCD generally were Class III, “Noncompliance with Army/DOD regulation, SOP, guidance, or inconsistent with best management practice”. Significant findings included:

- Asbestos was identified in 100 buildings at the UCD;
- Lack of current certificate for Building 655;
- Expired permit for WWTP;
- Several unused septic tanks were not decommissioned;
- Missing Operations and Maintenance Manual for WWTP;
- Leak was identified in the water supply system;
- No backflow prevention devices were installed in the water supply system; and
- Unprotected water supply wells.

A copy of the EPAS finding is included in Appendix L. Mr. Wenzl indicated the finding regarding the expired permit for the WWTP was incorrect, as the WPCF expires 28 February 2015. A copy of the WPCF permit is included in Appendix K.

The following EPAS findings were made: the presence of asbestos in many buildings at UCD; unused septic tanks located at UCD; lack of backflow prevention devices installed in the water supply system; and unprotected water supply wells. Additionally, a leak identified in the water supply system was interpreted to represent a breach of integrity in the water supply system could introduce contaminants into the water system.

3.5.2 Storage of Hazardous Substances

The UCD is permitted to handle and store a variety of hazardous substances. Waste storage areas are detailed in the Hazardous Waste Management Plan (*Earth Tech., 1995; UCD Archive Document, 2005*), and are summarized in Table 10.

Table 10: RCRA Permitted Materials

Hazardous Material	Locations
Basic Cleaning Chemicals	Household cleaners, solvents, alcohol, ink, and toner are stored in Buildings 4, 5, 6, 7, 18, 30, and 82. All chemicals are stored in closed, labeled, Flammable Materials Storage Lockers or cabinets. Quantities of chemicals are insignificant. Any spills would be on concrete floors and are cleaned up immediately. Spill kits or spill cleanup supplies are available in the buildings.
Paint and Paint Products	Small quantities (1 gallon or smaller) of latex paint, spray paint, primer, and paint thinner are stored in Flammable Materials Storage Lockers in Building 4 (Support Services). Building 5 (Vehicle Maintenance) has similar paint products in containers as large as 5 gallons. Building 7 (Carpentry Shop) has a Flammable Materials Storage Locker containing quart or smaller containers of latex paint, aerosol paint, stain, varathane, and paint thinner. The Carpentry Shop also maintains a 30-gallon drum of waste paint thinner and a 30-gallon drum of waste paint residue from punctured spray cans. The drums are sealed and stored inside the building on a concrete floor.
Machinery Maintenance Products	Machinery and vehicle maintenance products are stored at UCD in containers up to 1 gallon in size and include cutting oil, lubricants, tool oil, starter fluid, brake fluid, brake cleaner, battery reconditioner, fuel and fuel additives, antifreeze, and WD-40™. Building 4 (Support Services) has a portable flammable materials cabinet that contains gallon or smaller containers of oils and lubricants. A spill kit is available to clean up minor leaks and spills. A Flammable Materials Storage Locker located in Building 5 (Motor Pool) stores 1 gallon or smaller containers of vehicle maintenance products. Several spill kits are located in the building. Spills or leaks would be on concrete floors and are cleaned up immediately. Fifty-five-gallon drums of recycled antifreeze and POLs are stored on spill skids. Any leaks or spills would be contained in the spill skid.
Pesticides, Herbicides, Rodenticides	Building 8 is the Pesticide, Herbicide, and Rodenticide Storage Building. All chemicals are stored in locked rooms. In-service drums of liquids are stored in plastic containment trays or plastic spill containment tubs. A labeled spill kit containing floor dry, a shovel, a broom, and bleach is available in the room. The pesticide mixing room is bermed so all material would remain in the containment area in the event of a spill or leak. All mixing is done in this room. A labeled spill kit similar to the herbicide spill kit is available. All containers are triple rinsed and rinse water is reused. The rinsed empty containers are punctured and disposed of as solid waste.

Hazardous Material	Locations
Batteries	Building 27 is the Battery Storage Building. Batteries for forklifts are stored on wooden pallets on a concrete floor. The smaller batteries for motor vehicles are stored on shelves. An elevated, bermed concrete area in the center of the building is used for storage of large-equipment batteries. Previously, floor drains in the elevated area directed spills and wash water to a 1500-gallon below-grade tank. Spills and wash water were previously neutralized with bicarbonate soda and lime, and then rinsed into the floor drains. In 2006 this 1500-gallon tank was removed. A corrosive materials storage cabinet is used to store containers of battery acid. A spill kit containing bicarbonate soda is located near the storage cabinet. All corrosive materials spilled would be neutralized and contained within the building.
Boiler and Air Conditioning Chemicals	Building 9 is the Boiler and Air Conditioning Shop. Chemicals used in the boilers and air conditioners are stored here. The boiler chemical storage room contains 55-gallon plastic drums of sodium hydroxide, sulfite, Possca^{TM}, and Morpholine^{TM}. The drums are all seated in plastic secondary containment drums. During use, the chemicals are transferred to smaller transport containers that are taken to the boiler, triple-rinsed, and then the rinse water is added directly to the boiler. Freon R-12 and R-22 are also stored here.
Laboratory Chemicals	Building 656 is the monitoring facility that supports K-Block activities. A Flammable Materials Storage Locker in this building contains solvents, alcohol, toluene, hexane, and propanol in 1 gallon or smaller containers. Acid and caustic spill cleanup kits are stored on top of the storage locker. Various chemicals and standards are stored in small quantities under fume hoods throughout the facility. Any spills would occur inside the building or inside the fume hood and would be cleaned up immediately (US Army CMA, 2004).

Hazardous substance surveys of the installation were completed during the enhanced PA and CERFA investigations discussed in Section 4.1.2. There are no extremely hazardous substances (as specified in Superfund Amendment and Reauthorization Act [SARA], Title II, Section 302) present at the UCD. The UCDF, maintains, or utilizes sufficient quantities of hazardous chemicals to require reporting under SARA Title III, Section 312, Tier Reporting, or SARA Title III, Section 313, Toxic Chemical Release Form R reporting (*USACE, 2010*).

The UCD maintains Material Safety Data Sheets for all hazardous chemicals on the installation, and spill response equipment is present. Hazardous substance notifications have been submitted to local emergency response agencies, and spill response has been coordinated with the UCD Fire Department located in Area VII - Admin (*Earth Tech., 1995*). RCRA Permit 2005 is the most recent document describing hazardous waste storage locations.

The UCD has 104 agent-related hazardous waste storage facilities permitted under RCRA and several non-agent related storage locations. The agent-related hazardous waste storage facilities on the Subject Site consist of 47 of the 90 igloos in K-Block and 14 igloos in J-Block. Non-agent-related hazardous waste storage on the Subject Site consists of two 90-day storage locations and several satellite accumulation sites in Area VII - Admin. One additional 90-day storage location is in Area II, adjacent to the southwest of the Subject Site. The hazardous waste storage facilities located on the Subject Site are identified in Table 11.

Table 11: Hazardous Waste Storage Locations on Subject Site

Agent-Related Hazardous Waste Storage Locations
47 igloos in K-Block
14 igloos in J-Block (#1797 through #1810)
Non-agent related hazardous waste storage locations
Two 90-day storage locations in Admin Area - Area VII
Satellite accumulation points in Admin Area - Area VII

3.5.2.1 Agent-Related Storage of Hazardous Substances

As presented in Section 3.5.1.1, agent-related hazardous waste is stored in K-Block and agent-related secondary waste is stored in J-Block igloos.

3.5.2.2 Non Agent-Related Storage of Hazardous Substances

Activities in several buildings at UCD, identified below, have the potential to generate or serve as satellite accumulation sites for non-agent related hazardous wastes, and are a summary of the building descriptions found in the RCRA Permit 2005. Non-agent wastes generally follow a path from a satellite accumulation point and then to the permitted Hazardous Waste Storage (HWS) Facility in Building 203 (*DEQ, 1997b, c*). All non-agent-related hazardous wastes generated and managed at the storage facilities are characterized for off-site disposal. The UCD does not accept hazardous waste generated off-site for storage; however, the facility has included into the RCRA permit, in accordance with 40 CFR 270.61, emergency provisions, if necessary.

Building 2 Fire Department: The fire department and offices are located in Building 2 in Area VII – Administration Area and contain small quantities of hazardous materials including linseed oil, paint cans, tool oil, lubricants, and aerosol paints stored in flammable materials storage lockers. Absorbent spill socks are installed on the fire trucks (*US Army CMA, 2004*). Building 2 is identified as ECOP Category 1 with a location identification number of 80(1)A,HS,PS on Figures 11 and 13.

Building 4 Public Works Directorate: Building 4 is located in Area VII - Administration Area and supports the UCD Public Works Department. Flammable materials, including paint, oil, paint thinner, and sealants stored in quart to gallon containers are kept in a non-flammable storage locker. Building 4 has storage locations for compressed gasses cylinders, including acetylene and oxygen. Other items stored in the Building 4 satellite accumulation site awaiting transport to Building 203 include mercury-containing fluorescent light tubes. Any spills would occur inside the cabinet or on concrete and would be immediately cleaned up (*US Army CMA, 2004*). Building 4 is identified as ECOP Category 7 with a location identification number of 72(7)A, HR(P) as shown on Figures 11 and 13.

Building 5 Vehicle Maintenance Facility: Building 5 is located in Area VII - Administration Area and is a fully equipped maintenance and repair facility supporting the UCD vehicles, and actively generates waste. The building maintains three satellite accumulation sites. Materials stored in flammable materials storage lockers include paint, thinners, aerosols, starter fluid, brake fluid, brake cleaner, lubricants, battery reconditioner, fuel additives and conditioners, petroleum products, and other household items. The Central Shop Area contains gear oils and motor oils in 55-gallon drums. Waste paint thinner and paint sludge are contained in 30-gallon containers inside 85-gallon overpacks. Recycled and new antifreeze is kept in 55-gallon drums. Gallon bottles of windshield washer fluid and diesel fuel conditioner are also kept in the shop. An oil-water separator is installed outside the building to collect discharge from the wash bay. Any spills would occur inside a cabinet or on concrete and would be immediately cleaned up. A spill kit is available in the building (*US Army CMA, 2004*). Building 5 is identified is identified as ECOP Category 6 with a location identification number of 67(7)A,HS,PS,P, as shown on Figures 11 and 13.

Building 7 Carpentry Shop: Building 7 is located in Area VII - Administration Area and is a 3,600 square-foot shop, which maintains four satellite accumulation sites. The building actively generates wastes and is permitted for the storage of paint, aerosols, stains, lubricants, paint thinner, varnish, alcohol, glue, adhesive, and sealants. The facility maintains paint thinner, aerosol paint, and pesticide containers in 55-gallon drums and three 35-gallon drums for paints and cutting oil (*US Army CMA, 2004; DEQ, 1997b, c*). Because of a former UST located near the building, Building 7 was identified as ECOP Category 4 with a location identification number of 68(4)A,PS,PR, as shown on Figures 11 and 13.

Building 8 Pesticide/Herbicide Storage and Mixing Operations: Building 8 is located in Area VII – Administration Area and contains small volumes of herbicides, pesticides, rodenticides, and mixing operations. Liquid herbicide in 2.5-gallon plastic containers is kept inside containment trays. The pesticides are kept in a locked storage room and are in single-use containers or small containers up to a 50-pound bag size. Mixing is done inside a bermed area. Rodenticides are kept in small containers in the building. Containers of 5 percent bleach are mixed in 20-gallon containers in the mixing room (*US Army CMA, 2004*). Building 8 was not identified as a Study Site in previous environmental investigations at the UCD, nor was it given an ECOP Category number in the June 2010 ECOP Report. In addition, no field evidence or research completed as part of this ECOP/EBS study indicated an ECOP condition was necessary.

Building 9 HVAC and Boiler Shop: Building 9 is located in Area VII - Administration Area and is the Boiler and Air Conditioning Shop. Chemicals used in the boilers and air conditioners are stored here, including 55-gallon plastic drums of sodium hydroxide, sulfite, Possca^{TM}, and Morpholine^{TM}. The drums are all seated in plastic secondary containment drums. During use, the chemicals are transferred to smaller containers for transportation to the boiler. The smaller containers are triple-rinsed and the rinse water is added directly to the boiler. Freon R-12 and R-22 are stored in Building 9. Three 50-pound recovery tanks of R-22 and R-12, along with small quantities of lubricating oils, are kept inside the locked shops. Building 9 was not identified as a Study Site in previous environmental investigations at the UCD, nor was it given an ECOP Category number in the June 2010 ECOP Report. In addition, no field evidence or research completed as part of this ECOP/EBS study indicated an ECOP condition was necessary.

Building 11 Medical Clinic, Chemical Protection Equipment (CPE) and Tool Crib: Building 11 is a 33,150 square-foot facility located in Area VII – Administration Area and houses the tool crib, offices, medical clinic, CPE, protective mask fit area, and mail room. Small amounts of waste are infrequently generated here, and include expired acids and batteries, and occasionally, expired chemicals such as formaldehyde. A flammable materials storage locker holds alcohol, ink, solvents, acetone, toner, sealants, and insecticides in gallon or smaller containers. Any spills would occur inside the cabinet or on concrete and be immediately cleaned up. If waste is generated it is immediately transferred to Building 203 for storage. Building 11 is identified as ECOP Category 7 with a location identification number of 76(7)A,HS, as shown on Figures 11 and 13.

Building 27 Battery Shop: Building 27 is located in Area VII - Admin. Activities in the Battery Shop include handling acidic electrolyte solutions. Spilled materials from electrolyte-handling activities were previously drained to an underground collection tank via a pipe from a floor drain installed in the battery-charging platform. Access to the collection tank was through a manhole located approximately 20 feet to the southwest of the front entrance to the building. The 1,500-gallon circular collection tank was enclosed inside a concrete vault, and was accessible on all sides. The tank was previously inspected and the liquid in the tank was tested for acidity and neutralized whenever the tank was used. In 2006, this tank was removed and the drain was grouted. Any current spills would be immediately cleaned up (*US Army CMA, 2004*). Building 27 is identified as ECOP Category 3 with a location identification number of 63(3) HS, HR PS, PR, as shown on Figures 11 and 13.

Building 203 Hazardous Waste Storage Facility: Building 203 is located in Area II, adjacent to the Subject Site. Only a 3,600 square-foot section in the northeast corner of Building 203 is designated for the storage of hazardous waste. The storage area is designed to hold 660 55-gallon drums of wastes and has a secondary containment that is sufficient for this volume of waste. Once 75 percent of the capacity of the facility is reached, within 15 days, UCD manifests and removes a minimum of 25 percent of the waste to an authorized TSD facility. Building 203 was not considered for an ECOP category as part of this study since this building is located in Area II, adjacent to the Subject Site.

3.6 PETROLEUM PRODUCT USE, HANDLING, AND STORAGE

Several UST and AST surveys and investigations have been conducted at UCD, including two comprehensive surveys completed in 1989 and 1993. Additional information regarding petroleum product storage was obtained from interviews with UCD personnel during the 1990 Enhanced PA. Several locations of USTs were identified as "Study Sites" from previous investigations.

3.6.1 Petroleum Releases and Disposal

Multiple petroleum release incidents at the UCD have been documented in historical records. According to OAR 340-142-0050(1c), oil spills occurring on the surface of the land and not likely to escape into waters of the state must be reported if the quantity of oil spilled is greater than or equal to one barrel (42 gallons). Records of releases smaller than 42 gallons were reported internally via memoranda. These incidences are presented in Table 12.

Table 12: Reported Petroleum Spills and Incidents

Incident Date	Area	Description
21 March 1991	VII	Approximately 40 gallons of diesel fuel were spilled in an 8 foot (ft) by 16 ft area in the petroleum, oil, and lubricant (POL) yard, north of the service station (Building 6). The spill occurred on an asphalt/concrete surface, and no fuel escaped into the sounding soils. Spill residue treated with absorbent and was swept up and contained in a 55-gallon drum for disposal. (Daugherty, 1991).

Incident Date	Area	Description
11 January 1992	VII	A broken hydraulic line on an M1 Tank resulted in 3 to 5 gallons of hydraulic oil spilling just southwest of Building 27. The spill occurred on a gravel/soil surface. The top 6 inches of soil was excavated to plastic-lined 55-gallon drums, which were placed in Building 115 in Area II for temporary storage (*Daugherty, 1992*).
21 December 1992	IV	An undocumented quantity of diesel fuel was spilled at an oil pad in K-Block. Three cubic yards of soil were removed and placed in the landfill located in Area VIII (*Del Grasso, 1992*)
21 February 1993	VII	An overfill of UST 37, located between Buildings 4 and 5, released approximately 75 gallons of heating oil on the snow covered, frozen soil. The spill was reported to DEQ, which assigned the Incident Spill Report Number 93-2836. All snow, soils, and rocks were removed and containerized the same day. (*McDune, William D. "Spill Report #93-283, clean up report of Heating Oil #5." 2 March 1993. Memorandum*)
13 June 2003	V	A tote fell off of a forklift near Igloo J-1729, causing the seal to break and spilling tetrachloroethylene (PCE). Approximately 3 gallons spilled in the truck, 2 gallons to the pavement, and 3 to 4 ounces to the ground next to the pavement. The Hazmat team responded to the scene and performed cleanup operations. All contaminated material was bagged and drummed per procedure (*Thurman, 2003*).

In addition to the incidents identified in Table 12, undocumented petroleum releases have been reported by UCD personnel or were discovered during the various environmental investigations conducted at UCD (USACE, 2010). These are discussed in the following paragraphs.

Building 29, Former Diesel Tank: Former UCD employees interviewed during the 1990 Enhanced PA describe UST 100 as a diesel tank formerly located below Building 29 in Area VII - Admin. During the PA field reconnaissance conducted, no observable evidence of a tank was found, and no historical documents were identified detailing the installation and removal of this tank. During the 1995 UST investigation, Dames and Moore conducted a soil gas survey followed by a subsurface investigation in and around the vicinity of the reported UST location. Soil samples were collected at 2.5, 5, 7.5, and 10-foot depths and analyzed for total petroleum hydrocarbons (TPH), target compound list (TCL) VOCs, and TCL BNAs. TPH was detected at high concentrations in shallow soil samples (2.5’) in all four borings drilled. Concentrations of TPH were not detected above laboratory method reporting limits at depths below 2.5 feet, indicating that petroleum contamination may have been due to a surface spill rather than a leaking tank. The UST Investigation Report recommended the soil at the eastern quarter of Building 29 be excavated and disposed of properly *(USACE, 2010)*. No other information was found regarding whether additional soils were removed. The former diesel tank and its location at Building 29, is identified as ECOP Category 2 with a location identification number of 71(2)PS, PR, as shown on Figures 11 and 13.

Diesel Fuel Spill, Study Site 73: Study Site 73 is located in Area VII - Administration Area and reportedly was a former gasoline service station which included former USTs 42, 43, and 65. During the 1990 PA, a former UCD employee reported an 800-gallon diesel fuel spill occurred around 1995 in the area of the former USTs; however no documentation on this spill was found. A soil gas survey was conducted during the 1995 UST investigation to evaluate the potential for contamination around the three USTs. Fifty-seven soil samples were collected in a 25-foot rectangular grid and analyzed for benzene, ethylbenzene, toluene, and xylenes (BTEX); Total Volatile Hydrocarbons (TVHCs); TCL VOCs; TCL BNAs; and TPH. Three soil borings also were drilled and samples were collected at 2.5, 5, 7.5, and 10-foot intervals. Soil gas samples generally were low, but a ubiquitous presence of BTEX across the area indicated soil contamination. Contaminant concentrations in the soil samples were low to moderate and decreased significantly with depth, suggesting the contamination may be a result of surficial spill and not from an underground tank. A removal action was recommended for the soil west of UST 42 and 43. During the removal of these USTs in 2000, 130 cubic yards of Petroleum Contaminated Soil (PCS) was removed and analyzed for Total Petroleum Hydrocarbons-Hydrocarbon Identification (TPH-HCID). Results revealed that contaminant concentrations in soil were below cleanup standards. The excavation was backfilled with the PCS in accordance with DEQ UST Cleanup Policy No. 550, for reuse of petroleum contaminated soil. Study Site 73 is identified as ECOP Category 4 with an identification number of 114(2)PS, PR. .

Building 23 Fuel Oil Transfer Station, Study Site 74: Study Site 74 is known as the Fuel Oil Transfer Station, where various types of oil and fuel were transferred from railcars to vehicles or storage tanks over a period of 50 years. Localized spillage may have occurred throughout the historic use of Study Site 74, though the precise location of these spills is unknown and undocumented. During an aerial photographic analysis, completed as part of a UST investigation, darker toned soil appears throughout historic photos. A passive soil gas survey was conducted around the Fuel Oil Transfer Station in a 50-foot rectangular grid. Passive samples were collected from a depth of one foot and analyzed for BTEX, PCE, and Trichloroethylene (TCE). Based on the results, three 10-foot borings were drilled and the soil was sampled at 2.5, 5, 7.5, and 10-foot depths. Results of the passive soil gas sampling indicated moderately elevated BTEX in areas east and west of Building 23, near the railroad tracks and north of UST 102. Low to high ion counts for PCE were detected in the eastern and northeastern quarter of the site, potentially attributable to train engine maintenance operations in Building 10; and in a third area of in the eastern quarter of the survey, also near Building 10. Study Site 74 is identified as ECOP Category 7 with an identification number of 112(7) PS, HR, as shown on Figures 11 and 13.

Former UST 102 at Study Site 74: Former UST 102 was located in Area VII - Administration Area, south of Building 23 at Study Site 74, which was a 12,000-gallon fuel oil tank believed to be installed around 1941. In 1995, a geophysical and soil gas survey was conducted to precisely locate the tank and determine its condition. A geophysical anomaly was identified to be the tank. Twenty-nine soil gas samples were collected in a rectangular grid around the location of the anomaly and analyzed for BTEX, TVHC, carbon dioxide, and methane. Low levels of benzene, toluene, and TVHCs were detected southeast of the tank, and not from the samples closest to the tank. Based on these results, three soil borings in the vicinity of the elevated soil gas samples were drilled to a depth of 10 feet. Soil samples were collected at 2.5, 5.0, 7.5 and 10 feet bgs and analyzed for TCL VOCs, TCL BNAs, and TPH. Low concentrations of several BNAs and TPH were detected in limited locations. The results indicated the low levels of organics around the tank do not appear to be associated with the buried UST. The tank was later removed in 1993 by Martech USA Inc. (*USACE, 2010*). Study Site 74 is identified as ECOP Category 7 with an identification number of 112(7) PS, HR, as shown on Figures 11 and 13.

Former Gas Station/Possible UST Location, Study Site 43: Site 43 is located in the central part of UCD at the intersection of Rim and Center Roads and north of the EWL. During the 1995 UST investigation, several current and former UCD employees recall that four USTs (USTs 59 through 62) were located at Study Site 43, though no surficial evidence existed that suggested the USTs were present at the time of a 1995 investigation. A geophysical and soil gas survey was conducted to determine the presence of USTs and whether soil contamination existed. Twenty-five soil gas samples were analyzed for BTEX and TVHC, with the results indicating trace concentrations of benzene, toluene, xylene, and TVHCs were present. The investigation report concluded the concentrations did not represent a significant point source like a leaking UST, but suggests minor surface spillage or the introduction of asphalt constituents (*Dames and Moore, 1990, 1995; USACE, 2010*). Study Site 43 is identified as ECOP Category 2 with an identification number of 44(2)PS, PR,C, as shown on Figures 9A and 12.

3.6.2 Historic Underground Storage Tanks

In 1989, USACE conducted an investigation to identify USTs present at the UCD. The objective was to evaluate the condition of the USTs and determine if further remedial action was necessary. During the investigation the USTs were assigned Other Regulated Underground Material (ORUM) designations. Eighty-three ORUMs were inventoried and compiled into a database that included tank size, installation date, and contents; if known. Of the 83 USTs inventoried, 19 were identified as septic tanks, one was identified as a water tank, and one was identified as a manhole cover. The remaining 62 ORUM locations were USTs containing petroleum products. During the Enhanced PA of 1990 (*Dames and Moore, 1990*), 33 additional tanks were identified and inventoried. In 1992, Dames and Moore conducted a field reconnaissance, in support of a site-wide UST investigation. The intent was to field-locate and map the USTs, identify any additional tanks, and gather information for a UST investigation. Dames and Moore identified six additional tanks and one underground piping structure, also listed as a tank. This brought the total number of known USTs at UCD to 102.

Due to the ORUM designation in the original investigation of USTs, septic and water tanks, and the subsequent discovery of additional USTs at UCD, the ORUM numbering system was not continued. Additional USTs were numbered sequentially. Therefore, the ORUM and UST numbers are not always the same. The historical record of UST removal is not complete because of the UST number confusion and changing reporting requirements.

All known former USTs were summarized in a table prepared by USACE-Seattle and presented in Table 19 in the June 2010 ECOP report, which is included in Appendix M. A map showing the current and former UST and AST locations at the UCD was prepared by USACE-Seattle and is included in Appendix M. Note the locations of the USTs and ASTs within the UCDF are not shown in these figures.

3.6.3 Current Underground Storage Tanks

The UCD currently has five USTs. Two regulated USTs within the UCDF, with current DEQ permits, two unregulated USTs within the K-Block, and one unregulated UST within Area VII - Admin Area. The USTs in K-Block include a 4,000-gallon diesel tank and an oil-water separator. The UST in Area VII - Admin is an unused oil-water separator. Table 13 identifies current USTs located at UCD.

Table 13: Current USTs at UCD

Location	Tank ID	Material	Vol (gals)	Tank Material	Tank Size	Overfill Protection	Leak Detection
Bldg. 655; K-Block	A655	Diesel	4,000	Fiberglass, double-walled	6' 3" (dia.) x 19' 9"	Locking cap, 20-gal spill container and overfill prevention valve.	Leak detection monitoring in annular space; auto gauging.

Location	Tank ID	Material	Vol (gals)	Tank Material	Tank Size	Overfill Protection	Leak Detection
UCDF (MDB) - regulated	OIL-TANK-101	Diesel	4,000	Unk	Unk	Unk	Unk
UCDF (ECF) - regulated	ECF-TANK-101	Diesel	550	Fiberglass, double-walled	Unk	Locking cap, 20-gal spill container and overfill prevention valve.	Leak detection monitoring in annular space; auto gauging.
K-Block - not used	Oil-Water Separator	unk	Not Used	Unk	Unk	Unk	Unk
Bldg. 5 - not used	Oil-Water Separator	Steel	Not Used	System is three-chambered unit. Oil in wash water is trapped in waste oil compartment and pumped out periodically.	Oil-free water downstream of oily waste separator flows to storm drain.	Unk	Unk

3.6.4 Underground Storage Tank Investigations

In 1992, Pegasus Environmental Management Service, Inc. removed five USTs (UST 41, 44, 45, 46, and 56, and one AST containing pesticides (near Building 8), and installed tank leak detection at two USTs (UST 42 and 43). The tank removals resulted in DEQ issuing a petroleum release number of 30-91-0200. When the tanks were removed, soil sampling was used to locate pockets of PCS above cleanup concentrations at three sites. Corrective action reduced the concentrations of contamination to below cleanup standards at all sites except at Building 5 (UST 44), as further excavation would have compromised the structural integrity of the building. In a letter dated 4 November 1992, DEQ informed USACE that NFA was required at all sites investigated, with the exception of Building 5 (UST 44). DEQ stated that petroleum contaminated soil can remain in place until at Building such time that the access to the soil improves at which time the US Army must then finish characterizing the extent of the release and proceed with cleanup as necessary. Given the PCS that remains in place, Building 5 was identified with a ECOP Category 6, with a property identification number of 67(7)A,HS,PS,PR, as shown on Figures 11 and 13.

In 1992, Martech USA Inc. removed five USTs from the UCD including, the 1,000-gallon tanks identified as ORUM 5, 7, and 34; one 500-gallon tank identified as ORUM 75 (UST 56); and an unnumbered 500-gallon tank identified as “airport runway tank.” UST ORUMs 5, 7, and 34 stored diesel #3 fuel, UST ORUM 75 reportedly contained either gasoline or diesel fuel, and the airport runway tank contained diesel #2 fuel. UST ORUMs 5, 7, and 34 were installed in 1945 and inactivated in 1984. UST ORUM 75 was installed sometime between 1950 and 1960 and was also inactivated in 1984. The installation and inactivation of the airport runway tank is not known. Tanks were removed using standard practices; no field evidence of contamination was found. Soil samples were collected from the sides and bottom of each tank basin. The soil samples collected near UST ORUMs 5, 7, and 34 were analyzed by EPA method 5030/8015 for TPH-diesel, EPA method 8010 for halogenated solvents, EPA method 8020 for BTEX, and EPA method 7421 for lead. Soil samples from UST ORUM 75 and the airport runway tank were analyzed the same as USTs ORUMs 5, 7, and 34, except EPA method 5030/8015 was used for TPH-gasoline rather than TPH-diesel. The analytical results from soil samples indicate low levels of TPH-d were detected at USTs ORUM 5, 7, and 34. Low concentrations of toluene were detected from two soil samples collected from UST ORUM 34, one soil sample collected at UST ORUM 7, and one soil sample from UST ORUM 75. Low concentrations of lead were detected in all four samples from UST ORUM 75 and one sample from the airport runway tank. The analytical results indicated the former UST sites were not contaminated and NFA status was recommended; however no information was found regarding whether the DEQ had granted an NFA for this Site. These sites were not identified previously with ECOP Categories. Based the analytical results for sampling around these tank locations and documented lack of field evidence of a release, no ECOP category is necessary for these locations.

In 1993, Martech USA Inc. removed 19 USTs. Analytical results for soil samples collected from the excavations were only available for four USTs (ORUM 36, 38, 80, and 102). The analytical results indicated the soil was not contaminated above cleanup levels, and an NFA was recommended for the UST sites. There was insufficient data to consider NFA for the 15 other sites. These 15 sites were further evaluated by Dames & Moore in 2000 (discussed further in this section).

Foss Environmental Services Company removed UST 87 and UST 20 in 1994. UST 87 was a 1,000-gallon tank installed in the 1950s to store diesel #2 fuel, used to fire a furnace at a munitions deactivation building. A map presented in an environmental report prepared for the UST removal (Foss, 1995) showed the UST to be located off-site, in Area II. Soil sampling at UST 87 indicated that TPH concentrations were below regulated levels, and clean soil was backfilled into the excavation. UST 20 was a 10,000-gallon tank actively used for storage of No. 5 heating oil at Building 37 in Area VII – Administration Area. During removal of UST 20, the soil was over-excavated, sampled, and found to be free of petroleum hydrocarbons. Petroleum contaminated soil was discovered beneath piping at the east end of the excavation, but was not removed due to the danger of damaging a water line. The UST and Building 37 were identified as ECOP Category

7 (due to apparent lack of investigation around an oil-water separator), with a property identification number of 67(7)A,HS,PS,PR, as shown on Figures 11 and 13.

In March 1995, Shannon and Wilson completed an Engineering Analysis for Repair and/or Replacement of 18 UST Upgrades. Three upgrade options for each UST were considered, including upgrading the existing UST in place, removing and replacing the existing UST with a new UST, and removing and replacing the existing UST with a new AST. The preferred option for each tank was determined based on field visits, interviews with base personnel, and review of available records.

Dames and Moore prepared an Underground Storage Tank Investigation Report in June 1995 (*Dames and Moore, 1995*). The objective of the investigation was to evaluate whether any of 66 USTs leaked or were presently leaking and what effect that leakage might have on the surrounding soil and groundwater. Five inactive tanks (USTs 92, 93, 96, 98, and 101) with unknown contents were sampled. Tank leak testing was conducted on 30 active USTs. Twenty-one of the thirty tanks leak-tested met Oregon State tightness criteria and required no immediate action. Two of the thirty tanks failed the leak tests and seven had inconclusive results; one tank could not be leak tested. If the test determined a tank was leaking or if the test was inconclusive, potential soil contamination was investigated by analyzing subsurface soil samples collected near the tank. Geophysical surveys were conducted to evaluate the reported presence of 20 USTs. Active soil gas surveys were conducted at 17 locations where USTs were reported to exist, and a passive soil gas survey was conducted at Study Site 74. The soil gas surveys indicated potentially significant soil contamination at Study Sites 73 and 74, and the remaining 15 sites contained insignificant contamination or low concentrations not anticipated to be a concern. Shallow soil borings were completed to confirm potential soil contamination at inactive UST sites that had significant soil gas contamination, or at active UST sites that failed the leak test or had inconclusive results. The results of all of the sampling methods ultimately helped determine whether the analyzed tanks had leaked and how the surrounding media was affected. As presented previously, Study Site 73 is identified as ECOP Category 4 with an identification number of 114(2)PS, PR. Also as discussed previously, Study Site 74 is identified as ECOP Category 7 with an identification number of 112(7) PS, HR, as shown on Figures 11 and 13.

In July 1995, Foss Environmental Services removed 11 heating oil USTs: 9, 11, 13, 14, 21, 22, 23, 25, 32, 33, and 93 (*Foss Environmental Services, 1995a*). Two additional tanks, “blow-down” structures related to a boiler and air compressor system at Building 433 (located outside the Site boundary in Area VIII), were removed (tanks 94 and 97). With the exception of UST 93, petroleum-contaminated soil was present at all UST locations as a result of spills around the fill pipes or leaks from damaged piping. After excavation, soil samples were collected, and if laboratory analysis indicated the presence of TPH contamination above cleanup levels, further excavation and sampling occurred until contamination was removed. Confirmation samples collected at each excavation confirmed all petroleum-contaminated soil had been removed at each tank site. Excavations were backfilled with clean soil.

A discrepancy was identified during the historical documentation review between USTs 92 and 93. The contents of UST 92, adjacent to the south side of Building 486, were sampled when the tank was identified in the 1992 UST investigation report. The report recommended that this UST be cleaned out and closed according to DEQ tank closure procedures. UST 93 was identified in the investigation report as a vented sump constructed of concrete. Later, during the 1995 tank removal by Foss, UST 93 was identified as a tank, not as a sump, and the report described the decommissioning and removal process. Both the UST 92 and the sump (UST 93) were assumed to have been removed from this location. However, no definitive documentation was reviewed to verify the discrepancy in numbering or removal. Building 486 is identified as ECOP Category 3 with a location identification number of 103(3)HS,HR,L(P),A(P), as shown on Figures 9B and 12.

In 2000, AGI Technologies removed two 50,000-gallon USTs from the Administration Area, on the northwest side of the intersection of D Street and Elm Street. Records indicated the two tanks were installed in 1990. No UST numbers were cited in the document, but based on size and location of the tanks it is believed that they correspond to USTs 42 and 43. One of the tanks stored unleaded gasoline and the other stored diesel. During decommissioning of the tanks, approximately 130 cubic yards of soil was removed and sampled, and analysis indicated that petroleum hydrocarbons were present, but at concentrations below cleanup levels. This was assigned DEQ Petroleum Release Number 30-00-0001. During excavation activities it was determined that groundwater was not impacted and that no significant future threat to groundwater exists. DEQ determined NFA was necessary. DEQ listed the status of this release as closed (*AGI Technologies, 2000*). The release and cleanup is identified as ECOP Category 2, with a property identification number of 114 (2) PS, PR, as shown on Figures 11 and 13.

Dames and Moore prepared the Final Site Closure Report in March 2000 (*Dames and Moore, 2000*). This involved investigation of 18 former UST locations: 15 sites where no soil analysis results were reported by Martech in 1993 (UST 2, 2b, 12, 24, 35, 37, 39, 40, 47, 48, 49, 50, 54, 55, and 77), two sites (UST 75 and 41) where the soil samples were analyzed for the incorrect petroleum hydrocarbon range, and one site (UST 80) where the analytical results were difficult to interpret. Results of the field and laboratory soil investigations at the former UST locations indicated petroleum hydrocarbon contamination was not present above cleanup levels. Low levels of diesel or motor oil range hydrocarbons were detected in two subsurface soil samples at UST 2 and UST 80; however, both detections were below cleanup levels. The analytical results demonstrated a no further investigation at these former UST locations was appropriate. It was recommended that UCD proceed with the final closure of all 18 sites.

3.6.5 Historic Above Ground Tank Storage

AST compliance programs are conducted under US Army regulation 200-1; Federal requirements including 40 CFR Parts 100, 112, and 116; and Oregon State oil pollution prevention regulations. All known former ASTs are summarized in a table included in Appendix M. A map showing the current and former UST and AST locations at the UCD was prepared by USACE-Seattle and is included in Appendix M.

3.6.6 Current Above Ground Storage Tanks

Currently, there are 16 active ASTs at UCD. Most of the tanks are used for storage of propane, diesel fuel, fuel oil, and used oil. Current ASTs at the UCD are shown in Table 14. These ASTs are managed in compliance with the installation SPCC Plan and applicable regulations (*Earth Tech., 1995*). The ASTs range in size from 275 gallons to 15,000 gallons. Current ASTs at UCD are shown in Table 14.

Table 14: UCD Current ASTs

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 5 Motor Pool, Vehicle Maintenance Facility	Steel, single wall	275	Diesel	No containment tank or structure. Will drain to triple-chambered oil-water separator outside south wall of Building 5. Spill kit inside Bldg.5.	N/A	Separator drains to the WWTP in Area VI. Solids removed periodically by third party contractor for offsite disposal	Tank outside, south of Bldg. 5. Steel tank on supports. Discharge from the oil/water separator to WWTP represents a REC.
Bldg. 5	Steel, single wall	300	Motor Oil	Tank inside building. Will drain to floor drain in steam cleaning bay to oil-water separator. Spill kit inside Bldg.5.	N/A	None Separator drains to the WWTP in Area VI. Solids removed periodically by third party contractor for offsite disposal	Discharge from the oil/water separator to WWTP represents a REC.
Bldg. 6 Fueling Facility	Steel, double wall	10,000	Diesel	Double wall tank on concrete pad. Spill kit in Bldg. 6.	N/A	Shut off valve on line to prevent overfill, reverse flow valve. Emergency shutoff on pump.	Inside locked fenced area. Protective barriers to prevent collision.
Bldg. 6 Fueling Facility	Steel, double wall	15,000	Gasoline	Double wall tank on concrete pad. Spill kit in Bldg. 6.	N/A	Shut off valve on line to prevent overfill, reverse flow valve. Emergency shutoff on pump.	Inside locked fenced area. Protective barriers.
Bldg 457, I-Block	Steel, double wall, concrete (Supervault)	1,000	Fuel Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅1240 gal.)	Has a 16-gallonoverfill pan that encapsulates fill pipe.	Fuel for backup diesel generator.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 28 Steam Heating Plant	Steel, double wall, concrete (Supervault)	1,000	Fuel Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅1240 gal.)	Has a 16-gallon overfill pan that encapsulates fill pipe.	Located on concrete pad east of Bldg. 28. Fuel for boiler to provide steam heat to Bldg. 11.
Bldg. 32 Operations Center	Steel tank supports generator	650	Diesel	Self-contained diesel generator above fuel tank. On concrete pad with protective barriers. No containment structure. Locking fill pipe access through generator panel access.	N/A	None. The lack of containment for this tank resulting in direct discharge to ground surface in the event of a leak from this tank.	Tank for power generator located west of Bldg. 32. The lack of containment for this tank represents a REC for the Site.
Bldg. 37 Boiler-steam heating plant	Steel, double wall, concrete (Supervault)	1,000	Used Motor Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅1240 gal.)	Overfill pan that encapsulates fill pipe.	Tank stores used oil generated at the maintenance facility and supplies fuel for the steam heating plant at Bldg. 4.
Bldg. 37 Boiler-steam heating plant day tank	Carbon Steel	100	Used Motor Oil	Boiler day tank relief valve discharges to 1,000 gal used oil storage Supervault on south side of building. Piping trench collection of spills is directed to concrete floor sump.	N/A	Relief valve to storage tank (1,000 gallon Supervault).	
Bldg. 57 Telephone Equip. Bldg.	Steel, contained in generator	500	Diesel	Self-contained diesel generator above fuel tank. On concrete pad. No containment structure. Locking fill pipe access through generator panel access.	N/A		Tank for power generator, located east of Bldg. 57.
Bldg. 58	Steel, single wall	275	Diesel	None. Spill kit in Bldg. 5.	N/A	None	Outdoor fuel tank for backup generator in Bldg. 58.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 401 Magazine Washington Demil Corp. Operations	Steel, single wall	2,000	Fuel Oil	Curbed concrete containment structure with volume of 2240 gallons. No drainage from curbed area.	Over 110% ≅2,240 gal	Overfill containment pan on fill pipe, level indicator gauge.	Tank outside on the east side of Bldg. 401.
Bldg. 403 Magazine Washington Demil Corp. Operations	Steel, single wall	2,000	Fuel Oil	Curbed concrete containment structure with volume of 2240 gallons. No drainage from curbed area.	Over 110% ≅2,240 gal	Overfill containment pan on fill pipe, level indicator gauge.	Tank outside on the east side of Bldg. 401.
Bldg. 656/653 K-Block Monitoring Branch generator building	Steel, single wall	275	Diesel	Single wall steel tank on supports. Concrete pad. No containment structure. Spill kit in Bldg. 656.	N/A	Lock on fill pipe. No overfill pan.	Tank for generator in Bldg. 653, backup power for Bldg. 656. The lack of overfill pan to contain any leak from this tank represents a REC.
Bldg. 660 Security Bldg. inside entrance to K-Block	Steel, dual wall, concrete lined	10,000	Diesel	Double walled concrete lined tank on concrete pad.	N/A	Lock on fill pipe.	North of Bldg. 660. Fuel gravity feeds to the emergency generator tank feed pump in Bldg 660.
Between wells 6 and 7	Steel, contained in generator	540	Diesel	Self-contained diesel generator above fuel tank. On concrete pad. No containment structure. Locking fill pipes located below generator inside access panel.	N/A	None. The lack of containment for this tank resulting in direct discharge to ground surface in the event of a leak from this tank	Located west of Bldg.618. Tank for power generator. The lack of containment for this tank represents a REC for the Site.
Mobile Tanker Truck	Steel tank on truck	1,000	Diesel	Spill kit on truck.			Truck at vehicle storage facility-across from Bldg. 11.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Mobile Tanker Truck	Steel tank on truck	1,000	Gasoline	Spill kit on truck.			Truck at vehicle storage facility-across from Bldg. 11.
Five portable double-walled steel tanks	Steel tank	-	Diesel	Double walled.			Have indicators that shows if leaking between double walls. Kept in K-Block for heating igloos.

ASTs throughout the facility for storage of diesel fuel, gasoline, heating oil, and other petroleum products. The five AST categories are: Supervaults, self-contained tanks in generator units, large volume double-walled tanks, steel tanks in containment structures, and older steel tanks on supports with no containment. Miscellaneous petroleum, oil, and lubricants (POL) storage containers include drums and mobile tanker trucks. Several of the older steel tanks are empty and are scheduled to be removed (*US Army CMA, 2004*).

3.6.6.1 Supervaults

There are three 1000-gallon Supervault tanks at the facility; two are located in Area VII - Administration Area, and one is located in the I-Block. A Supervault containing fuel oil is located east of Building 28, the steam heating plant. A Supervault containing used motor oil is located south of Building 37. The used oil is burned in the boiler-steam heating plant (Building 37) to supply heat to Building 4. The third Supervault is located west of Building 457 in the I-Block. It contains fuel for a backup diesel generator. The Supervaults are double-walled tanks, with a steel inner tank encased in 6-inches of concrete and enclosed by a steel secondary containment tank. The tanks are located on concrete pads to provide stability. The secondary containment tank exceeds 110 percent of the primary tank volume, so no external secondary containment is necessary. The tanks are equipped with leak detection tubes, level gages, and overfill pans surrounding the fill pipes (*US Army CMA, 2004*).

3.6.6.2 Generator Tanks

The UCD currently utilizes five self-contained diesel powered backup generators. These stand-alone power generators have diesel fuel tanks ranging in size from 500 gallons to 650 gallons. Two generators are located in the Area VII – Administration Area, near Buildings 32 and 57. A third generator provides backup power for water wells 6 and 7 and is located near Building 618. The final two generators are located within K-Block (near Building 660). All five generators are located on concrete pads with protective barriers where necessary. The fuel tanks are located inside each of the generator’s housing and are equipped with locking fill pipes. A 10,000-gallon diesel AST is in the K-Block, northwest of Building 660 and is used to fill the day tank for the emergency generators. The tank is constructed of two steel tanks with 4 inches of concrete between them, and is equipped with a locking fill pipe. The 10,000-gallon AST feeds by gravity through a strainer and solenoid valve to a day tank for the emergency generator; it does not have a pump for fueling directly from the tank. The generator uses very little fuel; consequently, it is rarely necessary to refill the tank (*US Army CMA, 2004*).

3.6.6.3 Large-Volume Double-walled Tanks

There are three large-volume, double-walled ASTs at the Subject Site; two are used for vehicle fueling at UCD, and a third is used to fill the day-use tank for the emergency generator at Building 660. The fueling area at Building 6 in the Area VII - Admin is a fenced and locked fuel yard containing a 10,000-gallon diesel AST and a 15,000-gallon gasoline AST, which were both installed in 2000. The tanks are seated on a concrete pad with protective barriers and are equipped with shut-off valves and reverse flow valves to prevent overfill. Underground piping with cathodic protection leads from the tanks to the fuel pumps at Building 6. The fuel pumps are not manned, but can only be activated with access cards.

As described in the previous section, a 10,000-gallon diesel AST is located in the K-Block, northwest of Building 660 and is used to fill the day tank for the emergency generators. The tank is constructed of two steel tanks with 4 inches of concrete between them and is equipped with a locking fill pipe. The AST feeds by gravity through a strainer and solenoid valve to a day tank for the emergency generator; it does not have a pump for fueling directly from the tank. The generator uses very little fuel; consequently, it is rarely necessary to refill the tank (*US Army CMA, 2004*).

3.6.6.4 Steel Tanks in Containment Structures

Two fuel oil ASTs are located outside of Buildings 401 and 403 in the standard magazine area, which is north of Area VII - Admin. The two fuel oil ASTs are used to supply heating oil to the buildings currently being utilized by Washington Demilitarization Company Operations. The tanks are nearly identical and are constructed of single-walled steel with a 2,000-gallon capacity, an overfill containment pan on the fill pipe, and a level indicator gauge. The tanks are seated in 2,240-gallon capacity, curbed, concrete containment structures with no drainage outlets. There is no potential for spills or discharges from the containment area and any precipitation that collects will evaporate before it overflows the structure (*US Army CMA, 2004*).

3.6.6.5 Steel Tanks on Supports

Five single-wall steel tanks without containment structures were reported in the June 2010 ECOP report to be located at UCD. However, during the January 2011 field reconnaissance only three tanks were observed, with a fourth tank located in K-Block, which was not accessible at the time of the field reconnaissance. The tanks were confirmed to be between 275 and 300 gallons in capacity and were supported on elevated platforms, resulting in easy detection of any spills or leaks. All five tanks are listed below.

- A 275-gallon diesel fuel tank is located outside the south side of Building 5, and supplies fuel to the steam cleaner located inside the building. A major spill from the tank would drain to the underground oil-water separator at Building 5 and then to the WWTP. Although, solids from the oil-water separator are removed periodically for disposal, the discharge of wastewater impacted with petroleum hydrocarbons and other chemicals miscible in water to the WWTP is possible.

- A 300-gallon tank containing motor oil was observed inside Building 5. In the event of a tank failure, the contents would flow into the floor drain in the steam-cleaning bay and into the oil-water separator. A spill kit is available inside Building 5 for cleanup of leaks and/or overfills.
- A 275-gallon diesel tank is located next to Building 58 (generator shed located southwest of Building 5) and is used to supply fuel to the Administrative Area backup generator. A spill kit is available inside the adjacent Building 5 for cleanup of leaks and/or overfills.
- A 275-gallon diesel tank is located near Building 653, as a backup generator for Building 656 in K-Block. K-Block was not accessible during the January 2011 field reconnaissance; however, reportedly, the tank is on a concrete pad and has a locked fill pipe. A spill kit is located inside Building 656.

The tanks observed were single walled and did not appear to have secondary containment. However, spill kits and absorbent materials are reportedly readily available and weekly inspections are conducted (*US Army CMA, 2004).*

3.6.6.6 Boiler Day Tank

A 100-gallon steel single-wall day tank provides fuel directly to the boiler in Building 37. The tank is located on the south side of the building. Relief and overfill protection are provided by return piping from the tank to the 1,000-gallon Supervault supply tank (*US Army CMA, 2004*).

3.6.7 Miscellaneous Petroleum, Oil, and Lubricants Storage

Petroleum products primarily related to vehicle servicing and maintenance are stored in steel drums in several locations in the administration area at UCD.

Building 5 maintains an inventory of motor oil, hydraulic oil, gear oil, lubricating oil, transmission oil, grease, and used oil. Most of the products and waste materials are stored in 55-gallon drums. The drums are located inside the building on spill skids. Spill kits are available in the building for cleanup of minor leaks and spills. Any larger spills, such as a complete drum failure, would be contained within the building and would eventually drain to the steam-cleaning bay and finally into the oil/water separator (*UCD Archive Document, 2005*).

Building 82 (POL storage building) is a small shed located outside the southwest corner of Building 5. It is currently used to store empty hydraulic oil and motor oil drums. Any product drums stored in the building will be stored on spill skids. Spill kits are maintained in Building 5 for any minor spills on the concrete floor of Building 82.

Motor oil may also be stored in Building 6, generally in two 55-gallon steel drums. Empty drums are transferred to Building 5 or 82.

Two mobile tanker trucks, each with a 1,000-gallon diesel fuel tank, are used to fuel stationary equipment, agent transport equipment, and other equipment that cannot be filled at Building 6. The two mobile tanker trucks are stored across from Building 11. Spill kits are available on each truck. There are also five diesel portable double-walled steel tanks. These portable tanks have indicators that show if there is a leak between the double walls and are kept in the K-Block for heating the igloos (*US Army CMA, 2004*).

3.7 OTHER ENVIRONMENTAL CONTAMINATION

3.7.1 Polychlorinated Biphenyls

An initial inventory of transformers began with a June 1989 study where all 239 transformers at the UCD were sampled and tested for PCBs. Analyses of dielectric fluids collected from the transformers were performed by two laboratories for each transformer. In cases where different analytical results were provided by the two laboratories, the higher of the two values was reported. The dielectric fluid in 79 transformers was found to have a PCB concentration greater than 10 parts per million (ppm), EPA's PCB cleanup level for soil under the Toxic Substances Control Act ([TSCA] 52 FR 10688, 2 April 1987). Although transformers with less than 50 ppm PCBs are considered non-PCB transformers, the report notes that maintaining transformers with less than 10 ppm PCBs is advantageous (e.g. spills of dielectric fluid with PCB concentrations <10 ppm are not likely to contaminate soil above the 10 ppm PCB cleanup level for soil [*Dames and Moore, 1993c*]).

The Supplementary Remedial Investigation *([SRI]; report date 1993)* indicated 61 transformers out of the 79, with PCB concentrations greater than 10 ppm, were determined to be leaking or to have leaked in the past. The SRI field investigation included a field survey to observe transformer locations, soil sampling at each transformer site where leakage was known or suspected to have occurred, and wipe sampling collected from selected stained transformer pads and wooden frames. The SRI Report did not indicate if transformers were labeled according to TSCA regulations; however, pad-mounted transformers observed within Area VII during the field reconnaissance were labeled with regards to PCB content. Pad-mounted transformers observed contained less than 50 parts per million PCBs. Pole-mounted transformers were observed in the vicinity of Building 62 (Fitness Center) with labels that were illegible. However, a set of pole-mount transformers observed inside Building 14 (former transformer building, now universal waste storage) were labeled in the same manner. The labels on these transformers indicated No PCBs results of the soil analyses indicated that only one type of PCB (PCB 1260) was detected in five of the 63 soil samples; however, all detected concentrations were well below the comparison criterion of 10 micrograms per gallon (µg/g). Similarly, PCB 1260 was the only PCB detected in the wipe samples. Seven of the 25 samples collected contained this contaminant, but all detected concentrations were below the comparison criterion of 0.1 micrograms per square centimeter (µg/cm^2). Therefore, PCBs were not considered to be a concern at any of the sampled transformer locations. Additional information, including the location and dielectric fluid PCB concentration for each transformer, as of February 1992, can be found in Table 15 below (*Dames and Moore, 1993c*).

Table 15: Transformers with PCB Concentrations Greater than 10 ppm

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
8	In Use	N 604	1X57	pole	5.0	7.0	Yes	06-19-89	20
18	In Use	611	1X82	pole	10.0	5.0	No	06-19-89	13
21	Replaced	Well #6	1X93	pole	25.0	20.0	No	06-19-89	56
22	Replaced	Well #6	1X93	pole	25.0	20.0	Yes	06-19-89	60
23	Replaced	Well #6	1X93	pole	25.0	20.0	No	06-19-89	51
24	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	98
25	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	68
26	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	86
32	In Use	W 204	2X21	pole	10.0	14.5	Yes	06-19-89	13
40	Replaced	E 200	2X44	pole	10.0	10.5	Yes	06-19-89	58
42	Replaced	E 200	2X44	pole	10.0	10.5	Yes	06-19-89	365
46	Replaced	E 201	2X51	pole	25.0	20.0	Yes	06-19-89	634
48	Replaced	E 202	2X54	pole	10.0	10.5	Yes	06-19-89	96
50	Removed	200 Pier	2X67	pole	25.0	20.0	Yes	06-19-89	56
51	Removed	200 Pier	2X73	pole	25.0	30.0	Yes	06-19-89	265
58	Replaced	E 131	2X99	frame	37.5	31.0	Yes	06-19-89	244
59	Replaced	E 131	2X99	frame	75.0	50.0	Yes	06-19-89	400
62	In Use	E 122	2X112	pole	37.5	25.0	Yes	06-19-89	12
63	In Use	E 118	2X118	frame	15.0	23.0	Yes	06-19-89	15
64	In Use	E 118	2X118	frame	15.0	23.0	Yes	06-19-89	15
66	In Use	Substation	2X116B	pad	37.5	35.0	No	06-19-89	25
69	Replaced	E 116	2X122	pole	25.0	22.5	Yes	06-19-89	67
86	Removed	SW Pier 28	4X7	pole	15.0	16.0	Yes	06-20-89	330
89	In Use	E 457	4X33	pole	25.0	15.0	No	06-20-89	13
90	Replaced	S Well #3	4X39	pole	5.0	15.0	No	06-20-89	112

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
92	Removed	W Pier 32	4X47	pole	5.0	6.5	Yes	06-20-89	61
95	Replaced	NW 427	4X60	pole	5.0	7.5	Yes	06-20-89	69
119	Removed	W Pier 10	4X158	pole	5.0	12.0	Yes	06-21-89	132
123	Removed	W Pier 13	4X178	pole	5.0	12.0	Yes	06-21-89	239
124	Removed	N R-52	5X4	pole	1.5	3.5	Yes	06-20-89	222
136	Removed	SW 11	5X86	pole	10.0	15.0	No	06-20-89	16
137	Removed	SW 11	5X86	pole	10.0	15.0	No	06-20-89	15
141	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	174
142	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	133
143	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	158
156	Removed	NE 417	5X222/22 3	frame	25.0	30.0	Yes	06-21-89	137
157	Removed	NE 417	5X222/22 3	frame	15.0	16.0	Yes	06-21-89	80
158	Removed	NE 417	5X222/22 3	frame	25.0	30.0	Yes	06-21-89	173
159	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	140
160	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	250
161	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	150
162	In Use	E 493	5X493B	pad	50.0	30.0	No	06-21-89	20
163	In Use	E 493	5X493B	pad	50.0	30.0	No	06-21-89	21
166	Replaced	W 419	5X419B	pole	15.0	20.0	Yes	06-21-89	250
168	Replaced	W 419	5X419B	pole	15.0	20.0	Yes	06-21-89	210
175	In Use	N 54	5X54B	pole	10.0	15.0	Yes	06-20-89	12
177	In Use	W 33	5X283	pole	100.0	35.0	No	06-20-89	23
179	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	422
180	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	391
181	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	379
182	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	317
183	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	348

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
184	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	363
185	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	280
186	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	229
187	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	190
188	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	279
196	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	139
197	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	146
198	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	182
200	Replaced	Substation	5X31B	pad	75.0	50.0	No	06-20-89	532
201	Replaced	Substation	5X31B	pad	75.0	50.0	No	06-20-89	436
202	In Use	Substation	5X31B	pad	75.0	50.0	No	06-20-89	19
203	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	633
204	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	143
205	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	156
206	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	337
207	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	260
208	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	377
209	Replaced	Well #1	5X24B	floor	10.0	11.0	Yes	06-20-89	1348
210	In Use	Well #2	5X25B	floor	37.5	25.0	Yes	06-20-89	11
211	Replaced	Well #2	5X25B	floor	37.5	25.0	Yes	06-20-89	230
213	Replaced	Well #2	5X25B	floor	10.0	11.0	Yes	06-20-89	178
225	Removed	Parade Grounds	5XPG	Underground vault	25.0	20.0	Yes	06-20-89	160
226	Removed and replaced by above ground vault	W 2	5X2B	Underground vault	10.0	15.0	Yes	06-20-89	300
228	Removed and replaced by above ground vault	W 2	5X2B	Underground vault	10.0	15.0	Yes	06-20-89	309

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
229	Removed and replaced by above ground vault	N 15	5X15B	Underground vault	37.5	25.0	Yes	06-20-89	1105
231	Removed and replaced by above ground vault	NW 55	5X55B	Underground vault	25.0	20.0	No	06-20-89	17
237	Replaced	W Pier 15	7X3	pole	5.0	7.5	Yes	06-21-89	226

The Enhanced PA (*Dames and Moore, 1990*) reported 25 transformers were found to have been taken off-line were in storage in the Building 203 Hazardous Waste Storage Facility, and were found to contain PCBs in excess of 50 ppm. During a 1990 site reconnaissance, Dames and Moore observed appropriate use of containment and liners and no significant staining on the floor. In the 1993 Supplementary Remedial Investigation, it was stated that all units stored in the building had been removed and disposed according to regulatory requirements. The removal date of the 25 transformers from Building 203 is not documented. Dames and Moore inspected Building 203 and collected a wipe sample from the only stained area observed on the building floor. No PCBs were detected in the wipe sample. Therefore, PCBs are not expected to be a concern in this part of Building 203 (*Dames and Moore, 1993c*).

Historical research did not reveal the likelihood of PCB caulking existing throughout the buildings at UCD. PCBs are man-made chemicals that persist in the environment and were widely used in construction materials and electrical products, prior to 1978. PCBs may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in many buildings constructed or renovated, prior to 1978. Because PCBs can migrate from the caulk into air, dust, surrounding materials and soil, there is a potential for PCB exposure from these building materials.

3.7.2 Asbestos-containing Materials

An Asbestos Assessment Survey (*Dames and Moore, 1992a*) was conducted in 1992 to evaluate 289 buildings at UCD for suspected ACM. The survey results indicated ACMs were in good condition and the risk of exposure to building occupants from ACM was low. Greater risk of exposure is expected for maintenance personnel who enter inactive buildings, or spaces not normally accessible. Asbestos containing material was found in 121 buildings. ACMS in 37 of these buildings were damaged greater than 10 percent, and in 15 additional buildings the damage was between 3 and 10 percent. Although 52 buildings included damaged or significantly damaged ACM, this material was predominantly located in unoccupied areas such as attic spaces, crawl spaces, or roofs. These areas typically were accessed only by maintenance staff. Estimates of the cost to remove ACM was included in the 1992 report (*Dames and Moore, 1992a*), and the cost to remove all known or assumed ACM was reported to be between $11.5 million and $22.75 million, based on individual unit costs. A decision algorithm developed as part of the survey was used to determine which buildings required asbestos abatement. Removal of ACM was recommended in 58 buildings. Since some of the areas included inactive buildings or areas that are not normally contacted, professional judgment was used by the inspectors to reduce the number of buildings to 32 (*Dames and Moore, 1992a*). However, the methodology used to reduce the number of buildings is unlikely to meet DEQ requirements. Friable materials may be present in buildings that were not accessible for inspection.

The 1992 Dames and Moore Asbestos Assessment Survey did not cover all of the buildings or structures at UCD. Specifically, buildings constructed or renovated after 1992 and buildings within secured areas at the time of the 1992 survey were not included. In addition, a large percentage of the buildings (i.e. igloos and vacated buildings) were homogenized during the survey. Thus, a comprehensive survey has not been completed to date at the UCD and therefore all asbestos containing building materials may not have been identified. There is a lack of comprehensive information regarding the presence and condition of asbestos-containing materials at UCD.

In the years since the 1992 Dames and Moore Asbestos Assessment Survey was performed, some abatement and demolition activities have been conducted, which were summarized in an Excel spreadsheet created by UCD personnel and titled *"Umatilla Chemical Depot Asbestos Inventory."* The spreadsheet incorporates information from the 1992 survey as well as information pertaining to building demolitions and asbestos abatements since 1992. The information in the spreadsheet was field verified by UCD personnel in September 2006. The spreadsheet identifies 40 buildings explicitly identified as having been demolished between 1992 and 2006. Comparison between UCD's spreadsheet and the 1992 Dames and Moore Asbestos Assessment Survey shows generally good agreement (*Dames and Moore, 1992a*). The 1992 survey effort omitted five buildings that are identified in the spreadsheet: Buildings 70, 438, 450, 454, and 681. Three of these (70, 438, 681) are reported in the spreadsheet to contain suspect materials which should be tested to confirm that they are ACM before disturbance. The other two buildings are considered low risk for ACM due to their age and construction (450 is a steel building constructed in 1984; 454 was constructed in 1998). The spreadsheet also identifies the fire doors on the storage igloos as a suspect ACM. The fire doors were not inspected as part of the 1992 survey effort (*Gillis, 2006*). According to Don Gillis, one more asbestos survey and abatement campaign will occur prior to the UCD property transfer (*Gillis, 2009*). The remaining structures requiring asbestos abatement before this event are identified in the ECOP Report (*US Army, 2010b*).

As part of the ECOP Report (*USACE, 2010*), a visual site inspection at representative buildings for each major series (i.e. 100 series buildings, 200 series buildings, etc.) was conducted. A particular focus of the visit was to evaluate the condition of exterior ACM components of the buildings, such as cement asbestos board (CAB) siding and asbestos containing roofing material. The 600 series buildings appeared to be abandoned and were not well maintained. Building 608 was more closely inspected as part of the visual site inspection. Many of the windows were broken and the window caulking was deteriorated and scattered on the ground near the building. The window caulking is a suspect material that was not sampled in the 1992 survey (*Dames and Moore, 1992a*). The rest of the buildings at UCD appeared to be more regularly used and in better condition. No further deterioration of exterior ACM was observed during the site visit.

During AMEC's January 2011 field reconnaissance, AMEC visually observed buildings that varied from being in a "good" condition to buildings that were in such "poor" condition that they were not identifiable and not safe for occupancy. The "poor" condition buildings primarily were the vacated buildings throughout UCD; in which, a majority of the buildings had animal feces throughout the interior flooring. Both suspect asbestos and lead-containing materials appeared to be located within these buildings that have not been previously identified and/or removed. Additional sampling will need to be conducted, prior to any renovation or demolition. In addition, ACM materials and lead-containing paint chips were in pieces and scattered around a majority of the vacated buildings due to weatherization and lack of building maintenance.

In the 2010 LRA BRP, Section A.2.4 states: "If not previously done, or planned as future work, surface (0-4 inch bgs) soils at sites exhibiting a high potential for asbestos release (e.g., adjacent to Transite-covered warehouse buildings) should be sampled. One approach to collecting these samples has been prepared by the State of Colorado (2007); sample analysis would probably be done by oil dispersion-polarized light microscopy (*EPA, 1993b*). Preliminary remediation goals of 0.25 to 1.0 percent by volume for asbestos-in-soils are expected to comply with the general workplace standard of 0.01 fiber/cc, as averaged over an 8-hr period [*EPA, 2003a; 29 CFR 1910.1001(c)*]. However, formal determination of need for and level of cleanup should be based on site-specific quantitative risk assessment." This should include a greater search depth to account for possible areas where asbestos materials could have been buried.

3.7.3 Lead and Lead-Based Paint

A quantitative lead-based paint (LBP) survey had been conducted at UCD as part of the 1996 CERFA report. LBP was assumed to be present in buildings constructed prior to 1978. None of the storage igloos in Blocks A through K, the safe houses (700 series structures), or transfer depots (800 series structures) were included in the CERFA report, because it was assumed the structures were not painted. In addition, former employees reported the use of LBP on interiors and exteriors of buildings ceased in the 1950s; therefore, LBP would not likely be found on any building constructed after 1959 (*Earth Tech., 1994*).

A LBP survey was conducted in 1996 at the UCD (*Hart Crowser, 1996*). The survey results are summarized in Table 16 and 17. The survey tested painted surfaces in the interior and exterior of 246 buildings constructed before 1959. Generally, most buildings had at least one LBP surface, and most LBP surfaces were exterior. The survey noted chipped and damaged paint surfaces at interior and exterior locations for many buildings. The survey also noted extensive weathering of LBP exterior surfaces, particularly on southern and western elevations of many buildings. The survey report attributes the weathering to sun exposure, as well as dust-laden winds, which generally blow from west to east at the UCD. The sand in the wind tends to further damage peeling paint through abrasion and causes the paint to fall onto the soil adjacent to the buildings. Paint flakes were observed on the soil surface at many of the tested buildings. Soil samples were collected from 5 areas; with lead detected in 18 of 44 soil samples at a concentration above 500 mg/kg. The 18 soil samples with a lead concentration greater than 500 mg/kg were collected adjacent to buildings with severely weathered exterior LBP; lead contamination appeared to be limited to the first 2 inches of soil. A summary of lead analytical results from soil samples is provided in Table 16, Soil Lead Data Report, and a summary of positive unsatisfactory condition for LBP can be found below in Table 17 (*Hart Crowser, 1996*).

Table 16: Soil Lead Data Report (12/5/1996)*

Building	Sample Location	Sample Number	Subsample Number	Lead Concentration (mg/kg)	Comment
9	8 ft. from bldg. 0-2 in. deep	9-8-1S	1	1,100	0% moisture content, 2-point composite.
9	8 ft. from bldg. 0-2 in. deep	9-8-1S	2	910	Moisture content not measured. Duplicate.
30-A	0 ft. from bldg. 0-2 in. deep	30A-0-1S	1	400	5% moisture content.
53	0 ft. from bldg. 0-2 in. deep	53-0-1S	1	3800	8% moisture content.
53	0 ft. from bldg. 2-4 in. deep	53-0-2S	1	240	6% moisture content.
53	0 ft. from bldg. 2-4 in. deep	53-0-2S	2	280	6% moisture content. Duplicate.
53	5 ft. from bldg. 0-2 in. deep	53-5-1S	1	560	15% moisture content.
63	0 ft. from bldg. 0-2 in. deep	63-0-1S	1	140	9% moisture content.
63	0 ft. from bldg. 2-4 in. deep	63-0-2S	1	6.00	8% moisture content.
63	10 ft. from bldg. 0-2 in. deep	63-10-1S	1	17.0	7% moisture content.
63	5 ft. from bldg. 0-2 in. deep	63-5-1S	1	19.0	9% moisture content.
419	0 ft. from bldg. 0-2 in. deep	419-0-1S	1	590	7% moisture content.
419	0 ft. from bldg. 0-2 in. deep	419-0-1S	2	590	7% moisture content. Duplicate.
419	0 ft. from bldg. 2-4 in. deep	419-0-2S	1	95.0	7% moisture content.
486	0 ft. from bldg. 0-2 in. deep	486-0-1S	1	280	7% moisture content.

Building	Sample Location	Sample Number	Subsample Number	Lead Concentration (mg/kg)	Comment
486	0 ft. from bldg. 2-4 in. deep	486-0-2S	1	64.0	11% moisture content.
486	10 ft. from bldg. 0-2 in. deep	486-10-1S	1	590	10% moisture content.
486	5 ft. from bldg. 0-2 in. deep	486-5-1S	1	4100	10% moisture content.
110	0 ft. from bldg. 0-2 in. deep	110-0-1S	1	1200	9% moisture content.
111	0 ft. from bldg. 0-2 in. deep	111-0-1S	1	20,000	9% moisture content. Paint chips, sand, and grit on floor.
111	3 ft. from bldg. 0-2 in. deep	111-3-1S	1	150	10% moisture content. 3-point composite.
111	3 ft. from bldg. 0-2 in. deep	111-3-1S	2	190	10% moisture content. Duplicate.
112	0 ft. from bldg. 0-2 in. deep	112-0-1S	1	2000	14% moisture content.
112	0 ft. from bldg. 2-4 in. deep	112-0-2S	1	210	5% moisture content.
112	10 ft. from bldg. 0-2 in. deep	112-10-1S	1	89.0	8% moisture content.
112	5 ft. from bldg. 0-2 in. deep	112-5-1S	1	240	6% moisture content.
113	0 ft. from bldg. 0-2 in. deep	113-0-1S	1	2000	32% moisture content.
113	15 ft. from bldg. 0-2 in. deep	113-15-1S	1	140	9% moisture content.
113	5 ft. from bldg. 0-2 in. deep	113-5-1S	1	240	8% moisture content.
119	0 ft. from bldg. 0-2 in. deep	119-0-1S	1	210	9% moisture content.
119	0 ft. from bldg. 2-4 in. deep	119-0-2S	1	54.0	6% moisture content.
119	10 ft. from bldg. 0-2 in. deep	119-10-1S	1	84.0	3% moisture content.
119	5 ft. from bldg. 0-2 in. deep	119-5-1S	1	88.0	3% moisture content.
119	5 ft. from bldg. 0-2 in. deep	119-5-1S	2	110	3% moisture content. Duplicate.
120	0 ft. from bldg. 0-2 in. deep	120-0-1S	1	620	18% moisture content.
120	5 ft. from bldg. 0-2 in. deep	120-5-1S	1	300	5% moisture content.
131	0 ft. from bldg. 0-2 in. deep	131-0-1S	1	11,000	7% moisture content.

Building	Sample Location	Sample Number	Subsample Number	Lead Concentration (mg/kg)	Comment
131	0 ft. from bldg. 2-4 in. deep	131-0-2S	1	80.0	7% moisture content.
131	0 ft. from bldg. 2-4 in. deep	131-0-2S	2	97.0	7% moisture content. Duplicate.
131	10 ft. from bldg. 0-2 in. deep	131-10-1S	1	570	12% moisture content.
131	5 ft. from bldg. 0-2 in. deep	131-5-1S	1	790	11% moisture content.
160	0 ft. from bldg. 0-2 in. deep	160-0-1S	1	590	10% moisture content.
160	10 ft. from bldg. 0-2 in. deep	160-10-1S	1	49.0	4% moisture content.
160	10 ft. from bldg. 0-2 in. deep	160-10-1S	2	46.0	4% moisture content. Duplicate.
160	5 ft. from bldg. 0-2 in. deep	160-5-1S	1	48.0	6% moisture content.
820	0 ft. from bldg. 0-2 in. deep	820-0-1S	1	1100	4% moisture content.
820	0 ft. from bldg. 0-2 in. deep	820-0-1S	2	960	4% moisture content. Duplicate.
820	10 ft. from bldg. 0-2 in. deep	820-10-1S	1	33.0	1% moisture content.
606	0 ft. from bldg. 0-2 in. deep	606-0-1S	1	2000	11% moisture content.
606	0 ft. from bldg. 2-4 in. deep	606-0-2S	1	28.0	4% moisture content.
606	10 ft. from bldg. 0-2 in. deep	606-10-1S	1	27.0	20% moisture content.
606	5 ft. from bldg. 0-2 in. deep	606-5-1S	1	24.0	5% moisture content.

Table 17: Lead-Based Paint Positive Unsatisfactory Condition Results (8/21/1996)*

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
2/Exterior	Door	1	>5.09 mg/cm^2	
3 A1/Exterior	Door (see comment)	1	2.11 mg/cm^2	Door-paint chips on ground.
4/Exterior	Various	5	>5.09 mg/cm^2	
5 /Maintenance Bay-1	Wall	1	1.72 mg/cm^2	

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
7/Exterior	Various	4	>5.09 mg/cm^2	
10/Furnace Room - 1	Door Molding	1	2.12 mg/cm^2	
13/Loading Dock - 1	Loading Dock Bumper (see comment)	1	>5.09 mg/cm^2	Yellow bumper.
17/Stairway - 3, Storage - 1	Various	4	>5.09 mg/cm^2	
19/Exterior	Various	2	>5.09 mg/cm^2	
28/Mechanical - 1	Window Sash (int)	1	1.76 mg/cm^2	
30/Exterior	Loading dock bumper	2	2.63 mg/cm^2	Bumper mounted on outside bldg wall (Yellow). Bumper board on this ½ bldg (south) wall only.
31/Garage/ Carport - 1	Walls	4	>5.09 mg/cm^2	Half wall studs at 3 of the sample locations.
32/Exterior	Register (Wall) (see Comment)	1	>5.09 mg/cm^2	2 ft x 2 ft louvered wall vent.
34/Porch - 1, Porch - 4	Floors	2	3.61 mg/cm^2	
53/Exterior, Stairway - 2	Various	5	>5.09 mg/cm^2	
54/Exterior, Stairway - 1	Various	11	>5.09 mg/cm^2	Wood siding beneath suspect asbestos siding.
70/Exterior	Various	9	>5.09 mg/cm^2	QC sample taken.
71/Exterior	Various	3	>5.09 mg/cm^2	
101/Exterior, Loading Dock - 1, Storage - 1	Various	16	>5.09 mg/cm^2	
102/Exterior, Loading Dock - 1	Various	6	>5.09 mg/cm^2	
103/Loading Dock - 1, Ramp - 1	Various	2	3.66 mg/cm^2	
105/Exterior, Loading Dock - 1, Ramp - 1	Various	28	>5.09 mg/cm^2	
106/Exterior, Loading Dock - 1	Various	21	>5.09 mg/cm^2	
107/Exterior, Loading Dock - 1	Various	24	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
108/Exterior, Stairway - 2	Various	39	>5.09 mg/cm^2	
109/Exterior	Various	21	>5.09 mg/cm^2	
110/Exterior, Loading Dock - 1	Various	25	>5.09 mg/cm^2	
111/Exterior, Loading Dock - 1	Various	15	>5.09 mg/cm^2	
112/Exterior, Loading Dock - 1	Various	32	>5.09 mg/cm^2	
113/Exterior, Storage - 1	Various	19	>5.09 mg/cm^2	QC sample taken.
114/Exterior	Various	33	>5.09 mg/cm^2	QC sample taken.
115/Exterior	Door	2	3.85 mg/cm^2	Same all sides, exterior rollup doors.
116/Exterior, Loading Dock - 1, Stairway - 2, Stairway - 3	Various	23	>5.09 mg/cm^2	
117/Exterior, Loading Dock - 2, Roof - 1, Storage - 1, Storage - 2	Various	89	>5.09 mg/cm^2	
118/Exterior, Loading Dock - 1	Various	67	>5.09 mg/cm^2	
119/Exterior	Various	39	>5.09 mg/cm^2	QC sample taken.
120/Exterior	Various	37	>5.09 mg/cm^2	
121/Exterior, Loading Dock - 1	Various	31	>5.09 mg/cm^2	
122/Exterior	Various	56	>5.09 mg/cm^2	
123/Exterior, Loading Dock - 2	Various	73	>5.09 mg/cm^2	
124/Exterior	Various	24	>5.09 mg/cm^2	
125/Exterior,	Various	73	>5.09 mg/cm^2	
Loading Dock - 2				
126/Exterior, Loading Dock - 1	Various	31	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
127/Exterior, Loading Dock - 2	Various	78	>5.09 mg/cm^2	
128/Exterior, Loading Dock - 1, Storage - 1	Various	40	>5.09 mg/cm^2	
129/Exterior, Loading Dock - 1	Various	8	>5.09 mg/cm^2	
130/Exterior	Doors and Jambs	12	>5.09 mg/cm^2	
131/Exterior	Doors	12	>5.09 mg/cm^2	
133/Exterior	Various	14	>5.09 mg/cm^2	
135/Exterior	Various	8	4.63 mg/cm^2	
139/Exterior	Various	9	>5.09 mg/cm^2	QC sample taken.
160/Exterior	Various	5	3.49 mg/cm^2	
161/Exterior	Various	4	2.97 mg/cm^2	
200/Exterior	Various	2	>5.09 mg/cm^2	
201/Exterior	Trim	1	>5.09 mg/cm^2	QC sample taken. Gutter board.
202/Exterior	Various	2	3.51 mg/cm^2	
204/Exterior	Various	2	>5.09 mg/cm^2	
205/Exterior, Storage - 1	Various	4	>5.09 mg/cm^2	
208/Exterior	Various	4	3.56 mg/cm^2	
415/Exterior, Office - 2	Various	3	3.90 mg/cm^2	
416/Exterior	Various	2	3.63 mg/cm^2	
417/Exterior, Storage - 2	Various	2	>5.09 mg/cm^2	
418/Bathroom - 1, Exterior	Various	2	>5.09 mg/cm^2	QC sample taken.
419/Exterior, Porch - 1	Various	5	>5.09 mg/cm^2	
420/Exterior, Stairway - 1	Various	4	>5.09 mg/cm^2	
421/Exterior	Various	4	>5.09 mg/cm^2	
422/Exterior	Various	3	>5.09 mg/cm^2	
423/Exterior	Various	2	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
424/Exterior	Various	3	>5.09 mg/cm^2	
425/Exterior	Various	7	>5.09 mg/cm^2	
426/Exterior	Various	4	>5.09 mg/cm^2	
427/Exterior	Various	4	>5.09 mg/cm^2	
431/Exterior	Various	4	>5.09 mg/cm^2	
433/Dressing Room - 2, Exterior	Various	4	>5.09 mg/cm^2	
434/Exterior	Various	3	>5.09 mg/cm^2	
442/Storage - 1	Door Molding	1	3.93 mg/cm^2	
486/Exterior	Door	1	2.99 mg/cm^2	
495/Electrical - 1, Exterior	Various	2	1.45 mg/cm^2	QC sample taken.
501/Exterior	Not Specified (See Comment)	1	>5.09 mg/cm^2	Clothes line pole.
506/Exterior	Door Threshold	1	1.47 mg/cm^2	
509/Exterior	Not Specified (See Comment)	1	>5.09 mg/cm^2	Clothes line pole.
605/Exterior	Trim, Upper (ext)	4	3.15 mg/cm^2	
606/Bathroom - 1, Entry/Foyer - 1, Exterior	Various	9	3.39 mg/cm^2	
00608/Hallway - 1	Wall	2	1.70 mg/cm^2	
613/Mechanical - 1	Not Specified (See Comment)	1	3.71 mg/cm^2	QC sample taken. Green metal base of pump.
00619/Exterior	Various	2	>5.09 mg/cm^2	
803/Loading Dock - 1, Ramp - 1	Various	2	>5.09 mg/cm^2	Concrete edge & 6-inch striping paint; All ramp components same yellow.
806/Exterior, Ramp - 1	Various	2	>5.09 mg/cm^2	All ramp components same yellow.
807/Ramp - 1	Porch Rail, cap (See Comment)	1	>5.09 mg/cm^2	All ramp components same yellow.
808/Exterior, Loading Dock - 1, Ramp - 2	Various	4	>5.09 mg/cm^2	
809/Exterior	Siding	1	3.57 mg/cm^2	

Building/Unit/Room	Component	Number of Samples Exceeding 1.0 mg/cm^2	Highest Recorded Lead Value	Comment
810/Exterior, Loading Dock-1, Ramp - 1	Various	4	>5.09 mg/cm^2	
811/Exterior	Siding	1	2.77 mg/cm^2	
812/Exterior, Ramp - 1	Various	2	4.04 mg/cm^2	
813/Loading Dock - 1, Stairway - 1	Various	2	>5.09 mg/cm^2	
814/Loading Dock - 1, Stairway - 1	Various	2	>5.09 mg/cm^2	
817/Loading Dock - 1, Ramp - 2	Loading Dock Bumper	3	1.72 mg/cm^2	
818/Exterior, Loading Dock-1, Ramp - 1, Stairway - 1	Various	15	3.79 mg/cm^2	
819/Exterior, Loading Dock - 1, Ramp - 1, Stairway - 1	Various	9	>5.09 mg/cm^2	QC sample taken.
820/Exterior, Ramp - 1	Various	5	>5.09 mg/cm^2	
823/Exterior, Stairway - 1	Various	2	>5.09 mg/cm^2	
825/Exterior, Loading Dock - 1, Stairway - 1	Various	5	>5.09 mg/cm^2	
826/Exterior, Loading Dock - 1, Ramp - 1, Stairway -1	Various	8	>5.09 mg/cm^2	
827/Exterior	Siding	2	3.67 mg/cm^2	
828/Exterior	Siding	1	4.07 mg/cm^2	Painted sign on wall.
829/Exterior, Stairway - 1	Various	2	4.40 mg/cm^2	
830/Exterior, Ramp - 1	Various	2	>5.09 mg/cm^2	
831/Loading Dock - 1, Ramp - 1	Various	2	2.67 mg/cm^2	All ramp components have the same paint.
00833/Exterior	Siding	1	3.13 mg/cm^2	
834/Exterior, Stairway - 1	Various	2	>5.09 mg/cm^2	
9900/Exterior	Window Sill	1	2.06 mg/cm^2	

As part of the USACE-Seattle ECOP *(USACE, 2010*), a visual site inspection was performed that identified representative structures from each series of buildings that were inspected for the condition of exterior paint. USACE field personnel observed that most surfaces in the administrative buildings and 400 series buildings were either unpainted or in generally good condition. Cracked and peeling paint was observed on buildings in the 600 series.

During the January 2011 field reconnaissance, AMEC personnel visually observed buildings that varied from being in a “good” condition to “poor” condition. Lead-containing materials appeared to be located within these buildings that have not been previously identified and/or removed. Additional sampling will need to be conducted, prior to any renovation or demolition. In addition, lead-containing paint chips were in pieces and scattered around a majority of the vacated buildings due to weatherization and lack of building maintenance.

LBP was assumed to be present in buildings that were constructed prior to 1978, until the 1996 Hart Crowser survey. Former employees reported that the use of LBP on interiors and exteriors of buildings ceased in the 1950s; therefore, LBP would not likely be found on any building constructed after 1959. Based on this information, Hart Crowser tested painted surfaces in the interior and exterior of 246 buildings that were constructed before 1959. The Hart Crowser, 1996 survey only tested the soil surface for lead contamination in 44 locations. Based on our experience with LBP, lead can and does exist in paint from dates later than 1959. Further, the industry standard of care is that painted surfaces must be assumed to be lead-containing until appropriate sampling and testing of paint samples can definitely determine lead content. OSHA considers any level of lead to be a potential health risk, thus it is safe to assume that all painted surfaces contain at least detectable amounts of lead. Appropriate health and safety guidelines should be followed renovating any painted surface throughout the facility.

3.7.4 Radiological Material

According to the BRP (*UMADRA, 2010*) approximately 50 M-43A1 chemical agent detectors are stored at Building 656, under US Army-wide NRC Materials License No. 12-00722-13. The detectors are used in the detection of aerosols and gases potentially released from chemical munitions stored in Block-K igloos. Each alarm contains no more than 300 μCi of the alpha-emitting isotope Americium-241 in a sealed cell; the sources are never opened on-site, and the alarms are sent offsite when they need service (*US Army 1995; Young et al., 1994*).

Radioactive Materials scheduled for removal from the site as well as Radioactive Materials recently turned in, per the Radiation Protection Officer (RPO) of UCD, includes:

- 41 ICAMS will be shipped for use at a National Guard unit in Clackamas, Oregon. The RPO will provide copies of shipping documentation for ECOP confirmation.
- 68 M8 Alarms were turned in to Pine Bluff Arsenal in April 2009.
- 7 Cs-137 Gamma Ray sources used as chute sensors for demilitarization of the M55 VX/GB rockets were turned in December 2009 to OHMART Corporation. These were sent to OSA Global in Baton Rouge, Louisiana, in January 2010 for disposition and were controlled under contractor's NRC license # 36-27689-01.
- The Medical Clinic X-Ray Machine at Building 11 was returned to Fort Lewis, Washington.
- XRFs were used in on-site characterization of metals (*Ecology and Environment Tier 1 sampling, 1993*) and portable instruments with Cs-137 and Ir-192 sources used for nondestructive materials testing were removed from the site after the work was completed. The last portable materials testing source (Ir-192) was removed from the site under 2007 Department of Army Radiation Permit (DARP).

3.7.5 Landfills

The following section describes known landfill areas used for disposal of waste generated at the UCD. Study Sites 11 and 12 are OU under the FFA, with issued RODs. Additional discussion on the landfills is included in Section 4.1.

3.7.5.1 Area VIII Active Landfill, Study Site 11

The 1992 ROD-designated Active Landfill OU is a 5-acre solid waste disposal area located in the northeastern portion of UCD, adjacent to the Subject Site. Although known as the Active Landfill to distinguish from other disposal areas, the Active Landfill was closed in 1997. The Active Landfill is located between storage Igloos Blocks E and D. The disposal area of the Active Landfill consisted of a depression approximately 50 feet deep, which was a former gravel pit. Materials disposed of at the site include general refuse and trash (garbage), demolition debris, asbestos from brake linings, dried sludge from the sewage treatment plant, possibly ash from the Deactivation Furnace, and sludges that contained explosive residuals (*US Army, 1993*).

The Army operated the Active Landfill from 1968 to 1997. DEQ issued a landfill permit to the Army in 1979, and the permit was renewed in 1982. Municipal wastes from the UCD, including debris generated by maintenance such as clearing and renovation activities, were disposed of at the Active Landfill, and were covered by soil on a weekly schedule. The extent of activity at UCD was significantly reduced over the last 20 years, with a corresponding reduction in the volume of material placed in the landfill until its closure (*USACE, 2004*).

The ROD selected NFA as the remedy for the Active Landfill OU (*US Army, 1993*). This selection was based on information generated during the RI, which indicated that the OU did not pose an unacceptable threat to human health and/or the environment. Under a future residential land use scenario, the potential carcinogenic risks and non-carcinogenic hazard quotient due to ingestion of groundwater at the Active Landfill OU were 5 x 10^{-5} and 2.0, respectively. The landfill was closed and capped in accordance with RCRA requirements and a closure permit issued by the DEQ in August 2000. Closure requirements for the landfill were conducted in accordance with the DEQ permit requirements. The DEQ provides oversight for inspections of the landfill to ensure that post-closure requirements are maintained.

Groundwater monitoring of the landfill was initiated in October 1996 to monitor groundwater quality. Monitoring has been conducted in accordance with the Environmental Monitoring Plan approved by DEQ in July 1997 (*US Army, 1997a*). With the exception of selenium, the results from the sampling have been compared to the Table 1, 2, and 3 values from the Oregon Administrative Rules, Department of Environmental Quality 340 Groundwater Quality Protection (OAR 340-040). For selenium, the results have been compared to a risk-based level of 50 μg/L established by the DEQ Cleanup Department in January 2003 (*DEQ, 2003*). DEQ has re-evaluated the selenium data and is developing a separate cleanup plan.

3.7.5.2 Area VI - Inactive Landfills Study Site 12

The ROD-designated Inactive Landfill OU, which includes six discrete former disposal areas totaling an area of approximately 300,000 square feet, or approximately 8 acres, located in Area VI, west of Area VII - Admin. The six inactive landfills include: the Northern Inactive Landfill (NIL), the Northern Inactive Landfill Extension (NILE), the Southern Inactive Landfill (SIL), the Southern Inactive Landfill Extension (SILE), the Western Inactive Drum Site (WIDS), and the Southeastern Inactive Landfill (SEIL). The SIL and NIL, the larger cells of the OU, originally were gravel pits and were converted to landfills when mining operations ceased.

Disposal into these landfills occurred from about the early 1940s into the mid-1980s, though reports indicate disposal activity ceased in the 1960s when the Active Landfill opened. Materials disposed at the landfills included nonhazardous waste, such as demolition debris, UCD garbage, asbestos from brake linings, and potentially ash from the Deactivation Furnace; though no official records were kept.

During the RI conducted in 1992, soil and groundwater samples were collected around the inactive landfill areas and analyzed for explosive constituents, nitrite/nitrates, metals, VOCs, SVOCs, pesticides, PCBs, and cyanide. This extensive list of analytes was established because a variety of compounds were disposed of at the landfills. Low concentrations of metals, nitrite/nitrates, trace concentrations of pesticides, and one PCB compound were detected in some soil samples. The concentrations were below health-based cleanup goals. Groundwater analytical results show concentrations similar to naturally occurring background levels of vanadium and arsenic. Slightly elevated levels of nitrite/nitrates were found in some groundwater samples but were attributed to off-site agricultural sources.

A Baseline Risk Assessment was conducted during the 1992 RI to identify contaminants found at background concentrations as well as compounds attributed to the landfill. Risks were calculated for future residential land use; risk for current land use was not calculated, as access to the site is restricted. Exposure pathways calculated were for residents living on-site, including ingestion of drinking water or crops grown at the site, contaminated irrigation water, and dermal contact from showering. Results of the risk assessment demonstrated the landfills do not pose an unacceptable risk to human health. Non-carcinogenic hazard index calculations were slightly above 1 due to the presence of the naturally occurring arsenic. Removal of arsenic from the calculations generated a hazard index below 1.

The ROD for the Inactive Landfill OU at UCD was issued in March 1993. The NFA remedy was selected, because the current use and potential future residential land use does not result in any unacceptable risk to public health or the environment. The site is not subject to the five-year review process. The Inactive Landfill OU is now closed out *(DERP, 1993; UMDA EPA announcement Aug. 1992; Dames and Moore, 1992b).*

During the January 2011 field reconnaissance of the Inactive Landfill OU, some parts of the landfill appeared to remain in use, as indicated by baled tumbleweed, concrete debris, and tires. Additionally, areas of the older portions of the landfill area remained exposed at grade, with no surface cover. Older exposed parts of the landfill areas indicate that DEQ closure requirements have not been met, suggesting a data gap. Therefore this location has been identified as a Category 7, with a property identification number of 107(7)A(P),L(P),CD, as shown on Figures 10 and 12.

3.7.5.3 Area VI - Gravel Pit Disposal Area, Study Site 33

Study Site 33 is located east of F-Block igloos, in the south-central part of the UCD. Historical aerial photographs reviewed during the Enhanced PA show Study Site 33 being used as a gravel pit, starting around 1949. A review of aerial photographs indicates the Gravel Pit began accepting waste around 1971. A former UCD employee reported the potential disposal of chemical agent GB and/or VX occurred during the 1960s, caused from the disassembly of a leaking bomb. The employee reported seeing white crystals surrounding the area of the disposal incident for approximately 1 year. During the assessment, a test pit was excavated in the area of the suspected disposal site, where gas masks and metal debris were found in the shallow excavation. Soil samples were collected and analyzed for HD, GB, and VX, as well as isopropyl methyl phosphonate (IMPA) and ethyl methyl phosphonate (EMPA), breakdown products of GB and VX. No agent or breakdown products were detected in any of the samples collected. The assessment determined that chemical agents were not disposed of at this location or were released in small quantities such that they would not pose an environmental risk. The current status per the RCRA permit for Study Site 33 is NFA. No long-term monitoring is required for this site. However, construction debris and other solid waste exposed at grade in these areas indicate that DEQ requirements for closure are not being met. Study Site 33 was identified as a Category 3, with a property identification number of 49(3)HR,CD, as shown on Figures 10 and 12.

3.7.5.4 Area VI - Railroad Landfill Areas, Study Site 50

Study Site 50 is also known as the Railroad Landfill Areas, and is composed of two discrete areas, one approximately 30 by 800 feet and the other composed of laterally discontinuous sections. The Railroad Landfill Areas is located along the south central UCD border, approximately 500 feet south-southeast of the WWTP. The landfill areas are topographic depressions on either side of the railroad spur. North of the railroad yard, the fill was limited to metal scrap materials, as indicated by rusty metal debris scatter. The area south of the rail yard was a “dry” landfill and consisted of construction debris, as indicated by abundant concrete fragment scatter. Study Site 50 is identified as ECOP Category 7, with a property identification number of 52(7)HR,PR,A(P),L(P),CD, as shown on Figures 10 and 12.

During an RI conducted by Dames & Moore in 12990, an aerial photographic analysis indicated fill material may have been deposited at the Railroad Landfill Areas from 1956 through 1970, and a variety of potential contaminants could be present in the landfill debris. Soil and groundwater samples were collected and analyzed for target compound list (TAL) inorganics, TCL VOCs, TCL BNAs, TCL pesticides/PCBs, oil and grease, explosive constituents, and nitrate/nitrites. Low concentrations of oil and grease were detected in both the soil and groundwater, and low concentrations of one known and several unknown BNA tentatively identified compounds (TICs) were detected. Low levels of RDX were detected in one groundwater sample, but not detected in the second round collected during the RI. The current status per the RCRA permit for Study Site 50 is NFA. No long-term monitoring is required for this site.

3.7.5.5 Area III - Former Gravel Pit/Disposal Location, Study Site 82

Study Site 82 is a former gravel pit located immediately south of I-Block igloos. During the RI, an aerial photographic analysis indicated the Former Gravel Pit appeared to operate as a gravel pit until around 1956, when fill material may have been placed into the smaller pits. Striations on the fill give the appearance of worked material. During the 1990 field investigation for the RI, pieces of what appeared as asbestos-containing transite siding were noted, as well as recently disturbed soil. Shallow and test pit soil samples were collected for asbestos, TAL inorganics, TCL VOCs, TCL BNAs, explosive constituents, and nitrate/nitrite analyses. TAL inorganics were not detected in any sample and no explosive constituents, TCL VOCs, TCL BNAs, or nitrate/nitrate were detected above reporting limits. Asbestos was identified in a soil sample collected near the surface. While ACM was detected in soil at Study Site 82, the sampling did not indicate widespread surficial disposal of ACM. The current status per the RCRA permit for Study Site 82 is NFA. No long-term monitoring is required for this site. Study Site 82 is identified as ECOP Category 3 with a property identification number of 34(3)HR, as shown on Figures 7 and 12.

3.7.6 Other Gravel and Borrow Pits

Several other gravel and borrow pits have been in use throughout the UCD's history. Study Site 51, also known as the Northern Large Storage Area, is located northeast of the EWL and northwest of Rim Road and the C-Block igloos. Recently, the area has been used as a gravel borrow pit by UCD contractors. During a routine visit to the borrow pit by a UCDF construction contractor, several old paint cans and other debris were uncovered during excavation. A distinct hydrocarbon odor was also noted. DEQ and UCD representatives visited the site on 16 October 1997 and noted the deteriorated paint cans as well as what appeared as paint residue. The USACE conducted a field investigation in which product and soil samples were collected and chemically analyzed from two zones where the debris and residue were located. Samples collected at each site and analyzed by EPA method 1311 for chromium, barium, cadmium, and lead, VOCs, and SVOCs. Low levels of metals and SVOCs were detected in the samples from the two locations. VOCs were not detected in the samples, and no further removal actions were deemed necessary (*USACE, 1997; UCD BRAC letter, 1997*). Study Site 51 is identified as ECOP Category 3, with a property identification number of 43(3)HR,CD, as shown on Figures 7 and 12.

An aerial photographic analyses conducted during the Enhanced PA identified at least 12 locations that appeared to have gravel and borrow pit operations. These areas were assigned separate site numbers. Sites AX-40 through AX-43 and AX-45 through AX-47 are located in Enhanced Preliminary Assessment Area Five, while Sites AX-5 and AX-57 through AX 60 are located in Area Seven. The assessment determined that none of these gravel pits appear to have been used for waste disposal. For further information on these locations see the 1990 Enhanced Preliminary Assessment conducted by Dames and Moore for the US Army Toxic and Hazardous Materials Agency (*Dames and Moore, 1990)*.

3.7.7 Explosives Contaminated Structures

Per communication with UCD, all structures at UCD have been abated and cleared of explosives contamination with the exception of the following: Building 608 and Bag house 610; and Building 614 and Bag house 615. Prior to demolition of buildings containing vacuum lines, testing and special disposal will be required (*UCD Personal Communication, 2009-10).* There is a potential that contamination remains in the vacuum lines and therefore there is a potential for a release to occur. Buildings 608-612 were identified as ECOP Category 6 with a property identification number of 31(6)HR,PS,A,L(P), as shown on Figures 7 and 12. Additionally, Buildings 614 through 617 were identified as ECOP Category 6, with a property identification number of 28(6)A,HR,PS,L(P), as shown on Figures 7 and 12.

3.7.8 Radon

The Enhanced PA stated there was a potential for naturally occurring radon to be present at UCD (*Dames and Moore, 1990*). A radon survey report was prepared in August 1993 under the 1988 BRAC program (*Dames and Moore, 1993b*). Two surveys were conducted: A 12-month survey in 1991 and a 90-day survey in 1992-1993. The 1991 effort sampled 165 buildings (no results were available for Buildings 5 or 165). The 1993 survey consisted of sampling in 97 separate buildings, including 5 that were also sampled in 1991. Only 10 percent of igloos in Blocks A through H and Block J were sampled because they were not inhabited. A total of 252 separate buildings and structures were considered, including 84 igloos.

NFA was recommended for 121 buildings with radon gas concentrations below the detection limit of 0.5 pCi/L. Another 121 buildings had radon concentrations between 0.5 pCi/L and 3.8 pCi/L. Buildings 1, 5, and 415, plus seven igloos, had radon concentrations above 4.0 pCi/L. Because the igloos are not routinely occupied spaces, no mitigation measures were recommended. In addition to the seven igloos, samples from Buildings 1 and 415 had radon gas concentrations greater than 4.0 pCi/L. Mitigation measures were recommended for both buildings, since the basements of the buildings are normally occupied and because the Oregon Health Division applies EPA criterion to both homes and workplaces (*Earth Tech., 1994*).

Historical information states that the two survey rounds in 1992-1993 were the only radon samples ever collected at the UCD. These test results were from a single point in time 18 to 20 years ago (1991 to 1993), which represents a data gap. Furthermore, industry standard is to conduct don’t update testing annually, which has not occurred. Thus, samples collected today may be different than in the past. The Dames and Moore radon surveys also didn’t include all the buildings and structures at UCD. Another comprehensive radon survey needs to be conducted to fill-in the aforementioned data gaps. Of course, only buildings that are anticipated to be occupied need to be included in the comprehensive radon survey.

3.7.9 Pesticides and Herbicides

Applicable regulations for pesticides and herbicides at UCD are the Toxic Substance Control Act (TSCA) and the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Pesticide storage and handling is conducted in accordance with applicable regulations, utilizing storage facilities with secondary containment and collection and proper disposed of wash water by an off-site vendor (*Earth Tech., 1995*).

Building 8 is the Pesticide/Herbicide/Rodenticide Storage Building. Products used in this building include herbicides, pesticides, rodenticides, and mixing operations. All chemicals are stored in locked rooms. In-service drums of liquids are stored in plastic containment trays or plastic spill containment tubs. A labeled spill kit containing floor-dry, a shovel, a broom, and bleach is available in the room. The pesticide mixing room is bermed so all material would remain in the containment area in the event of a spill or leak. All mixing is done in this room. All containers are triple rinsed and rinse water is reused. The rinsed empty containers are punctured and disposed of as solid waste.

Liquid herbicide in 2.5-gallon plastic containers are kept inside containment trays. Herbicides used include granular weed killer, Krovarl-DF, Roundup, Oust, Spraykil-13, and 2-4-D. The pesticides are kept in a locked storage room and are in single-use containers or small containers up to a 50-pound bag size. Pesticides used include aerosol wasp and hornet spray, Demon, and Sprakil-13. Rodenticides are kept in small containers. They include Talon-G, Cooke Gopher mix, and Ditrac rodent bait. A labeled spill kit similar to the herbicide spill kit is available (*US Army CMA, 2004*).

4.0 RESPONSE ACTIONS

Between 1979 and 1992, environmental assessments and remedial investigations were conducted at the UCD, which resulted in the identification of over 83 “Study Sites” of environmental interest. In some cases, a Study Site was designated to represent several locations with similar functions or infrastructure (e.g. all septic systems were identified as a single Study Site 29 in past reports). In 1989, an FFA was signed by the EPA, the Army, and the DEQ, to address investigation and cleanup at nine designated OUs. More than one “Study Site” was included with each OU. Throughout the 1980s and 1990s, soil and groundwater sampling occurred at the OUs and at other locations on the UCD. In some cases a decision of “no further action” was mutually made by all three parties to the FFA. Cleanup and closure occurred at some Study Sites within the OUs. CERCLA-listing and subsequent cleanup and/or ongoing remediation occurred at other Study Sites. Currently, investigation and cleanup is occurring at Study Sites within two OUs: Area I - ADA and Area V - EWL/Central.

Beginning in April 1990, the Army Toxic and Hazardous Materials Agency (USATHMA) conducted an enhanced PA and identified 82 individual and multiple location sites for inclusion in a follow-up Remedial Investigation/Feasibility Study (RI/FS). Seventy-two of these sites were recommended for further investigation, including 27 existing and 6 former buildings. Selection of sites requiring further investigation was based on evaluations of known and/or suspected releases of hazardous substances, potential contaminants of concern, and potential migration pathways. The initial RI and the human health and ecological baseline risk assessments were released in August 1992 and a supplemental RI report/baseline risk assessment was published in September 1993, which provided information on 13 additional sites not included in the August 1992 RI Report. The RI and baseline risk assessment studies resulted in an assessment of no further work necessary at some OUs; cleanup and closure at other OUs; and CERCLA-listing and subsequent cleanup or ongoing remediation at two remaining OUs: the ADA (Area I) and the EWL (Area V).

Table 18 lists Study Sites as identified from investigations and assessments conducted between 1978 to present, as presented in the June 2010 ECOP Report (*USACE, 2010*). Locations are described further in Section 4.1.

Table 18: Study Sites from Previous Investigations

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
1	Deactivation Furnace	Area II - DF	Located in the southwest corner of the property. Used to deactivate small munitions.	Y	Y	N	--	ROD signed December 1992
2	Storage Igloos	Areas II, III, IV, V, VI, VIII	1001 steel reinforced-concrete, earth-covered structures found throughout the facility. Were used as storage for various munitions and wastes.	N	N	Y	--	No Further Action (NFA) based on no occupancy of storage igloos, per the 1993 Radon Survey
3	Hazardous Waste Storage Facility	Area II - DF	Also known as Building 203 located in the 200 series of buildings in SW part of UCD.	N	Y	N	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
4	Explosives Washout Lagoons	Area V - EWL/Central	Two large infiltration lagoons for liquid wastes from bomb and munitions washing operations from the former Explosives Washout Plant.	Y	Y	Y	--	Remedial actions ongoing; ROD signed September 1994
5	Explosives Washout Plant (Building 489)	Area V - EWL/Central	This was a two-story metal and concrete building used to wash explosive constituents out of bombs and munitions. *Now demolished.*	Y	Y	Y	--	Remedial actions complete per ROD signed June 9, 1994
6	Sewage Treatment Plant	Area VI - South Central	The sewage treatment plant treats domestic sewage wastes from the Admin Area (Area VII).	Y	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
7	Aniline Pit	Area I-ADA	A former 40 ft x 40 ft fenced area within the ADA.	N	Y	N	--	NFA per ADA ROD, signed June 10, 1994
8	Acid Pit	Area I-ADA	A small limestone-lined, metal grating-covered pit formerly used to dump of acid wastes.	Y	N	E	--	NFA per ADA ROD, signed June 10, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
9	GB Bomb Disassembly Area	Area III - West Central	Formerly used to disassemble GB nerve agent.	N	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
10	Blister Agent HD Storage Area	Area IV - North Central	Blister Agent HD Storage Area is an open gravel strip of ground approximately 100 ft wide by 2,000-3,000 ft long used to store 1-ton containers of blister agent HD.	Y	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
11	Active Landfill	Area VIII - East	This landfill is now closed and covers approximately 5 acres and was used from 1968 until 1997 for the disposal of domestic and construction wastes	Y	Y	Y	--	Semi-annual groundwater monitoring currently being conducted; NFA per ROD signed March 1993
12	Inactive Landfills	Area VI - South Central	The inactive landfills are comprised of six cells and operated from the 1940s until 1968, though small sections of the inactive landfill continue to receive construction waste.	Y	Y	E	N	NFA per DEQ/Army SRI findings-ROD signed March 1993
13	Smoke Canister Disposal Area	Area I - ADA	This is a ridge of dirt approximately 150 ft long by 30 ft wide by 6 ft high. It contained burned debris from smoke canister burning operations.	N	Y	E	--	NFA per ADA ROD, signed June 10, 1994
14	Flare and Fuse Disposal Area	Area I - ADA	This area consists of a 30 ft by 50 ft by 6 ft high mound containing soil and burned reside, though no actual burning was reported to have taken place.	N	Y	E	--	NFA per ADA ROD, signed June 10, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
15	TNT Burn Area	Area I - ADA	This is an open gravel area approximately 1 acre in size and was used to dump and burn TNT containing sludges and dunnage wastes.	N	Y	E	--	Contaminated soil remediated per June 10, 1994 ADA ROD
16	Open Detonation (OD) Pits	Area I - ADA	Located throughout the ADA, several areas where there were shallow pits were used for the detonation of various convention munitions.	N	Y	E	--	RA pending, UXO clearance per June 10, 1994 ADA ROD
17	Above Ground OD Area	Area I - ADA	The Above Ground OD area was used for the detonation of decontaminated M55 rockets and M23 land mines.	N	Y	E	--	Contaminated soil remediated per June 10, 1994 ADA ROD
18	Dunnage Pits	Area I - ADA	The Dunnage Pits, located in the ADA, were two trenches, approximately 350 ft by 30 ft by 8 ft deep, which were used for the disposal and burning of dunnage and possibly liquid wastes.	Y	Y	Y	--	NFA per ADA ROD, signed June 10, 1994
19	Open Burning (OB) Trenches	Area I - ADA	This area was a series of Open Burning Trenches located near the Dunnage Pits within the ADA.	Y	Y	Y	--	Contaminated soil remediated per June 10, 1994 ADA ROD
20	Open Burning (OB) Area	Area I - ADA	Several Open Burning Areas were noted during the RFA within the ADA.	N	N	--	--	--
21	Missile Fuel Storage Areas	Area 1-ADA	This area consisted of three metal sheds used to store missile fuel components.	N	Y	N	--	NFA per ADA OU ROD, signed June 10, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
22	Defense Reutilization Marketing Office (former DRMO) area	Area VII - Admin	The former DRMO area was a large, fenced area, approximately 1 acre in size, located between the electrical shop and Building 17. It was used to store various scrap or salvage material until it was taken off the site.	N	Y	Y	--	Contaminated soil remediated per June 30, 1994 Misc. Sites OU ROD
23	Building 5 Waste Oil Tank	Area VII-Admin	A 500-gallon underground concrete tank was located outside of the maintenance garage in Building 5. It was used for temporary storage of waste oils prior to their removal.	Y	--	--	--	Per DEQ, contaminated soil may remain in place until access to it improves.
24	Building 10 Waste Oil Tank	Area VII - Admin	A 500-gallon underground steel or concrete tank was located outside of Building 10. It was used for temporary storage of waste oils from locomotive maintenance.	Y	--	--	--	NFA per 1992 DEQ letter
25	Metal Ore Piles	Area V - EWL/ Central	The Metal Ore Piles consisted of three piles of chromium ore located near the southern boundary of the K-Block igloos.	N	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
26	Metal Ingot Stockpile	Area II	The Metal Ingot Stockpiles consisted of several lead and aluminum ingots stacked in piles in an open-air storage area approximately 1 acre in size.	Y	Y	E	--	Contaminated Soil remediated under June 30, 1994 Misc ROD
27	Pesticide Storage Building (Building 8)	Area VII - Admin	Building 8 was an enclosed building that stored a minimum supply of pesticides in two bermed compartments.	N	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
28	Fuel Burning Area		This area was an open gravel area where missile fuel burning was conducted inside a portable furnace.	N	N	--	--	--
29	Septic Tanks*	All Areas	19 septic tanks were identified during the RFA.	Y	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
30	Storm Sewer Tile Field	Area VI - South Central	The Storm Sewer Tile Field was apparently located in the area of the treatment plant.	Y	Y	Y	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
31	Pesticide Pits	Area I - ADA	A row of existing pits at this site may have been used to dispose of or burn pesticide solution and general debris, or to detonate munitions.	--	--	E	--	Contaminated soil remediated per June 10, 1994 ADA OU ROD
32	Open Burning Trays	Area I - ADA	These two trays located on the ADA grounds were used to burn explosives propellant powder.	--	--	N	--	NFA per June 10, 1994 ADA OU ROD
33	Gravel Pit Disposal Area	Area VI	This site is located to the east of F-Block. A former UCD employee indicated there may have been an incident of GB/VX decontamination solution disposal at the site in the late 1960s.	--	Y	--	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
34	Paint Spray and Shot Blast Areas	Area II	Located in the southwestern part of UCD, these areas were used for temporary painting and shot-blasting activities.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
35	Malathion Storage Leak Areas	Area II	Former UCD employees reported that a shipment of leaking 5-gallon insecticide (malathion) containers was stored on the gravel to the north of Building 108.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
36	Building 493 Paint Sludge Discharge Area	Area V - EWL/Central	Building 493 was used to conduct spray-painting operations in wet spray booths that had drains that collected paint sludge and solvents. In addition, brass cleaning solution containing cyanide was reportedly disposed of in these drains. The drain pipes discharged to the coulee to the northwest of Building 493.	--	Y	E	--	Contaminated soil remediated per June 30, 1994 Misc. Sites OU ROD.
37	Building 131 Paint Sludge Discharge Area	Area II-DF	According to a former employee, a depression west of Building 131 was used to collect discharges from spray-painting operations formerly conducted in Building 131.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
38	Pit Field Area	Area I-ADA	This site consists of numerous pits that were most likely used to detonate or dispose of ordnance materials, but former employees had no recollection of the use of this area.	--	--	E	--	NFA per ADA OU ROD, signed June 10, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
39	QA Function Range	Area VIII-East	The QA Function Range is located in the northeast corner of UCD and occupies approximately 600 acres. The central part of the site served as a rifle and pistol range. The southern part of the site, east of the coulee, served as a QA testing area for flares, photoflash grenades, and mines.	--	Y	E	--	Remedial Action Complete per May 2005 ROD; NFA recommended per After Action Report, August 2009 (Bay West, Inc., 2009)
40	Jeep Storage Area	Area II - DF	This area was located in the Deactivation Furnace area and was used, at least in 1989 and 1990, to temporarily store used Jeeps prior to servicing.	--	N	--	--	--
41	GB/VX Decontamination Solution Burial Areas	Area III - West Central	Former employees indicated that decontamination solutions from a leaking GB bomb brought onsite in the early 1960s may have been disposed of in one of these two areas.	--	--	E	--	NFA per ADA OU ROD, signed June 10, 1994
42	Former Underground Storage Tank (UST) Locations	Area VII - Admin	Eleven USTs were formerly located in the Administration Area near the base gas station in the south-central part of the UCD.	--	Y	--	--	59 soil gas samples were collected during the 1995 UST investigation indicate only trace concentrations of petroleum. NFA recommended per 1995 UST Invest Report.

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
43	Former Gas Station/Possible UST Location (Central UCD Grounds)	Area V - EWL/Central	A gasoline station was once located in the central part of UCD, at the intersection of Rim and Center Roads. A UCD employee recalled that USTs were formerly located at this site.	--	Y	--	--	25 soil gas samples were collected during the 1995 UST investigation indicate only trace concentrations of petroleum. NFA recommended per 1995 UST Invest Report.
44	Road Oil Application/Disposal Sites	Area I - ADA; Area II - DF	Site 44 includes areas I and II. The first area reportedly experienced road oil disposal and possible spills (mid-1950s through the mid-1960s), road oil and tar drum storage (late 1940s), oil changing activities including draining waste oil directly into the soil (late 1940s), and storage of 50 to 60 transformers containing PCB-contaminated oil. The second area experienced a spill of hardened road oil material, occupying approximately 100 square feet.	--	Y	Y	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
45	Building 612 and Building 617 Boiler Discharge Areas	Area III - West Central	Buildings 612 and 617 are boiler houses that have blow-down effluent locations that discharge onto soils.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
46	Railcar Unloading Area	Area VI - South Central	Coal and/or ore was reportedly stored here in the 1950s and possibly early 1960s, and brass bullets were unloaded from railcars here in the late 1960s and early 1970s	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	**EPA**	**RI**	**SRI**	
47	Boiler/Laundry Effluent Discharge Site	Area V - EWL/Central	A metal trough was used to discharge effluent during blow-down of the plant boilers as well as laundry operations involving clothes contaminated with explosive residuals. From the trough, the effluent was then discharged into a rock-lined pit.	--	Y	Y	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
48	Pipe Discharge Area	Area VI - South Central	The large Imhoff tank associated with the Sewage Treatment Plant discharges through a pipe that ends in a long ravine approximately 25 feet deep	--	Y	Y	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
49	Drill and Transfer Site	Area IV - North Central	As part of a 1984 program to dispose of leaking chemical munitions, munitions were drilled, emptied, and decontaminated at this site.	--	N	--	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
50	Railroad Landfill Areas	Area VI	This site consists of two areas, one north of the railroad tracks, and one all along the southern boundary of the railroad classification yard.	--	Y	Y	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
51	Large Open Areas (Vicinity of Coyote Coulee)	Areas III, IV, V	This site consists of three areas in the north, south, and northwest corner of the UCD that were once used to store a variety of objects. The areas are no longer used and there are no visible signs of problems, except that the northern site still has some ground scarring.	--	N	--	--	--

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
52	Coyote Coulee Discharge Area	Area V-EWL/Central	These three gullies are presumed to be the result of liquid discharges from the various operations in the Explosives Washout Plant area.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
53	Building 433 Collection Sump/Cistern and Disposal Area	~~Area V-EWL/Central~~ Area VIII (outside Site boundary)	Building 433 is used as an oil-fired boiler house and restroom facility. The sump/cistern south of the building may have been used as a septic tank, but this is uncertain.	--	Y	E	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
54	Possible Disposal Pit Location		A small pit may have once been briefly used to dispose of unknown items. No sampling occurred at this site during the RI because it could not be located.	--	N	--	--	--
55	Trench/Burn Field	Area I - ADA	From 1950 to 1965, this site contained several rows of trenches where it is assumed that ammunition demolition or disposal activities may have been conducted.	--	--	E	--	NFA per ADA OU ROD, signed June 10, 1994
56	Munitions Crate Burn Area	Area I - ADA	This area was reportedly used to burn empty wooden crates from munitions, and it is assumed that ammunition demolition or disposal activities may have been conducted at this site.	--	--	E	--	NFA per ADA OU ROD, signed June 10, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
57	Former Pit Area Locations	Area I - ADA	This site consists of three areas of the ADA grounds where the soil is disturbed and in the form of trenches or pits. It is assumed that ammunition demolition or disposal activities may have been conducted at this site	--	--	E	--	NFA per ADA OU ROD, signed June 10, 1994
58	Borrow/Burn/Disposal Area	Area I -ADA	Located in the ADA, historical photographs indicate that this site may have been a borrow site and/or a burning site at one time. It is assumed that ammunition demolition or disposal activities may have been conducted at this site	--	--	N	--	NFA per ADA OU ROD, signed June 10, 1994
59	GB/VX Decontamination Solution Disposal Areas	Area I - ADA	This site consists of two areas of the ADA grounds where former employees indicated that GB/VX decontamination solutions were disposed of on the ground in the early 1960s on at least two occasions.	--	--	N	--	NFA per ADA OU ROD, signed June 10, 1994
60	Active Firing Range	Area I - ADA	Located on the ADA grounds, this site includes an active rifle and machine gun range and an active pistol range used by the National Guard since the early 1980s.	--	--	N	--	NFA per ADA OU ROD, signed June 10, 1994
61	Open Paint Spray Areas	Area II	These areas were reportedly used in the 1950s and 1960s to conduct outdoor spray-painting.	--	Y	--	E	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
62	Paint and Solvent Disposal Area	Area V-East Central	This area is located along the Coyote Coulee north of the Explosives Washout area. During interviews given during the investigations for the RI, UCD employees reported disposal of paint and solvent waste generated from a building formerly located east of the disposal location	--	Y	--	E	NFA per DEQ/Army SRI findings.
63	Pier 836 Chemical Solution Disposal Area	Area IV-North Central	Former employees reported that a laboratory trailer was set up in this area in the early 1980s to perform analyses on samples suspected to contain GB or VX agents, and some types of solution were spilled in the area around the trailer.	--	Y	--	--	NFA per DEQ/Army SRI findings
64	Leaking Railcar Shipment Inspection Area	Area IV-South Central	In the vicinity of the Sewage Treatment Plant, this area is approximately 1,000 ft long, extending from the main classification yard, turning eastward into a narrow ravine. During the 1990 RI interviews, UCD employees reported shipments arriving by railcar that were leaking or suspected of leaking were taken to the end of the rail line in the ravine to be inspected.	--	Y	--	E	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
65	Waste Paint and Solvent Disposal Area (Building 608)	Area III - West Central	During the 1990 RI interviews, employees reported that paint and solvents from Building 608 were disposed of on the soil covering the bunker storage areas north of the building.	--	Y	--	E	NFA per DEQ/Army SRI findings
66	Brass, Copper, and Steel Storage Area	Area II - DF	This site is located near the railroad tracks south of Igloo Block H. Aerial photographs and UCD employees report that copper, brass, and steel were stored at this site after being unloaded from the railcar (1992 RI/FS of Dames and Moore).	--	Y	--	E	NFA per DEQ/Army SRI findings
67	Building 439 Brass Cleaning Operations Area	Area V - EWL/Central	The cleaning of brass shells with a solution referred to as “Wedac” took place within and around Building 493 in the 1960s	--	Y	N	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
68	UDMH Operations Area (Building 129)	Area II-DF	Located within the Deactivation Furnace and Southwestern Warehouse Area, Building 129 was used to conduct stability test of UDMH and, potentially, red fuming nitric acid. Waste materials from the testing operations were drained through lead-lined pipes into a lime pit.	--	Y	--	N	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
69	Skunk Works Area	Area II - DF	Located within the Deactivation Furnace and Southwestern Warehouse Area, this area was reported to be used for cleaning of copper and brass cartridges in hydrochloric acid baths and WEDAC solutions, which were then either dumped at this site or burned at the ADA grounds	--	Y	--	E	NFA per DEQ/Army SRI findings
70	Wood Preserving Solution Spill Area	Area VII-Admin	Located within the former DRMO area and Administration Area, unconfirmed reports indicate that several hundred gallons of wood preservative solution pentachlorophenol (PCP), and, potentially, chromated copper arsenate (CCA) and creosote may have been spilled or dumped in this area.	--	Y	--	N	NFA per DEQ/Army SRI findings
71	Possible Fire Training Pits Area	Area VII - Admin	Pits were dug here and filled with flammable liquids such as solvents or oils to conduct fire-training exercises periodically from the 1940s to the 1970s.	--	Y	--	--	NFA per DEQ/Army SRI findings
72	Vehicle Storage Area	Area VII - Admin	Old vehicles were reportedly stored here and leaks of fuel, oil, and battery acid may have occurred in this area.	--	Y	--	--	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
73	Diesel Fuel Spill Location	Area VII-Admin	Former employees reported that in 1955 a spill of approximately 800 gallons of diesel fuel occurred on the soils in the area that is now covered with the concrete pad	--	Y	--	--	UST investigation found ubiquitous presence of BTEX and TVHC in soil gas and soil samples in area SW of USTs 42 and 43. Report recommended remediation of soil.
74	Oil/Fuel Transfer Station (Building 23)	Area VII-Admin	Building 23 and the areas surrounding it have been used to transfer oil and fuel from incoming railcars to vehicles or storage tanks at UCD since the early 1940s	--	Y	--	--	Passive Soil Gas Survey Conducted during the 1995 UST Investigation found 3 areas of potentially significant soil contamination.
75	Battery Acid Collection Sump (Building 31)	Area VII - Admin	Located within the former DRMO area and Administration Area, it has been reported that a concrete sump existed along the exterior of Building 31 that collected acid from a drain in the maintenance area.	--	Y	--	N	NFA for surrounding soil per SRI findings; recommended existing sump to be cleaned and decontaminated upon operation complete.
76	Photographic Chemical Disposal Area (Building 54)	Area VII - Admin	Located within the former DRMO area and Administration Area, Building 54 was reportedly used as a film developing laboratory and darkroom. It was reported during the 1990 RI site visit that approximately 50 to 100 gallons of film developing solutions were disposed of on the soil west of the building from the mid-1940s to early 1950s.	--	Y	--	N	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
77	Paint Storage and Disposal Area	Area VII - Admin	Located within the former DRMO area and Administration Area, paints, solvents, oils, photographic solutions, and antifreeze solutions were stored and disposed of in an area located within and surrounding Building 30A storage shed.	--	Y	--	E	NFA per DEQ/Army SRI findings
78	Buildings 608 and 614 Heat Exchange Systems	Area III - West Central	Buildings 608 and 614 are heated with a closed heat exchange system consisting of ethylene glycol solution that runs through a holding tank and piping located beneath the floor	--	Y	--	--	NFA per DEQ/Army SRI findings
79	Malathion Spray Areas	Area VIII - East	Located in the northeast corner of Igloo Block C, this area is reported to have been sprayed with the insecticide malathion during a commercial over-flight operation near UCD.	--	Y	--	N	NFA per DEQ/Army SRI findings
80	Disposal Pit and Graded Areas	Area I-ADA/Area III-West/Central	Parts of this site were located in the ADA area. There is some chance that that the pit remaining at the eastern end of the site may have been used to dispose of liquid waste materials.	--	Y	N	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
81	Former Raw Material Storage Locations	Area I - ADA	This site is located in the ADA and consists of two locations, I and II, where raw materials, possibly coal or ore, were stored in the 1940s and 1950s.	--	Y	N	--	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Location	Description	Recommended Further Action				Final Action or Determination
				RFA	EPA	RI	SRI	
82	Former Gravel Pit/Disposal Location		Historic aerial photographs indicate that this site was a gravel pit (1992 RI/FS of Dames and Moore). A 1990 investigation found asbestos-containing building siding.	--	Y	N	--	NFA per Misc. Sites OU ROD, signed June 30, 1994
83	Leaking Drum Storage Area	Area VII - Admin	Located within the former DRMO area and Administration Area, the area consisted of a fenced yard west of Building 39 and south of Building 23, which was used to store drums containing the degreasing solvent methyl isobutyl ketone (MIBK).	--	--	--	N	NFA per DEQ/Army SRI findings
N/A	PCB Transformer Locations	All Areas	According to UCD records, there were 239 transformers on post. All 239 transformers were tested for PCBs in 1989. 173 of the 239 transformers on the property were in use at the time of the SRI; the remaining were removed and disposed of off-post. 50 of the 66 transformers removed were replaced with transformers containing less than 50 parts per million (ppm) PCBs. The SRI focused its investigation on 79 transformers where the PCB concentration was greater than 10 ppm	--	--	--	Y	NFA per DEQ/Army SRI findings at transformer locations 162,163, 164, 197, and 198. Soil in vault at location 229 will be cleaned out and disposed of as a removal action according to Oregon background levels

Notes: NUS Corporation 1987. RCRA Facility Assessment, UADA, Hermiston OR, Prepared for the EPA, June 1987. Dames and Moore 1990. Enhanced Preliminary Assessment for Umatilla Depot Activity, Prepared for the US Army Toxic and Hazardous Materials Agency, April 1990. Dames and Moore 1992. Remedial Investigation Report for the Umatilla Depot Activity, Hermiston, Oregon. Prepared for the US Army Toxic and Hazardous Materials Agency, August 1992. Dames and Moore 1993. Supplementary Remedial Investigation Report, Umatilla Depot Activity, Hermiston, Oregon. Prepared for the US Army Environmental Center Command, September 1993. **N** = No Further Action Required, **Y** = Additional Study Recommended, **E** = Evaluate Potential Risks (No additional sampling is recommended).

4.1 ONGOING RESPONSE ACTIONS AND REGULATORY ORDERS

4.1.1 Federal Facilities Agreement

In 1989, an FFA was signed by the EPA, the Army, and the DEQ, to address investigation and cleanup at nine OUs. These OUs were comprised of multiple Study Sites based on environmental investigations that had occurred at the UCD up to and including the year 1989. In the FFA, the parties agreed that any remedial actions completed at the nine OUs would be implemented and completed with the result that NFA would be necessary. The following are principal points made in the FFA:

- The FFA will apply to subsequent owners of property, binding new property owners to the terms in the agreement;
- Releases of hazardous wastes not covered by the FFA remain subject to all state and federal requirements;
- Nine OUs were named in the FFA:
  - Washout Lagoons & Associated buildings;
  - Ammunition Demolition Activity (ADA);
  - Inactive Landfills;
  - Remote Disassembly Area;
  - Sewage Treatment Plant;
  - Storm Sewer Tile Field;
  - Defense Reutilization Marketing Office (DRMO) Area;
  - Active landfill; and
  - Deactivation Furnace.
- The FFA will be terminated when UCD receives written notices from the EPA and the DEQ that the terms of the FFA have been demonstrated.

In accordance with the FFA, additional assessment, soil and groundwater sampling, and human health and ecological risk assessments were conducted in the 1990s. A copy of the FFA is included in Appendix N. Sometime after the FFA was signed and before 1994, the OUs were re-designated as presented in Table 19.

Table 19: Original OUs Identified in the FFA

Operable Unit Name	Area	Study Sites Included in OUs
Explosives Washout Lagoons – Soil	V	Site 4
Explosives Washout Lagoons – Groundwater	I	Site 4
Explosives Washout Lagoons – Plant	VI	Site 5
ADA	III	7, 8, 13-19, 21, 31, 32, 38, 41, 55-60
Inactive Landfills	II	12
Active Landfill	VI	11
Deactivation Furnace	II	1
Miscellaneous Sites	All Areas	3, 6, 9, 10, 22, 25(I), 25(II), 26, 27, 29, 30, 33, 34-37, 39, 44(I), 44(II), 45-50, 52, 53, 67, 80(I), 80(II), 81, and 82

Study Sites not included in the OUs include 20, 23, 24, 28, 40, 42, 43, 51, 5, 61-66, 68, 69, 70-79, and 83.

4.1.1.1 Records of Decision

Once the FFA was signed in 1989, several investigations were conducted in the early and mid 1990s to support Records of Decisions (RODs) for each of the OUs. RODs for OUs located on the Subject Site are discussed in the following paragraphs.

Explosive Washout Lagoon - Soils OU (in Area V): A ROD was executed in 1992, where bio-treatment was selected among several other remedies as the treatment for soils affected by TNB, DNB, TNT, 2,4-DNT, HMX, NB and RDX. In 1997, an Explanation of Significant Difference (ESD) was written to explain a decision to use the bio-remediated soil as landscaping material rather than returning it to the former lagoons.

Explosive Washout Lagoon - Groundwater OU (in Area V): A ROD was executed in 1994, where pump and treat was selected among several other remedies as the treatment for groundwater affected by TNB, DNB, NB, TNT, 2,4-DNT, 2,6-DNT, RDX, HMX, and Tetryl.

Explosive Washout Lagoon - Plant OU (in Area V): A ROD was executed in 1994, where the remedy was to clean out and dispose of explosives, waste sludge, and contaminated wash water from washout sump located inside the plant. Additional remedies included decontaminating the washout sump by flaming and landfill disposal; pretreatment of plant equipment (remove asbestos, cleanup pigeon droppings, and solvent flush); treatment by solvent wiping and galvanized steel siding; and hot gas decontamination of aluminum siding, concrete, and process equipment. The pelletizer building also was demolished.

ADA OU (in Area I): A ROD was executed in 1994 to cleanup chemically contaminated soil, remove UXO items from the ground surface, detect and quantify UXO below the ground surface, and conduct retrieval and treatment of buried UXO to a depth that would allow for selected land use under BRAC. The ROD stated a phased approach would be used, with a metallic object survey over the entire ADA in the first phase, and removal of buried UXO in the second phase. Soil cleanup was selected for Sites 15, 17, 19, 31, and 32 (14,000 cubic yards).

Inactive Landfill OU (in Area VI): A ROD for no action was executed in 1993 for 6 discrete former disposal areas that covered approximately 8 acres in Area VI. The no action alternative was selected based on data collected during the 1992 RI. The Army, EPA, and DEQ determined the landfills did not pose an unacceptable human health or environmental risk. Also, the Army, EPA, and DEQ determined that a 5-year review was not required because the site conditions were not expected to be altered and no site access restrictions were necessary. However, the addition of construction debris to the former disposal areas since a ROD was executed in 1993 was apparent at the time of the January 2011 field reconnaissance. Therefore, the ROD agreement regarding the landfills needs to be revisited by the DEQ.

Miscellaneous Sites OU (multiple Areas): The Miscellaneous Sites OU is comprised of 32 individual sites not originally included in the FFA, with the exception Study Sites Site 6, Site 9, Site 30. A ROD was executed in 1994 for 2 of 32 Sites at the UCD: Site 22 (DRMO) and Site 36 (Building 493 Paint Sludge Discharge Area). Site 26 (metal ingot stockpile) was later added to the soil removal action by request of UCD. The selected remedy for the sites consisted of excavation and stockpile of 1,700 cubic yards of soil; treatment of the soil to produce a cement-like soil mix; disposal of treated soil in the Active Landfill OU in Area VIII; and replacement of excavated area with clean soil. Soils at the remaining 29 sites were determined to present acceptable human health and environment risks and NFA was taken at these sites.

4.1.1.2 Five Year Reviews

In accordance with the FFA, 5-year reviews were completed in 1999, 2004, and 2009.

> **First 5-Year Review:** The first 5-year review in 1999 concluded for the following OUs, the selected remedies “did not result in hazardous substances remaining on-site above levels that allow for unlimited and unrestricted use”: EWL Soils OU, Explosives Washout Plant OU, Deactivation Furnace Soils OU (Area II adjacent to SW of Subject Site), Miscellaneous Sites OU, Active Landfill OU (Area VIII, adjacent to E of Subject Site), and Inactive Landfills OU (Area VI). The first 5-year review concluded “no CERCLA 5-Year Review Requirements will apply” to the remedial actions undertaken at these OUs, and these OUs did not “require any long-term management or review.” For the EWL Groundwater OU and the ADA OU, the 1999 5-year review concluded that remedial actions resulted “in hazardous substances remaining on-site above levels that allow for unlimited and unrestricted use,” and that these OUs “will require long-term management or review,” with reviews conducted at least every 5 years.
>
> **Second 5-Year Review:** A second 5-year review was completed in 2004. The second 5-year review covered selected remedies for OUs at UCD as recommended from the first 5-year review and OUs with subsequent changes since the 1999 review (*UCD Archive Document, 1999; USACE, 2004*). On July 7, 2004, the Army and DEQ remedial managers conducted a site visit, after which the Army, EPA, and DEQ reviewed the remedies implemented for all eight operable units at that time. The second 5-year review found the remedies remain protective of human health and the environment. The remedial systems were operating and functioning as designed and no modifications were determined to be necessary at that time. Therefore, the Army certified the remedies implemented at UCD remained protective of human health and the environment.
>
> **Third 5-Year Report:** A third 5-year review was finalized in March 2010. The third 5-year review covered the EWL Groundwater OU located in Area V, the ADA OU in Area I, and the eastern adjoining Landfill OU located in Area VIII. This review found the remedy chosen for the EWL Groundwater OU was expected to be protective of human health and the environment upon completion and in the interim, prohibition on the use of groundwater would be required. The review also found all exposure pathways potentially resulting in an unacceptable risk are currently being controlled. The remedy at the ADA was found to be protective of human health and the environment in the short term because controls were in place to prevent exposure. However, it was acknowledged additional actions would be required. The Landfill OU in Area VIII of the UCD was found to be currently protective of human health and the environment because there was no current exposure pathway for

groundwater. However, the third 5-year report indicated that for the remedy to be protective in the long term, deed restrictions would be required to prevent the use of groundwater.

4.1.2 Environmental Investigations

This section describes key investigations on the environmental condition of the Subject Site and the UCD. Environmental investigations began at the UCD as early as 1978, when the UCD was placed into the Army's IRP. Throughout the time period between 1978 and 1992, environmental assessments were conducted, resulting in the identification of over 100 locations or "sites" of environmental interest at UCD. The UCD was placed on the NPL in 1987 due to the discovery of contamination at the EWL/Central Area - Area V. The EWL/Central area is an area where conventional bombs were dismantled and washed out with water in the 1950s and early 1960s. Among the compounds washed out in the cleaning process were TNT and RDX. Table 20 was extracted from the second 5-year review completed in October 2004 and presents a chronology of environmental investigations at UCD.

Table 20: History of Environmental Investigations at UCD

Event	Date	Document/Description
RCRA Facility Assessment	May 1980	Preliminary Assessment
Initial RI	December 1982	Site Investigation
NPL listing	21 August 1987	
Federal Facility Agreement Signed	31 October 1989	Federal Facility Agreement
Expanded RI/FS conducted	1990 - 1993	
ROD signatures	25 September 1992	EWL Soils
	31 December 1992	DF - Area II (off-site)
	10 August 1993	Active Landfill - Area VIII (off-site) Inactive Landfills - Area VI
	19 July 1994	EWL - Area V (Central), Miscellaneous Sites
	2 May 2005	QA Function Range (Site 39, off-site)
	28 August 1995	EWL Plant - Area V
	27 June 2002	ADA Soils

Event	Date	Document/Description
Remedial design start	25 February 1993	Lagoon Soils
	25 February 1993	DF
	12 September 1994	Lagoon Groundwater
	2 September 1994	ADA
	19 July 1994	Washout Plant
	2 September 1994	Miscellaneous Sites
Remedial design complete	23 June 1993	Lagoon Soils
	14 September 1993	DF
	31 July 1995	
	10 August 1995	ADA Soils Tier I
	2 August 2002	ADA Soils Tier 2
	19 October 1995	Washout Plant
	10 August 1995	Miscellaneous Sites
	August 2008	Site 39 QA Function Range
Remedial action start	September 23, 1993	Lagoon Soils
	26 October 1993	DF
	N/A	Active Landfills, Inactive Landfills
	30 December 1995	Lagoon Groundwater
	30 September 1995	ADA Soils Tier 1
	8 January 2002	ADA Soils Tier 2
	1 February 1996	Washout Plant
	6 November 1995	Miscellaneous Sites
	7 October 2008	Site 39 QA Function Range
Construction dates (start/finish)	November 1993 / May 1997	Lagoon Soils
	November 1993 / December 1997	dF
	NA	Active Landfill, Inactive Landfills
	January 1996 / December 1996	Lagoon Groundwater
	November 1995 / April 2000	ADA Soils Tier 1
	February 2002 / August 2003	ADA Soils Tier 2
	February 1996 / April 1998	Washout Plant
	November 1995 / December 1997	Miscellaneous Sites
	October 2008 / November 2008	Site 39 QA Function Range

Event	Date	Document/Description
Final Remedial Action Reports	28 September 2001	Lagoon Soils
	28 September 2001	DF
	N/A	Active Landfill, Inactive landfills
	RA Ongoing	Lagoon Groundwater
	February 2005	ADA Soils
	28 September 2001	Explosive Washout Plant
	28 September 2001	Miscellaneous Sites
	August 2009	Site 30 QA Function Range
Five-Year Review (FYR) Report	September, 1999	First 5 Year Report (UCD Archived Document, 1999)
	October 2004	Second 5 year Report (USACE, 2004)
		Third 5-Year Report (USACE, 2010)
DEQ Cleanup Program Remedial Action Recommendation Report	March 2005	Landfill (draft version)

4.1.2.1 Initial Installation Assessment, 1978

In accordance with the recommendation of the Commander, US Army Depot Systems Command, UCD was included in the Army’s IRP in October 1978 (*Earth Tech., 1978*). The first component of the program was an Initial Installation Assessment (IIA) performed in December 1978. The primary purpose of the IIA was to assess the environmental quality of the UCD with regards to hazardous and toxic materials, and define any conditions that may adversely affect health and welfare or result in environmental degradation (*Earth Tech., 1978*).

The results of the IIA revealed two contaminated areas: the Ammunition Washout Facility (in Area V) and the burning, demolition, and burial sites within the ADA (Area I). The IIA highlighted contaminants of concern (COC) that included explosive wastes, rocket fuels, insecticides, and heavy metals, and identified a potential for migration of these contaminants to groundwater. The IIA recommended that a contamination survey and assessment be conducted (*Earth Tech., 1994; IIA, 1978*).

4.1.2.2 Environmental Contamination Survey and Assessment, 1982

The environmental contamination survey and assessment recommended by the IIA was completed in April 1982 and consisted of soil and groundwater sampling at suspected contaminated areas. The survey concluded that the EWL (In Area V) was the source of significant groundwater contamination. The survey also concluded the groundwater plume was moving slowly, and upon reaching the installation boundary would be diluted. The results of the survey revealed several locations within the ADA and the EWL where there was significant soil contamination by explosive constituents, metals, and pesticides (*Earth Tech., 1994; Battelle, 1982*).

4.1.2.3 RCRA Facility Assessment, 1986

A RCRA Facility Assessment (RFA) was conducted in the fall of 1986 to evaluate areas of the UCD where there had been known or suspected releases of hazardous waste, and to implement corrective actions as necessary. The RFA identified 30 solid waste management units (SWMUs) and included recommendations regarding the need for further action at each. The RFA recommended that 15 identified SWMUs and three unidentified, potential SWMUs be investigated further (*Earth Tech., 1994; NUS, 1987*).

4.1.2.4 Enhanced Preliminary Assessment, 1990

An enhanced PA was conducted in 1990 for the US Army Toxic and Hazardous Material Agency (USATHAMA; now Army Environmental Command [AEC]) under the BRAC program). The objective was to identify potential hazardous waste sites, buildings, tanks, and PCB transformer locations that might warrant further environmental characterization.

The enhanced PA identified 82 individual and multiple locations (Study Sites) where past operations may have resulted in releases to the environment. Documentation was reviewed, interviews were conducted with current and former employees, and additional aerial photography was located and analyzed. A visual site inspection was conducted to observe land areas, buildings, and evidence of underground storage tanks. As a result, 72 of the 83 Study Sites were recommended for further investigation based on evaluations of known and/or suspected releases, potential COCs, and potential migration pathways. Additional historical information and aerial photography resulted in a number of additional sites identified for further investigation. Potential sources of contamination were identified at 41 existing buildings and the sites of 8 former buildings. Of these, further investigation was recommended for 26 existing buildings and the sites of 6 former buildings. Over time, further investigation led to a total of 148 investigated sites and 11 OUs (expanded from the original 9OUs [*Earth Tech., 1994; Dames and Moore, 1990]*).

4.1.2.5 Risk Assessment for Study Site 4 Explosives Washout Lagoons, 1992

An RA for the EWL (in Area V) was conducted in March 1992 to address current and potential future health risks posed by the explosive contaminated soil and groundwater prior to remediation, and to identify safe residual explosive concentrations if soil remediation was determined to be necessary. The intention of the RA was to address the extent to which the soil was affecting groundwater quality, not to assess remediation of the groundwater. Groundwater assessment was addressed in the installation-wide Human Health Baseline Risk Assessment (*[HHBRA], Dames and Moore, 1993a*).

Risk was calculated for three future land use scenarios: residential, light industrial, and military. Risk calculations accounted for four exposure pathways: soil ingestion, dust inhalation, dermal contact with soil, and ingestion of groundwater. Risks were evaluated for explosive constituents, primarily TNT exposure. The EPA target risk range used during the assessment was 10-4 to 10-6 for all pathways and future land uses. Results of the HHBRA show that risk calculations were either between or exceeded the EPA risk range for all pathways, except inhalation of dust for military use. Non-cancer hazardous indices exceeded 1 for soil ingestion and dermal contact with soil pathways for all future land use (*Earth Tech., 1994*). Risk and hazard values were calculated based on groundwater ingestion for land use scenarios and receptor location near the lagoons. Results showed the risk and hazard calculations exceeded the EPA risk range with hazard indices of 65 and 37 for residential and industrial use, respectively (*Earth Tech., 1994*).

4.1.2.6 Feasibility Study for Explosives Washout Lagoons Soils, 1992

A Feasibility Study (FS) was conducted in April 1992 for Study Site 4, the EWL, to evaluate potential alternatives for remediation of the explosives-contaminated soil. The FS provided a summary of the RI results, provided a summary of the RA, presented remedial objectives, and evaluated potentially viable technologies for soil remediation. The alternatives presented in the FS were: 1) no action; 2) excavation and incineration of soil, and 3) excavation and composting of soil.

All alternatives were evaluated for: 1) protection of human health and the environment; 2) compliance with appropriate state and Federal applicable, or relevant and appropriate requirements (ARAR); 3) long-term effectiveness; 4) reduction in toxicity, mobility, and volume of contaminants; 5) implementability; and 6) cost (*Earth Tech., 1994*).

4.1.2.7 Remedial Investigation, 1992

An RI report was prepared in 1992, which documented the results of the field investigation of more than 50 Study Sites. A HHBRA and Ecological Assessment (EA) report were submitted concurrently with the RI report. The RI divided the UCD into 10 OUs. It is noted that the 10 OUs identified in the RI did not coincide with the OUs as designated in the 1989 FFA. The 10 OUs identified in the RI are described in Table 21.

Table 21: Operable Units identified in the 1992 Remedial Investigation Report

Operable Unit	Location
EWL and associated buildings	Area V
ADA	Area I
Inactive Landfills	Area VI
Remote Munitions Disassembly Area	Area II
DF and southwestern warehouse Area	Area II (off-site)
Sewage Treatment Plant and Vicinity	Area VI
Active Landfill	Area VIII (off-site)
DRMO and other Administration Area sites	Area VII
Chemical Agent/Agent Decontamination Solution Sites outside of the ADA	Area IV
Miscellaneous Sites	Areas III, IV, V, and VI

No Further Action (NFA) was recommended at 16 sites. Additional investigation was suggested at 12 sites. At 30 of the sites, sufficient data was collected to evaluate potential risks associated with the detected contamination, and it was recommended that these sites proceed to an evaluation of remedial action alternatives.

The 1992 Human Health Baseline Risk Assessment evaluated all risks and hazards for all currently exposed populations via all pathways. Under the residential future land use scenario, 30 sites were found to have multiple pathway carcinogenic risk estimates within or exceeding the risk range of 1×10^{-4} to 1×10^{-6}, and 29 sites had non-carcinogenic indices that exceeded 1. Preliminary remediation goals were developed for both soil and groundwater contamination at these sites (*Earth Tech., 1994; Dames and Moore, 1992b*).

4.1.2.8 Human Health Baseline Risk Assessment, 1992

An HHBRA was conducted on the UCD by USATHAMA in August of 1992 as a part of the RI/FS investigations. The objective was to characterize environmental contamination at the Study Sites in terms of potential impacts to human health under current and three potential land use scenarios.

The risk assessment demonstrated that exposure to current populations through all exposure pathways was below the EPA risk range and below a hazard index of 1. Although the risk assessment demonstrated that current exposed populations were not at risk, 30 UCD sites were found to have carcinogenic risks associated with multiple exposure pathways, and 29 sites were found to have hazard indices for non-carcinogenic risks above 1. The results of the risk assessment indicated that these sites may require remedial action (*Dames and Moore, 1993a*).

4.1.2.9 Asbestos Assessment Survey, 1992

The Asbestos Assessment Survey conducted in August 1992 presented the results of an evaluation of 289 buildings at UMDC suspected to have ACM. The report did not evaluate individual igloos; rather, a representative number of igloos were sampled, and it is assumed that all of the igloos are constructed of similar materials. Additionally, the report does not cover buildings in secured areas or those constructed after August 1992, notably the UCDF and associated buildings. The report was divided into a base summary and an individual building report. The base summary described the scope, methodology, and suspected ACM areas. The individual building report detailed the materials sampled, the results, and recommended remedial actions.

Results of the survey found ACM in 121 buildings, 37 of which were damaged to an extent greater than 10 percent, and 15 that were damaged to an extent of between 3 and 10 percent. Fifty-two buildings were significantly damaged, but only in isolated areas, such as attics and crawl spaces. Based on these findings, ACM removal was recommended in 58 buildings at UMDC, and included buildings that were in isolated areas of the installation or that were inactive buildings. The recommended ACM removal actions at all 58 buildings were accomplished during the fall of 1994 (*Dames and Moore, 1992a; Earth Tech., 1995*).

4.1.2.10 Supplemental Remedial Investigation, 1993

A Supplemental Remedial Investigation (SRI) report was prepared in September 1993 to provide information on: 1) 13 additional site areas; 2) areas of Site 12 (Inactive Landfill); and 3) 79 PCB transformer areas that were not included in the RI report. The purpose of the SRI was to document the results of the field investigations, such as the monitoring well installation, sampling of soil and groundwater, reporting of sample chemical analyses, aquifer testing, and other field activities. This documentation helped to present site-specific physical characteristics and to verify and characterize any contamination present at the SRI sites and transformer locations.

Seven sites were recommended for NFA, including: the Inactive Landfill, four sites located within the former DRMO area, one site in the Deactivation Furnace and Southwestern Warehouse Area, and one site located in Igloo Block C. Eight sites were recommended for further evaluation of remedial action alternatives. These sites are located in: the PCB transformer areas; Igloo Block C; Igloo Block H; the area north of the Explosives Washout Lagoons; the area north of the WWTP; the area east of the ADA near the northern installation fence boundary; the Deactivation Furnace Area;

and the former DRMO area. PCB transformer locations recommended for further evaluation are located throughout the installation (*Earth Tech., 1994; Dames and Moore, 1993c*).

4.1.2.11 Supplementary Baseline Risk Assessment, 1995

A Supplementary Baseline Risk Assessment was conducted in conjunction with the SRI. For this assessment, analytical results from samples collected were used to calculate risk at the sites investigated. Risks and hazard indices were calculated for currently exposed populations via all exposure pathways. Calculations of less than 10^{-6} and hazard indices of 1 or less were determined to have no risk. Five land use scenarios were used: light industrial, military, construction, agricultural, and recreational. The SRI determined that 10 sites and 73 of the 79 PCB transformer sites did not contain COC and thus required no risk calculations. Using the most conservative residential future land use scenario, the risk calculations determined that three sites had calculations in excess of 10^{-6}, one of which had a hazard calculation greater than 1; six transformer locations had calculated risks of 7×10^{-6}, due to the presence of PCB 1260. None of the supplementary sites had concentrations that resulted in unacceptable exposure levels for future use. For current land use conditions, all calculated risk was below the EPA risk range, and hazard indices were less than 1.

4.1.2.12 Underground Storage Tank Investigation Report, 1995

A UST Investigation was completed in June 1995 to evaluate whether any USTs had leaked or were leaking their contents, and what effect such leakage might have on the surrounding soil and groundwater. The report presented results of the field investigation, which included:

- Identifying the presence of USTs via geophysical survey.
- Identifying the contents of the USTs including chemical analyses of unknown substances.
- Performing leak testing to determine tank integrity.
- Conducting soil, soil gas, groundwater sampling and/or monitoring well installation.
- Evaluating the data generated during the investigation.

Thirty tanks were evaluated for potential leakage. Twenty-one tanks met the state tank tightness criteria and required no immediate action. Two tanks failed the leak tests (UST 2 and UST 12) and were removed under the State of Oregon regulations. Results for tightness tests for seven of the tanks (USTs 17, 18, 20-23, and 25) were inconclusive. The results for these seven tanks were inconclusive because the fuel product in the tanks exhibited unstable temperature readings, which did not allow proper calibration of the testing equipment. Due to these inconclusive results, soil samples were collected for six of the seven tanks. Soil sampling at UST 17 could not be obtained because of security regulations involving the tank's location in the K-Block. Analytical results for all tests are available in the 1995 UST Investigation Report (*Dames and Moore, 1995*). A summary of results for the seven inconclusive tanks can be found in Table 22.

Table 22: UST Soil Sampling Results

UST	Soil Samples	Conclusions / Recommendation
17	No	Recommendations for UST 17 were that UCD should collect several soil samples adjacent to UST 17, the tank/pipeline juncture, and the pipeline to evaluate the potential for contamination. Samples should be collected from a depth of approximately 10 feet near the tank and 6.5 feet near the pipeline. The samples should be analyzed for TCL VOCs, TCL BNAs, and TPHs.
18	Yes	Tank leak test results were inconclusive. No TCL VOCs were detected in soil at UST 18, and TPHs and one TCL BNA were detected in only one sample, each at low concentrations. Because the potential for contamination at this tank is low, no immediate action was recommended for UST 18.
20	Yes	Tank leak test results were inconclusive. TPHs were detected at low to high concentrations in soil at UST 20, indicating that fuel stored in this tank has leaked to the surrounding soil. Therefore, it was recommended that UST 20 be excavated and removed, and that the contaminated soil surrounding the tank be excavated and properly disposed.
21-23	Yes	Tank leak test results for USTs 21 to 23 were inconclusive. No TCL VOCs, TCL BNAs, or TPHs were detected in soil at the tanks. No immediate action was recommended for USTs 21 to 23, because the potential for contamination was found to be low.
25	Yes	Tank leak test results for UST 25 were inconclusive. Petroleum hydrocarbons were detected in only one soil sample, at a low concentration. Because the potential for contamination was found to be low, no immediate action was recommended for UST 25.

Notes: BNAs = Base-neutral and acid extractable organics; TCL =Target Compound List; TPHs = Total Petroleum Hydrocarbons; VOCs = Volatile Organic Compounds, Source: *Dames and Moore, 1995*

For the seven tanks with the inconclusive results and the two tanks that failed testing, a total of 151 soil samples were collected from 35 borings drilled adjacent to the tanks and fuel supply lines. These samples were analyzed for VOCs, TPH, and BNAs.

The results of the geophysical survey indicated the presence of USTs was unlikely at 10 UST locations, potential at 3 UST locations, and likely at 1 UST location. NFA was recommended at the 10 locations where USTs were unlikely, and excavation was recommended for the remaining geophysical locations.

The analytical results of the soil gas survey at 17 sites indicated that soil contamination at sites 73 and 74 was potentially significant. It was recommended that soil samples be collected from borings to confirm contaminant concentrations. The remaining soil gas sites contained low to trace concentrations of VOCs, and thus NFA was necessary (*Earth Tech., 1994; Dames and Moore, 1995*).

4.1.2.13 Radon Screening of Buildings, 1993

Two radon surveys were conducted and reported in August 1993, including a 12-month survey from August 1990 to August 1991, and a 90-day survey from January 1993 to April 1993. In total, radon levels in 252 separate buildings and structures at UCD were evaluated. Based on survey results and in accordance with EPA guidelines, the report recommended that NFA was necessary in 121 buildings where radon gas concentrations did not exceed the detection limit of 0.5 pCi/L.

Seven of the 84 igloos that were subject to the 90-day test had radon gas concentrations ranging from 4.1 to 16.9 pCi/L. Of these seven igloos, three were located in Block D, three located in Block E, and one in Block H. No action was recommended for these seven igloos, based on the fact that these igloos were not occupied. The survey found that Building 1 displayed radon concentrations slightly above the recommended value of 4 pCi/L. The short-term survey for Building 415 displayed radon concentrations that ranged from 1.1 to 5.1 pCi/L. The report recommended that mitigation measures be considered for Building 1 and Building 415 (*Dames & Moore, 1993b*).

A follow-up document in 1993 showed that to mitigate effects from radon, employees had been moved so that Building 415 was not occupied on a routine basis. Building 1 was still occupied on a routine basis, and therefore actions to reduce radon levels to less than or equal to 4 pCi/L was to be accomplished by installing an exhaust fan in the mail room, where radon concentration exceeded the EPA limit. An exhaust fan has been installed in Building 1 to reduce the radon level (*UCD Personal Communication, 2009-10; UCD Archive Document, 2002; Umatilla Depot Activity [UMDA] Radon Program 23 June, 1993*).

4.1.3 Military Munitions Response Program

The National Defense Authorization Act of 2002 modified DERP to address Military Munitions Response Program (MMRP). The Army's cleanup process follows the requirements of the NCP as promulgated under CERCLA and amended by the Superfund Amendment and Reauthorization Act (SARA). The MMRP was established to address UXO, discarded military munitions (DMM), and munitions constituents. The ADA Area I is the only location on the Subject Site that is a current MMRP site. The Quality Assurance Function Range (Study Site 39) also is an MMRP site and is located adjacent to the northeast of the Subject Site, in Area VIII.

4.1.4 Compliance Cleanup

Compliance cleanup activities at UCD are differentiated from CERCLA/IRP related actions because they are regulated under other statutes, such as RCRA Subtitle C and D, the Clean Water Act (CWA), and the Clean Air Act (CAA). Compliance activities can be divided into two categories:

1) operational or mission-related activities necessary for the normal operations of UCD, and
2) closure-related activities necessary for base closure. Table 23 is reposted here from the BCP report, which describes the mission/operational-related and closure related compliance projects for UCD (*Earth Tech., 1995*).

Table 23: UCD Mission-Related and Closure-Related Compliance Projects

Project	Status	Regulatory Program
Mission/Operational-Related Compliance Projects (Table 3-3 of BCP Report*)		
Hazardous Waste Disposal	Ongoing as required. Hazardous materials and SPCC Plan maintained.	SARA Title III and Facilities Management Regulations
Worker Training	Training scheduled.	RCRA, SARA Title III, and Facilities Management Regulations
Air Quality Permit	Facility boilers are only units currently permitted. Ammunition demolition in ADA as required under new mission will also require a permit.	State of Oregon Clean Air Quality Act Program
Solid Waste Disposal	Ongoing as required. Solid waste disposed of at off-site landfill.	State of Oregon Solid Waste Disposal Permit Program
Wastewater Discharge Management	Permit may be required for discharge from ammunition demolition in ADA Area as required under new mission.	State of Oregon Pollutant Discharge Elimination System Permit Program
Closure-Related Compliance Projects (Table 3-4 of BCP Report)		
Depot-wide Asbestos Removal	Friable ACM identified in the asbestos survey removed in fall of 1994.	Clean Air Act/OSHA 29 CFR 1910.1001
Deactivation Furnace Soils OU	Remediation of lead-contaminated soil is ongoing and expected to be completed in FY 1995 under IRP.	CERCLA/RCRA
Solid Waste Landfill	No longer accepting solid waste.	RCRA, Subtitle D
Lead-Based Paint	Paint survey of LBP to be conducted in FY 1995.	AR 200-1 and the US Army Policy Memorandum “Lead-based Paint and Asbestos in US Properties affected by Base Closure and Realignment,” 15 November 1993
ADA Area OU	Remediation is to begin under IRP once Draft ROD is signed.	CERCLA/RCRA
UST Management	Compliance activities are continuing.	RCRA, Subtitle I
Radon Testing	Completed.	AR 200-1, Chapter 11; US Army Radon Radiation Program

4.1.5 CTT and Munitions and Explosives of Concern Inventory

An inventory of Closed, Transferring, and Transferred (CTT) ranges and sites with Munitions and Explosives of Concern (MEC) was conducted at the UCD during 2003. The results identified two closed ranges totaling 2,132.79 acres at the installation, and four closed MEC sites totaling 43.53 acres. As a part of the inventory, an assessment of the explosive constituents safety risk was conducted for each of the six sites using the RAC process. The RAC is a priority sequencing score generated for a range or site with UXO and DMM and is based on the munitions determined to have been used, discarded, or disposed of at the site. The RAC might not reflect the current risk, as it does not take into account cleanup actions. The scores are as follows:

- RAC 1 - High Risk, indicating the highest priority for further action;
- RAC 2 - Serious Risk, indicating a priority for further action;
- RAC 3 - Moderate Risk, recommending further action;
- RAC 4 - Low Risk, recommending further action; and
- RAC 5 - Negligible Risk, indicating that no DOD action is necessary.

Sites where no RAC score was given indicates that the site is either a munitions constituent site or that the site is not eligible for Defense Environmental Restoration Program (DERP) Table 24 summarizes the CTT ranges and site details for UCD.

Table 24: Closed, Transferring, and Transferred (CTT) Ranges and Site Details

Range	Area	Status	Acreage	Current use	Historic Use	RAC
Ammunition Demolition Activity (UMAD-148)	1	1950-1994 Military Munitions Response Program (MMRP) Closed	1,741.04	Undeveloped	OB/OD Burial Pits	1
Drill and Transfer Site (UMAD-119)	IV	1984-1985 Closed	6.08	Undeveloped	Munitions were drilled, drained, and decontaminated in a mobile unit; agent waste placed in holding tanks	NA
Explosive Washout Lagoons (2) (UMAD-023 and -024)	V	1955-1965 Closed	1.63	Undeveloped	Bomb washout effluent treatment	NA
GB Bomb Disassembly Area (UMAD-039)	VI	1965-1970 Closed	34.19	Undeveloped	Drain and disassemble bombs with GB	NA

Range	Area	Status	Acreage	Current use	Historic Use	RAC
Gravel Pit Disposal Area (UMAD-108)		1940-1969 Closed	1.63	Undeveloped	Burial Pits GB and VX decontamination solution disposal	NA
QA Function Range (UMAD-001-R-01)	Off-site	1945-1975 MMRP Closed	391.75	Undeveloped Falls within safety arc of chemical demil Incinerator project	R&D Small Arms Rifle Range	3
TOTAL ACREAGE			**2,176.32**			

Source: *Range Inventory Report 2003.*

The two ranges identified during the inventory include the ADA and the Drill and Transfer Site (DATS) in K-Block (Study Site 49), both located on the Subject Site. As discussed previously in this report, the ADA was used to dispose of conventional ordnance and other ammunition wastes by burning, detonation, and burial of munitions such as land mines, rockets, propellants, flares, and GB and VX decontamination solution. A geophysical survey has been completed and a second geophysical survey is planned. Cleanup of the MEC has yet to be completed. The DATS (Study Site 49) was the location of a mobile unit used between 1984 and 1985 to dismantle and dispose of leaking chemical munitions. Drained chemical agents were stored in holding tanks. This site where the mobile unit DATS operations were conducted was investigated in the 1990 Enhanced PA and no contamination was detected.

The four MEC sites identified in the CTT are: 1) the EWL (Study Site 4); 2) the GB Bomb Disassembly Area (Study Site 9); the Gravel Pit Disposal Area (Study Site 33); and the Quality Assurance (QA) Function Range (Study Site 39).

- EWL Site 4 is approximately 1.63 acres in size and was used from 1955 to 1965 to collect liquid waste from the Explosives Washout Plant. Ordnance were disassembled and the explosive residuals removed via the use of water or steam cleaning. Remediation is currently complete for the soil contamination under IRP, but is ongoing for contamination found in the groundwater.
- The GB Bomb Disassembly Area (Study Site 9) is located east of the ADA and was used from 1965 to 1970 to disassemble conventional munitions, on a concrete pad, under a metal pavilion. This site was investigated during the 1992 RI/FS and it was determined that no additional response was necessary under IRP.
- The Gravel Pit Disposal Area (Study Site 33) is located in the central part of UCD, and it was reported that VX decontamination solution was disposed of here. Soil samples collected during

the 1992 Remedial Investigation determined no form of agent or degradation product was present in the soil, and thus no response was necessary under IRP.

- The QA Function Range (Study Site 39) is located adjacent to the northeast corner of the Subject Site. From 1945 to 1975 this site was used as a rifle and pistol range, and from 1945 to 1970 flares, photoflash grenades, and mines were tested in the southern part of the site. A geophysical survey of the site has been conducted and remedial actions (RA) have been completed. NFA at the QA Function Range (Study Site 39) is deemed necessary. Study Site 39 will continue to be included in the 5-year review process to ensure the remedy remains protective of human health and the environment.

4.2 CLOSED RESPONSE ACTIONS

As discussed in Section 4.1.1.1, RODs have been executed for the 8 OUs located at the UCD. Agreement among the Army, Oregon DEQ, and UCD has been reached regarding NFA at five of the eight OUs: EWL - Soils OU; EWL - Plant OU; Inactive Landfill OU; Miscellaneous Sites OU; and the Deactivation Furnace OU. Response actions continue at the EWL - Groundwater OU; the ADA OU; and the Active Landfill OU. The following OU response actions on the Subject Site have been closed:

Explosive Washout Lagoon - Soils OU (Area V): Biotreatment was completed as the chosen remedial action in May 1997. The Explosives Washout Lagoons Soils OU is now closed out.

Explosive Washout Lagoon - Plant OU (Area V): The Explosives Washout Plant remediation was completed in 1998, and the plant has now been closed out.

Inactive Landfills OU (Area VI): As indicated in Section 4.1.1.1, A ROD for no action was executed in 1993 for the 6 discrete former disposal areas comprising the Inactive Landfilsl OU located west of Area VII in Area VI. However, evidence of continued use of the Inactive Landfills for disposal of construction debris and potentially other materials, could invalidate the 1993 finding.

Miscellaneous Sites OU (Multiple Areas): In accordance with the 1994 ROD, cleanup at Sites 22, 26, and 36 were completed. Soils at the remaining 29 Sites were determined to present acceptable human health and environment risks and NFA was taken at these sites.

According to Mr. Mark Daugherty, UCD BRAC Coordinator, UCD plans to augment the current pump and treat system for the EWL -Groundwater OU in Area V to increase the efficacy of removal of explosives constituents from the groundwater. He indicated the ROD for the EWL - Groundwater OU includes a stringent cleanup goal to meet residential cleanup standards; he stated that UCD may revisit the groundwater cleanup standard and negotiate a more applicable industrial cleanup standard in the future.

Mr. Daugherty also indicated that UCD plans conduct a second clearance survey at the ADA OU in Area I in an attempt to reach UXO and munitions at a depth up to 4 feet below ground surface.

Quarterly groundwater monitoring is ongoing at the Active Landfill OU in Area VIII; however, Mr. Daugherty indicated that UCD, EPA, and DEQ will be discussing the need to continue groundwater monitoring at this closed landfill. According to the ROD, groundwater in the vicinity of the landfill was affected only by selenium at concentrations slightly greater than background.

Mr. Daugherty added that UCD will be responsible for decommissioning the many groundwater monitoring wells across the UCD installation, once remediation is complete.

5.0 FIELD RECONNAISSANCE

A physical reconnaissance of the Subject Site was conducted the week of 10 January 2011. During the week of the field reconnaissance the Army granted access to all areas of the Subject Site with the exception of Area I and Area IV. The AMEC field team was accompanied by Mr. Jim Arnold, the OMD Environmental Restoration Manager.

The purpose of the field reconnaissance was to identify potential releases or locations where historical releases may have occurred, but where visual surface indicators are no longer present. The results from previous investigations conducted at the subject site were used to guide the field reconnaissance, with special emphasis on areas with the potential for subsurface releases. During the field reconnaissance, buildings and structures were visually inspected for the presence of hazardous building materials, including ACM, lead based paint, and materials containing PCBs.

Photographs of Areas III-VI were taken during the field reconnaissance using a camera equipped with an integrated global position system (GPS) receiver with embedded location coordinates and directional views. Selected photographs of each Area are plotted on Field Reconnaissance Maps, Figures 6 through 11. Subject Site Photographs are included in Appendix O. Study Sites identified from previous environmental investigations were located in the field for inspection by AMEC field reconnaissance personnel. Study Sites from previous environmental investigations are discussed at length in the USACE-Seattle June 2010 ECOP report (*USACE, 2010*).

5.1 ECOP CATEGORY DESIGNATIONS

ECOP Category designations are identified in the text, where appropriate, for every former Study Site as well as additional locations identified as a result of the January 2011 field reconnaissance and research. As discussed previously in this report, it should be noted that Study Site numbers were re-designated using a sequential numbering system in the June 2010 ECOP Report. Therefore Study Site numbers do not correlate with property identification numbers. The ECOP Categories are summarized in the Executive Summary table ES-1 as well as in Table 26. The ECOP Summary Table at the back of this report provides an expansive discussion on the rationale for the ECOP designation as well as an indication of whether that ECOP category represents a REC, historic REC, data gap, or de minimis condition.

5.2 SITE-WIDE OBSERVATIONS

With the exception of Area VII, all buildings were vacant and at the time of the field reconnaissance and the majority of buildings were inaccessible because they were locked or not safe to enter. The majority of observations of building interiors were viewed from windows and doorways.

Observations applying to all accessed areas of the Subject Site are discussed in the following sections.

5.2.1 Railroad Loading Piers

The railroad loading piers are the 800-series buildings located in Areas III, IV, V, and VI. The piers are of concrete construction and suspect asbestos and lead-containing materials appeared to be located within the buildings. Possible lead-containing paint chips were in pieces and scattered around the buildings due to weathering and lack of building maintenance.

5.2.2 Igloos, Safety Shelters, and Y-sites

Representative igloos in Blocks F, G, I, and J, as well as smaller safety shelters positioned throughout the igloo Blocks, were observed to have suspect ACM tar coating between the interface of the roofs and soil caps. Fire doors on igloos were observed to have suspect ACM. K-Block igloos were not accessible during the field reconnaissance; however, K-Block igloos are constructed similar to the other UCD igloos.

5.2.3 Suspect ACM and Lead-based Paint

Suspect ACM were observed in many buildings throughout Areas I, III, IV, V, VI, and VII, which may not have been previously identified and/or sampled. Examples of suspect hazardous building materials observed during the field reconnaissance include the following.

> **Areas I and III:** cementitious piping (Building 622/624); window glazing, window/doorframe sealant, and electrical wire wrap (Building 605); magnesia-block piping insulation, mastic dots associated with fiberglass ceiling insulation (Building 608);
>
> **Area V:** Cement asbestos board electrical arc shields/fuses, window glazing, roofing (Building 426); fire door and window glazing (Building 442); fire door and electrical wire wrap (Building 447);
>
> **Area VI:** Vinyl floor tile, cove base, ceiling tiles, and gypsum wallboard (Building 402); boiler gaskets, firebrick, window glazing, exhaust vent tar, chimney tar, bituminous waterproofing tar on foundation;
>
> **Area VII:** Vinyl floor tile, asphalt shingles scattered on ground around railroad tracks (Building 19), boiler room ceiling (Building 10), and scattered firebrick (north of Building 19); potentially old electrical insulators (stored in Building 19).

Cementitious siding also was observed at pier dock supply buildings along the railroad lines in Areas III, V, and VI. The siding material was observed on the ground around building perimeters and adjoining roadways where the material is crushed by passing vehicle traffic, potentially creating a friable state of asbestos-containing material.

Cementitious siding, roofing materials, window glazing, and numerous other confirmed ACMs were readily observed in building debris scattered around the structures due to weatherization and lack of building maintenance. Federal regulations require "poor" condition ACMs be immediately abated and properly disposed.

Personnel interviews indicated cementitious piping was utilized for drain and steam piping; therefore, transite piping is assumed to be located in the subsurface around the buildings throughout the Subject Site.

Previous paint chip surveys have been performed at UCD to identify lead-containing paint (greater than 1.0 mg/cm^2). Prior surveys did not include igloos or railroad transfer depots; both sets of structures were confirmed to have paint during AMEC's field reconnaissance. Suspect LBP was observed on many buildings throughout Areas I, III, IV, V, VI, and VII, which may not have been previously identified and/or sampled. The OSHA considers any detectable concentration of heavy metal to be a potential hazard during construction activities. Additional sampling for LBP would be needed prior to any renovation or demolition.

5.2.4 Instrument Air Monitoring Buildings

Instrument Air Monitoring Buildings were observed throughout the perimeters of the UCD and were observed to be in good condition with no apparent regulated building materials.

5.2.5 Universal Waste

Materials that may classify as universal hazardous wastes were observed in buildings located in all areas of the Subject Site. Such materials included mercury-containing fixtures (fluorescent light tubes, high-intensity discharge lighting, and thermostats), CFC-containing equipment (air conditioners), and PCB containing items (light ballasts).

5.2.6 Other Site-Wide Observations

Evidence of the following was not observed in any area of the Subject Site at the time of the field reconnaissance:

- wetlands or wetland-type vegetation.
- debris or refuse along roadways.

- stressed vegetation.
- areas of ponded water.

5.3 AREA I - AMMUNITION DEMOLITION AREA

Area I - ADA observations were made from adjoining roadways on 10 January 2011. Area I photograph locations and observations are shown on Figure 6.

At the time of the field reconnaissance, access to Area I was limited to Buildings 622 (firing range bunker) and 624 (change house) located along the east-central boundary of Area I. The south and east perimeters of Area I also were viewed from adjoining roadways. As discussed in Section 4.1, Area I currently is undergoing additional investigation and cleanup under CERCLA for past practices related to range uses and burial, detonation, and open burning of munitions and other solid wastes.

Area I is located at the far west end of the UCD installation and is an approximately 1,270-acre rectangular parcel as shown on Figure 6. The topography of Area I ranges from level to gently rolling. Area I is undeveloped, with the exception of the south end where two firing ranges are located. The firing ranges currently are being utilized by OMD and UCDF security staff. No evidence of past Area I activities (detonation, demolition, munitions burial, etc) was observed from adjoining roadways. AMEC personnel discussed past ammunition demolition activities in Area I - ADA with Mr. Doug Barnett, UCD Public Works Director. Mr. Barnett's description of the general methodologies for detonating munitions at the ADA, are presented in the interview report, Appendix E.

The following Area I - ADA Study Sites were identified from previous reports:

Study Site 7 - Aniline Pit	Study Site 29 - Septic Tanks
Study Site 8 - Acid Pit	Study Site 31 - Pesticide Pits
Study Site 13 - Smoke Canister Disposal Area	Study Site 32 - Open Burning Trays
Study Site 14 - Flare & Fuse Disposal Area	Study Site 38 - Pit Field Area
Study Site 15 - TNT Burn Area	Study Site 41 - GB/VX Decontamination Solution Burial Areas
Study Site 16 - Open Detonation (OD) Pits	Study Site 54 - Possible Disposal Pit Location
Study Site 17 - Above Ground OD Area	Study Site 55 - Trench/Burn Field
Study Site 18 - Dunnage Pits	Study Site 56 - Munitions Crate Burn Area
Study Site 19 - Open Burning (OB) Trenches	Study Site 57 - Former Pit Area Locations
Study Site 20 - OB Areas	Study Site 58 - Borrow/Burn/Disposal Area

Study Site 21 - Missile Fuel Storage Areas	Study Site 59 - GB/VX Decon. Solution Disposal Area
Study Site 28 - Fuel Burning Area	Study Site 60 - Active Firing Range

5.3.1 Buildings and Structures

Due to access restrictions, only Buildings 622 and 624 and the immediate vicinity were accessible during the field reconnaissance. Building 622 and Building 624 were vacant at the time of the reconnaissance; and the interiors of each building were not accessible.

5.3.2 Fuel Storage Tanks

Reportedly, a boiler had been located in Building 624, which was evident during the field reconnaissance by visible roofing vents. According to UCD records, Buildings 622 and 624 were heated by a furnace located in Building 624. A UST that fueled the furnace was removed in 1995 (*USACE, 2010*). No visual evidence of USTs or ASTs associated with Building 622 and 624 was identified at the time of the field reconnaissance.

5.3.3 Storage Areas and Sheds

No storage sheds were identified in Area I - ADA, as observed from adjoining roadways. Small shelters associated with the firing ranges were observed at the south end of Area I. The shelters were open structures that appeared to be used as covers for military personnel during training.

5.3.4 Chemical Materials

No evidence of chemical materials was observed on Area I - ADA as observed from adjoining roadways.

5.3.5 Refuse and Debris

Five-gallon sized oil cans were observed to the west of Building 624. No other debris or obvious signs of waste disposal was observed around Building 622 and 624 at the time of the field reconnaissance.

5.3.6 Drainage and Drywells

No drywells were observed around Buildings 622 and 624 at the time of the field reconnaissance.

5.3.7 Fill Areas

No fill areas were observed in the vicinity of Buildings 622 or 624 at the time of the field reconnaissance.

5.3.8 Water Wells and Water Service

Water service was observed in Buildings 622 and 624. A vault was observed to the north of the two buildings and may have been associated with the water service. However, the vault was not accessible. Reviews of investigation reports indicate groundwater monitoring wells are located in Area I. However, the number and location of groundwater monitoring wells could not be determined in the field.

5.3.9 Sewer and Septic Systems

At the time of the field reconnaissance, Building 622 appeared to have a septic tank and an associated leach field to the west of the building. Suspect asbestos transite piping was exposed near the building and appeared to be directed into the leach field.

5.3.10 Electrical Utilities and Transformers

One pole-mounted transformer was observed to the east of Buildings 622 and 624. Although the transformer did not display labeling with regards to PCB content, the transformer appeared to be in good condition, with no signs of leakage or staining on the ground surface beneath the unit.

5.4 AREA II - DEACTIVATION FURNACE AREA

Only 35.88 acres of the larger 1,022-acre Area II - Deactivation Furnace (DF) is part of the Subject Site. Previous reports documented Study Site 34 - Paint Spray and Shot Blast Area in the Subject Site portion of Area II. At the time of our field reconnaissance, the Study Site 34 area appeared to be vegetated, with no evidence of past activities.

5.5 AREA III - WEST CENTRAL

The northern two-thirds of Area III-West Central (2,550 acres) is part of the Subject Site and is bordered on the west by West Patrol Road and Larch Road, on the east by Juniper Road and Ironwood Road, and on the north by the UCD installation fence line. Observations of Area III-West Central were made 10 to 13 January 2011. Photograph locations and observations of Area III are shown on Figure 7. The southern third of Area III is located south of the Subject site and is occupied by the H-Block Igloos. Area III is sparsely developed with igloos and buildings where former ammunition renovation, munitions disassembly, and munitions storage operations were conducted.

The topography of Area III ranges from level to gently rolling. No installation activities currently take place in Area III. AMEC personnel discussed past ammunition disassembly activities in Buildings 608 and 614 with Mr. Doug Barnett. Mr. Barnett’s description of the disassembly and repackaging activities in these buildings is provided in this section and is presented in the interview report in Appendix E.

The following Study Sites were identified for Area III from previous reports.

Study Site 9 - GB Bomb Disassembly Area	Study Site 66 - Brass, Copper and Steel Storage Area
Study Site 29 - Septic Tanks	Study Site 78 - Buildings 608 and 614 Heat Exchange Systems
Study Site 45 - Building 612 and Building 617 Boiler Discharge Areas	Study Site 81 - Former Raw Material Storage Locations
Study Site 65 - Waste Paint and Solvent Disposal Area (Building 608)	Study Site 82 - Former Gravel Pit/Disposal Location

5.5.1 Buildings and Structures

Area III - West Central contains the following buildings and structures:

I-Block Igloos	I-Block Guard Sheds
Building 457	Buildings 601-606, and 623 (Study Site 9)
Buildings 608-612 (Study Sites 45, 65, & 78)	Buildings 614-617, and 619 (Study Sites 45 & 78)
Buildings 613, 618, and 621	Building 670
Former building foundation NE of I-Block	Former Gravel Pit/Disposal Area (Study Site 82)

The only structures in use at the time of the field reconnaissance were air monitoring instrument stations, Building 670 (security gate building), Building 618 (water tower), Buildings 613 (Well house for Well 7), and Building 621 (Well House for Well 6). The majority of buildings in Area III were inaccessible during the field reconnaissance, have not been in used for more than 20 years, and due to weatherization and lack of upkeep, the buildings are severely dilapidated. Most of these buildings had animal feces up to three feet deep throughout the interior flooring, as visible through the exterior windows.

5.5.1.1 I-Block Guard Sheds

Guard sheds were observed at six locations around I-Block. The sheds were constructed in late 2001 to monitor security of ammunitions stored at I-Block after the events of 9/11. Each guard shed was observed to be a 5-foot by 5-foot wood structure situated atop a concrete-lined earthen mound. One guard shed was entered during the field reconnaissance to observe interior finishes. No paint or finishing building materials were observed.

5.5.1.2 Building 457 (Guard House)

At the time of the field reconnaissance, Building 457 was vacant and not accessible. Records indicate that the building was constructed in 1962, with some renovation work performed in 2001 (*USACE, 2010*). The exterior of the building was constructed of concrete and did not appear to be the original 1962 construction. The interior of the building, as observed through windows, appeared to contain building materials associated with the original structure. A CFC-containing air handling unit was located on the roof. Evidence of a septic tank and associated leach field were observed east of Building 457. Building 457 and the associated septic leach field is identified as ECOP Category7 with a property identification number of 117(7)HR(P),PR(P), as shown on Figures 7 and 12.

5.5.1.3 Buildings 601-606 and 623 (Remote Disassembly Area)

The former use of the building cluster known as Remote Disassembly Area (Buildings 601, 602, 603, 604, 605, 606, and 623) was to remotely disassemble munitions for future repair work. The buildings and structures at the Remote Disassembly Area are located centrally in Area III, surrounded by an earthen embankment, which appeared to have been built up using concrete castes from empty munitions shell casings. At the time of the field reconnaissance, Buildings 601 through 606 and 623 were vacant and the interior of each building had limited access. Bird droppings were observed throughout the interiors of the structures, as visible through the windows and open doorways. Building 606 was a former latrine with an open pit for waste Building 605 had an unlabeled tank inside, which appeared to be a pressurized expansion tank for potable water. Electrical vaults were observed outside the buildings, which appeared de-energized and in disrepair. These buildings were identified as ECOP Category 3 with a property identification number of 20(3)HR,PS,A,L(P), as shown on Figures 7 and 12.

5.5.1.4 Buildings 608 - 612 (Ammunition Maintenance and Disassembly)

At the time of the field reconnaissance the Ammunition Maintenance and Disassembly buildings (Buildings 608 through 612) were vacant and the interior of the buildings was inaccessible, with the exception of Building 611. The Ammunition Maintenance and Disassembly buildings were formerly used for ammunition maintenance and disassembly. Bird droppings covered the floors of the buildings to a depth up to 3 feet in some areas, as visible through the exterior windows. The Ammunition Maintenance and Disassembly buildings were heated with a boiler house (Building 612), which supplied steam to the buildings through a pipe chase to the north of Building 608 (munitions disassembly). At the time of the field reconnaissance, the boiler house was not accessible. Two vaults were located adjacent to Building 612 but could not be accessed to determine their use. Buildings 608-612 were identified as ECOP Category 6 with a property identification number of 31(6)HR,PS,A,L(P), as shown on Figures 7 and 12.

A former rail spur was identified to the south of the buildings and appeared to be a “turn-around” area and terminus. Study Site 65 was identified as a waste paint and solvent disposal area near Building 608. No visual evidence of past activities at Study Site 65 were observed during the field reconnaissance; however, Study Site 65 is included in Ammunition Maintenance, and Disassembly area as ECOP Category 6 with a property identification number of 31(6)HR,PS,A,L(P), as shown on Figures 7 and 12.

5.5.1.5 Buildings 614 - 617 and 619 (Ammunition Disassembly and Renovation)

The Ammunition Disassembly and Renovation buildings (Buildings 614 through 617 and 619) were vacant and the interior of each of the buildings was inaccessible. However, observations were made through windows. The Ammunition Disassembly and Renovation buildings was heated by a boiler located in Building 617 (boiler house), which supplied steam to the buildings through a pipe chase located to the east of Building 614. Buildings 614 through 617 were identified as ECOP Category 6, with a property identification number of 28(6)A,HR,PS,L(P), as shown on Figures 7 and 12. Building 619 was identified as ECOP Category 7 with a property identification number of 27(7)R,A(P),L(P), as shown on Figures 7 and 12.

5.5.1.6 Buildings 618, 613, and 621 (Water Tower and Well Houses)

Buildings 618 (water tower), 613 (well house for Well 7), and 621 (well house for Well 6) were observed on the north-central boundary of Area III. Buildings 621 and 613 were modular in construction and appeared to be newer than the reported date of 1955 (*USACE, 2010*). A small un-numbered structure identified with a placard, stating ”danger chlorine”, was located on the same concrete foundation as Building 613 and was assumed to be the tank used to contain chlorine for treatment of water pumped from Wells 6 and 7. A vault was located adjacent to the water tower but was not accessible at the time of the field reconnaissance. Buildings 613, 618, and 621 were identified as ECOP Category 1 with a property identification number of 100(1)PS, A(P), L(P), as shown on Figures 7 and 12.

5.5.1.7 Building 670 (Security Gate Building)

Building 670 is located on the northwest part of Area III, at a security gate entrance to UCD. Building 670 is used by security personnel as a locker room. Building 670 was not accessible at the time of the field reconnaissance.

5.5.1.8 Concrete Foundations

Two foundations for former structures were observed to the northeast of I-Block near the intersection of Road A and North Juniper Road. One foundation was observed to have numerous water pipes and floor drains and that appeared to have been associated with use as a restroom.

The second foundation also was observed to have water pipes and drains. Evidence of a septic tank and an associated leach field were observed in the vicinity of the foundations. This area was identified as ECOP Category 7 with a property identification number of 116(7)HR(P), PR(P), as shown on Figures 7 and 12.

5.5.2 Roadways and Thoroughfares

Asphalt and gravel roadways were observed throughout Area III to access the ammunition renovation and disassembly buildings and I-Block Igloo area. In addition to access roads, approximately 12 roads arranged out in a grid were observed across the north half of Area III. Gravel pads approximately 20 x 50' in size, were overgrown with vegetation. The gravel pads were positioned at regular 500 foot intervals within the roadway grid. Reportedly, "strat-o-lift" transport trucks containing munitions transferred from the railroad piers would be temporarily parked in this area to await a second transfer to one of the inspection, maintenance, or disassembly buildings at UCD (*UCD personal communication, Barnett, 2010*).

5.5.3 Fuel Storage Tanks

Fuel storage tanks or evidence of former fuel storage tanks was observed at the following locations:

Supervault at Building 457: An AST labeled "Supervault" was observed to the west of Building 457. The AST was not labeled with regards to contents, but records indicate it holds diesel. Records indicate a UST near Building 457 was removed in 1992 I (*USACE, 2010*). No evidence of the former UST was observed during field reconnaissance. The Supervault appeared to be in good condition, with secondary containment.

Buildings 608 - 612: Records indicate a UST was located west of Building 612, which was removed in 1995 (*USACE, 2010*). Evidence of excavation was observed west of Building 612; however, the precise location of the former UST could not be determined during the field reconnaissance.

Buildings 614 - 617 and 619: Records indicate a diesel UST was located east of Building 617, which was removed in 1993. A second UST was reported to be adjacent Building 617; however, its contents, size, and removal date were not specified (*USACE, 2010*). During the field reconnaissance, evidence of a former UST consisting of visibly excavated soils and buried plastic sheeting, were observed near Building 617.

5.5.4 Storage Areas and Sheds

No storage areas or sheds were observed in Area III at the time of the field reconnaissance.

5.5.5 Chemical Materials

Evidence of chemicals or former chemicals was observed at the following locations in Area III:

Building 457: A CFC-containing air handling unit was observed on the roof of Building 457.

Building 613: A small structure adjacent to Building 613 was labeled as containing chlorine, for use in the potable water supply system.

Buildings 608 and 614: Previous reports indicate Buildings 608 and 614 were heated with a closed heat exchange system consisting of ethylene glycol solution that runs through a holding tank and piping located beneath the floor (*USACE, 2010*). No evidence was identified indicating the ethylene glycol system had been decommissioned and the chemical removed.

5.5.6 Refuse and Debris

Refuse and debris was observed at the following locations in Area III:

Buildings 601 - 606 and 623: Cementitious siding debris was observed on the hillside adjacent to Building 606. However, no cementitious siding was observed on any of the buildings in the Remote Disassembly Area. It is likely that the cementitious siding was transported by the wind to the observed location.

Buildings 608 - 612: An unknown pressure tank was embedded in the ground, north of Building 612. The tank had a vent pipe discharging vertically out of the tank and piping extending down gradient into topographically lower area. The purpose and content of the tank was not obvious, but writing on the tank indicated it may have contained air.

Buildings 613, 618, and 621: Discarded, un-insulated piping debris was observed in the vicinity of Buildings 613 and 621.

Building 670: Construction demolition debris comprised of concrete and asphalt rubble was observed north of Building 670.

5.5.7 Site Drainage, Catch-Basins, and Drywells

The following site drainage, catch basins were observed in Area III:

> **Buildings 608 - 612:** Two catch basins were located in the east loading dock areas of Building 608. One of the catch basins was observed to contain thick layer of petroleum product. No evidence of spills into the catch basin was observed and field personnel could not determine the origin of the petroleum product at the time of the field reconnaissance. UCD installation maps indicate drywells are associated with Buildings 608.
>
> **Buildings 614 - 617 and 619:** Site drainage from Buildings 614 through 617 and 619 appeared to be directed from a graded area where the buildings were located to a topographically lower area located to the north. Site drainage appeared to be directed by two ditches, one located west of Building 616 and one located west of Building 619. In addition, a discharge pipe was observed to lead directly into the topographically lower area north of Building 614. The topographically lower area north of this building cluster had elevated graded roadways. A culvert was located under one roadway and it appeared any flow would be directed further to the north, away from the buildings.

5.5.8 Fill Areas

Evidence of surface disturbance and potential fill activities were observed at the Former Gravel Pit/Disposal Area (Study Site 82) located south of I-Block. Parts of the Former Gravel Pit/Disposal Area were comprised of gravelly and/or rocky exposed terrain. Construction debris such as metal and concrete were observed at the ground surface; however, the overall type and extent of the fill material at the Former Gravel Pit/Disposal Area was not evident during the field reconnaissance. . Study Site 82 is identified as ECOP Category 3 with a property identification number of 34(3)HR, as shown on Figures 7 and 12.

5.5.9 Water Wells and Water Service

Water service was confirmed at the Buildings 608 through 612, 614 through 617, and 619. No evidence of potable water wells was observed in the vicinity of the buildings; however, as shown on Figure 5, water service connections to the buildings come from the Building 618 (water tower), via Wells 6 and 7.

5.5.10 Sewer and Septic Systems

No evidence of sanitary sewer connections were observed in Area III. The following septic systems were observed:

Building 457: Evidence of a septic tank and an associated leach field were observed east of Building 457.

Buildings 601 - 606 and 623: Building 606 was observed to be a former latrine with an open pit for waste.

Buildings 608 - 612: Evidence of a septic tank and leach field was observed at Building 608.

Buildings 614 - 617 and 619: Evidence of a septic tank and leach field was observed at Building 619.

Foundation Area: A leach field partially covered in gravel was observed approximately 200 feet north of foundation area.

All leach fields associated with septic systems located at UCD represent locations where chemicals could have been disposed. Therefore, all leach field locations are considered RECs at the site.

5.5.11 Electrical Utilities and Transformers

Evidence of current or former electrical utilities and/or transformers were observed at the following locations in Area III:

Building 457: One pad-mounted transformer was located to the north of Building 457. The transformer was in good condition with no visible signs of leaking; however no labeling with regards to PCB content was observed on the unit.

Buildings 601 - 606 and 623: A former substation was observed between Buildings 603 and 604; no transformers present. A single transformer was observed on a utility pole near the former substation. The transformer was not labeled and appeared to be inactive.

Buildings 614 - 617 and 619: A former elevated transformer platform was southeast of Bldg 614; however, no transformers were observed.

Buildings 613, 618, and 621: A former elevated transformer platform substation was observed southeast of Bldg 614; however, no transformers were observed.

Building 670: One transformer was observed adjacent to Building 670 and was labeled as containing less than 50 ppm PCBs.

5.6 AREA IV - NORTH CENTRAL

The Subject Site of Area IV includes 670 acres of western half of K-Block. The primary usage for Area IV is for storage of the HD agent chemical munitions remaining at UCD. Area IV is bounded on the west by Ironwood Road, on the north by the UCD property fence line, on the south by rail lines and J-Block Igloos, on the east by Area VIII, and southeast by the UCDF (in U-Block), see Figure 8. Area IV was observed by driving around a security fence-enclosed road, which surrounds K-Block. The Subject Site portion off K-Block includes 47 igloos. Information describing the number of igloos containing HD agent was not provided; however, several igloos were labeled with placards at the time of the field reconnaissance, indicating that the igloo stored HD agent.

Area IV was not accessible during the field reconnaissance and photography of Area IV was prohibited. Area IV observations were made from adjoining roadways on 10 January 2011. A map showing the location of the igloos and the buildings in K-Block is presented as Figure 8. In addition to the igloos, Buildings 654, 655, 656, and 659 are located within K-Block on the Subject Site. Copies of photographs and floor plans for Buildings 654, 655, 656, and 659 were provided by UCD personnel. Copies of the photographs and floor plans of Buildings 654, 655, 656, and 659 are presented in Appendix P.

5.6.1 Previously Identified Study Sites

The following Study Sites were identified for Area IV from previous reports.

Study Site - 2 Storage Igloos (M-55 Rockets in K-Block, Chemical Waste in J-Block)	Study Site - 49 Drill and Transfer Site
Study Site - 10 Agent H Storage Area	Study Site - 63 Pier 836 Chemical Solution Disposal Area
Study Site - 29 Septic Tanks	

5.6.2 Buildings and Structures

Area IV contains the following buildings and structures located on the west half of K-Block (Subject Site):

Building 654 - Toxic Chemical Munitions	Building 655 - Change House and Laundry
Building 656 - Chemical Laboratory	Building 659 - Former HD agent container warehouse
Building 660 - Guard Shed	47 Igloos and three loading piers

Access to these buildings was prohibited at the time of the field reconnaissance. However, UCD personnel provided a layout plans for the Buildings and photographs of the interiors of Buildings 654, 656, and 659. Layout Plans and photographs for Buildings 656 or 660 were not provided. The buildings were constructed in approximately 1986. Additions were made to Building 655 and Building 656 in 2000.

5.6.2.1 Building 654 - Toxic Chemical Munitions Building

Building 654 was used to conduct maintenance on chemical munitions and is no longer in use. Uses of the building included spray painting within a paint booth and a vapor containment room where maintenance was performed on chemical munitions including bombs and projectiles. Other activities in this building consisted of repackaging and re-stenciling chemical munitions (*UCD personal communication, Ferguson, 2010*). Most of the ammunition peculiar equipment (APE) was removed and photographs show much of the building as empty with the exception of overhead pulleys and conveyor systems and vapor containment equipment. Building 654 was identified as ECOP Category 7 with a property identification number of 102(7)HS,HR, as shown on Figures 8 and 12.

5.6.2.2 Building 655 - Change House and Laundry

Building 655 is the Change House and laundry Building. It maintains a 1,500-gallon septic tank and dosing chamber with three drain fields; and a separate drain field for the laundry wastewater system. The presence of the septic leach field represents a REC for Building 655. Additionally, the lack of information regarding what types of laundry surfactants and/or chemicals were used in the laundry represents a data gap. Like Building 654, Building 655 was identified as ECOP Category 7 with a property identification number of 102(7)HS,HR, as shown on Figures 8 and 12.

5.6.2.3 Building 656 - Chemical Laboratory

Building 656 is the monitoring facility that supports K-Block activities. Hazardous wastes generated from Building 656 include agent-related decontamination and laboratory wastes, such as chemical agent standards, and personal protective equipment. Non-agent related laboratory wastes, such as solvents, acids and plastics, are stored here. Reportedly, there is a satellite accumulation site here for these hazardous wastes *(USACE, 2010).* Like Buildings 654 and 655, Building 656 was identified as ECOP Category 7 with a property identification number of 102(7)HS,HR, as shown on Figures 8 and 12.

5.6.2.4 Building 659 - Former HD Agent Warehouse

Building 659 is a large (300 ft x 150 ft) corrugated metal, double warehouse structure constructed on a concrete foundation. Historically, the building was used to hold containerized HD agent. Photographs of the building interior show a clean concrete floor with steel support beams and a pitched corrugated metal roof. Photographs show an empty building with no containers, equipment, or other materials inside. Like Buildings 654 and 655, and 656, Building 659 was identified as ECOP Category 7 with a property identification number of 102(7)HS,HR, as shown on Figures 8 and 12.

5.6.2.5 Building 660 - Security Building

Building 660 is located at the entrance to K-Block (southwest corner) and contains offices, restrooms with a septic leach field. Like Buildings 654 and 655, 656, and 659, Building 660 was identified as ECOP Category 7 with a property identification number of 102(7)HS,HR, as shown on Figures 8 and 12.

5.6.3 Fuel Storage Tanks

ASTs were visible at multiple locations within K-Block. Area IV could not be accessed to observe for evidence of USTs.

5.6.4 Water Wells and Water Service

Water service is provided to K-Block from Wells 4 and 5 in Area II.

5.6.5 Sewer and Septic Systems

Access was not provided to inspect sewer and septic systems.

5.7 AREA V – EWL/CENTRAL

Area V is1,990 acres and is bordered on the west by Juniper Road, on the east by Rim Road, on the north by Area IV and on the south by Coyote Road and Road J, see Figure 9. The northern half of Area V is occupied by the J-Block Igloos, and the south half is occupied by the G-Block Igloos. Area V is sparsely developed with buildings where former ammunition renovation, munitions disassembly, remediation pump and treat operations took place. Conventional munitions were stored in the igloos of G-Block and J-Block, with the exception of 14 J-Block igloos that currently store agent-related secondary waste. Area V observations were made on 11 to 13 January 2011. Photograph locations and observations of Area V are shown on Figure 9.

Area V is the location of the EWL OU and currently is undergoing CERCLA cleanup. A groundwater pump and treat system is being used to remediate explosives contaminated groundwater from 350 acres between Area V and Area VIII (located to the east of Area V).

The topography of Area V is level to gently rolling for the western two-thirds, while the eastern third is occupied by Coyote Coulee and its eastern ridge. No installation activities currently take place in Area V.

5.7.1 Previously Identified Study Sites

The following Study Sites were identified for Area V from previous reports.

Study Site 2 - Storage Igloos (M-55 Rockets in K-Block, Chemical Waste in J-Block)	Study Site 43 - Former Gas Station/Possible UST Location (Central UMCD Grounds)
Study Site 4 - Explosive Washout Lagoons (North Lagoon of EWL is UMAD-023) & (UMAD-024 for Surface Impoundment Lagoon)	Study Site 51 - Large Open Areas (Vicinity of Coyote Coulee)
Study Site 5 - Explosives Washout Plant (Building 489) (UMAD-022) & (UMAD-042 for Washout Bldg Sump (OU6))	Study Site 52 - Coyote Coulee Discharge Area
Study Site 29 - Septic tanks	Study Site 62 - Paint and Solvent Disposal Area
Study Site 36 - Building 493 Paint Sludge Discharge Area	Study Site 67 - Building 439 Brass Cleaning Operations Area
Study Site 47 - Boiler/Laundry Effluent Discharge Site	

5.7.2 Buildings and Structures

Several buildings formerly located in Area V have been demolished. Area V contains the following current and former buildings and structures:

J- and G-Block Igloos	Building 450
Pump and Treat Building	Building 455
Buildings 356 and 357	Former Gas Station/Possible UST Location (Study Site 43)

Buildings 417, 418, 478, 486, 493, 494, and 495	Large Open Areas and Paint/Solvent Disposal Area (Study Sites 51 and 62)
Building 419	Borrow Pit (Northeast of J-Block)
Building 442	Dunnage and Storage Buildings (400 building series; examples include 426, 427, and 442 Buildings)
Building 447	

Buildings 356, 357, 450, and the Pump and Treat Building were the only buildings in use during the January 2011 field reconnaissance.

5.7.2.1 Pump and Treat Building

The Pump and Treat Building is a large, 2-story metal building with a concrete foundation. It was inaccessible during the site reconnaissance. Due to the materials and recent construction date, the building appeared to be a low risk for hazardous building materials issues.

5.7.2.2 Buildings 356 and 357

Buildings 356 and 357 are unoccupied buildings that appear to be pump stations for the pump and treat remediation system.

5.7.2.3 Buildings 417, 418, 478, 484, 486, 493, 494, and 495 (Ammunition Work Shop Cluster)

The Ammunition Work Shop Cluster, including Buildings 417 (Renovation Building), 418 (Latrine), 478 (Booster Pump House), 484 A & B (Heat Pump and Valve Houses), 486 (Boiler House), 493 (Clean and Paint Shop), 494 (Paint Storage Building), and 495 (Air Compressor Building), were vacant at the time of the field reconnaissance and the interior of each building had limited access. In addition, the Ammunition Work Shop Cluster included concrete foundation pads of former Buildings 489, 490, and 492 that have been demolished and removed, located along the western portion of this cluster. The Ammunition Work Shop Cluster also included dilapidated buildings to the east of Building 417, which were not identifiable and the building numbers are unknown. The Ammunition Work Shop Cluster was heated using boiler located in Building 486, which supplied the buildings through a steam pipe chase. The Boiler House (Building 486) had three boilers, two associated condensate tanks, an oil-fired generator, water heater, and restroom. The Compressor House (Building 495), which is adjacent the Boiler House, was inaccessible during the field reconnaissance. Building 486 included a former chimney, which was sealed closed, with unknown contents. Building 417 is identified as ECOP Category 3 with a property identification number of 119(3)HR, as shown on Figures 9 and 12.

5.7.2.4 Explosive Washout Lagoons/Coyote Coulee Discharge Area (Study Sites 4 and 52)

Study Sites 4 and 52 are associated with the former explosives washout and discharge area, which was remediated in the 1990’s and is located west and below the ammunition work shop area in Coyote Coulee. The Explosive Washout Lagoons and Coyote Coulee Discharge Area included the former remediated lagoon, several monitoring wells associated with the remediation process, and the associated remedy surface cap. The Explosives Washout Lagoons are identified as ECOP Category 5 with a property identification number of 45(5)HR,PS,PR,RAD,A,L,R, as shown on Figures 9 and 12.

5.7.2.5 Building 419 (Former Laundry)

Building 419 was vacant and the interior was inaccessible at the time of the field reconnaissance. A brick chimney stack was observed coming out of the roof on the western part of the building, indicating the existence of a boiler or other heating source. A manhole cover was located at the northwest exterior corner of the building, which was inaccessible and may have been the access hatch to a water well or septic system. A portable gasoline generator and high pressure water system was located southwest of the building. Building 419 is identified as ECOP Category 3 with a property identification number of 118(3)HR,PR(P), as shown on Figures 9 and 12.

5.7.2.6 Building 442 (Black Powder Storage Building)

At the time of the field reconnaissance, Building 442 was vacant and the interior was inaccessible.

5.7.2.7 Building 447 (Transformer House)

At the time of the field reconnaissance, Building 447 was vacant and the interior was inaccessible. A capped pipe drain was located on the exterior west side of the building, which had unknown contents and use.

5.7.2.8 Building 450 (Storage Building for vehicles)

Building 450 was being utilized as RV, automotive, and boat storage. Due to the materials and recent construction date, the building has a low risk for hazardous building materials issues. The building is metal construction with an asphalt interior pad. There was approximately 30 square feet of oil staining on the interior asphalt, possibly as a result of storing vehicles. The staining appeared to be recent and limited to the surface of the asphalt.

5.7.2.9 Building 455 (Pump House Well #3)

Building 455 was a pump house for Well #3, which was unoccupied and inaccessible. Adjacent to Building 455 was concrete foundation pads from a former structure, along with water main piping and what appeared to be an L-shaped fill station device for a truck. Building 455 as well as Building 426 were identified as ECOP Category 7 with a property identification number of 33(7)PS,A(P), L(P), as shown on Figures 9 and 12.

5.7.2.10 Former Gas Station/Possible UST Location (Study Site 43)

Study Site 43 is located to the north of the ammunition renovation building cluster (Buildings 417, 418, 478, 486, 493, 494, and 495). Study Site 43 is identified in report documents as being a former gas station and possible UST location. During the site reconnaissance, this area was observed as being a former borrow pit, which had been littered with miscellaneous construction debris (i.e. metal and concrete). Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material was unclear. Evidence of burning was observed in the center of Study Site 43. A former loading pier was observed near the center of Study Site 43. Adjacent to the loading pier was a former water station and plastic drain piping, which may have been used for vehicle washout. Study Site 43 is identified as ECOP Category 2 with a property identification number of 44(2)PS,PR,CD, as shown on Figures 9 and 12.

5.7.2.11 Large Open Areas and Paint/Solvent Disposal Area (Study Sites 51 and 62)

Study Sites 51 and 62 are located to the north of Site 43. During the site reconnaissance, the Large Open Areas and Paint/Solvent Disposal Area was observed as being a former borrow pit, which had been littered with miscellaneous construction debris, including metal and concrete. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. Study Sites 51 and 62 are identified as ECOP Category 3 with a property identification number of 43(3)HR,CD, as shown on Figures 9 and 12.

5.7.2.12 Borrow Pit (Northeast of J-Block)

A former borrow pit covering approximately 12 acres, was observed adjacent to the northeastern corner of J-Block. This borrow pit was observed to contain miscellaneous construction debris, including metal and concrete. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material was unclear. This borrow pit is identified as ECOP Category 7 with a property identification number of 106(7)CD, as shown on Figures 9 and 12.

5.7.2.13 Dunnage and Storage Buildings (400 building series; examples include 426, 427, and 442 Buildings)

A few of the Dunnage and Storage Buildings appeared to have unmarked former drains on the exterior of the buildings (i.e. Building 442). Also, Building 442 had a large pit that is likely a gravel borrow pit noted in the USACE June 2010 ECOP report. Transite siding, roofing materials, and window glazing were readily observed ACMs, some in pieces and scattered around the buildings due to weatherization and lack of building maintenance. Buildings 426 and 455 are identified as ECOP Category 7 with a property identification number of 33(7)PS,A(A), L(P), as shown on Figures 9 and 12.

5.7.3 Fuel Storage Tanks

Fuel storage tanks or evidence of former fuel storage tanks were observed at the following locations:

Building 486: The Boiler House (Building 486) had a visible UST vent pipe on the south side of the building. According to records, the Boiler House potentially had three USTs (#'s 39, 92, and 98). UST #39 (bunker C) was reportedly removed in 1993. UST #92 was a 1,000-gallon tank with unknown contents and no record of removal. UST #98 was identified as a sludge-filled sump in the floor of the Boiler House (*USACE, 2010*). Building 486 is identified as ECOP Category 3 with a property identification number of 103(3)HS,HR,L(P), A(P), as shown on Figures 9 and 12.

Building 419: An associated propane AST was observed west of Building 419. A concrete pad potentially associated with a former AST was observed adjacent to the propane AST. Also, records indicate that a UST was located south of Building 419, which was removed in 1992. Evidence of excavation was observed south of Building 419; however, the precise location of the former UST could not be determined during the site reconnaissance. Building 419 is identified as ECOP Category 3 with a property identification number of 118(3)HR,PR(P), as shown on Figures 9 and 12.

Building 455: Records indicated a former UST is associated with Building 455, but evidence was not found during the site reconnaissance. Building 455 is identified as ECOP Category 7 with a property identification number of 33(7)PS,A(P),L(P), as shown on Figures 9 and 12.

5.7.4 Storage Areas and Sheds

Storage areas and sheds were observed at the following locations:

Building 442: This building was inaccessible, but was formerly used for black powder storage.

Building 494: This building was formerly used for paint storage and did not show any signs of spilled paint.

5.7.5 Chemical Materials

Chemical materials within Area V were not observed during the site reconnaissance.

5.7.6 Refuse and Debris

A couple of building structures were located to the east of Building 417 that were unidentifiable and dilapidated. Two empty 55-gallon drums were located inside Building 493. Former compressed air and un-insulated steam piping were located in random pieces throughout the building cluster.

5.7.7 Site Drainage, Catch Basins, and Drywells

The following site drainage was observed in Area V:

> **Building 419:** South of Building 419, a rock-lined drainage channel was observed running southward approximately 300 feet. Two large uniform excavated pits were identified approximately 500 feet south of Building 419 and are likely the location of previous soil sampling investigation conducted previously. The west pit was approximately 200 feet by 30 feet and 10 feet deep; the east pit was approximately 800 feet by 60 feet and 12 feet deep. No evidence of recent usage was observed, and vegetation was present in both pits. No documentation was available regarding potential past uses of the pits, and it could not be determined if the pits were associated with Building 419 or the rock-lined drainage channel located south of Building 419. An undocumented fill port and vault with a shutoff valve was located to the southwest of Building 419, which appeared to be a shutoff valve for non-potable water, possibly a former wash station for vehicles. To the southeast of Building 419 was another possible undocumented fill station, which included an electrical hookup. As indicated previously, Building 419 is identified as ECOP Category 3 with a property identification number of 118(3)HR,PR(P), as shown on Figures 9 and 12.
>
> **Building 450:** There was a catch basin located northeast of the building in the parking lot, which showed no signs of sheen or other indications of petroleum.
>
> **Buildings 417, 478, and 493:** Open drains were located on the exterior southeastern corner of Building 478, in the southeast corner of Building 493, and within Building 417 (fire suppression system), which showed no signs of sheen or other indications of petroleum.

5.7.8 Fill Areas

Study Sites 43 and 44, and the Borrow Pit (northeast of J-Block) were observed as being former borrow pits, which had been littered with miscellaneous construction debris (i.e. metal and concrete). Indications of the fill areas were present; however, the overall type and extent of the potential subsurface fill material could not be determined.

5.7.9 Water Wells and Water Service

Water service was confirmed at the Pump and Treat Building, Buildings 356, 357, 419, and throughout the Ammunition Work Shop cluster. Building 455 was Pump House Well #3. Area V includes many monitoring wells, with a majority in the Ammunition Work Shop and Washout Lagoons located below in Coyote Coulee.

5.7.10 Sewer and Septic Systems

Septic systems were identified for the following buildings:

Buildings 417, 418, 478, 486, 493, 494, and 495: Building 418 (Restroom) had a septic tank and an associated leach field. This building also had a large sump pit for the septic system adjacent to a steam pipe trench, assumed to run to Building 486. A septic system and associated leach field were observed south of Building 417; with records indicating they are associated with Building 417.

Building 486: Building 486 contains a restroom, but a septic tank and leach field were not observed or recorded in earlier documents. A trench drain was observed around the boilers in Building 486, which drained to a leach field south of the building. The restroom may have drained to this same area.

Building 419: A septic tank and an associated leach field were observed south of Building 419. Information was not identified to determine if the rock-lined drainage channel located south of Building 419 is associated with the observed septic tank and associated leach field.

Building 450: Evidence of a potential former septic system and associated leach field was observed near Building 450; however, the evidence was not conclusive and records of the septic system were not discovered.

Former Gas Station/Possible UST Location (Study Site 43): An open pit latrine was located at the eastern part of this Study Site.

5.7.11 Electrical Utilities and Transformers

5.7.11.1 Building 356

Three pole-mounted transformers were located adjacent Building 356. The transformers did not show visual signs of leakage.

5.7.11.2 Building 419

Four pole-mounted transformers were observed to the west of Building 419. Staining was observed on one transformer and labels were not observed on any of the transformers.

5.7.11.3 Building 447

Building 447 is an electrical utility facility demarcated as "Transformer House No. 2." The inside of the building was not accessible during site reconnaissance. In addition, a former substation was observed adjacent to Building 447. No transformers were present at Building 447.

5.7.11.4 Building 455

A pole-mounted transformer was located adjacent the building. The transformer did not show signs of leakage and was not labeled.

5.7.11.5 Buildings 417, 418, 478, 486, 493, 494, and 495

A few pole-mounted transformers were located throughout the Ammunition Work Shop building cluster. The transformer did not appear to be operational and did not show signs of leakage. The transformers were not labeled with regard to PCB content.

5.8 AREA VI - SOUTH CENTRAL

Area VI is fully enclosed in the Subject Site and is 1260.84 acres, which is bordered on the west by Juniper Road, on the east by Rim Road, and on the north by Coyote Road and Road J, and on the south by the southern property line, see Figure 10. The western half of Area VI is occupied by the F-Block Igloos, and the eastern half is occupied by Imhoff Wastewater Treatment Plant, the standard magazine buildings (400 series), and numerous borrow pit/landfill area. Photograph locations and observations of Area VI are shown on Figure 10.

The topography of Area VI is level to gently rolling for the western half, while the eastern half is occupied by Coyote Coulee and an eastern plateau. The southern portion of Area VI has been graded for the UCD rail system. No UCD activities currently take place in Area VI, except at the Imhoff WWTP.

5.8.1 Previously Identified Study Sites

The following Study Sites were identified for Area VI from previous reports. ECOP categories are identified below each Study Site.

Study Site 6 - Sewage Treatment Plant	Study Site 33 - Gravel Pit Disposal Area
Study Site 12 - Closed Landfill	Study Site 48 - Pipe Discharge Area
Study Site 29 - Septic Tanks	Study Site 50 - Railroad Landfill Areas
Study Site 30 - Storm Sewer Tile Field	Study Site 64 - Leaking Railcar Shipment Inspection Area

5.8.2 Buildings and Structures

All the buildings were vacant and/or unused at the time of the site reconnaissance. The wastewater treatment facility and 400-series standard magazine buildings were the only buildings in use at the time of the site reconnaissance. Area VI contains the following structures and building clusters:

F-Block Igloos	Suspect Railcar Area (Study Site 64)
Buildings 401-413	Gravel Pit Disposal Area (Study Site 33)
Buildings 415, 416, and 420	Railroad Landfill Area (Study Site 50)
Imhoff Waste Water Treatment Plant (Study Sites 6, 30, and 48)	Abandoned Sanitary Landfill Area (Study Site 12)

5.8.2.1 Buildings 401 - 413 (Standard Magazine Buildings)

The Standard Magazine Buildings (Buildings 401 through 413) are occupied by various tenants. At the time of the field reconnaissance, access was only provided to Building 402. Building 402 was the only building in this cluster that had been renovated in the past to accommodate and office area in the eastern section of the building. Suspect ACM appeared to be located within this area of the building that has not been previously surveyed. Additional sampling will need to be conducted, prior to any renovation or demolition of Building 402. Building 402 had a heat pump. A gravel borrow pit was identified to the west of the Standard Magazine Buildings. Other than suspect ACM, no observations of environmental concern were made to warrant an ECOP category designation for this location.

5.8.2.2 Buildings 415, 416, and 420 (Ammunition Surveillance)

At the time of the field reconnaissance, Buildings 415 (Inspector’s Workshop), 416 (Boiler House), and 420 (Inspector’s Workshop/Breakroom) were vacant and the interior of each building was inaccessible, except Building 415 that had limited access. This cluster of buildings was heated by the boiler located in Building 416, which supplied the buildings through a steam pipe chase to each building. An electrical vault was located north/northwest of Building 416, which appeared de-energized and in fair condition. At the time of the field reconnaissance, Buildings 415 and 420 each appeared to have a septic tank and leach field associated with a restroom

5.8.2.3 Imhoff Wastewater Treatment Plant; Study Sites 6, 30, and 48

At the time of the field reconnaissance, the Imhoff WWTP included two treatment tanks, a chlorine treatment building, and associated gravel leach field. Historical documents identify this cluster of structures as Buildings 428, 443, and 444; however, none of the documents state which number corresponds with each structure and none of the structures were physically labeled at the time of the January 2011 field reconnaissance. The chlorine treatment building was of corrugated metal construction with no suspect hazardous building materials. The interior of the chlorine treatment building was inaccessible. Documentation of for the disposal of the wastewater treatment plant sludge was not provided. The wastewater treatment plant and associated storm sewer tile field and pipe discharge area is identified as ECOP Category 7 with a property identification number of 51(7)HR,PR, as shown on Figures 10 and 12.

5.8.2.4 Stormwater Discharge Pipe

A stormwater discharge pipe, which reportedly conveys stormwater runoff from Area VII – Administration Area, was observed just southwest of the Imhoff WWTP location. The stormwater discharge pipe was located in a ravine that directed runoff from the pipe towards the west and southwest towards the UPRR rail lines along the southern boundary of the Site. The stormwater discharge pipe and the types of runoff conveyed by the pipe represent a data gap that is included in the ECOP Category for the Imhoff WWTP, which is a Category 7, with a property identification number of 51(7)HR,PR, as shown on Figures 10 and 12.

5.8.2.5 Suspect Railcar Area (Study Site 64)

At the time of the field reconnaissance, this area was a rail spur with a terminus east of the Imhoff Wastewater Treatment Plant. Reportedly, the rail spur was formerly used for rail cars with “leaking” munitions. No visible evidence of spills or stains on the ground around the rail spur was observed during the January 2011 field reconnaissance. Study Site 64 is identified as ECOP Category 3 with a property identification number of 50(3)HR, as shown on Figures 10 and 12.

5.8.2.6 Gravel Pit Disposal Area (Study Site 33)

During the site reconnaissance, this area was observed as being a former borrow pit, which had been littered with miscellaneous construction debris (i.e. metal and concrete). Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. Study Site 33 is identified as ECOP Category 3 with a property identification number of 49(3)HR,CD, as shown on Figures 10 and 12.

5.8.2.7 Railroad Landfill Area (Study Site 50)

The abandoned Railroad Landfill Area (Study Site 50) is located along the southern rail lines of the Subject Site. During the site reconnaissance, the Railroad Landfill Area was observed as being a former borrow pit and landfill, which was reportedly closed, but a NFA determination was not identified in the UCD records. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. Study Site 50 is identified as ECOP Category 7 with a property identification number of 52(7)HR,PR,A(P),L(P),CD, as shown on Figures 10 and 12.

5.8.2.8 Inactive Landfill (Study Site 12)

During the site reconnaissance, the Abandoned Landfill Area (Study Site 12) was observed as being a former borrow pit and landfill. This landfill was reportedly closed, but a NFA determination was not identified in the UCD records. During the site reconnaissance, this area was littered with miscellaneous construction debris; including suspect ACM and lead-containing materials. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined.

The Abandoned Landfill Area also had evidence (i.e. targets) of small arms practice ranges. The targets were installed throughout the various elevation grades. It was not clear whether the range was still being utilized, and what type of ammunition was being utilized. Study Site 12 is identified as ECOP Category 7 with a property identification number of 107(7)A(P),L(P),CD, as shown on Figures 10 and 12.

5.8.3 Roadways and thoroughfares

Asphalt and gravel roadways were observed throughout Area VI to access the standard magazine, Imhoff Wastewater Treatment Plant, and F-Block Igloo area.

5.8.4 Fuel Storage Tanks

Buildings 401-413: A majority of the Standard Magazine Buildings were occupied by various contractors, storing miscellaneous compressed gas tanks and propane ASTs. A majority of the ASTs were being stored outside Building 401; approximately 150-200 compressed gas tanks were observed.

Building 415, 416, 420: Records indicated a UST was associated with Building 416; however, a UST was not identified during the site reconnaissance.

5.8.5 Storage Areas and Sheds

Buildings 401-413: At the time of the field reconnaissance, various contractors were using the buildings for storage purposes.

Chlorine Storage Building: The chlorine storage building at the Imhoff WWTP Plant did not actively house personnel; and is assumed to store materials for treating water. The storage building was small and no visible evidence of spills or chlorine or other chemical odors were observed at the time of the January 2011 field reconnaissance.

5.8.6 Chemical Materials

Evidence of chemical materials or locations where chemicals may be located was observed at the following locations:

Building 402: A CFC-containing heat pump was observed on the east side of Building 402.

Chlorine Storage Building: A small building at the Imhoff Wastewater Treatment Plant was labeled as containing chlorine, for use in the potable water supply system.

5.8.7 Refuse and Debris

Building 415, 416, and 420: Building 420 had ACM debris and lead-containing paint chips in pieces and scattered around the building due to weatherization and lack of building maintenance.

5.8.8 Site Drainage

Area VI did not appear to have any water ponding where access was available during the field reconnaissance. The following drainage area observed:

Buildings 428, 443, and 444: The outfall drainage (Study Site 48) from the Ammunition Surveillance building cluster was located approximately 500 yards to the west, which had a mostly empty 55-gallon oil drum, located in the drainage feature.

5.8.9 Fill Areas

Gravel Pit Disposal Area (Study Site 33): During the site reconnaissance, the former borrow pit was observed to be littered with miscellaneous construction debris (i.e. metal and concrete). Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. As discussed previously, Study Site 33 is identified as ECOP Category 3, [49(3)HR,CD], as shown on Figures 10 and 12.

Railroad Landfill Area (Study Site 50): During the site reconnaissance, the Railroad Landfill Area was observed as being a former borrow pit and landfill, which was reportedly closed, but a NFA determination was not identified in the UCD records. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. As discussed previously, Study Site 50 is identified as ECOP Category 7, with a property identification number of 52(7)HR,PR,A(P),L(P),CD], as shown on Figures 10 and 12.

Abandoned Landfill Area (Study Site 12): During the site reconnaissance, the Abandoned Landfill Area (Study Site 12) was observed as being a former borrow pit and landfill. This landfill was reportedly closed, but a NFA determination was not identified in the UCD records. During the site reconnaissance, this area was littered with miscellaneous construction debris; including suspect ACM and lead-containing materials. Indications of a fill area were present; however, the overall type and extent of the potential subsurface fill material could not be determined. As discussed previously Study Site 12 is identified as ECOP Category 7 with a property identification number of 107(7)A(P),L(P),CD, as shown on Figures 10 and 12.

The abandoned landfill area also had evidence (i.e. targets) of small arms practice ranges. The targets were installed throughout the various elevation grades. It was not clear whether the range was still being utilized or not, and what type of ammunition was being utilized.

5.8.10 Water Wells and Water Service

Buildings 415, 416, and 420, At the time of the field reconnaissance, water service was confirmed at Buildings 415, 416, and 420; however, the water source could not be identified. A water well main shutoff was located within a vault located north/northwest of Building 416.

5.8.11 Sewer and Septic Systems

Buildings 401 - 413, At the time of the field reconnaissance, Building 402 was the only building with a septic tank and leach field, which was located to the east of the building.

Buildings 415, 416, and 420, At the time of the field reconnaissance, Buildings 415 and 420 each appeared to have a septic tank and leach field, but no records of Building 415 were found.

5.8.12 Evidence of wetlands

No evidence of ponded water or wetland-type vegetation was observed in Area III at the time of the field reconnaissance.

5.8.13 Electrical Utilities and Transformers

Pole-mounted transformers were present adjacent the buildings within Area VI. The transformers were in good condition with no visible signs of leakage; however no labeling with regards to PCB content was observed on the transformers.

5.8.14 Surface Vegetation

No areas of visibly stressed vegetation or areas devoid of vegetation (indicating potential disposal of hazardous materials) were observed during the field reconnaissance.

5.9 AREA VII - ADMIN

Area VII is 200 acres, and is bordered by Locust Road on the east, a fence line on the north, Rim Road on the West and the UPRR railroad and Kari Street on the south. Area VII is the administrative center for the UCD and is comprised of approximately 57 buildings including offices, security stations, maintenance shops, medical facilities, housing, mess hall, community center, fitness center and pool, warehouses, transportation service buildings, two potable water well houses, and a variety of ancillary buildings. Area VII observations were made 10-13 January 2011. Photographs taken during the field reconnaissance are included in Appendix O. Area VII photograph locations and observations are shown on Figure 11.

5.9.1 Previously Identified Study Sites

The Study Sites identified for Area VII from previous reports are listed in Table 25. A NFA determination has been achieved for the majority of the Study Sites in Area VII.

Table 25: Study Sites Identified for Area VII

Study Site Number	SWMU Name	Description	Final Action or Determination
3	Pier 836 Chemical Solution Disposal Area	Former employees reported that a laboratory trailer was set up in this area in the early 1980s to perform analyses on samples suspected to contain GB or VX agents, and some types of solution were spilled in the area around the trailer.	NFA per DEQ/Army SRI findings
22	Defense Reutilization Marketing Office (former DRMO) area	The former DRMO area was a large, fenced area, approximately 1 acre in size, located between the electrical shop and Building 17. It was used to store various scrap or salvage material until it was taken off the site.	Contaminated soil remediated per June 30, 1994 Misc. Sites OU ROD
23	Building 5 Waste Oil Tank	A 500-gallon underground concrete tank was located outside of the maintenance garage in Building 5. It was used for temporary storage of waste oils prior to their removal.	Per DEQ, contaminated soil may remain in place until access to it improves.
24	Building 10 Waste Oil Tank	A 500-gallon underground steel or concrete tank was located outside of Building 10. It was used for temporary storage of waste oils from locomotive maintenance.	NFA per 1992 DEQ letter
27	Pesticide Storage Building (Building 8)	Building 8 was an enclosed building that stored a minimum supply of pesticides in two bermed compartments.	NFA per Misc. Sites OU ROD, signed June 30, 1994
28	Fuel Burning Area	This area was an open gravel area where missile fuel burning was conducted inside a portable furnace.	Was not found in past field visits
29	Septic Tanks*	19 septic tanks were identified during the RFA.	NFA per Misc. Sites OU ROD, signed June 30, 1994
42	Former Underground Storage Tank (UST) Locations	Eleven USTs were formerly located in the Administration Area near the base gas station in the south-central part of the UCD.	59 soil gas samples were collected during the 1995 UST investigation indicate only trace concentrations of petroleum. NFA recommended per 1995 UST Invest Report.
70	Wood Preserving Solution Spill Area	Located within the former DRMO area and Administration Area, unconfirmed reports indicate that several hundred gallons of wood preservative solution pentachlorophenol (PCP), and, potentially, chromated copper arsenate (CCA) and creosote may have been spilled or dumped in this area.	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Description	Final Action or Determination
71	Possible Fire Training Pits Area	Pits were dug here and filled with flammable liquids such as solvents or oils to conduct fire-training exercises periodically from the 1940s to the 1970s.	NFA per DEQ/Army SRI findings
72	Vehicle Storage Area	Old vehicles were reportedly stored here and leaks of fuel, oil, and battery acid may have occurred in this area.	NFA per DEQ/Army SRI findings
73	Diesel Fuel Spill Location	Former employees reported that in 1955 a spill of approximately 800 gallons of diesel fuel occurred on the soils in the area that is now covered with the concrete pad	UST investigation found ubiquitous presence of BTEX and TVHC in soil gas and soil samples in area SW of USTs 42 and 43. Report recommended remediation of soil.
74	Oil/Fuel Transfer Station (Building 23)	Building 23 and the areas surrounding it have been used to transfer oil and fuel from incoming railcars to vehicles or storage tanks at UCD since the early 1940s	Passive Soil Gas Survey Conducted during the 1995 UST Investigation found 3 areas of potentially significant soil contamination.
75	Battery Acid Collection Sump (Building 31)	Located within the former DRMO area and Administration Area, it has been reported that a concrete sump existed along the exterior of Building 31 that collected acid from a drain in the maintenance area.	NFA for surrounding soil per SRI findings; recommended existing sump to be cleaned and decontaminated upon operation complete.
76	Photographic Chemical Disposal Area (Building 54)	Located within the former DRMO area and Administration Area, Building 54 was reportedly used as a film developing laboratory and darkroom. It was reported during the 1990 RI site visit that approximately 50 to 100 gallons of film developing solutions were disposed of on the soil west of the building from the mid-1940s to early 1950s.	NFA per DEQ/Army SRI findings
77	Paint Storage and Disposal Area	Located within the former DRMO area and Administration Area, paints, solvents, oils, photographic solutions, and antifreeze solutions were stored and disposed of in an area located within and surrounding Building 30A storage shed.	NFA per DEQ/Army SRI findings
79	Malathion Spray Areas	Located in the northeast corner of Igloo Block C, this area is reported to have been sprayed with the insecticide malathion during a commercial over-flight operation near UCD.	NFA per DEQ/Army SRI findings

Study Site Number	SWMU Name	Description	Final Action or Determination
83	Leaking Drum Storage Area	Located within the former DRMO area and Administration Area, the area consisted of a fenced yard west of Building 39 and south of Building 23, which was used to store drums containing the degreasing solvent methyl isobutyl ketone (MIBK).	NFA per DEQ/Army SRI findings
N/A	PCB Transformer Locations	According to UCD records, there were 239 transformers on post. All 239 transformers were tested for PCBs in 1989. 173 of the 239 transformers on the property were in use at the time of the SRI; the remaining were removed and disposed of off-post. 50 of the 66 transformers removed were replaced with transformers containing less than 50 parts per million (ppm) PCBs. The SRI focused its investigation on 79 transformers where the PCB concentration was greater than 10 ppm	NFA per DEQ/Army SRI findings at transformer locations 162,163, 164, 197, and 198. Soil in vault at location 229 will be cleaned out and disposed of as a removal action according to Oregon background levels

5.9.2 Buildings and Structures

Area VII buildings and structures accessed during the field reconnaissance are identified in Table Q-1 in Appendix Q. Descriptions of buildings or structures, and observations regarding use and storage of hazardous materials and/or petroleum products, evidence of current or former USTs and ASTs; and sumps, catch-basins and/or drywells are described in the following sections.

5.9.3 Hazardous materials

Hazardous materials and chemicals were observed in the following buildings during the field reconnaissance:

Building 4 Public Works: At the time of the field reconnaissance, housekeeping practices were very good and petroleum products were stored in appropriate 55-gallon drums on top of secondary spill protection. Several non-flammables cabinets were observed in the building and contained paint thinner and sealants stored in quart to gallon containers. Compressed gas cylinders of acetylene and oxygen were anchored and stored appropriately. Building 4 is identified as ECOP Category 7 with property identification number of 72(7)A,HR(P), as shown on Figures 11 and 13.

Building 5 Vehicle Maintenance Facility: Building 5 is a vehicle maintenance garage, with typical activities consisting of: battery charging, steam cleaning, welding, engine maintenance and overhaul, and parts cleaning. Materials stored in flammable materials storage lockers include paint, thinners, aerosols, starter fluid, brake fluid, brake cleaner, lubricants, battery re-conditioner, fuel additives and conditioners, petroleum products, and other household items. The central part of Building 5 was observed to handle vehicle oil changes and contained gear oils and motor oils in 55-gallon drums. Waste paint thinner and paint sludge were contained in 30-gallon containers inside 85-gallon overpacks. Recycled and new antifreeze is kept in 55-gallon drums. The vehicle wash-bay located inside the building is connected to an oil-water separator located outside the south wall of the building. According to maintenance personnel, water is discharged from the oil-water separator to the WWTP. Periodically the oil from the separator section is pumped out and transported offsite for disposal. Building 5, along with Building 37, and associated former UST locations, is identified as ECOP Category 6 with a property identification number of 67(7)A,HS,PS,PR, as shown on Figures 11 and 13.

Building 7 Carpentry Shop: Building 7 is a 3,600 square foot carpentry shop with activities consisting of wood cutting, spray painting, and brush painting. At the time of the field reconnaissance, the building was in use. Five-gallon buckets of paint, aerosol spray paints, stains, lubricants, paint thinner, varnish, alcohol, glue, adhesive, and sealants were stored at the back of the carpentry shop. The materials appeared to be in good condition and in their original containers, with no signs of leaks or spills. A single flammable materials storage locker containing quart or smaller containers of latex paint, aerosol paint, stain, varathane, and paint thinner. Former UST locations associated with Buildings 6, 7, and 10 are identified as ECOP Category 4 with a property identification number of 68(4)A,PS,PR, as shown on Figures 11 and 13.

Building 8 Pesticide/Herbicide Storage and Mixing Operations: Building 8 contains small volumes of herbicides, pesticides, rodenticides, and mixing operations. At the time of the field reconnaissance, liquid herbicide in 2.5-gallon plastic containers was observed within containment trays near the entrance to two locked storage rooms. The pesticides are kept in a locked storage room and are in single-use containers or small containers up to a 50-pound bag size. Mixing is done inside a bermed area with a sink. Rodenticides and rodent control boxes were observed in small containers within in the building. The building itself was observed to have good ventilation. A list of pesticides and herbicides was posted on the locked storage doors. Pesticides listed included aerosol wasp and hornet spray, Demon, and Sprakil-13, strychnine alkaloid, Razor Prode, Reward, Glyfos Pro, Crossbow, and Arsenal. Building 8 was not identified as a Study Site in previous environmental investigations at the UCD, nor was it given an ECOP Category number in the June 2010 ECOP Report. In addition, no field evidence or research completed as part of this ECOP/EBS study indicated an ECOP condition was necessary.

Building 9 HVAC and Boiler Shop: At the time of the field reconnaissance chemicals used in the boilers and air conditioners are stored in this building, including 55-gallon plastic drums of sodium hydroxide, sulfite, Possca^{TM}, and Morpholine^{TM}. The drums were all seated in plastic secondary containment drums. During use, the chemicals are transferred to smaller containers for transportation to the boiler. The smaller containers are triple-rinsed and the rinse water is added directly to the boiler. Freon R-12 and R-22 are stored in Building 9. Three 50-pound recovery tanks of R-22 and R-12, along with small quantities of lubricating oils, are kept inside the locked shops. Building 9 was not identified as a Study Site in previous environmental investigations at the UCD, nor was it given an ECOP Category number in the June 2010 ECOP Report. In addition, no field evidence or research completed as part of this ECOP/EBS study indicated an ECOP condition was necessary.

Building 11 Medical Clinic, Chemical Protection Equipment and Tool Crib: Building 11 is a 33,150 square-foot facility and houses the tool crib, offices, medical clinic, chemical protection equipment (CPE), protective mask fit area, and mail room. Small amounts of waste are infrequently generated here, and include expired acids and batteries, and, on a rare occasion, expired chemicals such as formaldehyde. A flammable materials storage locker holds alcohol, ink, solvents, acetone, toner, sealants, and insecticides in gallon or smaller containers. Any spills would occur inside the cabinet or on concrete and be immediately cleaned up. Building 11 is identified as ECOP Category 6 with a property identification number of 76(7)A,HS, as shown on Figures 11 and 13.

Building 27 Battery Shop. At the time of the field reconnaissance, Building 27 was clean and well-kept with good housekeeping practices. Small containers of acidic electrolyte solutions were observed in a bermed area of the building and according to UCD personnel, solutions were hand mixed to fill batteries that arrive without the electrolyte solution (UCD personal communication, Case, 2010). A cabinet labeled “corrosives” was observed in within the bermed area containing the containers of electrolyte solution.

Batteries for forklifts were observed on wooden pallets on a concrete floor. The smaller batteries for motor vehicles are stored on shelves. An elevated and bermed concrete area in the center of the building is used for storage of large-equipment batteries. Previously, floor drains in the elevated area directed spills and wash water to a 1500-gallon below-grade tank. Spills and wash water were previously neutralized with bicarbonate soda and lime, and then rinsed into the floor drains. In 2006 this 1500-gallon tank was removed. A corrosive materials storage cabinet is used to store containers of battery acid. A spill kit containing bicarbonate soda is located near the storage cabinet. All corrosive materials spilled would be neutralized and contained within the building. Building 27 as well as Building 30A are identified as ECOP Category 3 with a property identification number of 63(3)HS,HR,PS,PR, as shown on Figures 11 and 13.

Building 30 Dunnage Shop: Drums of material (not identified) were observed on the west side of building 30 and were stored on a wood pallet. The drums were located adjacent to a graveled strip cut into the asphalt with a grated cover. Building 30 is identified as ECOP Category 3 with a property identification number of 64(3)A,PS,HR, as shown on Figures 11 and 13.

5.9.4 Roadways and Thoroughfares

No evidence of dumping along roadways or thoroughfares was observed in Area VII during the field reconnaissance.

5.9.5 Fuel Storage Tanks

ASTs were observed throughout Area VII and included propane tanks used for heating and several empty ASTs located at Building 77 and within the fenced petroleum AST area associated with Building 6, Fueling Station. The ASTs at the Fueling Station included fuel tanks associated with fueling activities at B6, and disconnected residential heating oil tanks. No spills, petroleum odors, or other evidence of a release was observed around the ASTs at the time of the field reconnaissance.

5.9.6 Storage Areas and Sheds

Building 77 is the storage area used by the UCD Public Works Department, and is a large rectangular and corrugated metal structure with a gravel floor. One side of the buildings is open and faces a fenced storage yard. At the time of the field reconnaissance the following items were stored in the building: two dump trucks, a decommissioned boiler, and approximately 20 empty residential heating oil ASTs, portable toilets, a stack of gypsum wall board, and coiled wire. Ponded water was observed in places on the gravel ground surface.

5.9.7 Refuse and Debris

Large stockpiles of refuse and debris were observed at the following two locations in Area VII.

DRMO Storage Area (Study Site 22): A fenced, asphalt and gravel storage and salvage yard was observed west of Building 42 and north of Buildings 11 and 77. Materials observed in DRMO Storage Area were segregated by type and included used motors, numerous used ASTs (labeled “empty” and “3 rinse”; used supplied-air gas cylinders, discarded wood planking, coiled wire, metal electrical boxes, empty 55-gallon drums, commercial-grade dryers, air conditioning units, and many other items. Some items were stored on wood pallets; however many items were stored directly on the asphalt and gravel ground surface. At one time, leaking transformers containing PCB-contaminated oil reportedly were stored temporarily on the bare ground under the west end of a metal shelter (presumably, Building 77). Study Site 22 is identified as ECOP Category 3 with a property identification number of 75(3) HS,HR,PS,PR, as shown on Figures 11 and 13.

Area West of Building 19 and East of Fir Street: Construction demolition debris was observed in an unfenced, approximately 3 acre area, located west of Building 19 and East of Fir Street. Debris observed in this area included metal fence posts embedded in concrete foundations, brick, telephone wiring, piles of asphalt debris, fencing wire, and ceramic insulators.

In addition to the two large stockpiles of debris, other debris was observed throughout Area VII and included asphalt shingle roofing and PVC piping connections observed between rail road lines on and Buildings 17 and 19; metal debris and writing located north of the water tower and east of Building 30. The presence of the construction demolition debris in the vicinity of Building 19 does not warrant an ECOP category designation.

5.9.8 Site Drainage and Dry wells

Site drainage is directed to catch-basins located along the roadways at the facility. Site drainage is directed to the east to a single stormwater outfall located approximately 500 feet southwest of the WWTP.

Drywell on East Side of Building 10, Locomotive House: The location of a drywell noted on a UCD installation map for Building 10, was observed on the west side of the building. Building 10 was used as a diesel train engine repair shop with activities consisting of the cleaning and maintenance of diesel engines, brush painting, and battery charging. Building 10 is used only for vehicle storage at this time. No other information regarding this drywell was identified during the course of the ECOP/EBS. Building 10 was identified as ECOP Category 6 with a property identification number of 122(7)HR(P),PR(P), as shown on Figures 11 and 13.

Drywell between Buildings 4 and 5: Based on review of UCD installation plans, one dry well was located just north of Building 4 to the west. Evidence for the dry well was not observed at the time of the field reconnaissance. However, based on review of maps, it appears that there were several connections to the drywell. From Building 5 and from the vehicle wash pad currently located between the two buildings, Building 4 was identified as an ECOP Category 7, with a property identification number of 72(7)A, HR(P), as shown on Figures 11 and 13. Due to lack of apparent investigation around an oil water separator, Building 5 was identified as an ECOP Category 7, with a property identification number of 67(7)A,HS,PS,PR, as shown on Figures 11 and 13.

5.9.9 Fill Areas

No evidence of fill areas was observed in Area VII at the time of the field reconnaissance.

5.9.10 Water Wells and Water Service

Two potable water wells are located in Area VII, Well No. 1 located in Building 24 and Well No. 2 located in Building No. 25. Wells 1 and 2 are not currently active. Water service to Area VII is provided by Wells 4 and 5 located in Area II, southwest of the Subject Site. AMEC field personnel entered both well houses to observe the condition of each well and building.

Building 24, Well No. 1: Building 24 was entered to inspect the interior and the status of Well No. 1. At the time of the field reconnaissance the building was locked, and the interior of the building floor was covered in dirt and debris was scattered about the room. The wellhead had been removed from the well and the pump motor was removed. A 5-gallon bucket was fitted snuggly over the well however, with pressure the bucket started to dislodge. The chlorination tank had been removed from the building. Building 24 was identified as ECOP Category 6 with a property identification number of 26(7)PS,R,A(P),L(P), as shown on Figures 11 and 13.

Building 25, Well No. 2: Building 25 was entered to inspect the interior of the building and the status of Well No 2. At the time of the field reconnaissance the building was not locked, with the interior of the building was in disrepair, suspect ACM floor tiles scattered around the floor, and paint peeling from the walls and ceiling. The chlorination tank had been removed. The well head was intact and bolted to the floor, thereby limiting direct access to the well; however the unsecured door allowed access to the well.

5.9.11 Sewer and Septic Systems

All buildings in Area VII are connected to the WWTP located to the west in Area VI. As described in Section 5.7.2.3, the WWTP is comprised of an Imhoff tank, standby Imhoff tank, sludge drying bed, and tile field percolation system. An oil/water separator that receives wash water from an interior vehicle wash station located in Building 5, is also connected to the WWTP. During the field reconnaissance, no evidence of buildings or structures on septic systems were observed.

5.9.12 Electrical Utilities and Transformers

Transformers were observed throughout Area VII and included pole-mounted and pad-mounted transformers. Most transformers were labeled with regard to PCB content; however, several no labeling was observed on pole-mounted transformers located near the gym (Building 62) and tennis courts. No visible evidence of spills or releases around the transformers was observed.

5.9.13 Surface Vegetation

Surface vegetation observed in Area VII consisted of landscaped areas and natural vegetation growth in storage yards and gravel parking lots. No evidence of distressed vegetation was observed in Area VII during the field reconnaissance.

5.9.14 Foundations and Former Structures

During the field reconnaissance, foundations of former structures with drain and pipe connections, were observed in the southern part of Area VII south of South Street.

6.0 FINDINGS AT ADJACENT PROPERTIES

Properties adjacent to the Subject Site include adjoining Area II, Area VIII, and the UCDF (U-Block) on the UCD installation. The remainder of adjoining properties to the north, west, and south of the Subject Site are comprised of agricultural lands.

6.1 UMATILLA CHEMICAL DISPOSAL FACILITY

The sole mission of the UCDF is to destroy and dispose of the chemical warfare materials stored at the UCD. The UCDF uses high temperature incineration technology to destroy the chemical warfare materials. The facility began its munitions campaign on September 7, 2004. The UCDF is located in the north-central part of the UCD, northeast of the Subject Site. The facility consists of a Deactivation Furnace System (DFS), a Liquid Incinerator System (LIS), and a Metal Parts Furnace (MPF) located in the munitions demilitarization building. In support of the disposal mission, there is also a container handling building, a process utility building, a personnel and maintenance building, and a laboratory. A Pollution Abatement System (PAS) is also installed at the LIS and MPF. This system cools and cleans the incinerator gases to ensure they meet clean air regulations. Each PAS uses a wet scrubber to clean the incinerator gases before discharging. The scrubber waste, called scrubber brines, accumulates in tanks in the Brine Reduction Area (BRA).

Access to the UCDF is tightly controlled by the Army and operations at the UCDF are monitored closely by EPA and DEQ. At the time of the field reconnaissance, AMEC personnel did not view the UCDF or obtain access to view the UCDF.

6.2 SURROUNDING PROPERTIES

Groundwater in the area of UCD has been impacted by low concentrations of nitrate and nitrite, known to be common in groundwater of the Lower Umatilla Basin (LUB). In the 2003, the DEQ LUB Ground Water Management Area (GWMA) Synoptic Sampling Event Report, nitrate concentrations from groundwater samples collected basin-wide were compared to samples collected in 1992. The report determined that nitrate concentrations in the LUB GWMA increased between 1992 and 2003, with more than ⅓ of the 2003 samples analyzed exceeding the 10 mg/L nitrate drinking water standard. As discussed in previous reports for UCD, off-post nitrate/nitrite sources of contamination have likely impacted groundwater beneath the UCD. Off site sources of nitrate/nitrite in the vicinity of UCD include fertilizer application/irrigation, livestock feedlots, fertilizer manufacturing (southwest of the installation), and private septic systems. Pesticide and herbicide use is likely due to the large amount of off-site agriculture. The report recommended that best management practices be continued and expanded in the basin to reduce the nitrate loading to the groundwater (*USACE, 2010; DEQ, 2006b*).

6.2.1 Crop Cultivation

Nitrate fertilizers are used on many of the crops grown in the irrigated areas surrounding UCD. Nitrate leaching rates from soil to groundwater are likely to be high, and historical nitrate application rates are likely to have been much higher in the past than in recent years. It is estimated that 40 to 60 pounds of nitrates per acre per year may have leached into groundwater from the late 1960s to 1975. The Agricultural Extension Service at Hermiston, Oregon provided information on crops and nitrate application ranges, and the information is summarized in the CERFA report (*Earth Tech., 1994*).

6.2.2 Potato Processing

Lamb-Weston of Hermiston operates a potato processing plant east of UCD and disposes of process wastewater by irrigation of two areas. One area (1.5 square miles) is just east of the northeast corner of UCD; the second area is approximately 1 mile south of the southeast corner of UCD. Process wastewater from the plant is discharged first into a holding pond and then is used for irrigation. In the area east of UCD, nitrate and groundwater elevations are being monitored by 10 wells located within and at the boundaries. Six of the ten wells had nitrate/nitrite levels generally above10,000 µg/L during the period November 1986 to January 1991 *(USACE, 2010)*.

7.0 CONCLUSIONS

AMEC Environment & Infrastructure, Inc. (AMEC) is pleased to submit this Environmental Condition of Property (ECOP)/Environmental Baseline Survey (EBS) Report to the Oregon Military Department (OMD) for the 7,421-acre OMD Parcel of the Umatilla Chemical Depot (UCD), located near Hermiston, Oregon. The purpose of the ECOP/EBS Report is to document the potential environmental liabilities associated with transferring the Federally-owned Department of Defense (DOD) land to the OMD. The EBS satisfies the environmental due diligence and disclosure requirements of Army Regulation (AR) 200-1, 42 USC9620(h), and Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The work is being conducted under the State of Oregon Standard Professional Services Contract number 109985A001 dated October 12, 2010.

The OMD, Installations Division retained AMEC under Contract #109985A001, to conduct an ECOP/ EBS on approximately 7,421 acres of the 19,728-acre UCD in Umatilla and Morrow Counties, Oregon. The UCD is 19,728-acre military facility located near Hermiston, Oregon, shown relative to surrounding land features in Figure 1, which has been closed by a 2005 Base Realignment and Closure (BRAC) action. The UCD Umatilla Land Reuse Authority (LRA) identified 7,421 acres for transfer to the OMD for development as an Intermediate Training Complex (ITC). Activities on the OMD Parcel include:

A field reconnaissance was conducted the week of 10 January 2011 to field-verify previously identified locations of environmental concern and to identify other areas of environmental concern. Information was reviewed describing discharges of hazardous materials, leaks of storage tanks, dumping, content of known landfills, and the historic storage of chemical agent, conventional munitions, and petroleum products. Specific areas of Subject Site were classified into ECOP Parcel and Condition types as defined by the ASTM D-5746-98, Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Facilities (*ASTM, 2002*). ECOP Parcels were identified and classified into one of seven ECOP condition types. Each ECOP Parcel was assigned a unique ECOP Parcel identification number, an ECOP Condition number in parentheses, and type of release or environmental issue known or suspected for that parcel.

7.1 ENVIRONMENTAL CONDITION OF PROPERTY

ECOP Categories were developed by comparing the results of AMEC's January 2011 field reconnaissance and research (including a review of previous environmental investigation reports from the 1990's) with the June 2010 ECOP report prepared for the UCD by the US Army Corps of

Engineers. As a result of the additional research and field reconnaissance, some previously-designated ECOP categories were changed. As shown in Table ES-1 and Table 26, ECOP categories identified from the June 2010 ECOP report are shown in black text. ECOP categories determined from the results of AMEC's field reconnaissance and research are shown in red text, with previous ECOP categories shown in black strike-out mode. An expanded version of Table ES-1 and Table 26, which includes the rationale for each ECOP category, is included at the back of the report and is identified as "ECOP Summary Table". ECOP Parcel categories for Areas I-VI are shown on Figure 12. ECOP Parcel categories for Area VII are shown on Figure 13.

Classifications for property contaminated with hazardous substances are provided below, in accordance with Appendix B of the Army National Guard's ECOP Standard Operating Procedure dated 14 March 2007:

Category 1	Areas where no release or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).
Category 2	Areas where only release or disposal of petroleum products has occurred.
Category 3	Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial action.
Category 4	Areas where release, disposal, and/or migration of hazardous substances has occurred and where all remedial actions necessary to protect human health and the environment have been taken.
Category 5	Areas where release, disposal, and/or migration of hazardous substances has occurred and where removal or remedial actions are under way, but where all required remedial actions have not yet been taken.
Category 6	Areas where release, disposal, and/or migration of hazardous substances has occurred but where required actions have not yet been implemented.
Category 7	Areas that have not been evaluated or require additional evaluation

Table 26: Environmental Condition of Property Categories

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Area I - Ammunition Demolition Activity[2]				
All ADA grounds (not including ECOP Parcels 3, 8, 11, 14)	1,670	All ADA Grounds	~~6~~ 1	~~1(6)X~~ 1(1)X
Aniline Pit	40'x40'	7	1	18(1)X
Acid Pit	Small Pit	8	3	19(3)X
Borrow/Burn/Disposal Area	3.5	58	~~6~~ 1	~~2(6)HR,X~~ 2(1)HR,X
Open Burning Trenches	49.5	19	3	3(3)HR,X
Former Pit Area Locations	17.5	57	~~6~~ 3	~~4(6)HR, X~~ 4(3)HR,X
Dunnage Pits	6.3	18	~~6~~ 3	~~5(6)HR,X~~ 5(3) HR, X
Munitions Crate Burn Area	1.6	56	~~6~~ ~~3~~	~~6(6)HR,X~~ 6(3) HR,X
Sludge Burial/TNT Burn Area	4.6	15	5	7(5)HR,X
Trench/Burn Field	8.6	55	~~6~~ 3	~~8(6)HR,X~~ 8(3)HR,X
Smoke Canister Disposal Area Above Ground Open Detonation Area	26.67 1.7	13 17	~~5~~ 3	~~9(5)HR,X~~ 9(3) HR, X
GB/VX Decontamination Solution Disposal Area	3.2	59 41	~~6~~ 3	~~10(6)HR,X~~ 10(3)HR,X
Open Burning Trays	1.4	32	~~5~~ 6	~~11(5)HR,X~~ 11(6)HR,X
Flare and Fuse Disposal Area Pit Field Area	55.5 77.24	14 38	~~6~~ 3	~~12(6)HR,X~~ 12(3)HR,X
Open Detonation Pits	61.0	16	~~6~~ 3	~~13(6)HR,X~~ 13(3)HR,X

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Pesticide Pits	33.9	31	5	14(5)HR,X
Fuel Burning Area	2.5	28	6	15(6)HR,X
Missile Fuel Storage Area Disposal Pit and Graded Areas	39.3 7.5	21 80	~~6~~ 3	~~16(6)HR,X~~ 16(3)HR,X
Active Firing Range	17.7	60	~~6~~ 3	~~17(6)HR,X~~ 17(3)HR,X
Area II - Deactivation Furnace and 100/200 Warehouse Series				
Paint Spray and Shot Blast Area	1.2	34	~~4~~ 3	~~25(4)HR,PR~~ 25(3)HR, PR
Area III - West Central				
Buildings 601 - 606 and 623 GB Bomb Disassembly (aka remote munitions disassembly area)	0.6 23.0	No Study Site number was identified for this location in the 2010 ECOP Report. 9	~~6~~ 3	~~30(6)A,HR,PS,L(P)~~ 20(3)HR,PS,A, L(P)
Buildings 608-612 (Ammunition Maintenance and Disassembly)	2.7 0.5	45B 65	6	31(6)HR,PS,A,L(P)
Former Gravel Pit/Disposal Location	15.0	82	3	34(3)HR
Northern fenced portion of Block-I Igloos & USTs and ASTs near NE corner	139.1	No Study Site number was identified for this location in the 2010 ECOP report.	7	32(7)A,PS,L(P)
Buildings 613, 618, and 621 (Water Tower and Well Houses)	14.09	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 1	~~100(2)PS,A(P),L(P)~~ 100(1), PS, A(P), L(P)
Building 619	0.02	No Study Site number was identified for this location in the 2010 ECOP report.	7	27(7)R,A(P),L(P)

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Buildings 614 through 617 (Ammunition Disassembly and Renovation)	0.4	No Study Site number was identified for this location in the 2010 ECOP report.	6	28(6)A,HR,PS,L(P)
Building 270 and adjacent AST	0.02	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 1	~~29(2)PS~~ 29(1)PS
Concrete foundations	unknown	N/A[2]	7	116(7)HR(P), PR(P)
Building 457 Guard House	Unknown	N/A[2]	7	117(7)HR(P), PR(P)
Area IV - North Central				
Former Blister Agent HD Storage Area	8.6	10	3	41(3)HR
Drill and Transfer Site (DATS)	6.50	49	1	101(1)HS
All K-Block Igloos and associated former USTs and ASTs	514.5	No Study Site number was identified for this location in the 2010 ECOP report.	7	40(7)HS,HR,PS,PR,R,A, L(P)
Building 655 Change House and Laundry Building 654 Toxic Chemical Munitions Building 656 Monitoring Building Building 659 Former HD Agent Storage Building 660 Security Building	Area Not Accessible at time of January 2011 Field Reconnaissance	N/A[2]	7	102(7)HS,HR

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Area V - East Central				
Large Open Areas in Vicinity of Coyote Coulee Paint and Solvent Disposal Area	22.9 1.3	51 62	3	43(3)HR,CD
Former Gas Station/Possible UST Location	38.6	43	2	44(2)PS, PR,CD
Explosives Washout Lagoons Explosives Washout Plant - Building 489 Explosive Washout Lagoons - Groundwater Plume	1.6 acres 352.4 (total) Not listed	4 5 No Study Site number was identified for this location in the 2010 ECOP report.	5	45(5)HR, PS, PR, RAD, A,L,R
Building 486 Boiler/Laundry Effluent	0.08	47	3	103(3)HS,HR,L(P),A(P)
Building 493 – Paint Sludge Discharge Area Building 493 - Brass cleaning area	0.31	36 67	3	104(3)HS,HR,A(P),L(P)
~~Building 433 Collection Sump/Cistern and Disposal Area~~	~~0.09~~	~~53~~	~~4~~	~~46(6)A, PS~~ ~~105(4)HS,HR,A(P),L(P)~~
Building 825	0.04	No Study Site number was identified for this location in the 2010 ECOP report.	~~6~~ 1	~~38(6)A,L(P)~~ 38(1)A,L(P)
Former ASTs near Building 825	1.28	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ ~~1~~	~~39(2)PS~~ 39(1)PS

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Buildings 426, 455 and associated USTs	4.56	No Study Site number was identified for this location in the 2010 ECOP report.	~~2~~ 7	~~33(2)PS,A(P),L(P)~~ 33(7)PS, A(P),L(P)
All J Block Igloos (1797-#1810)	11.2	No Study Site number was identified for this location in the 2010 ECOP report.	~~7~~ 1	~~99(7)HS,A(P),L(P)~~ 99(1)HS, A(P), L(P)
Borrow Pit located northeast of Block J Igloos	14.6	No Study Site number was identified for this location in the 2010 ECOP report.	7	106(7)CD
Building 419 Former Laundry	Unknown	This location was not identified as a Study Site and was not given an ECOP category number in the report	~~7~~ 3	~~118(7)HR(P), PR(P)~~ 118(3)HR, PR(P)
Building 417 Renovation Building	Unknown	This location was not identified as a Study Site and was not given and ECOP category number in the report	~~7~~ 3	~~119(7)HR(P)~~ 119(3)HR
~~Building 431~~	~~Unknown~~	~~This location was not identified as a Study Site nor was it given an ECOP category number, in the report~~	~~7~~	~~120(7)A, L HR (P)~~
~~Building 434~~	~~Unknown~~	~~This location was not identified as a Study Site nor was it given an ECOP category number, in the report~~	~~7~~	~~121(7)HR (P)~~

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Area VI - South Central				
Former Raw Material Storage Locations	2.0	81	3	36(3)HR,HS,PS
Brass, Copper, and Steel Storage Area	1.4	66		
Gravel Pit Disposal Area	2.6	33	3	49(3)HR,CD
Landfill Area	2.5	This location was not identified as a Study Site nor was it given an ECOP category number, in the report	7	115(7)CD
Leaking Railcar Shipment Inspection Area	14.94	64	3	50(3)HR
Imhoff Wastewater Treatment Plant	17.6 total	6	~~3~~ 7	~~51(3)HR,PR~~ 51(7)HR,PR
Storm Sewer Tile Field		30		
Pipe Discharge Area		48		
Railroad Landfill Areas	53.4	50	~~3~~ 7	~~52(3)HR,PR~~ 52(7)HR,PR,A(P),L(P),CD
Inactive Landfills	36.33	12	7	107(7)A(P),L(P),CD
Former ASTs along Juniper Road	2.25	--	~~2~~ 1	~~37(2)PS~~ 37(1)PS
Area VII - Administration Area				
Former DRMO Area Between Buildings 42 and 77	6.6	22	3	75(3)PS, PR, HS,HR
Wood Preserving Solution Spill Area	0.9	70	3	61(3)HR
Paint Storage and Disposal Area	0.1	77	3	62(3)HR,PS

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Buildings 27 and 30A	0.1	--	3	63(3) HS, HR PS, PR
Building 31 Motor Pool Battery Acid Collection Sump	0.57	75	3	66(3)HS,PS
Former UST Locations Buildings 6,7, and 10	0.4	42	4	68(4)A,PS,PR
Former UST Locations Buildings 21, 24, 46	Admin Area – 3.0 Building 21 – 0.04 Building 24 – 0.03 Building 46 – 0.02	42A	~~3~~ 4	~~69(3)HR,HS,PS,PR~~ 69(4)HR,HS,PS,PR
Road Oil Application/Disposal Sites Building 54 Photographic Chemical Disposal Area	39.12	44 76	~~6~~ 4	~~79(6)A,PS,PR,HS,HR~~ 79(3)A,PS,PR,HS,HR
Former UST Near intersection of Fir Street and D Street	0.03	--	~~2~~ 1	~~70(2)PS~~ 70(1)PS
Building 29 Former Diesel Tank	0.07	--	2	71(2)PS, PR
Building 4 Public Works	0.34	--	~~4~~ 7	~~72(4)A~~ 72(7)A, HR(P)
Building 18 Warehouse Office	0.36	--	~~4~~ 1	~~73(4)A,PS~~ 73(1)A, PS
UST NE of Building 17	0.03	--	~~2~~ 1	~~74(2)A, PS~~ 73(1)A, PS
Building 11 Dispensary	0.79	--	~~6~~ 7	~~76(6)A,HS~~ 76(7)A,HS
Building 36 and 53 N	0.32	--	~~6~~ 1	~~77(6)A,PS~~ 77(1)A,PS
Building 53S	0.16	--	~~6~~ 2	~~78(6)A,PS~~ 78(2)A,L,PS, PR
Building 30 Dunnage Shop	0.45	--	~~6~~ 3	~~*64(6),A,PS*~~ 64(3),A,PS,HR

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Building 5 Vehicle Maintenance Shop Building 37 Boiler house Associated former USTs	1.09	--	~~6~~ 7	~~*67(6)A,HS,PS,PR*~~ *67(7)A,HS,PS,PR*
Building 42 Salvage and Surplus	0.52	--	2	*65(2)PS,PR*
Building 2 Fire Department	0.16	--	~~4~~ 1	~~*80(4)A,HS,HR,PS*~~ *80(1)A,HS,PS*
Building 41 USTs Standby Generator Plant	0.07	--	~~2~~ 1	~~81(2)PS~~ 81(1) PS
Building 57 Telephone communication building	0.09	--	~~7~~ 1	~~*82(7)A,R,PS*~~ 82(1)A,PS
Building 51 Commanders Quarters	0.08	--	~~4~~ 7	~~*83(4)A,PS*~~ *83(7)A,PS, PR(P)*
Building 73 Residence garage	0.03	--	~~7~~ 1	~~*84(7)R, A*~~ *84(1) A*
Building 55 Office space converted from residence	0.02	--	~~7~~ 1	~~*85(7)R, A*~~ *85(1) R,A*
Building 55G Identified twice	0.07	--	~~2~~ 1	~~*86(2)PS*~~ *86(1)PS*
Former PCB Transformer Vault	0.02	--	3	*87(3)HS,HR*
Building 1 UCD Headquarters	0.26	--	3	*88(3)R*
Building 35 Residence	0.06	--	~~7~~ 1	~~*89(7)R,PS, A*~~ *89(1)R, PS, A*
Buildings 15 and 16 Building 14 - Former PCB Transformer Vault	0.1 0.37	--	3	*90(3)HR,PS*
Building 70 Residence garage	0.05	--	~~7~~ 1	~~*91(7)A,R*~~ 91(1)A,R
Building 32 Office and theater	0.19	--	~~6~~ 1	~~92(6)A,PS~~ 92(1)A,PS
Former PCB Transformer Vault	0.07	--	3	93(3)HR

Study Site Name	Acreage	2010 ECOP Site Study Number(s)[1]	ECOP Condition	ECOP Parcel (Category)
Building 33 Community center	0.14	--	~~2~~ 7	~~94(2)PS~~ 94(7) PS
Building 34 Housing NCO	0.10	--	~~4~~ 2	~~95(4)A,PS~~ 95(2)A,PS
Building 71 Residence garage	0.06	--	~~7~~ 1	~~96(7)R~~ 96(1)R
Buildings 38 Bathhouse Building 40 Swimming Pool	0.26	--	~~2~~ 1	~~97(2)A, HR, PS~~ 97(1)A, HR, PS
Building 24 and adjacent UST Well house No. 1	0.03	--	~~3~~ 7	~~26(3)PS, R~~ 26(7) PS,R, A(P),L(P)
Former USTs along Birch Road	1.9	--	~~6~~ 1	~~46(6)A,PS~~ 46(1)A,PS
~~Former AST location East of Rim Road South~~	~~0.72~~	~~--~~	~~2~~	~~48(2)PS~~
Building 6 Service Station	0.03	--	~~3~~ 2	~~108(3)PS,PR,A(P),L(P)~~ 108(2)PS,PR,A(P),L(P)
Leaking Drum Storage Area	0.08	83	3	109(3)HS,HR
Vehicle Storage area		72	3	~~110(3)PS~~
Possible Fire Training Pits	0.33	71	7	111(7)HS,HR
Building 23 Oil Fuel transfer station	0.17	74	7	112(7) PS, HR
Building 39 Oil Storage Dock	0.02	--	7	113 (7) PS, PR(P), HS, HR(P)
Diesel Fuel Spill	0.02	73	2	114 (2) PS, PR
Building 10 Locomotive House	--	--	7	122(7)HR(P), PR(P)

[1] Study Site Numbers referenced in this column are based on the USACE 2010 ECOP Report (March 2010). The Study Site numbers originally were developed to compile the extensive historical studies and activities into a standardized approach.

[2] The entire ADA – Area I is considered an Operable Unit by the EPA, where the cleanup was determined to be protective of human health and the environment in the short term because controls were put into place to prevent exposure. At this time, the entire ADA is surrounded by chain link fencing and is in accessible. The most recent 5-year report for ADA Operable Unit prepared in March 2010 acknowledged additional remedial actions would be required.

N/A = Not Applicable, since the March 2010 ECOP Report did not identify as a Study Site.

-- = Not identified as a “Study Site” in previous environmental reports.

Notes:

Buildings and/or structures with identified or suspected asbestos, radon, lead-based paint were not included in this table and were not designated with an ECOP Category, unless petroleum products or hazardous materials also were identified with an ECOP category of 2 or greater.

Buildings or structures determined to be located outside the Site boundaries are shown in strike-out mode.

7.1.1 ECOP/EBS Summary

Results of the ECOP/EBS are summarized below. It should be noted, based on conversations with DEQ personnel in Pendleton, Oregon, the DEQ intends to revisit all NFA findings at the Subject Site prior to any transfer of the facility from the US Department of the Army to other entities.

7.1.1.1 Site Wide Findings

Federal Facilities Agreement: The OMD Parcel is subject to the FFA signed in 1989 by Army, EPA, and DEQ. The FFA indicates the Army and all subsequent property owners are bound to cleanup requirements for nine designated cleanup locations, identified as OUs. The number of OUs was reduced to eight in a series of RODs in the mid 1990s, which established cleanup goals and remediation strategies for each of the OUs. Six of the eight OUs are within the boundaries of the Subject Site. The Army, EPA, and DEQ have agreed remedial actions at four of the OUs are protective of human health and environment and NFA is required at these four OUs. Two of the OUs remain in the process of cleanup: ADA in Area I, and EWL-Groundwater in Area V.

Miscellaneous Sites OU: The Miscellaneous Sites OU includes 32 separate locations throughout the Subject Site, where past environmental investigations have identified potential contamination from historical operations. Remediation in the form of soil removal occurred at three of the 32 locations (Site 22: DRMO in Area VII; Site 26: Metal Ingot Pile in Area II; and Site 36: Building 493 Paint Sludge Discharge Area in Area V). Subsurface soil and groundwater investigations indicated no need for further cleanup at the remaining 30 locations.

Petroleum Underground Storage Tanks: Several investigations to identify historical locations of petroleum USTs, UST sampling investigations, and UST removals have taken place since the 1980s. However, there is a potential that petroleum USTs may exist in areas of the Subject Site that were not previously identified or were not documented.

Gravel Borrow Pits: Approximately 10-12 gravel borrow pits were observed throughout the Subject Site. Disposal of construction demolition debris, metal, tires, and wood was observed in all former borrow pits. Former borrow pits also could have been used for disposal of other materials. Most gravel borrow pits were identified as Study Sites in previous investigations. The Army, EPA, and DEQ have determined that no environmental work is required at the gravel borrow pit. However, gravel pits used for the disposal of construction and other debris with NFAs from the DEQ should be revisited to determine if proper closure protocols have been followed. A gravel borrow pit located in J-Block was not identified as a previous Study Site, and was observed to contain construction debris.

Igloo Blocks: Approximately 412 igloos are located within the Subject Site. The majority of igloos are now empty, with the exception of 14 igloos located in J-Block (#1797 - #1810), which contain agent-related hazardous waste waiting disposal at the UCDF. I-Block Igloos had contained HD agent prior to transfer of the material to K-Block. The I-Block Igloos were approved by the DEQ as RCRA-closed in December 2009. The Army plans to RCRA close J-Block and K-Block Igloos in a manner similar to I-Block.

Igloos may have lead-containing paint and asbestos tar surfacing at the interface between the rooftops and vegetation. Igloos were not included in lead paint surveys formerly conducted at the UCD.

Septic Systems: Although most current and former septic systems have been identified. Not all former septic systems may have been documented or properly investigated. As an example, foundations and a possible septic leach field were observed in Area III.

Transformers: Comprehensive sampling, removal, and replacement surveys for transformers were completed in 1989 and 1993. During the field reconnaissance, out-of-service transformers were observed at several locations on the Subject Site. Materials associated with former transformers, such as electrical lines, insulators, metal transformer platforms, and utility poles were observed at several locations.

Natural and Cultural Resources: An Environmental Assessment is planned for the UCD once the Army has approved of the BRP. The UCD is working with SHPO to obtain full compliance with Section 106. Additionally, UCD is in formal consultation with the CTUIR regarding archaeological and cultural properties at UCD.

Animal Waste: Animal waste comprised of bird feces was observed in buildings located in Area III and V. Bird feces can are considered a health hazard when airborne and would need to be removed prior to conducting other removal actions.

7.1.1.2 Hazardous Building Materials

Locations identified with “special contamination concerns” as defined by Appendix C of the ARNG ECOP SOP (ARNG, 2007), including asbestos, LBP, radon, PCBs, or pesticides are included in Table Q-1 in Appendix Q. This table was included in the USACE-Seattle June 2010 report and lists asbestos, LBP, radon, PCBs, and pesticides associated with buildings and structures, based on sampling surveys.

Suspect ACM: Suspect ACMs were observed in many buildings throughout the Subject Site. Additional sampling will be required, prior to any renovation or demolition of the buildings. Examples of suspect ACMs observed during the field reconnaissance include: transite piping, window pane glazing, window/doorframe sealant, electrical wire wrap, magnesium-block piping insulation, mastic dots associated with fiberglass ceiling insulation, and tar coating between the interface of the roofs and soil caps of igloos and safety shelters. Current conditions of suspect ACM can be divided into a) structures requiring immediate mitigation and b) structures requiring mitigation based on planned future use:

Immediate Mitigation: Transite siding, roofing materials, window glazing, and numerous other confirmed ACMs were readily observed in pieces and scattered around the buildings due to weatherization and lack of building maintenance. Federal regulations require non-intact ACM be immediately abated for proper disposal.

Future Mitigation: If renovations or demolition is performed at one more buildings in the future, a site-specific pre-renovation or pre-demolition survey needs to be completed to identify materials to be abated prior to disturbance.

Lead-Containing Paint: Paint containing detectable levels of lead is present in many buildings and structures at the Subject Site. Historical lead paint chip surveys of the Subject Site were performed to identify paint suspected of having LBP (greater than 1.0 mg/cm^2). Historical lead paint chip surveys were not comprehensive and did not include the Igloos or Railroad Transfer Depots, which were confirmed to have paint during the field reconnaissance. Paint suspected of having detectable concentrations of lead was observed on many buildings throughout Areas I, III, IV, V, VI, and VII and may not have been previously identified and/or sampled. OSHA considers any detectable concentration of heavy metals to be a potential hazard during construction activities. Additional paint sampling will need to be conducted prior to any renovation or demolition.

Radon: Past radon surveys showed radon concentrations between 0.5 pCi/L and 3.8 pCi/L in 121 buildings at UCD. Buildings 1, 5, and 415, plus seven igloos, had radon concentrations above 4.0 pCi/L. It was recommended that renovations be made to Buildings 1, 4, and 415 to reduce the accumulation of radon gas. The previous radon tests may not be representative of current conditions.

Universal Waste: Regulated materials potentially classified as universal hazardous wastes were observed in buildings located within all Areas of the Subject Site, including mercury-containing fluorescent light tubes, high-intensity discharge lighting, and thermostats; and CFC-containing air conditioners. PCB-containing light ballasts were observed within all Areas of the Subject Site.

PCB Bulk-Waste Product: PCBs may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in many buildings built or renovated prior to 1978.

7.1.1.3 Wells and Underground Injection Controls

Potable Water Wells: The UCD's operational water needs have been supplied by seven potable water wells. These wells include five wells on the Subject Site (Wells 1, 2, 3, 6, and 7) and two in Area II (Wells 4 and 5) southwest of the Subject Site. Wells 1 and 2 are located in Area VII and are not in use at this time. Building 25 for Well 2 was not secured at the time of the field reconnaissance. The cover and pumping mechanism for Well 1 had been removed and replaced with a 5-gallon bucket, in violation of OWRD regulation 690-215-0050 regarding well covers. Currently, water for Area VII is supplied by water wells outside the boundaries of the Subject Site. Unless the OWRD approves an application to transfer the water right to a different parcel of land, the water right may be exercised only on the specific land identified in the water right certificate and only for the uses recognized on that certificate. Currently, uses described on the water rights certificates cover the categories of "fire protection"; "domestic"; and "irrigation". It is unclear whether water from each well is being utilized in accordance with the use required on each well's certificate. Additional research is needed for each water right certificate to determine appropriate use of water and to determine whether water rights, as they exist currently for the Site, need to be revisited with the OWRD.

Groundwater Monitoring Wells: Groundwater monitoring wells are located throughout the property. No map currently exists documenting all groundwater monitoring wells at the UCD. Reportedly, there are approximately 116 groundwater monitoring wells at the Subject Site; however, observations made during the field reconnaissance suggest the number is higher. At least one groundwater monitoring well was installed adjacent to the wastewater treatment system in Area VI, which has never been sampled.

Drywells and Underground Injection Control facilities: UCD installation maps depicted drywells near Buildings, 4, 10 and 608. Catch-basins were observed around buildings in Areas III and V and were not connected to a storm sewer system. Since Area VII is the only area of the Subject Site connected to a storm sewer system, catch-basins outside of Area VII are likely connected to drywells. Roof drains on buildings within Area VII direct precipitation directly to the ground surface. Roof drains and dry wells qualify as UICs per DEQ regulation 340-044-0005(24).

7.1.1.4 Area I - Specific Findings

- Area I is the location of the ADA, a 1,750 acre former ammunition demolition area located on the western portion of the UCD. Over 20 individual sites where munitions were burned, detonated, buried, or otherwise disposed have been identified at the ADA. An active firing range, operated by the OMD and UCDF contractors, is located near the southwest corner of the ADA, and includes a rifle range and machine gun range, and a pistol range. The BRP indicates a large caliber small arms range was formally present, at the active firing range, but was closed because of safety concerns. The surface danger zone for the active firing ranges covers a large extent of the ADA.
- A ROD for this ADA OU was signed by the Army, EPA, and DEQ. Cleanup operations are ongoing at the ADA and have included a surface UXO survey and a groundwater investigation to evaluate groundwater quality. A second survey is planned in the future. Twenty individual contamination sites within the ADA were identified from past investigations.

7.1.1.5 Area II - Specific Findings

- Approximately 30 acres of Area II are included in the Subject Site and one Study Site was identified from past environmental investigations. Site 34 Paint Spray and Shot Blast area was investigated as part of the Miscellaneous OU ROD. A NFA determination was made for Site 34. No evidence of former disposal activities was observed in this area during AMEC's field reconnaissance.

7.1.1.6 Area III - Specific Findings

Catch-basins: Catch-basins were observed around buildings 608 and 614. Area III is not connected to a storm sewer system and it is likely the catch-basins are connected to dry wells. One catch basin contained what appeared to be petroleum product.

Buildings 608 and 614: Ethylene glycol reportedly remains in the cooling lines for Buildings 608 and 614. According to UCD personnel, Buildings 608 and 614 still require remediation to remove explosives constituent residues.

Concrete foundations: Concrete foundations for former restrooms were observed northeast of I-Block at Road A and North Juniper Road. A septic leach field was observed in the vicinity of the foundations.

Possible Air Pressure Tank: A partially-buried pressure tank was observed south of Building 608 and associated Building 612. Its use could not be identified from visual inspection during the field reconnaissance. A 4-inch pipe attached to the tank was directed downgradient to a topographically lower area to the north and appeared to follow a graded trench.

Possible Drainage from Building 614: At the time of the field reconnaissance, the area north of Building 614 and associated buildings appeared to have been purposely graded and bermed to a topographically lower area.

7.1.1.7 Area IV - Specific Findings

K-Block Buildings: Buildings in K-Block (654, 655, 656, 659, 660) were not accessible at the time of the field reconnaissance.

Septic systems: The septic system associated with the laundry building (Building 655) is subject to sampling under the UCD’s WPCF permit. No investigation around the septic leach field has been conducted.

7.1.1.8 Area V - Specific Findings

EWL-Groundwater OU: The explosives contaminated groundwater plume extends over an approximate 350-acre area between Area V and the adjoining Area VII. Groundwater cleanup is being conducted by the Army in accordance with the ROD and with oversight from EPA and DEQ.

Laundry Building 419: The field reconnaissance identified numerous vaults, manhole covers, washing station, and leach field associated with Building 419. Building 419 was not identified as a Study Site in previous investigations.

7.1.1.9 Area VI - Specific Findings

Inactive Landfills OU: A NFA determination was made for the Inactive Landfills OU. During the field reconnaissance, there was visible evidence of continued use of the landfills to dispose of construction demolition debris, bales of tumbleweed, and potentially other waste. The regulatory status of the Inactive Landfill OU will need to be re-evaluated

Railroad Yard and Storage: A 140-acre railcar storage area is located along the southern border of the UCD. The area contains approximately 8 miles of railroad car classification/storage areas. Historically, this area has been leased to the Union Pacific Railroad (UPRR), but is currently unused. Fill has been documented along the length of the rail yard and includes construction waste.

Small Arms Range: Evidence of a small arms range was observed among the rail spurs in the vicinity Inactive Landfills area. Evidence consisted of targets arranged at intervals.

Wastewater Treatment Plant (WWTP): The WWTP has received sanitary sewer wastes from Area VII since its construction in 1941. During this time, operations in Area VII that could have resulted in disposal of photographic chemicals, petroleum products, solvents, pesticides and other materials could have been discharged from floor and sink drains within Area VII buildings in to the sanitary sewer system. No groundwater monitoring wells were observed around the leach field, with the exception of one. This well was located near the Imhoff tanks and reportedly has never been sampled.

Storm sewer discharge Pipe: Stormwater runoff is directed from Area VII to a single discharge pipe located approximately 500 yards southwest of the WWTP. The discharge pipe was located within a deep trench near the WWTP and could have discharged surface water runoff from Area VII that could contain concentrations of petroleum hydrocarbons and other constituents from storm drains and catch basins located in Area VII.

7.1.1.10 Area VII - Specific Findings

Drywells: The locations of documented were observed to the east of Building 10 and to the north of Building 4. Possible evidence of the drywell associated with Building 10 was observed; no evidence of the drywell north of Building 4 was identified in the field.

Scrap yards/Storage yards: Two scrap yards were identified in Area VII during the field reconnaissance. A storage yard located north of Building 77 is known as the DRMO storage yard was identified as Study Site 22 in previous investigations. Materials stored in this area included used motors, numerous used empty ASTs; commercial dryers, equipment, and used supplied-air gas cylinders. Many items were stored directly on the asphalt and gravel ground surface. At one time, leaking transformers containing PCB-oil were stored temporarily in this area.

Construction demolition debris was observed in an unfenced west of Building 19 and East of Fir Street. Debris observed in this area included metal fence posts embedded in concrete foundations, brick, telephone wiring, piles of asphalt debris, fencing wire, and ceramic insulators.

Areas of Debris: Debris including asphalt shingle roofing, PVC piping connections, steel piping and scrap metal were observed at various locations around Area VII, generally in undeveloped areas and along rail lines.

Former Foundations and manhole covers: Former foundations, manhole covers, and piping connections were observed over a large area to the south of South Street. This area was used in the past to spray used oil for dust control. This area was identified as Study Site 44 in previous reports.

Former Fire Training Pit: The area of a reported former fire training pit where solvents and other flammables were burned, was observed in the grass courtyard area south of Building 57. No evidence of former fire training activities in this area was identified.

Wood Treatment: Wood treatment using pentachlorophenol may have occurred in Building 11. Treated wood had been stored in the DRMO area to the north of Building 11.

7.2 KNOWN OR SUSPECTED AREAS WITH TRANSFER RESTRICTIONS

No known or suspected areas with transfer restrictions were observed during the course of this investigation.

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9.0 LIMITATIONS

This report was prepared exclusively for Oregon Military Department (OMD) by AMEC Environment & Infrastructure, Inc. (AMEC). The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This “Environmental Condition of Property/Environmental Baseline Survey” is intended to be used by the Oregon Military Department for an approximately 7,421-acre portion of the larger 19,728-acre Umatilla Chemical Depot installation only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party’s sole risk.

The findings contained herein are relevant to the dates of the AMEC Site visit and should not be relied upon to represent conditions at later dates. In the event that changes in the nature, usage, or layout of the property or nearby properties are made, the conclusions and recommendations contained in this report may not be valid. If additional information becomes available, it should be provided to AMEC so the original conclusions and recommendations can be modified as necessary.

U.S. Army BRAC 2013
Environmental Condition of Property Report
Umatilla Chemical Depot – Oregon

September 2013

Prepared By

U.S. Army Corps of Engineers
Seattle District

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Table of Contents

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

1,3,5-TNB	1,3,5-Trinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
°F	Degrees Fahrenheit
µg/L	Micrograms per liter
ACDP	Air Contaminant Discharge Permit
ACM	Asbestos Containing Material
ACS	Agent Collection System
ACTS	Army Compliance Tracking System
ADA	Ammunition Demolition Activity
ADMIN	Administration Area
AEC	Army Environmental Command
AEDB-R	Army Environmental Database-Restoration
AMC	Army Materiel Command
AOC	Areas of Concern
AR	Army Regulation
ARAR	Applicable, or Relevant and Appropriate Requirement
Army	United States Army
AST	Above Ground Storage Tank
ASTM	American Society for Testing Materials
BBTs	Blue Band Tubes
BCC	Birds of Conservation Concern
BCP	Base Cleanup Plan
bgs	Below Ground Surface
BNA	Base-neutral and Acid Extractable Organics
BRA	Brine Reduction Area
BRAC	Base Realignment and Closure
BRRM	Base Redevelopment and Realignment Manual
BTEX	Benzene, Toluene, Ethyl-benzene, Xylenes
BTU	British Thermal Units
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERFA	Community Environmental Response Facilitation Act
CEQ	Council on Environment Quality
C.F.R.	Code of Federal Regulations
CGA	Critical Groundwater Area
CMA	U.S. Army Chemical Materials Agency
COC	Contaminant of Concern
CPE	Chemical Protective Equipment
CGA	Critical Groundwater Area
CTT	Closed, Transferring, and Transferred
CWA	Clean Water Act
CWM	Chemical Warfare Material
DDD	Dichloro Diphenyl Dichloroethane
DDE	Dichloro Diphenyl Dichloroethylene
DDT	Dichloro Diphenyl Trichloroethane
DERP	Defense Environmental Restoration Program
DF	Deactivation Furnace

DFS	Deactivation Furnace System
DMM	Discarded Military Munitions
DNB	1,3-Dinitrobenzene
DoD	U.S. Department of Defense
DOI	U.S. Department of Interior
DRMO	Defense Reutilization Marketing Office
DUN	Dunnage Furnace
EA	Environmental Assessment
EBS	Environmental Baseline Survey
ECF	Entry Control Facility
ECP	Environmental Condition of Property
EE/CA	Engineering Evaluation/Cost Analysis
EMPA	Ethyl Methylphosphonic Acid
EPA	U.S. Environmental Protection Agency
EQR	Environmental Quality Report
ESD	Explanation of Significant Differences
EWL	Explosives Washout Lagoons
Fe	Iron
FIFRA	Federal Insecticide Fungicide and Rodenticide Act
FFA	Federal Facility Agreement
FS	Feasibility Study
ft^2	Square Feet
Furnace	Deactivation Furnace
FYR	Five-Year Review
GAC	Granular activated carbon
GB	Nerve Agent (Sarin)
GIS	Geographic Information System
GOCO	Government Owned Contractor Operated
gpm	Gallons per minute
gpd	Gallons per day
GM	Geiger Müller
GW	Groundwater
GWMA	Groundwater Management Area
HA	Health Advisory
HCID	Hydrocarbon Identification
HD	Blister Agent
HHRA	Human Health Risk Assessment
HMX	Octahydro-1,3,5,7-tetranitrol-3,5,7-tetrazocine
HWS	Hazardous Waste Storage
IC	Institutional Control
ICAM	Improved Chemical Agent Monitor
IIA	Initial Installation Assessment
IMPA	Isopropyl Methyl Phosphonic Acid
in.	Inch
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
kVa	Kilovolt-Ampere
LBP	Lead Based Paint
LIC	Liquid Incinerator
LRA	Land Reuse Authority

LUB	Lower Umatilla Basin
LUC	Land Use Control
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MDAS	Material Documented as Safe
MDB	Munitions Demilitarization Building
MDEH	Material Documented as Explosive Hazard
MEC	Munitions and Explosives of Concern
MIBK	Methyl isobutyl ketone
MMRP	Military Munitions Response Program
MPF	Metals Part Furnace
MPPEH	Materials Potentially Presenting an Explosive Hazard
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mm	Millimeter
Mn	Manganese
N/A	Not applicable
NB	Nitrobenzene
N. Central	North Central
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, more commonly referred to as the National Contingency Plan
ND	Non-Detect
NEPA	National Environmental Policy Act
NFA	No Further Action
Ni-63	Radionuclide Nickel-63
NIL	Northern Inactive Landfill
NILE	Northern Inactive Landfill Extension
NON	Notice of Noncompliance
NORM	Naturally Occurring Radioactive Material
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
OB	Open Burning
OD	Open Detonation
ODEQ	Oregon Department of Environmental Quality
ORUM	Other Regulated Underground Material
OU	Operable Unit
OWRD	Oregon Water Resources Department
PA	Preliminary Assessment
PAS	Pollution Abatement System
PA/SI	Preliminary Assessment/Site Investigation
Pb	Lead
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PCS	Petroleum Contaminated Soil
pCi/L	picocuries per liter
PEN	Pre-Enforcement Notice

pH	measure of the acidity or alkalinity of a solution
POL	Petroleum, Oil, and Lubricants
ppm	Parts per million
PQL	Practical Quantitation Limit
PWS	Public Water System
QA	Quality Assurance
QRA	Quantitative Risk Assessment
RA	Remedial Action
RAC	Risk Assessment Code
RCRA	Resource Conservation and Recovery Act
RCRA-CESQG	RCRA Conditionally Exempt Small Quantity Generators
RCRA-LQG	RCRA Large Quantity Generator
RD	Remedial Design
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RFA	RCRA Facility Assessment
RFNA	Red Fuming Nitric Acid
RI	Remedial Investigation
ROD	Record of Decision
RQ	Reportable Quantity
S/S	Solidification/Stabilization
SARA	Superfund Amendment and Reauthorization Act (SARA) amended CERCLA
SBCCOM	Soldier Biological and Chemical Command
S. Central	South Central
SHPO	State Historic Preservation Officer
SEIL	Southeastern Inactive Landfill
SIL	Southern Inactive Landfill
SILE	Southern Inactive Landfill Extension
SPCC	Spill Prevention, Control, and Countermeasures
SRI	Supplemental Remedial Investigation
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
Tetryl	2,4,6-tetranitro-N-methyaniline
TNT	2,4,6-Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
TPH-D	Total Petroleum Hydrocarbons-Diesel
TPH-G	Total Petroleum Hydrocarbons-Gasoline
TPH-HCID	Total Petroleum Hydrocarbons-Hydrocarbon Identification
TSD	Treatment, Storage, and Disposal
TVHC	Total Volatile Hydrocarbons
UDMH	Unsymmetrical dimethyl hydrazine
UMADRA	Umatilla Army Depot Re-Use Authority
UMCD	Umatilla Chemical Depot
UMCDF	Umatilla Chemical Agent Disposal Facility
UMDA	Umatilla Depot Activity
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency

USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
UXO	Unexploded Ordnance
UXO-DMM-MC	Unexploded Ordnance, Discarded Military Munitions and Munitions Constituents
VOA	Volatile Organic Analytes
VOC	Volatile Organic Compound
VSI	Visual Site Inspection
VX	Nerve Agent S-2-(diisopropylamino)ethyl-O-ethyl-methylphosphonothioate
W. Central	West Central
WIDS	Western Inactive Drum Site
XRF	X-ray Fluorescence
Y/N	Yes/ No

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2010 Version

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) has prepared this Environmental Condition of Property (ECP) Report for the U.S. Army Umatilla Chemical Depot (UMCD). UMCD is located three miles south of the Columbia River near Hermiston, Oregon positioned at the intersection of Interstates 82 and 84 with a size of 19,728 acres. The Army owns 17,054 acres with the remaining acreage, a buffer area of 2,674 acres on the north and east boundaries, is privately owned and is covered by restrictive easements.

The purpose of the ECP is to summarize the past and present environmental contamination condition of the property to be used by the U.S. Army (Army) in decision-making activities associated with real property transactions for real property disposal. The ECP assessment was developed in compliance with Title 40, Code of Federal Regulations (C.F.R.), Part 373 (40 C.F.R. Part 373); Chapter 8, Section 3 of U.S. Department of Defense (DoD) 4165.66-M, *Base Redevelopment and Realignment Manual* (BRRM), dated 01 March 2006; and U.S. Army Regulation (AR) 200-1, *Environmental Quality, Environmental Protection and Enhancement*, dated 27 December 2007, which requires that an Environmental Baseline Survey (EBS) be prepared to determine the environmental conditions of properties being considered for disposal.

This executive summary briefly describes the current and former uses of the installation and areas of potential environmental concern that were evaluated during the ECP process. Table 1 includes a summary of the acreage at UMCD determined for each ECP condition type and the standard map colors used to classify each ECP condition type within this report (Appendix G). Detailed information associated with the summary presented below is provided in the body of this report.

Historical Use

UMCD is a military facility located in northeastern Oregon. It was established as an Army ordnance depot in 1941. Activities at the site have included the disassembly, analysis, modification, reassembly, repacking, and storage of conventional munitions, and the storage and disposal of chemical agent-filled munitions and containerized chemical agents. Originally known as the Umatilla Ordnance Depot, the facility first stored a variety of military items, from blankets to conventional munitions, in support of the United States entry into World War II. Over the years, the facility title transitioned to Army Depot, then Umatilla Depot Activity, and finally the Umatilla Chemical Depot.

In 1962, the Army began storing chemical munitions at the facility. The Explosives Washout Lagoons were formally listed on the National Priorities List (NPL) (FR Vol. 52, No. 140, p 27620-27642 July 22, 1987). The Base Closure and Realignment (BRAC) Commission listed the facility for realignment in 1988. From 1990 to 1994, the facility reorganized in preparation for eventual closure, shipping all conventional ammunition and supplies to other installations.

The Umatilla Chemical Agent Disposal Facility (UMCDF) was designed for the sole purpose of destroying the chemical agents stored at the site. UMCDF is a federal government-owned and contractor-operated (GOCO) facility. This facility was completed in 2001 and incineration of chemical agents began in 2004. A high-temperature incineration technology was used to destroy agents, a technology employed by the Army for more than a decade to safely and successfully dispose of chemical agents. As of 2009, the incineration campaigns for nerve agents sarin (GB) and VX were completed. The destruction of the blister agent, Mustard (HD) was completed in October 2011. This marked the end of the UMCDF's mission and the facility is now in Resource Conservation and Recovery Act (RCRA) closure. UMCDF destroyed 220,604 munitions and containers containing 3,717 tons of GB, HD and VX via high-temperature incineration, representing 100 percent of the base's stockpile.

On 1 August 2012, Umatilla Chemical Depot, OR was closed and transferred to inactive operational status in accordance with the Defense Base Closure and Realignment Act of 1990, Public Law 101–510, as amended, and the National Defense Authorization Act for Fiscal Year 2012, Public Law 112-81. As of 1 August 2012, UMCD is reassigned to the U.S. Army Installation Management Command for management. The U.S. Army Garrison Commander, Joint Base Lewis-McChord assumed command authority for Umatilla Chemical Depot and property accountability pending disposal of excess property. The US Army Base Realignment and Closure (BRAC) division will manage the installation and oversee a caretaker contractor to operate the facility pending disposal of the property.

Environmental Concerns by Type

The following information was obtained through a review of general property information, observation of neighboring properties, research of available historical information, interviews with knowledgeable parties, environmental records search, and site reconnaissances.

Hazardous Substances – Chemicals containing Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) designated hazardous substances were used and stored at UMCD in amounts necessary to support unit-level vehicle and building maintenance activities and ammunition maintenance and destruction activities. Hazardous substances such as batteries, solvents, paints, and adhesives have been used and are currently used for maintenance activities at UMCD.

Defense-related chemicals stored at UMCD included CERCLA hazardous substances 2,4,6-Trinitrotoluene (TNT); Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); chemical nerve agents VX and GB; and the blister agent HD. Hazardous substances from past releases at several locations have been systematically identified, evaluated, and cleaned up or are undergoing remediation. All chemical munitions stockpiles were destroyed by 25 October 2011.

Underground Storage Tanks/Above Ground Storage Tanks – UMCD currently has a total of six underground storage tanks (UST); three regulated tanks and three unregulated tanks. The three permitted and active USTs are located in the UMCDF and have current Oregon Department of Environmental Quality (ODEQ) permits. The unregulated USTs include a 4,000-gallon diesel tank and two currently unused oil-water separators (see Section 4.4.2). There are 19 active above ground storage tanks (AST) present at UMCD. See Figure 8 in Appendix G for locations.

Polychlorinated Biphenyls – Polychlorinated biphenyls (PCB) contamination has occurred in trace to low concentrations below the regulatory action limit at former transformer sites located between Buildings 493 and 419, Building 14, Building 11, Building 25, east of Building 20, west of Building 2, and northwest of Building 15. PCBs historically were stored at Building 203 and at the former Defense Reutilization and Marketing Office (DRMO) area at Building 42.

Asbestos-Containing Materials – An asbestos survey was completed in 1992 *(*Dames and Moore 1992a*)*. Many of the buildings and igloos were found to contain asbestos-containing materials (ACM). A substantial amount was removed from UMCD. In addition, the locations of asbestos burial areas throughout the installation were identified. The warehouse Area 100 buildings' asbestos siding debris (on the ground) was removed in October 2011. Additional ACM debris from this area has not been characterized or removed.

Lead-based Paint **–** The majority of facilities and buildings at UMCD were constructed before the DoD ban on the use of lead-based paint (LBP) in 1978 and are likely to contain one or more coats of such paint (Table 30. Summary of ECP Findings for Buildings).

Radiological Materials **–** No radiological materials are stored at UMCD.

Radon **–** All buildings tested for radon at UMCD have radon levels below the action level of 4 picocuries per liter (pCi/L).

Munitions, Explosives, and Chemical Warfare Material **–** Except for the controlled access (and fenced) Ammunition Demolition Area, which will be remediated by 2015, all munitions, explosives, and chemical warfare materials were destroyed by October 2011.

Adjacent Property **–** The surrounding property at UMCD is rural, agricultural cropland, paper pulp orchards, and pastures. Land use for the areas immediately adjacent to the installation, are zoned agricultural (Umatilla and Morrow counties). No environmental concerns were noted during the visual site inspection (VSI) of the adjacent property in 2009. An Environmental Data Resources report (2010) was previously completed for UMCD and the surrounding area (Appendix D).

Ongoing Remediation

Currently at UMCD there are four ongoing CERCLA/RCRA environmental cleanup projects. These projects are at different stages of completion and represent the bulk of the last known environmental concerns for the installation. Each remediation project's location is outlined in Figure 12 of Appendix G.

Explosives Washout Lagoon Groundwater Operating Unit

The Explosive Washout Lagoon (EWL) Groundwater operating unit (OU) addresses contamination in groundwater caused by past waste disposal of RDX/TNT at the lagoons, plus contamination above the water table but below the depth to which soil was excavated and treated under the EWL Soils OU. The lagoons leached RDX/TNT explosive constituents process water through the native permeable soils into groundwater. The depth from the bottom of the lagoons to groundwater generally varied from 45 to 50 feet. Once the explosive constituents reached groundwater, they formed dissolved-phase plumes originating beneath the lagoons and dispersing laterally and vertically within the unconfined, alluvial aquifer, primarily due to the advective and dispersive forces acting on groundwater.

The ability of the groundwater treatment system to continue to meet the Record of Decision (ROD) cleanup requirements was questioned by stakeholders, as the pump and treat system became less effective at removing explosives contaminant mass and reducing explosives contaminant concentrations. Therefore, a Focused Feasibility Study (FFS) for groundwater at EWL was completed in December 2011, recommending expansion of the current pump and treat system combined with bioremediation. These treatability studies included the application of nutrient amendments (including lactose, ethanol, emulsified oil, and corn syrup) to promote the natural microbial degradation of the contaminants of concern. Expansion of the existing pump and treat system will be completed in Spring 2013 and will include the installation of two additional extraction wells and upgrades to the pump & treat facility. During the initial stages of the recommended remedy, pilot studies will continue to be implemented in the former explosives washout lagoons area, applying carbon substrate to the subsurface and enhancing biodegradation of RDX/TNT. Expansion of the pump and treat system is authorized in the ROD with EPA Region 10.

Initial activities are expected to result in significant contaminant mass reduction in the former explosives washout lagoons and main plume areas, thereby resulting in a smaller plume footprint.

Performance and monitoring data gathered during the initial stages of the recommended remedy will be used to refine the site groundwater model and optimize the final number and placement of extraction and injection wells used to circulate bioremediation substrate in the plume. Prior to implementing full-scale bioremediation, an Explanation of Significant Difference (ESD) or ROD Amendment will need to be developed and approved by stakeholders.

Ammunition Demolition Area (ADA) Operating Unit

Soil contamination exists at 20 sites within the ADA. In addition, ADA activities resulted in the presence of quantities of munitions and explosives of concern (MEC) at locations across the entire ADA. The ADA site falls within the boundaries of the Oregon National Guard Military Training area (Range), but it has been noted that it has the potential for industrial use. Therefore BRAC, USACE, EPA, and ODEQ have agreed that additional Phase II MEC clearance activities will be conducted to the depth of four (4) feet below ground surface and to full depth of all trenches (not expected to exceed 20 feet below ground surface). In accordance with the ROD, Phase II MEC clearance activities were initiated within 15 months after the final land use and disposal decision which was made for the ADA by the Umatilla Army Depot Re-Use Authority (UMADRA). The selected remedy for the contamination at the ADA includes: (1) excavation, treatment, and disposal of contaminated soils; (2) remove munitions and explosives of concern (MEC)/munitions debris (MD) items from the ground surface; (3) detect and quantify potential MEC below the ground surface; and (4) conduct removal and disposal of buried MEC/MD to a depth of detection.

The contract for Remedial Design/Remedial Action regarding MEC removal was awarded in September 2012. Upon completion of the Phase II MEC clearance actions (currently scheduled through 2015), appropriate institutional controls will be applied to the ADA to permanently limit the use of, and access to, the ADA. These institutional controls will be consistent with the final use selected for the area and the degree to which MEC was successfully cleared. Possible controls could include deed restrictions and/or maintenance of existing fencing and security.

Area 100 Buildings

Warehouse buildings in Area 100 were built with asbestos siding. The material is in a state of disrepair since the buildings are unoccupied. Wind storms and climatic conditions weathered the siding on the buildings frequently leaving friable asbestos on the ground where workers have the potential to be exposed. All asbestos containing materials (ACM) on the ground were removed during the October 2011 cleanup action. However ACM siding continues to weather and additional exposure to humans and the environment occurs. There is no date for removing the remaining siding from the Area 100 buildings.

Building 608 and 614

These buildings are contaminated with explosive hazards. Recent sampling found that the contamination was limited in extent but cleanup was necessary. A remedial design/plan will lead to the subsequent remediation and/or decontamination planned for FY13.

Umatilla Chemical Agent Disposal Facility (UMCDF)

The UMCDF is currently conducting closure activities in accordance with RCRA and other environmental permits. Site decommissioning work that still remains includes the continued decontamination and dismantling of the UMCDF incineration plant. The final closure package is scheduled to go to Oregon Department of Environmental Quality (ODEQ) in December 2014.

Table 1. ECP Condition Type, Acreage at UMCD, and Standard Map Colors

ECP Condition Type	Total Acreage at UMCD*	Definition	Map Color**
1	13,641	Areas in which no release or disposal of hazardous substances or petroleum products above de minimis*** quantities has occurred, and to which there has been no migration of such substances from adjacent areas.	White
2	37	Areas in which release or disposal of petroleum products above de minimis quantities has occurred.	Blue
3	267	Areas in which release, disposal, or migration of hazardous substances has occurred, but in concentrations that do not require removal or other remedial response.	Yellow
4	300	Areas in which release, disposal, or migration of hazardous substances has occurred, but all removal or other remedial actions necessary to protect human health and the environment have been taken.	Green
5	2022	Areas in which release, disposal, or migration of hazardous substances has occurred, and removal or other remedial actions are underway, but all required actions have not been taken.	Orange
6	51	Areas in which release, disposal, or migration of hazardous substances has occurred, but required remedial actions have not been implemented.	Red
7	736	Areas that have not been evaluated or that require additional evaluation.	Brown

Notes:

*The acreage of land that is ECP Categorized is 17,054 acres. Note that of the original 19,728 acres, 2,674 acres are associated with explosive safety area easements from private property owners. The ECP does not cover in detail buildings that were related to chemical agents in secured areas or those constructed after August 1992, notably the UMCDF and associated buildings. Facilities related to chemical agents are in RCRA closure as of this writing.

** See Figures 9 and 10 of Appendix G for Standard Map Colors.

*** Conditions that generally do not present a material risk of harm to the public health or the environment, and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

1. PURPOSE

This document updates the June 2010 Environmental Condition of Property (ECP) Report, Umatilla Chemical Depot-Oregon. Those sections, where new information exists, have been added to the original document. The majority of the document remains unchanged. This section discusses the purpose of the updated ECP assessment of UMCD, including the general requirements necessary to prepare an ECP, the scope of the ECP based on the requirements, any assumptions made while conducting the updated ECP, limitations, and the report organization. As specified in AR 200-1, the content of the ECP Report depends on the nature of the transaction and the proposed transferee/lessee. Transfers or leases between the Army and non-Federal entities require an ECP Report.

1.1 General

This ECP meets the DoD preparation requirements for an ECP Report. The ECP was performed to collect reliable information regarding the environmental condition of the property to determine the property's suitability for outgrant or transfer, and to meet the requirements under §120(h)(1) and (3)(A)(i) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 40 C.F.R. Part 373, Section 15-5 of AR 200-1, and DoD BRRM, 4165.66M, Section C8.3. The information gathered during this assessment will be used to assist the Umatilla Army Depot Re-Use Authority (UMADRA) and the purchaser in making informed business decisions about the transfer of the property by reducing uncertainty regarding its environmental condition. The Army prepares an ECP for the following purposes (AR 200-1 2007; DoD 2006):

- Summarize historical, cultural, and environmental conditions and include references to publicly available related reports, studies, and permits.
- Provide an accurate summary of the environmental condition of the property.
- Provide the Military Department with information used to make disposal decisions regarding the property.
- Provide the public with information relative to the environmental condition of the property.
- Assist in community planning for the reuse of BRAC property.
- Assist Federal agencies during the property screening process.
- Provide information for prospective buyers.
- Assist prospective new owners in meeting the requirements under EPA's "All Appropriate Inquiry" regulations. The EPA issued the All Appropriate Inquiry Rule on November 1, 2005 (40 C.F.R. Part 312).
- Provide information about completed remedial and corrective actions at the property.
- Assist in determining appropriate responsibilities, asset valuation, and liabilities with other parties to a transaction.

This update of the 2010 ECP Report contains the information required to comply with the provisions of 40 C.F.R. 373, which requires a notice that accompanies contracts for the sale of, and deeds entered into, for the transfer of Federal property on which hazardous substances may have been stored, released, or disposed of.

The updated ECP Report was performed in substantial compliance with ASTM Standard Practice D6008-96, *Standard Practice for Conducting Environmental Baseline Surveys (*ASTM 2005*)*. Although many of the ECP development activities may be considered "due diligence" functions, the

ECP Report is not prepared to satisfy a real property purchaser's duty to conduct an "all appropriate inquiry" to establish an "innocent purchaser defense" to CERCLA 107 liability. Any such use of the ECP by any party is outside the control of the United States Department of Defense (DoD) and its components and beyond the scope of the ECP. The DoD, its components, its officers, employees, or contractors make no warranties or representations that any ECP Report satisfies any such requirements for any party.

1.2 Scope

The scope of work for the updated ECP requires general conformance with Section 15-5 of AR 200-1, *Environmental Quality, Environmental Protection and Enhancement*, dated December 13, 2007, and specific conformance with Section 8.3 of DoD 4165.66-M, *Base Redevelopment and Realignment Manual* (BRRM), dated March 1, 2006.

Within this ECP Report, 17,054 acres of UMCD land have been ECP categorized. Note that of the original 19,728 acres, 2,674 acres are associated with explosive safety area easements from adjacent property owners. The terms of the easements grant perpetual rights to the U.S. Government and reserves the right to prohibit human habitation or erection of buildings which would be occupied by persons (grazing and farming are permitted). Union Pacific Railroad tracks run adjacent to the installation's southern boundary. There is a license agreement with the Union Pacific Railroad Company for a private 24-foot wide road crossing and a wire line agreement underneath the track. Interstate 84 runs east-west just south of UCMD and Interstate 82 runs north-south on the UMCD eastern border (Earth Technology Corporation 1995).

The ECP does not cover in detail buildings in secured areas or those constructed after August 1992, notably the UMCDF and associated buildings. Buildings within secured areas should be further evaluated.

Within this report, Study Site Numbers are used to describe small units of land that can be related to: (1) geographical area, (2) process description designation, or (3) an installation Operable Unit (OU). The ECP Report divides the installation into eight major geographical areas (Study Sections I through VIII) defined in Section 2.1. Section 3.3 breaks up the industrial facilities of the installation into eight categories relating to the process descriptions associated with current or past missions. In Section 4.2.5, the installation is broken up into nine OUs. A Record of Decision (ROD) was issued for each of these nine OUs from 1992 to 1994. The areas associated within these UMCD designations (geographical area, process description, and OU) are not equivalent; however, information presented in each can be related by individual Study Site Number. In general, Study Sites are typically referenced by Study Section throughout the ECP.

1.3 Assumptions

To comply with the requirements in AR 200-1 and ASTM Standards, this updated ECP Report was prepared to permit formulation of an opinion of the environmental condition of the subject property. Opinions on the environmental conditions at the site are based on information from site reconnaissance, collection, previous interviews, review of readily available information, and samples of groundwater collected from the site. New information or changes in property use could require a review and possible modification of the findings and conclusions contained in this report.

The information obtained from the Army, the Army's representatives and prior environmental reports was considered to be accurate unless reasonable inquiries indicated otherwise. Conditions observed were considered representative of areas that were not accessible unless otherwise indicated. The report did not evaluate individual igloos as a representative number of igloos were sampled, and it is assumed that all of the igloos are constructed of similar materials.

1.4 Limitations

This updated ECP Report presents a summary of readily available information on the environmental conditions of, and concerns relative to, the land, facilities, and real property assets at UMCD. Findings are based on environmental investigations, reports, site historical documents, and visual site inspections (VSI) from 2009. Information obtained from these other studies is reflected within this ECP Report by reference.

1.5 Report Organization

Section 2 describes the methods used to conduct the ECP. Section 3 provides a description of the UMCD installation and location, an account of historical land and facility use, an overview of the facility's past and current operations, a detailed infrastructure description, and a summary of the overall environmental setting. Section 4 provides a detailed description of UMCD's environmental condition, including permits held by the facility and previous environmental investigations, including federally designated OUs under the Federal Facility Agreement (FFA). The updated ECP findings are organized by relevant environmental issues (e.g., contaminant, contamination matrix, facility, or operation). ECP conclusions and property type definitions and designations are found in Section 5.

2. SURVEY METHODOLOGY

Methods employed in conducting the 2010 ECP are outlined in this section. Development of Study Sections, the VSI, aerial photography analysis, records review, and data management are addressed below.

2.1 Development of Study Sections

The UMCD property was divided into Study Sections to assist with the data retrieval, management, and the facilitation of the location of the investigation sites and parcel designations. Data such as historical use and practices and chemical usage and storage was collected and organized by Study Section. Development of Study Sections was based on the following considerations:

- Boundaries must be readily identifiable in the field.
- Boundaries must correspond closely with those of properties destined for transfer to specific entities.
- Boundaries have to be of a manageable size for a survey.
- Study Sections must encompass all of the UMCD installation property.
- No land area can fall into more than one Study Section.
- Study Sections must correspond with existing Installation Restoration Program (IRP) study areas (see Section 4.2.1).

Accordingly, Study Section boundaries were generally designated at the center of roads, along fences, and along township section lines. Study Sections are generally coincident with Areas I through VIII as established in the 1992 Remedial Investigation/Feasibility Study (RI) and correspond to Plates 1 and 3 of Dames and Moore (Dames and Moore 1990 1992b*).* However, due to the subsequent addition of the UMCDF, small changes have been made to the boundary of Study Section V, and references reverse the naming convention for Study Sections VII and VIII as compared with this historic 1992 RI document (Dames and Moore 1992b*).* A geographical description of the UMCD Study Sections is presented in Table 2. Appendix G, Figure 2, is a UMCD installation map that shows the boundaries for each of the eight Study Sections.

The eight Study Sections are broken down into smaller land areas that can be more easily related to past site activities and findings from previous studies. Due to the large extent of historical studies that have been conducted for the UMCD installation, there have been numerous naming conventions associated with previous areas of investigation within the UMCD installation. Therefore, the convention of Study Site Number and Building Number was developed in order to compile all information from historical studies and activities associated with the installation into a standardized approach. Study Site Numbers are related to a parcel number used to categorize ECP area types as defined by ASTM D-5746-98, *Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Facilities* (ASTM 2002).

A total of 100 parcels were identified and classified into 1 of 7 ECP area condition types. Each parcel was assigned a unique parcel identification number, an ECP condition number in parentheses, and the type of release or environmental issue that are known or suspected for that parcel. Additional information regarding the unique parcel identification numbers can be found in

Section 4.18, Section 5.1, Table 29 (Non-Condition Type 1 Property), and in Appendix G, Figures 9 and 10 (Installation and Administration Area Building Maps with ECP Property Condition Type).

The Study Site Numbers that relate to parcel numbers in Table 30 are listed in Table 3. Included in Table 3 are: (1) the corresponding Study Sections for each Study Site Number, (2) a description of the Solid Waste Management Units (SWMUs) and previously studied environmental sites located within each Study Site, (3) current remedial action status per the Resource Conservation and Recovery Act (RCRA) permit for each Study Site, and (4) Army Environmental Database-Restoration Module (AEDB-R) classification. Further information on each Study Site, the history of remedial investigation, and further recommendations are briefly described in Table 12.

Table 2. Study Section Area Description

Study Section	Acronym	Area Description[1]
I	ADA	This area encompasses the Ammunition Demolition Activities (ADA) Area. Study Section I is bounded by the UMCD property fence line to the north and west, by West Patrol Road to the east, and by Tenth Street to the south.
II	DF	This comprises the former Deactivation Furnace (DF) and the southwestern warehouse area. Study Section II is bounded by the UMCD property fence line (on south and west), by Tenth Street and West Center Road (on north) and by Larch Road (on east). Included in this section is Study Site Number 34 (the Paint Spray and Shot Area).
III	W. Central	The West Central Study Section is bounded by the UMCD property fence line (on south and north), by West Patrol Road and Larch Road (on west), and by Juniper Road and Ironwood Road (on east). Included in this section are Igloo Blocks H and I and Study Sites 9, 45, 66, 81, and 82.
IV	N. Central	The North Central Study Section is bounded by the UMCD property fence line (on north), by Ironwood Road (on west), and along the fence line of the K Block (on south and east). The North Central Study Section includes the K Block and Study Sites 10 and 49.

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[1] See Table 3, Table 30, and Figure 4 of Appendix G for corresponding Study Sites and Building Numbers within Study Section I through VIII

Study Section	Acronym	Area Description[1]
V	EWL	The East Washout Lagoon (EWL) Study Section is bounded by the fence line of the K Block (on north), by Juniper Road (on west), and by Road J and Coyote Road (on south). The eastern boundary of the site encompasses the UMCDF, but ends prior to the start of Igloo Blocks B and C along Rim Road (on east). Included in this section are the UMCDF facility, EWL soil, groundwater (GW), and plant OUs, Study Site 51, and Igloo Blocks G and J.
VI	S. Central	The South Central Study Section is bounded by Road J and Coyote Road (on north), to the UMCD property line (south), and from Rim Road (on east) to Juniper Road (on west). Included in this section is Igloo Block F and Study Sites 6, 12, 30, 33, 48, and 50
VII	ADMIN	The Administration (Admin) Study Section is comprised of all the administrative buildings bounded by Locust Road (on east) and Rim Road (on west). Included in this area are Study Sites 22, 27, and 44.
VIII	East	The East Study Section is bounded by the UMCD property fence line (on north, south, and east), and by Locust Road, South Rim Road, the boundary of Igloo Blocks B and C, the boundary of the UMCDF, and the boundary of K Block Igloos (on west). Included in this section are Igloo Blocks A, B, C, D, and E, the former airfield, and Study Sites 11, 39, and 53

Table 3 - Solid Waste Management Units (SWMUs) and Previously Identified Areas Requiring Environmental Evaluation in Base Realignment and Closure (BRAC) Property at UMCD

Study Site Number	Remedial Action Status	Name of SWMU or Previously Identified Areas Requiring Environmental Evaluation	Study Section Number	Study Section Name
1	NFA	Deactivation Furnace (UMAD-047)	II	DF
2	NFA	Storage Igloos (M-55 Rockets in K Block, Chemical Waste in J Block)	multiple	
3	NFA	Hazardous Waste Storage Facility (Building 203)	II	DF
4	Remedial Action (RA) in progress	Explosive Washout Lagoons (North Lagoon of EWL is UMAD-023) & (UMAD-024 for Surface Impoundment Lagoon)	V	EWL
5	RA complete, NFA	Explosives Washout Plant (Building 489) (UMAD-022) & (UMAD-042 for Washout Bldg Sump (OU6))	V	EWL
6	NFA	Sewage Treatment Plant	VI	S. Central
7	NFA	Aniline Pit	I	ADA
8	NFA	Acid Pit	I	ADA
9	NFA	GB Bomb Disassembly Area	III	W. Central
10	NFA	Agent H Storage Area	IV	N. Central
11	NFA,	Active Landfill (UMAD-034)	VIII	East
12	NFA	Closed Landfill	VI	S. Central
13	NFA	Smoke Canister Disposal Area	I	ADA
14	NFA	Flare and Fuse Disposal Area	I	ADA
15	RA complete, NFA	TNT Burn Area (UMAD-086)	I	ADA
16	Unexploded Ordinance (UXO) clearance pending	Open Detonation (OD) Pits	I	ADA
17	RA complete, NFA	Above Ground OD Area (UMAD-088)	I	ADA
18	NFA	Dunnage Pits	I	ADA
19	RA complete, NFA	Open Burning (OB) Trenches (UMAD-090)	I	ADA
20	NFA	OB Areas	I	ADA
21	NFA	Missile Fuel Storage Areas	I	ADA

Study Site Number	Remedial Action Status	Name of SWMU or Previously Identified Areas Requiring Environmental Evaluation	Study Section Number	Study Section Name
22	RA complete, NFA	Former Defense Reutilization Marketing Office (DRMO) Area (UMAD-058 & UMAD-105)	VII	ADMIN
23	RA pending building in place, thus no access to contaminated soil	Building 5 Waste Oil Tank	VII	ADMIN
24	NFA	Building 10 Waste Oil Tank	VII	ADMIN
25	NFA	Metal Ore Piles	II	DF
26	RA complete, NFA	Metal Ingot Stockpile (UMAD-048)	II	DF
27	NFA	Pesticide Storage Building (Building 8)	VII	ADMIN
28	NFA	Fuel Burning Area	I	ADA
29	NFA	Septic Tanks *	multiple	
30	NFA	Storm Sewer Tile Field	VI	S. Central
31	RA complete, NFA	Pesticide Pits (UMAD-094)	I	ADA
32	NFA	Open Burning Trays (UMAD-095)	I	ADA
33	NFA	Gravel Pit Disposal Area	VI	S. Central
34	NFA	Paint Spray and Shot Blast Area	II	DF
35	NFA	Malathion Storage Leak Area	II	DF
36	RA complete, NFA	Building 493 Paint Sludge Discharge Area	V	EWL
37	NFA	Building 131 Paint Sludge Discharge Area	II	DF
38	NFA	Pit Field Area	I	ADA
39	RA complete, NFA	Quality Assurance (QA) Function Range (UMAD-001-R-01)	VIII	East
40	NFA	Jeep Storage Area	II	DF
41	NFA	GB/VX Decontamination Solution Burial Areas	I	ADA
42	NFA	Former UST Locations (Administrative Area)	multiple	
43	NFA	Former Gas Station/Possible UST Location (Central UMCD Grounds)	VIII	East

Study Site Number	Remedial Action Status	Name of SWMU or Previously Identified Areas Requiring Environmental Evaluation	Study Section Number	Study Section Name
44	NFA	Road Oil Application/Disposal Sites	VII	ADMIN
45	NFA	Building 612 and Building 617 Boiler Discharge Areas	III	W. Central
46	NFA	Railcar Unloading Area	II	DF
47	NFA	Boiler/Laundry Effluent Discharge Site	V	EWL
48	NFA	Pipe Discharge Area	VI	S. Central
49	NFA	Drill and Transfer Site	IV	N. Central
50	NFA	Railroad Landfill Areas	VI	S. Central
51	NFA	Large Open Areas (Vicinity of EWL)	V	EWL
52	NFA	Coyote Coulee Discharge Area	V	EWL
53	NFA	Building 433 Collection Sump/Cistern and Disposal Area	VIII	East
54	NFA	Possible Disposal Pit Location	I	ADA
55	NFA	Trench/Burn Field	I	ADA
56	NFA	Munitions Crate Burn Area	I	ADA
57	NFA	Former Pit Area Locations	I	ADA
58	NFA	Borrow/Burn/Disposal Area	I	ADA
59	NFA	GB/VX Decontamination Solution Disposal Area	I	ADA
60	NFA	Active Firing Range	I	ADA
61	NFA	Open Paint Spray Areas	VIII	East
62	NFA	Paint and Solvent Disposal Area	V	EWL
63	NFA	Pier 836 Chemical Solution Disposal Area	IV	N. Central
64	NFA	Leaking Railcar Shipment Inspection Area	VI	S. Central
65	NFA	Waste Paint and Solvent Disposal Area (Building 608)	III	W. Central
66	NFA	Brass, Copper and Steel Storage Area	III	W. Central
67	NFA	Building 439 Brass Cleaning Operations Area	V	EWL

Study Site Number	Remedial Action Status	Name of SWMU or Previously Identified Areas Requiring Environmental Evaluation	Study Section Number	Study Section Name
68	NFA	UDMH Operations Area (Building 129)	II	DF
69	NFA	Skunk Works Area	II	DF
70	NFA	Wood Preserving Solution Spill Area	VII	ADMIN
71	NFA	Possible Fire Training Pits Area	VII	ADMIN
72	NFA	Vehicle Storage Area	VII	ADMIN
73	NFA	Diesel Fuel Spill Location	VII	ADMIN
74	NFA	Oil/Fuel Transfer Station (Building 23)	VII	ADMIN
75	NFA	Battery Acid Collection Sump (Building 31)	VII	ADMIN
76	NFA	Photographic Chemical Disposal Area (Building 54)	VII	ADMIN
77	NFA	Paint Storage and Disposal Area (Area 304)	VII	ADMIN
78	NFA	Buildings 608 and 614 Heat Exchange Systems	III	W. Central
79	NFA	Malathion Spray Areas	VIII	East
80	NFA	Disposal Pit and Graded Areas	II	DF
81	NFA	Former Raw Material Storage Locations	III	DF
82	NFA	Former Gravel Pit/Disposal Location	III	ADA
83	NFA	Leaking Drum Storage Area	VII	ADMIN
NA	NFA	PCB Transformer Locations	multiple	

ADA = Ammunition Demolition Area
DF = Deactivation Furnace
W. Central = West Central UMCD
N. Central = North Central UMCD
EWL = East Washout Lagoons
S. Central = South Central UMCD
East = East UMCD
ADMIN = Administration Area
NFA = No Further Action Required

2.2 Visual Site Inspection

A Visual Site Inspection (VSI) was conducted on September 22 and October 23, 2009, to field-verify information produced in the document review and to identify potential environmental concerns. The VSI involved a driving tour of the facility and its perimeter, as well as a systematic survey by vehicle and on foot through each section of the property. Several roads on the facility accessible by two-wheel drive vehicles were driven during the VSI. A driving inspection of each major group of buildings (i.e. 100 series, 200 series) was completed, and a closer visual inspection on foot was performed for 10 buildings selected in the field.

The 10 buildings chosen for closer inspection were Buildings 114, 117, 124, 202, 402, 403, 420, 605, 606, and 608. These 10 were chosen due to the amount of exterior damage visible during the driving tour. Generally, inspections on foot involved getting out of the vehicle to inspect the condition of paint and siding on the exterior of buildings. If a building was unlocked and not in use at the time of inspection, the building's interior was briefly inspected. Igloo interiors were not inspected during the VSI. Most buildings were locked or in use at the time of the visit, and the interiors of these buildings were not inspected. Details about the interiors of the few buildings that were open can be read in the Visual Site Inspection Memorandum for Record, dated 11 and 21 December 2009 (Appendix B). Per communication with UMCD personnel, and according to the 2006 Asbestos Inventory Spreadsheet, no significant changes to the interior locations and conditions of asbestos containing materials (ACM) have occurred, since much of the interior ACM was abated in 1996 *(*UMCD Personal Communication 2009-10).

It is assumed that the interior condition of buildings is as described in the various documents that were reviewed to generate the previous ECP Report. The number and type of buildings present at UMCD have remained unchanged for the past 15 years. Generally, the exteriors of occupied buildings have been maintained during this time, while the unoccupied or infrequently used buildings have deteriorated further.

During the 2009 visits, it was noted that significant areas of grass and shrubland at UMCD had burned, particularly the entire ADA area, areas around the 600 series buildings, and north of the K Block. Contact with UMCD personnel determined that the fires were set by lightning strikes in August 2009. A number of utility poles were down; these had been de-energized prior to the wildfires and no related transformers were observed. Apart from a small brick toilet building in the 600 series, buildings at UMCD were undamaged by these lightning-based fires. An aerial photograph (Google Earth dated Sept 1, 2011) shows no remaining evidence of the lightening strike fires.

A reconnaissance of the base perimeter was conducted on October 23, 2009 to evaluate adjacent property uses that could contribute to any environmental contamination detected on site. The field team drove on roads along the perimeter to visually identify any contiguous properties that appeared, in the team's professional judgment, to have contamination that could migrate to the installation. Typical properties that could pose a contamination risk are dry cleaners, gas stations, and industrial facilities. A field memo documenting the VSIs and photographs taken during the inspections are found in Appendix B.

2.3 Aerial Photography Analysis

A comprehensive aerial photograph analysis was conducted as part of the previous ECP (Appendix C). Aerial photographs covering the various sections of the facility for the period from 1984 to 2005 were obtained from USACE and Google™ Earth Pro. Forty aerial photographs were reviewed to identify any significant areas of disturbance. While reviewing aerial photographs, locations were noted that contained visible site activities, including: (1) evidence of excavation activities of unknown type, or industrial operations; (2) evidence of dumping or disposing of waste materials; (3) evidence of significant storage activities involving drums, tanks, or pipelines containing hazardous substances or petroleum products; and (4) evidence of staining associated with industrial activities or activities of unknown origin or type. Analysis noted disturbed soil, construction activities, traffic, active vehicle parking, landscape upkeep, and other notable changes within the site.

Analysis of aerial photos dating back to the 1950s is available in the 1992 RI. The aerial photographs reviewed from 1984 to 2005 are listed in Table 4, along with a brief description of potentially significant findings. Original aerial photographs from the time period prior to 1984 were not available. For aerial photographs taken from 1984 to 2005, selected frames that show potentially significant findings are cited in Table 4 with a frame number (Appendix C).

Table 4 - Aerial Photography Reviewed (Appendix C)

Date	Map Text ID	Scale	Study Section Number	Areas Photographed	Significant Findings
14-Apr-84	W84-2	1:4800	IV, V	Igloo Blocks K and J and location of current UMCDF	Disturbed soil and tire tracks at borrow pit (frame 121)
			VIII	Active Landfill; parts of Igloo Blocks D and E	Disturbed soil and possible active dumping at Active Landfill (frame 126); disturbed soil and tire tracks near road along west side of Igloo Block D (frame 124)
1-Nov-84	S84059-1	1:9000	N/A	Columbia River north of UMCD; land between Columbia River and northern border of UMCD	Land between Columbia River and northern border of UMCD is used for agriculture (frames 1-2 and 1-4)
			IV	Parts of Igloo Block K	None
			V	Explosives Washout Area, Parts of Igloo Block J	Plant and buildings present; Washout Area does not appear active (frame 2-5)
			VIII	Part of Igloo Blocks B, C, and D	None
			VII	Entire Section	None
20-Apr-87	W87-2 (Prints)	1:4800, 1:3000	IV	Igloo Block K	None
			V	Igloo Block J	None
20-Apr-87	W87-2 (Mosaic)	1:24000	N/A	Land adjacent to all UMCD borders	Nearly all land appears to be used primarily for agriculture
			I	Entire Section	Disturbed soil in several areas, but level of activity is indeterminable (frame 2)
			II	Entire Section	None
			III	Entire Section	Disturbed soil at Site 82 (frame 11)
			V	Entire Section	Disturbed soil in several areas, but level of activity is indeterminable (frame 11)
20-Apr-87 (cont.)	W87-2 (Mosaic)	1:24000	VI	Entire Section	None
			VIII	Entire Section	Disturbed Soil at Active Landfill (frame 6)
			VII	Entire Section	None

Date	Map Text ID	Scale	Study Section Number	Areas Photographed	Significant Findings
26-Jul-92	S92012	1:4200	VIII	Active Landfill	Vehicles and evidence of activity (frame PP-1)
26-Jul-92	S92013	1:4200	V	Explosives Washout Area	Signs of possible excavation in the explosive washout area and nearby gravel pit (frame 2-3)
10-Nov-93	S93018	1:5400	IV	Igloo Block K	None
10-Feb-95	S95003	1:4200	VIII	Part of Igloo Block A	None
			IV	Part of Igloo Block K	None
			V	Explosive Washout Area	New excavation near washout area (frame 1-5); gravel or soil piles, three new large buildings, and increased activity near washout area (frame 2-5)
			VI	Part of Igloo Block F	Disturbed soil, buildings, and pit near railroad tracks (frame 3-)
			VII	Entire Section	Disturbed soil with several storage bins or vehicles (not actively used) at Inactive Landfill (frame 1-11)
5-Feb-96	S9697003	1:7200	V	Explosive Washout Area	Very little activity; several buildings have been removed, one excavation has been recently backfilled (frame 2R-7)
			VIII	Part of Igloo Blocks B and C	None
13-Jan-97	S97002	1:4200	VIII	Active Landfill	Evidence of expansion and new buildings (frame 1-2)
13-Jan-97	S97003-B	1:7200	III	Site 9 and part of unoccupied area	None
			IV	Part of Igloo Block K	None
			V	Part of Igloo Block J	None
17-Dec-97	S97027	1:6000	IV	UMCDF	Active construction and excavation for incineration plant (frame PP-1)

Date	Map Text ID	Scale	Study Section Number	Areas Photographed	Significant Findings
15-Jul-00	S00008	1:4200	IV	UMCDF	Construction appears nearly complete, but crane shows evidence of continued construction; evidence of use of nearby gravel pit (frame 2-3)
29-Jun-05	Lower Left	Scale on map	II	Deactivation Furnace	Vehicles and evidence of activity
			III	Part of Igloo Block H	None
			V	Bottom left corner	None
			VI	Part of Igloo Block F	None
29-Jun-05	Middle Left	Scale on map	I	Lower section of ADA	None
			II	Deactivation Furnace	Vehicles and evidence of activity
			III	Part of Igloo Blocks H and I	None
			V	Part of Igloo Block G	None
			VI	Part of Igloo Block F	None
29-Jun-05	Upper Left	Scale on map	I	Upper section of ADA	None
			III	Upper section of West Central	None
			IV	Part of Igloo Block K	Vehicles and evidence of activity
			V	Part of Igloo Block J	None
29-Jun-05	Lower Right	Scale on map	VI	Part of Igloo Block F	None
			VII	Entire Section	Maintained vegetation, vehicles, and evidence of activity
			VIII	Igloo Block A	None
29-Jun-05	Middle Right	Scale on map	V	Part of Igloo Blocks J and G, and EWL	None
			VI	Part of Igloo Block F	None

Date	Map Text ID	Scale	Study Section Number	Areas Photographed	Significant Findings
			VIII	Part of Igloo Blocks B, C, and D	None
29-Jun-05	Upper Right	Scale on map	III	Upper right corner	None
			IV	Part of Igloo Block K	None
			V	Part of Igloo Block J and EWL	Vehicles and evidence of activity
			VIII	Part of Igloo Blocks E and D	None
29-Jun-05	Overvie w	Scale on map	I	Entire Section	None
			II	Entire Section	Vehicles and evidence of activity
			III	Entire Section	None
			IV	Entire Section	None
			V	Entire Section	Vehicles and evidence of activity
			VI	Entire Section	None
			VII	Entire Section	Maintained vegetation, vehicles and evidence of activity
			VIII	Entire Section	None

2.4 Records Review

The following section details the environmental record sources used during the2010 ECP document research. No additional record sources were used for the 2013 update.

2.4.1 Environmental Record Sources

A search of state and federal environmental databases was undertaken for the UMCD and any listed sites within standard search distances. The findings of the search are summarized below.

Reasonably accessible Army environmental documents, county and city records, and aerial photographs of the property were reviewed to investigate land uses at the site. Local authorities were contacted to learn about historic uses of buildings and lands on the site. Available information on past land uses and their potential impacts was assessed. Other documents and resources of historical import that were used include:

- Readily available records and files documenting where hazardous materials were stored and used onsite (a summarized list is included in Section 4.3).
- A Chain of Title summary, prepared to document the historic use of the property. This inquiry reviewed recorded deeds, leases, mortgages, easements, and other appropriate documents. A copy of the Chain of Title report is presented in Appendix D.
- Files at the US Army Public Health Command were reviewed for documents addressing human health matters.
- Environmental documents and files at the US Army Environmental Command (AEC).
- Historical documents and maps at the National Archives and Records Administration in College Park, Maryland.
- Copies of permit applications and any notices of violations concerning the site.

2.5 Interviews

Several interviews of key past and current facility employees were conducted in 2009 to aid in identifying environmental conditions at the installation. The names, titles, and years familiar with UMCD of personnel interviewed are provided in Table 5. The interviews included topics of general environmental interest and specific areas of interest identified during the records review and visual site inspections. Copies of the interview reports are included in Appendix E. Regarding interviews from local regulatory agencies, both ODEQ and EPA Region 10 personnel have been significantly involved in UMCD activities. Meetings with EPA occurred on a monthly, weekly, and sometimes daily basis regarding the UMCD facility. Both EPA and ODEQ have participated in the three Five-Year Reviews that have been completed to date for UMCD. EPA, ODEQ, and the Commander of UMCD have signed off on these Five-Year Review documents, showing a multiagency collaborative effort.

Table 5. List of Interviews Conducted in 2009 for the 2010 ECP (Refer to Appendix E)

Name	Title	Years Familiar with Installation
Mark E. Daugherty (retired)	BRAC Environmental Coordinator Assistant Chief of Staff for Installation Management BRAC Division	21
Donald C. Gills (no longer employed)	Environmental Protection Specialist Natural and Cultural Resource Project Manager Water Program Manager Air Program Manager NEPA Program Manager	14
Deborah S. Lopez (retired)	Environmental Protection Specialist RCRA Program Manager Risk Management Directorate	9
Phillip M. Ferguson	Base Transition Coordinator	19
Mervin Beck (no longer employed)	Radiation Safety Officer	20
David Anderson	ODEQ Project Manager	9

2.6 Data Management

The environmental conditions at the installation were evaluated facility-wide, and findings were compiled in an electronic database. Environmental conditions identified are defined in terms of their potential for environmental impacts in Section 4. The reference documents used in developing the ECP are in the administrative record, which is maintained at the Seattle District USACE.

3. PROPERTY DESCRIPTION

The environmental conditions at the installation were evaluated facility-wide and findings were compiled in an electronic database. It is organized by Study Section and facility number, where appropriate. The following sections describe the history of the UMCD property, along with buildings and sites of interest.

3.1 Installation and Location Description

UMCD is approximately three miles south of the Columbia River, in Umatilla and Morrow counties, Oregon (2009 population 73,347 and 11,533, respectively), and about 12 miles northwest of Hermiston (2008 population 15,297) (U.S. Census Bureau 2010). It is positioned at the intersection of Interstates 82 and 84, approximately 35 miles south of the Tri-Cities area of Washington State, in a region of gently rolling hills sloping northwest to the Columbia River. The installation is located in all or parts of Sections 1-28 in T4N, R27E, W.M.; Sections 31-36 in T5N, R27E, W.M.; Section 36 in T5N , R26E, W .M.; and Sections 1, 12, 13, and 24 in T4N, R26E, W.M., in Morrow and Umatilla counties, Oregon, containing 19,728 acres. The Army owns approximately 17,054 acres. The remaining acreage, a buffer area of 2,674 acres on the north and east boundaries, is privately owned and is covered by restrictive easements.

The site is entirely enclosed by fencing. The property's main features include 1,001 concrete igloo structures, active and inactive buildings, roads, and a chemical disposal facility (UMCDF). The igloos that were once used for the storage of conventional and chemical munitions are now empty, as all the remaining chemical stockpiles were eliminated by October 2011. Other actively used buildings are predominantly in the Administration Area in the south-central portion of the base, the UMCDF, and the K Block area. Information on ACM, lead, and LBP for all buildings at the facility that are not in secured areas, or those buildings constructed after August 1992 (notably the UMCDF and associated buildings), can be found in Sections 4.6 and 4.7.

3.2 Historic Land Use

The land occupied by UMCD was historically inhabited by the Sahaptin-speaking Umatilla Indians, and while there was some initial contact between the Umatilla Indians and Euroamericans in the latter part of the 18th century, actual settlement of the area by Euroamericans did not begin in earnest until the middle of the 19th century, when mining and grazing opportunities developed. In 1855, regional Cayuse, Umatilla, and Walla Walla tribes were relocated onto the Umatilla Indian Reservation. Portions of the present-day UMCD were once a part of that reservation *(*Earth Technology Corporation 1994, 1995, 2002*).*

Early in the 20th century, private companies attempted to cash in on the region's growing prosperity by developing irrigation systems. The Oregon Land and Water Company Canal, less than one mile north of UMCD, was completed in 1904. The town of Irrigon quickly became a thriving community. Likewise, the town of Hermiston was created by a private irrigation project, which was federally owned. An estimated 1,800 people were farming the irrigated lands around Hermiston by 1920. Dairy farms, alfalfa fields, vegetable gardens, and orchards sprang up in these irrigated tracts.

The Messner-Hinkle Cutoff was constructed in 1915 by the Oregon-Washington Railroad and Navigation Company. This is now the main line of the Union Pacific Railroad and forms the southern boundary of UMCD. The UMCD lands seem to have been used almost exclusively as rangelands before acquisition by the Army in 1940.

During World War I, American soldiers in training camps in the southern United States began dying of malaria. Because of these deaths, the Army started to look for locations in more arid climates where new training camps could be established. The war ended before the Army could carry out plans for a new camp at this location, but in 1940, when the Army needed to establish a new ammunition and supply depot, they returned to Umatilla. The area was sparsely populated, so the potential for casualties in an accident was decreased, and the climate was relatively mild with low humidity, which was good for long-term storage. Good rail transportation was available in the immediate vicinity. The parcel of land chosen was open, undeveloped, and easily acquired from the Bureau of Land Management and private owners (primarily the railroad) *(*Earth Technology Corporation 2002*).*

On October 14, 1941, War Department General Order No. 11 designated a 16,000-acre tract of land as a Military Reservation. In that same year, the U.S. Government acquired about 8,800 acres from various owners, including Umatilla and Morrow counties, the Northern Pacific Railway Company, and other private owners. An additional 7,200 acres were withdrawn from the Department of Interior and Bureau of Land Management. Safety easements were acquired for about 2,809 acres from private owners and an additional 1,280 acres of Federal withdrawn lands in mid-1950s on the north and east boundaries. Prior to acquisition and withdrawal, these lands were either undeveloped or used for agricultural pursuits, including fruit orchards, dairy farming, and poultry farming *(*USACE Seattle District Real Estate Division 2008*).*

Construction began in 1941 on shops, offices, warehouses, family housing, barracks, railroad siding, and the 1,000 igloos that would be used for ammunition storage. As many as 7,000 workers were employed at the peak of construction. The Umatilla Ordnance Depot (Depot) was dedicated on October 14, 1941, and charged with the mission of storage and issue of ammunition, small arms and components, lend-lease, quartermaster supplies, and the storage and processing of vehicles. Less than two months after the dedication, the United States entered into World War II. Employees began working around the clock to ship, receive, and store ammunition. Much of the civilian workforce lived in the community of Ordnance, which the government built for them in 1941, just outside the Depot's southern entrance. Many local Native Americans worked at the Depot as well. Italian prisoners of war from a camp near Stanfield, Oregon, were brought to the Depot to work, while other prisoners of war worked in canneries near the site. Eventually that camp was moved to the Depot. Migrant workers from Mexico and Haiti were recruited to work in the fields during the war (Boreson 1996). After World War II ended, activity decreased at the Depot, but large stocks of ammunition were sent there for maintenance and storage or demilitarization, and the Depot remained one of the major employers in the area.

During the Korean War, activity at the Depot increased again. Ammunition was shipped up the Columbia River by barge to Irrigon and then transported overland to the Depot. Following completion of the McNary Dam project and the end of the Korean War, the population of Ordnance decreased sharply. In 1958, Ordnance was declared surplus and sold to a local pig rancher.

Ammunition maintenance buildings were constructed at the Depot in 1955 and 1958. Between 1957 and 1960, 4,000 acres of adjoining land was added to Depot property as a safety precaution. In 1962, the Depot was renamed Umatilla Army Depot and given the mission of receiving, storing, issuing, and maintaining chemical munitions.

The Depot once again became a major employer in the area during the Vietnam conflict. The Depot shipped munitions to Vietnam from 1965 to 1973. After the Vietnam shipments ceased, the Depot became a reserve storage activity under the command of the Tooele Army Depot, and in 1973 was renamed Umatilla Depot Activity (UMDA).

By 1988, the Depot was recommended for realignment in accordance with BRAC provisions. Most conventional ordnance was either moved to Hawthorne Army Depot or destroyed. In October of 1995, the Depot was placed under the Soldier Biological and Chemical Command (SBCCOM), and was once again redesignated, this time as the Umatilla Chemical Depot (UMCD).

The Base Cleanup Plan (BCP) report by Earth Technology Corporation in 1995, provides a compilation of the previous landowners and acquisition dates in Table 1-2 *Property Acquisition Summary* and Table 1-3 *History of Installation Operations*, provides a compilation of the period of operations, types of operations, and hazardous substance activities *(*Earth Technology Corporation 1994, 1995, 2002)*.*

3.3 Facility History

The construction of 1,001 ammunition storage igloos began in February 1941. A total of 1,002 igloos were built over the life of UMCD. One of the original 1000 igloos, B 1014, exploded, and two new igloos (#1901 and #1902) were constructed. By the end of 1941, the installation began functioning as an ammunition storage facility. In 1947, an ammunition renovation complex was constructed. Two ammunition maintenance buildings were added in 1955 and 1958. The Army began storing chemical agent-filled munitions and 1-ton containers of chemical agents at K Block in 1962. However, no chemical weapons have been used, manufactured, or tested at the site. The chemical munitions were received for storage at the site from 1962 through 1969. Blue Band Tubes (BBTs) were used for chemical agent detection from approximately 1972 to early 1982 in the K-block igloos.

In addition to the chemical munitions, conventional munitions were stored in magazines and igloos in Blocks A through J. Missiles and missile fuel components, including unsymmetrical dimethyl hydrazine (UDMH) and red fuming nitric acid (RFNA), were stored from the mid-1950s until the early 1960s

No manufacturing operations were conducted at UMCD, but munitions testing, rework, demolition, and disassembly operations were performed in several areas throughout the installation. The Explosives Washout Plant area, located in the central portion of UMCD, and the ADA grounds, located along the northwestern boundary of UMCD, are the most noteworthy of the areas.

Umatilla's chemical stockpile consisted of projectiles, rockets, land mines, spray tanks, and bombs containing the nerve agents GB and VX. One-ton containers stored at the Depot were filled with GB, VX, and blister agent HD. Chemical agent storage facilities were previously operated under the U.S. Army Chemical and Biological Defense Command, and now under the Chemical Materials Agency (CMA). At one time, 12 percent of the nation's stockpiled chemical munitions were stored within UMCD (UMCD Personal Communication 2009-10)*.*

In 1986, in response to the public concerns about potential health threats posed by the disposal of chemical warfare materials, Congress passed Public Law 99-145 which required DoD to dispose of chemical warfare material stockpiles. In 1993, the United States signed an international disarmament treaty outlawing the development and stockpiling of chemical warfare materials.

This agreement was developed at the Convention for the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, otherwise known as the Chemical Weapons Convention. Under the terms of this agreement, the U.S. was to destroy its entire inventory of chemical warfare materials by October 2012. All chemical agents at this installation were destroyed by October 2011. The facility destroyed 220,604 munitions and containers containing 3,717 tons of GB, HD and VX via high-temperature incineration, representing 100 percent of the base's stockpile.

3.3.1 Operational History

A variety of activities involving the handling of hazardous substances and generation of listed hazardous wastes have occurred at UMCD through its history. These activities include fuel oil storage and distribution, motor pool and service station operations, munitions renovation, and ammunition maintenance. These activities generated waste petroleum, oil, and lubricants (POL), battery acid, solvents, paints, and pesticides.

Renovation of conventional munitions generated hazardous wastes, including RFNA, aniline, explosive contaminated rinse water, and solvents. Other wastes generated included expired ordnance and ordnance propellant. A timeline of operations follows.

Pre-1941	Private, county, and Bureau of Land Management lands - No hazardous substance activities
1941-1945	Conventional ordnance storage - Ordnance storage area - Vehicle maintenance - Fuel/oil storage - Landfills - Ordnance demolition areas
1947-1962	Conventional ordnance storage, renovation, maintenance - Ordnance storage areas - Vehicle maintenance - Fuel/oil storage - Landfills - Ordnance demolition areas - Ordnance renovation areas - Ordnance maintenance areas - Machine shop
1962-1994	Conventional ordnance storage/demolition and chemical munitions storage and maintenance - Ordnance storage areas - Vehicle maintenance - Fuel/oil storage - Landfills - Ordnance demolition - Chemical munitions storage areas
1994-2011	Depot realigned, storage and demilitarization of chemical agent - Vehicle maintenance - Fuel/oil storage

	- Chemical agent storage - Chemical demilitarization
2011 to present	All stockpiled chemical agents were destroyed by October 2011. Effective 1 August 2012, Umatilla Chemical Depot, OR (Site UID 7656, Legacy Site Code 41725) was closed and transferred to inactive operational status. UMCD is under the command of Joint Base Lewis McChord.

3.3.1.1 Umatilla Chemical Agent Disposal Facility (UMCDF)

Construction began in June 1997 on the Umatilla Chemical Agent Disposal Facility. UMCD's original chemical agent stockpile included nerve agents GB, VX, and blister agent HD. These chemical agents were stored in a variety of munitions, including:

- M55 rockets
- 155-millimeter and 8-inch artillery shells
- 500 and 750-pound bombs
- Land mines
- 1-ton containers
- Aerial spray tanks

The disposal facility construction was completed in 2001. Before disposal of the chemical warfare materials commenced, UMCDF had to first conduct "trial burns" using surrogate materials, which tested the incinerator's ability to meet performance standards under the most difficult conditions. Trial burn operations were conducted from 2003 to 2004.

On September 7, 2004, UMCDF began its chemical munitions disposal of GB munitions. GB munitions disposal was completed on July 8, 2007. From October 26, 2007, to November 5, 2008, UMCDF completed disposal of chemical agent VX. On June 11, 2009, UMCDF began the HD disposal campaign. All stockpiled chemical agents were destroyed by October 2011. The facility destroyed 220,604 munitions and containers containing 3,717 tons of GB, HD and VX via high-temperature incineration, representing 100 percent of the base's stockpile. Currently the UMCDF is completing RCRA closure activities. All buildings directly associated with the demilitarization activities will be dismantled. All other buildings and utilities are to remain as they are viable for reuse. The Land Reuse Authority (LRA) finalized a plan for the modification request of the UMCDF hazardous waste permit for industrial reuse of all UMCDF structures that do not require demolition. A December 2009 letter from LRA is located in Appendix F (UMCD Personal Communication 2009-10; Earth Technology Corporation 2002; U.S. Army CMA 2007; ODEQ 2008; U.S. Army CMA 2009a, b). The final closure package is scheduled to go to ODEQ in December, 2014.

3.3.2 Process Descriptions (Industrial Facilities Only)

The military mission at UMCD required the storage, handling, and disposal of chemical agent. Past activities at UMCD consisted of materials storage, ammunition demolition, maintenance, ammunition renovation, DRMO activities, waste disposal, and firing range operations. The UMCDF is where the chemical agent stockpiles were destroyed. Those activities may have resulted in known and suspected areas of environmental contamination, including soils, groundwater, and structures. The Army instituted an IRP to systematically identify and evaluate sites that may have been contaminated, and to remediate sites that were found to be contaminated. The following sections describe the industrial facilities associated with the mission at UMCD. See Section 1.2 for further detail on how Study Site Numbers presented in this section relate to the different sections of the ECP.

3.3.2.1 Materials and Munitions Storage Facilities

Earth-covered, reinforced-concrete storage igloos (1,001 total) are located throughout UMCD in Igloo Blocks A through K, and were originally used for storage of various conventional munitions, chemical agent munitions, and chemical agent-related secondary wastes. In accordance with BRAC realignment in 1988 and BRAC closure in 2005, conventional munitions were shipped off-site and no conventional munitions have been stored at UMCD since then. As stated in Section 3.3.1, Operational History, UMCDF has completed its GB, HD blister agent, and VX disposal campaign. Secondary agent-related hazardous wastes were stored in selected J Block igloos. Types of secondary wastes included decontamination equipment, protective clothing, and carbon filters. Secondary wastes in the igloos were stored in 55-gallon drums, wood/cardboard containers, and metal containers. Block I igloos previously contained HD, conventional munitions, and binary munitions, but have been RCRA-closed since December 2009 *(*Earth Technology Corporation 1994; Vista Engineering Technologies, L.L.C. 2007; UMCD Personal Communication 2009-10*)*. The UMCD Partial Closure Plan states that blue band tubes (BBTs) were used for chemical agent detection from approximately 1972 to 1982 (Section 14.2.1 in the partial closure plan). A primary component of the BBT is mercuric cyanide. After use, if agent was not detected, the common practice was to bury the tubes in shallow hole outside of the K-block igloo and outside the south man door of building 659 (if agent was detected they were managed as agent related waste).

3.3.2.2 Umatilla Chemical Disposal Facility

The mission of the UMCDF was to destroy and dispose of the chemical warfare materials stored at the UMCD. The UMCDF used high temperature incineration technology to destroy the chemical warfare materials. The facility began its munitions campaign on September 7, 2004 and completed it in October 2011. The UMCDF was located in the north-central portion of the UMCD, immediately east of Igloo Blocks J and K. The facility consisted of a Deactivation Furnace System (DFS), two Liquid Incinerators (LIC), and a Metal Parts Furnace (MPF) located in the munitions demilitarization building. In support of the disposal mission, there was a container handling building, a process utility building, a personnel and maintenance building, and a laboratory. A Pollution Abatement System (PAS) was installed at the LIC and MPF. This system cooled and cleaned the incinerator gases to ensure they met clean air regulations. Each PAS used a wet scrubber to clean the incinerator gases before being discharged. The scrubber waste, called scrubber brines, accumulated in tanks in the Brine Reduction Area (BRA).

The container handling building received and stored chemical agents waiting for processing. The agent was transferred to the munitions demilitarization DFS, the LIC, or the MPF. The DFS accepted solid, energetic materials and any remaining agent in the rocket and land mine pieces. The DFS consisted of two furnaces, the primary and secondary chambers, operating at 1,050 degrees Fahrenheit (^oF) and 2,000 ^oF, respectively. Containers with liquid agent were drained into an agent collection system and then fed to the LIC. The LIC accepted chemical agents and decontaminating solutions. The LIC consisted of a primary and a secondary chamber operating at 2,700 and 2,000 ^oF, respectively. The drained 1-ton containers were sent to the MPF for thermal decontamination and to destroy remaining agents. The MPF accepted solid metal parts, such as land mine over-pack pails, bulk/1-ton containers, and plant operations and maintenance wastes. The MPF consisted of a primary and a secondary chamber operating at 1,600 and 2,000 °F, respectively.

The original design of the facility was to include a Dunnage Furnace (DUN) for the destruction of all secondary waste streams. Construction of the DUN was placed on hold in June 2000 when UMCD was granted a permit modification by the Oregon Department of Environmental Quality (ODEQ). UMCD requested this modification after lessons learned at the Johnson Atoll chemical agent disposal system and the Tooele Chemical Agent Disposal Facility disposal facilities in Johnson Atoll and Utah, respectively. The UMCD conducted a Human Health Risk Assessment (HHRA) and a Quantitative Risk Assessment (QRA), both of which found that the lack of a DUN furnace would not cause an increase in long-term health risks to the general public. After the material was treated, it was either sent to a metal recycler or the hazardous waste disposal facility in Arlington, Oregon *(*RDC 2000; U.S. Army CMA 2007, 2009a; UMCD Personal Communication 2009-10)*.*

In May 2008, the CMA submitted an Environmental Assessment (EA) that proposed an evaluation of the effect of the installation and operation of additional equipment and systems for processing of HD at the facility. The CMA determined that a portion of the inventory of 1-ton containers of blister agent HD stored at UMCD may contain more elevated levels of mercury than previously anticipated. The content was considered to be too high to process in the MPF without exceeding compliance limits established under RCRA or the Clean Air Act. The EA determined that there was a potential for a large amount of solids in the 1-ton containers, which may make it difficult to drain the agent out. This excess of solids in the 1-ton containers could lengthen the MPF processing .

To control and prevent mercury emission exceeding allowed levels, the facility modified the PAS filtration systems at the LIC and the MPF. The activated carbon was replaced with sulfur-impregnated carbon to remove mercury from the stack gases. To address the excess solids in the 1-ton containers, the agent collection system capacity was expanded and additional equipment was installed to break up and mobilize the 1-ton container of excess solids. In addition, the management of liquid brines was modified during the processing of mercury contaminated wastes. Originally, the BRA created brine salts by evaporating the water from the brines of processed, non-mercury contaminated, distilled HD. Operation of the BRA using this methodology when processing mercury-contaminated, distilled HD could have resulted in the emission of mercury. Instead, the EA proposed that all scrubber brines be shipped off-site in liquid form and no brine salt would be created.

3.3.2.3 Ammunition Demolition Activities (ADA)

The ROD-designated ADA OU is a 1,750-acre area located in the northwestern corner of UMCD. From 1945 to 1992, the ADA was used by the Army to dispose of ordnance by burning, detonation, dumping, or burial. Activities were conducted at a number of locations throughout the ADA. Soil contamination exists at 20 sites within the ADA. In addition, ADA activities resulted in the presence of quantities of munitions and explosives of concern (MEC) at locations across the entire ADA. Former UMCD employees who worked in this area indicated that materials other than those reported may have been handled at ADA area sites. ADA area sites include those listed below.

Study Site 7, **Aniline Pit** – The Aniline Pit was a 40 ft x 40 ft fenced area within the ADA. During the period in which the pit was used, aniline was reportedly hauled to this unit and dumped. No significant levels of inorganics were detected and no organics were detected. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 8, Acid Pit – This was a limestone-lined pit used to dispose of RFNA (acid wastes) from 1955 to 1962. Approximately 300 to 400 20-gallon barrels of RFNA were reportedly disposed of in the pit. In addition, WEDAC solutions from Site 67 were reportedly disposed of in the acid pit. High nitrate concentrations, moderate heavy metals contamination, and low pH levels have been detected in the subsurface soil of the pit. A low level of RDX was detected in a groundwater monitoring well believed to be hydraulically down-gradient of the acid pit; however, a duplicate sample from the same well did not contain RDX above the laboratory detection limit. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 13, Smoke Canister Disposal Area – The Smoke Canister Disposal Area is a ridge of dirt approximately 150 ft long by 30 ft wide by 6 ft high in the central portion of the ADA grounds. It was used to dispose of burned debris from the UMDA-era smoke canister burning operations. Air photos indicate the possible existence of a trench prior to 1970. Some burning may have occurred here. Low concentrations of heavy metals have been detected by previous sampling of the surface soil. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 14, Flare and Fuse Disposal/Bird Cage Area – The Flare and Fuse Disposal area is located in the ADA and consists of a 30 ft by 50 ft by 6 ft high mound containing soil and burned reside, though no actual burning was reported to have taken place. Former UMDA employees reported that the site was used to burn pyrotechnics in an area referred to as the "bird cage." A 1970 aerial photograph shows that the semicircular bird cage was replaced by a circular pit and a mound. Aerial photographs of the site in subsequent years indicate no significant changes in the site area other than decreased activity and less definition (Dames and Moore 1992b). Previous sampling of the site surface soil detected some heavy metals and nitrate at low concentrations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

Study Site 15, 2,4,6-TNT Sludge Burial and Burn Area – The TNT Burn Area is an open gravel area within the ADA approximately 1 acre in size. This area was used to dump and burn TNT-containing sludges and dunnage wastes. In addition, a scrap metal pile was located in the vicinity of the site prior to October 1990. Soil samples show elevated concentrations of metals and moderate levels of 2,4,6-TNT, HMX, and RDX.

Study Site 16, **Open Detonation Pits** – This site consists of numerous active and inactive pits used to explode defective or unwanted ordnance. Elevated levels of metals and some explosive constituents were detected in some of the test pit soil samples. Analytical results suggest that groundwater does not appear to be impacted by past operations. In the 1994 ROD, it states that risks and hazards indices for this site are within or below the acceptable cancer risk range or non-cancer level for future light industrial users.

Study Site 17, **Above Ground Open Detonation Area** – This site was used for the detonation of M55 rockets and M23 land mines. The munitions were detonated in a steel tube running through the center of a metal-filled gravel bin. Chemical agents from the M55 rocket canister were drained and collected as part of operations at the Drill and Transfer Site (Study Site 49) prior to detonation at Site 17. Eleven metals were detected above background levels in one or more of the samples, and low to moderate levels of three explosive constituents were detected in one or more samples.

Study Site 18, Dunnage Pits – The Dunnage Pits are located in the ADA and were two trenches, approximately 350 ft by 30 ft by 8 ft deep, used for the disposal and burning of dunnage and possibly liquid wastes. Base personnel interviewed during the RFA stated that waste solvents, oils, and paint strippers had been disposed of in the trenches. Interviews with UMCD retirees and aerial photos indicate that several dunnage pits were once located farther east of the existing pits (Dames and Moore 1992b). An ash residue sample collected from one of the pits in 1981 was found to contain arsenic and chromium above toxicity limits established under RCRA. Sampling of the surface soil in the eastern pit in 1988 did not detect any nitrate/nitrite, volatile organic analytes (VOA), or priority pollutant base-neutral and acid extractable organics (BNAs). The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

Study Site 19, Open Burning Trenches/Pads – This area was a series of open burning trenches located near the dunnage pits within the ADA. There were approximately eight trenches that were laid out parallel to each other and were approximately 10ft wide by 100 ft long, with depths not exceeding 1 ft. Results from soil samples indicate high levels of metals and explosive constituents, mainly in the shallow soil, and likely due to past incomplete burning operations of debris and waste.

Study Site 20 OB Areas - Several Open Burning Areas were noted during the RFA within the ADA. The areas were characterized by burnt soils with little to no vegetation and metal scraps on the ground. These areas are included as an SWMU, as the waste material burned could not be verified.

Study Site 21, Missile Fuel Storage Areas – This area consisted of three metal sheds used to store missile fuel components. Presently, there is no storage of fuel components at the site. A surface soil sample was collected by a previous investigation and the results indicate no explosive constituent contamination, nitrate/nitrate slightly above background, and low levels of one VOA and BNA TIC and three unknown BNA TICs. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 28, Missile Fuel Burning Area – The Missile Fuel Burning Area is located in the ADA near the east-central portion of the grounds. During the 1990 Enhanced PA, UMCD employees reported that RFNA fuel was burned in a portable kiln in this area. Due to the fact that the RFNA was burned in a portable kiln, any contamination was limited to spills while filling the kiln and would be localized in the near surface soil below the gravel.

Study Site 31, Pesticide Pits – A row of existing pits at this site may have been used to dispose of or burn pesticide solutions and general debris, or to detonate munitions. The area to the north of the existing pits has been identified as a torpedo burn area; however, no information concerning the activities in this area was provided by current or former UMCD employees. A large area to the south of the row of existing pits once contained numerous pits that are now graded over. Previous sampling investigations results of soil and sludge identified 12 metals that were detected above the comparison criteria, occurring primarily in the shallow soil, but with some isolated pockets of contamination at depth. Low concentrations of explosive constituents were detected at two test pits, and the sludge sample and five pesticides were detected in two test pits. Analytical results suggest that groundwater does not appear to be impacted by past operations.

Study Site 32, Open Burning Trays – Two burning trays located on gravel pads within the ADA grounds were used to burn explosive propellant powder. The northern tray area previously included an operation in which cartridges were flashed with diesel fuel. Soil results indicated high levels of aluminum, antimony, barium, copper, lead, magnesium, potassium, silver, and zinc above background concentrations. In addition, low levels of 2,4-DNT and nitrate/nitrite were detected. UMDA previously had a permit from ODEQ to conduct this operation. Both the northern tray and a related 150-gallon above ground fuel tank have since been removed.

Study Site 38, Pit Field Area – The pit field area consists of numerous existing pits, 6 to 8 feet in diameter and currently 1 to 2 feet deep. The site covers an area of approximately 50 acres. The pits were apparently used to detonate or dispose of ordnance materials, based on their resemblance to other ADA pits and debris observed at the site; however, present and former UMCD employees had no recollection of the use of this area. Results show that limited localized contamination from some metals and a few explosive constituents are present, and are limited to the shallow soil, though isolated contamination exists at depths of 10 feet. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 41, GB/VX Decontamination Solution Burial Areas – Former UMDA employees indicated that decontamination solutions from a leaking GB bomb brought onsite in the early 1960s may have been disposed of in one of two areas in the northern portion of the ADA grounds. A previous investigation collected surface and subsurface soil in one of the suspected disposal areas. These samples were analyzed for Isopropyl Methyl Phosphonic Acid (IMPA), a degradation product of agent GB, but none of the analytes were detected in the soil. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 54, Possible Disposal Pit Location – A small pit may have once been briefly used to dispose of unknown items. During the aerial photographic analysis done for the Enhanced PA, an area resembling a dark pit can be discerned, though the photo examined was of very poor quality. In the subsequent 1956 aerial photo, the area is no longer discernible. No sampling occurred at this site during the RI because it could not be located.

Study Site 55, Trench/Burn Field – This site is located in the north-central portion of the ADA grounds. From 1950 to 1965, this site contained several rows of trenches where it is assumed that ammunition demolition or disposal activities may have been conducted. The trenches appear in all of the aerial photographs reviewed through 1965 (Dames and Moore 1992b). Analytical results indicate low levels of silver, arsenic, and magnesium slightly exceeding the background comparison criteria, and low levels of two explosive constituents were detected at one pit. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 56, Munitions Crate Burn Area – This site is located in the north-central portion of the ADA grounds. The area was reportedly used to burn empty wooden crates from munitions. The aerial photographs reviewed during the RI indicate that the site was active prior to 1950. A dark circular pit is evident in the aerial photographs in 1951 and 1956. In the 1958 photograph, the pit appears to have been partially filled in. The site is no longer visible in the aerial photographs taken in 1972 or in following years (Dames and Moore, 1992b). The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 57, Former Pit Area Locations – This site consists of three areas located in the central and south-central portions of the ADA grounds that were active prior to 1950 and through the early 1970s, as indicated by site aerial photographs. Soil in these areas is disturbed and in the form of trenches or pits (Dames and Moore, 1992b). It is assumed that ammunition demolition or disposal activities may have been conducted at this site. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 58, Borrow/Burn/Disposal Area – Located in the northeast corner of the ADA grounds, this site appears to be a borrow site in the 1949 aerial photograph. In the early to mid-1950s, the site is more distinguishable in the aerial photographs. The surface of the site is covered with very neat rows of soil, similar to crop rows. It is assumed that ammunition demolition or disposal activities may have been conducted at this site. A dark pit is apparent on the north side of the feature during this time period. Evidence of disturbed soil was observed in aerial photographs through 1968. In 1970, the definition of the site had faded in the photographs (Dames and Moore, 1992b). The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 59, GB/VX Decontamination Solution Disposal Areas – This site consists of two areas located in the central area of the ADA grounds. Former UMDA employees indicated that GB/VX decontamination solutions were disposed of on the ground in these areas in the early 1960s, on at least two separate occasions. The exact locations of the disposal activity could not be determined. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site 60, Active Firing Range – Located near the southwest corner of the ADA grounds, this site includes an active rifle and machine gun range and an active pistol range used by the Depot and the National Guard since the early 1980s. Targets are set up at each of the firing areas. There are no impact areas behind the targets; bullets that miss the targets landed in open areas (Earth Technology Corporation, 1994). The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

3.3.2.4 Maintenance Activities

Throughout UMCD's history, maintenance operations have taken place at Buildings 4, 5, 7, 10, 11, 31, and 75. Building 4 was used as a machine shop. Activities included metal parts machining, welding, repair and cleaning of steam cleaning equipment, and brush painting. Building 5 was a vehicle garage. Typical activities included battery charging, steam cleaning, welding, engine maintenance and overhaul, and parts cleaning. Building 7 was a carpentry shop. Wood cutting, spray painting, and brush painting are performed here. Building 10 was the diesel repair shop. Activities include cleaning and maintenance of diesel engines, brush painting, and battery charging. Building 11 housed the tool crib, offices, medical clinic, chemical protection equipment (CPE), protective mask fit area, and mail room. Activities performed in Building 4 included welding, soldering, cleaning of electrical motors, plumbing, pipe fitting, and brush painting. Prior to 2002, Building 31 was used as the motor pool. Light maintenance and battery charging operations have been performed here. Building 8 is the pest control building where pesticide mixing occurred *(*Earth Technology Corporation 1994; UMCD Personal Communication 2009-10*).*

3.3.2.5 Ammunition Renovation Activities

Building 131 was used for abrasive blasting, welding, cleaning of rocket cases, and spray painting of ammunition. Building 417 housed spray painting and deep drill of 105-millimeter (mm) shell operations. Building 431 was used for spray painting and stenciling of ammunition operations. Building 434 operations included spray painting and removing 2,4,6-tetranitro-N-methyaniline (tetryl) charges from grenades. Building 489 housed the shell washout operations. Building 493 was used for spray painting, abrasive cleaning of shell bases, and ammunition demilitarization. Building 608 was used for spray painting and buffing of shell bands. Building 608 was used for renovation of HD containers from 1978 to 1979 *(*Earth Technology Corporation 1994; UMCD Personal Communication 2009-10).

3.3.2.6 Former Defense Reutilization Marketing Office (DRMO) Area Activities

Site 22 is the former Defense Reutilization Marketing Office (DRMO), which occupied approximately 1 acre in the southwestern portion of the administration area until the early 1990s. The former DRMO area includes warehouse Building 42 and both paved and bare-ground storage areas. The area currently is used to store scrap or salvage material, such as scrap metals, wooden crates, and pallets prior to removal and disposal off-site. Rifles, empty projectiles, brass and lead bullets, scrap metals, vehicles, and furniture are stored in this area prior to being sold. Leaking transformers containing PCB-contaminated oil were reportedly stored temporarily on the bare ground under the west end of a metal shelter located at the southwest end of the site. This site is included in the Miscellaneous Sites OU under the Federal Facilities Agreement (FFA).

3.3.2.7 Firing Range Operations

Two firing ranges are located near the southwest corner of the ADA grounds. The site in the western portion of this area includes a rifle and pistol range. A rifle/pistol pop-up range is in the eastern portion of this area. Impacted areas have been created behind the targets in both shooting locations; bullets that miss the targets impact berm in the Ammunition Demolition Activity grounds to the north. The remains of a former trench are located north of the rifle and pistol range (western portion). No materials appear to have been intentionally disposed of in the trench, but many bullets landed in this area *(*Earth Technology Corporation 1994; UMCD Personal Communication 2009-10).

3.3.2.8 Explosives Washout Plant Operations

From the mid-1950s until 1965, UMCD operated an on-site Explosives Washout Plant. The plant processed munitions to remove and recover explosives using a pressurized hot water system. The principal explosive constituents consisted of 2,4,6-trinitrotoluene (TNT), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), octahydro-l,3,5,7-tetranitrol-3,5,7-tetrazocine (HMX), and 2,4,6-tetranitro-N-methyaniline (tetryl). In addition, the munitions contained small quantities of 2,4-dinitrotoluene (2,4-DNT), 2,6-dinitrotoluene (2,6-DNT), 1,3,5-trinitrobenzene (1,3,5-TNB), 1,3-dinitrobenzene (DNB), and nitrobenzene (NB), occurring as either impurities or degradation products of TNT *(*U.S. Army 1992*).*

Operation of the plant included periodic flushing and draining of the explosives washout system. The wash water was discharged via an open metal trough to two infiltration lagoons located northwest of the plant. The lagoons were constructed in the 1950s and used until 1965, when plant operations and all discharges to the lagoons ceased. The Explosives Washout Lagoons (EWL) was two adjacent, unlined rectangular lagoons constructed in the native sandy, gravelly soil. The north and south lagoons measured 80 feet by 39 feet, and 80 feet by 27 feet, respectively, and both were 6 feet deep. A 15-foot wide gravel berm separated the lagoons, and gravel berms encircled both lagoons as well. The depth from the bottom of the lagoons to groundwater generally varied from 45 to 50 feet. The lagoons were typically dry; any collected precipitation tends to infiltrate rapidly. A total of 85 million gallons of effluent is estimated to have been discharged to the lagoons during the period of plant operation. The wastewater from the washout operation, also known as "pink water," contained high concentrations of explosive constituents, primarily TNT and RDX (U.S. Army 1992; USACE 2004*).*

3.3.3 Occupancy, Lease, and Easement History

The great majority of the UMCD was acquired or withdrawn from the Bureau of Land Management in the early 1940s in the build-up to World War II. In the mid-1950s, easements were acquired for additional land and withdrawn from federal lands on the north and east boundaries of the installation for a safety buffer area. A summary of the interests in the 19,728 acres currently held by the U.S. Government and under the jurisdiction of the Army is shown below in Table 6. A complete tract register of all acquired fees, easements, and withdrawn tracts, a legal description, and a real estate map reflecting all acquired interests are included as Appendix D.

Table 6. Interests and Areas

Interest	Acreage/ Certificates/ Licenses
Fee Estate	17,054.41 acres
Easements	2,673.61 acres
Subtotal For Ownership	19,728.02 acres
“No Area” Licenses	2 areas
Water Rights Certificates	8 certificates

3.3.3.1 <u>Acquired Interests</u>

During the early 1940s, the United States acquired 8,774.55 acres in fee simple estate from private owners by direct purchase and condemnation. These are identified as Tracts 1-20 in Appendix D.

The Army obtained use and jurisdiction of lands from the Bureau of Land Management by a series of withdrawals from the Public Domain. These lands are whole or parts of sections (640 acres) in a checkerboard configuration, and are identified as Tracts A, B, and C. Use and jurisdiction of 6,999.86 acres in Tract A was obtained by Executive Order No. 8794, dated June 14, 1941; and 160 acres in Tract B were obtained by Executive Order No. 8999, dated December 26, 1941. These withdrawals were amended by Executive Order 9526 and Public Land Order 986, which restored jurisdiction to the federal control and allowed continued use by the Army. An additional 1,280 acres in Tract C, north and east of the installation, were withdrawn by Public Land Order 1789, published February 10, 1959, to establish a safety area. In 1971 and 1972, 40 and 160 acres, respectively, of Tract C were relinquished to the Bureau of Land Management for disposal. The relinquishments were done with a request that they issue any patents subject to certain restrictive easement rights necessary for a safety area. The total remaining area of withdrawn lands is 8,279.86 acres.

By Public Law 108-375, Section 2846, on October 28, 2004, it was decreed that the approximate 8,300 acres of withdrawn lands within the installation (from Tracts A, B, and C) were no longer suitable for return to the public domain and shall remain under the administrative jurisdiction of the Army for purposes of management and disposal pursuant to the BRAC Act of 1988. Thus, the Army has jurisdiction and is authorized to treat this former withdrawn land as a fee disposal.

Between 1956 and 1958, the United States acquired restrictive easements for the north and east safety areas by direct purchase and condemnation. The 2,648.69 acres in the easements are shown as Tracts 23E through 29E on the Tract Register. In 1974 and 1977, additional easements were acquired over 160 acres in Tracts 130E and 131E for the safety area. These easements were acquired over the same 160 acres formerly held and relinquished to Bureau of Land Management as a part of Tract C, thus preserving the integrity of the safety area. These same rights in Tracts 130E and 131E already existed by virtue of Pubic Land Order No. 1789, dated February 10, 1950, and were still a matter of record in the patent files. In 1971, 135.08 acres of the originally acquired 143.12 acres in Tract 28E were disposed of by sale to the owner of the underlying servient estate. The net easement area is 2,673.61 acres.

The Army has specific restrictions for use of the estate taken for the perpetual restrictive easement:

- The right to prohibit human habitation and remove buildings presently or hereafter used.
- The right to prohibit occupation or erection of buildings or roofed structures, including barns and sheds as well as dwellings, that would be occupied by persons either usually or intermittently.
- The right to prohibit gatherings of more than 25 persons.
- The right to post signs indicating the nature and extent of United States control.
- The right and easement of access for ingress and egress over and across the said lands for the purpose of exercising the above rights. RESERVING, HOWEVER, to the owners, their heirs and assigns, all right, title, interest and privilege as may be used and enjoyed without interfering with or abridging the rights hereby taken, including, but not limited to the right to graze livestock on said lands, and the right to farm the lands, subject to existing easements for public roads and highways, public utilities, railroads and pipelines.

Tracts 23E and 29E were acquired through negotiations granting the U.S. Government the above rights and the additional rights to grant, convey, transfer or assign, or permit the use and occupation of the easement area, by most legal means, as further specified in the Restrictive Easement Deeds dated December 13, 1956 and May 1, 1958, respectively. Only the deeds for Tracts 23E and 29E have these additional rights.

License agreements were obtained for Tract 21L and 22L from the Union Pacific Railroad Company in the form of two agreements dated August 5, 1943 and January 13, 1943, respectively. The Tract 21L agreement was for a private 24-foot-wide road crossing, and Tract 22L Wire Line Agreement was for a ¾-inch galvanized iron pipe conduit underneath and across the roadbed and track for a telephone wire crossing, both along the south boundary of the installation. These agreements essentially provide permissions to cross the railroad tracks and convey no interest in the lands. They are subject and subordinate to the paramount use of railroad purposes by the licensor. The road agreement was to "continue in full force and effect for the duration of the present emergency and for a period of six (6) months thereafter." The document has never been terminated or otherwise amended; thus, by its terms it has expired but the road may still exist and be used by the U.S. Government. The wire agreement is in effect until terminated. The successor railroad company will probably want to enter into new agreements with new installation owners.

During the course of the installation operation, a number of recorded Water Rights were obtained from the State of Oregon. In Oregon, water rights are "appurtenant" (attached) to the specific property where the water use is authorized. Unless an application to transfer the water right to a different parcel of land or an in-stream lease is approved, the water right may be exercised only on the specific land identified in the water right certificate. Maps with illustrations of tract register and Water Right and Jurisdiction are present in Appendix G, Figure 11. The water rights are granted in the certificates presented in Table 7.

Table 7. Water Rights

Description	Well No.	Date	Study Section Location of Well
Certificate of Water Right	Well 1	March 13, 1967	Area VII (Admin)
Certificate of Water Right	Well 2	March 13, 1967	Area VII (Admin)
Certificate of Water Right	Well 3	May 24, 1967	Area V (EWL)
Certificate of Water Right	Well 4	March 13, 1967	Area II (DF)
Certificate of Water Right	Well 5	May 24, 1967	Area II (DF)
Certificate of Water Right	Well 6	January 11 1963	Area III (West Central)
Certificate of Water Right	Well 7	March 13, 1967	Area III (West Central)
Certificate of Water Right	Well 8	January 11, 1963	Not applicable as this well was never drilled

3.3.3.2 Legal Description (Summary)

A summary of the legal description is as follows: all or parts of Sections 1-28 in T4N, R27E, W.M.; Sections 31-36 in T5N, R27E, W.M.; Section 36 in T5N, R26E, W.M.; and Sections 1, 12, 13, and 24 in

T4N, R26E, W.M., in Morrow and Umatilla counties, Oregon, containing 19,728.02 acres. See the legal description in Appendix D.

3.3.3.3 Property Leases and Easements

There are a number of grants of easements for: (1) significant facilities supporting or passing through the UMCD, and (2) training by the Oregon Army National Guard. These are listed below.

DACA67-2-03-72, Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years from October 1, 2002 and ending September 30, 2052, over portions Sections 35 and 36, T5N, R27E, WM; and Section 1, T4N, R27E, WM.

DACA67-2-03-73, Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years beginning October 1, 2002 and ending September 30, 2052, over portions Sections 12,13, 24, and 25, T4N, R27E, WM.

DACA67-2-97-302, Easement for Electric Power or Communication Facility, to Umatilla Electric Cooperative Association, term of 50 years beginning September 26, 1997 and ending September 25, 2047, over portions Sections 1, 12, 13, and 24, T4N, R27E, WM.

DACA67-3-08-109, License for National Guard Purposes, to State of Oregon, term of 5 years beginning January 1, 2008 and ending December 31, 2012, for use of Buildings 115, 53, 36, 30, M1 SIMNET, rifle range, tank commander's proficiency course and the Mobile Conduct of Fire Trainer Pad and associated lands. The lease was extended for another five years (expiring 31 December 2017) for Buildings 18, 31, 62, 6 (and associated fuel farm), 115, 53, 36, 30, Structure 77 (and associated staging area), the field maintenance sub-shop and associated fenced compound, the barracks, the dining facility, the M1 SIMNEY, rifle range area, a tank commander's proficiency course, and the Mobile Conduct of Fire Trainer Pad with transformer.

DACA67-9-03-71, Consent to Cross U.S. Government Easement, to Umatilla Electric Cooperative, indefinite term beginning October 3, 2002, for construction of 115 kV electric transmission line over Tracts 26E and 27E.

DACA67-2-83-72, Easement for Communication Facility, to US West Communications, term of 50 years beginning May 27, 1983 and ending May 26, 2033, for buried cable lines.

DACA67-2-82-137, Easement and Relinquishment of Access rights for a Section of the National System of Interstates and Defense Highways, to State of Oregon, term indefinite beginning January 16, 1984, for right-of-way expansion of I-82 on east boundary of UMCD.

DACA67-2-83-72, Easement for Right of Way for Electric Power Transmission or Communication Facilities, to Pacific Northwest Bell Telephone, term 50 years beginning May 27, 1983 and ending May 26, 2033, for "said facilities" in Section 25, T4N, R27E, WM, and Section 26, T4N, R27E, WN.

There are a number of expired leases, licenses, and permits to various entities that were not renewed, such as the American Red Cross, Oregon State Police, and US West Communications. It is not known whether these or other entities are occupying building or land areas. In addition, there are other entities, such as the Oregon State Health Department, County Disaster Control, and Umatilla Fire Department that are occupying buildings or land areas for storage and other purposes without benefit of documentation.

There may be encroachments on the northwest corner of UMCD from the adjacent farm operations. In addition, the Bureau of Land Management has granted Grazing Permits in Section 32 and three quarters (Tract C) of Section 34; T5NR27EWM. These Permits were terminated and the lands vacated by October 30, 2010.

3.3.4 Range Operations

There are two active small arms ranges at UMCD, located in the southwest tip of the ADA. Authorized personnel at UMCD, as well as the U.S. Army National Guard, use these ranges for small arms practice. As mentioned in Section 3.3.2.3, the ADA is no longer used for demilitarization of munitions (UMCD Personal Communication 2009-10).

An inventory of Closed, Transferring, and Transferred (CTT) and Munitions and Explosives of Concern (MEC) (previously documented as Unexploded Ordnance, Discarded Military Munitions, and Munitions Constituents [UXO-DMM-MC]) sites was conducted at the UMCD during 2003. The results determined that there are two closed ranges totaling 2,132.79 acres at the installation, and four closed MEC sites totaling 43.53 acres. As a part of the inventory, an assessment of the explosive constituents safety risk was conducted using the Risk Assessment Code (RAC) process. These codes were generated for each of the six sites. The RAC is a priority sequencing score generated for a range or site with UXO-DMM and is based on the munitions determined to have been used, discarded, or disposed of at the site. The RAC might not reflect the current risk, as it does not take into account cleanup actions. The scores are as follows: RAC 1 – High Risk, indicating the highest priority for further action; RAC 2 – Serious Risk, indicating a priority for further action; RAC 3 – Moderate Risk, recommending further action; RAC 4 – Low Risk, recommending further action; RAC 5 – Negligible Risk, indicating that no DoD action is necessary. Sites where no RAC score was given indicates that the site is either a munitions constituent site or that the site is not eligible for Defense Environmental Restoration Program (DERP) funding. Table 8 summarizes the CTT ranges and site details for UMCD.

Table 8. Closed, Transferring, and Transferred Ranges and Site Details

Range	Status	Acreage	Use Prior to Closure	Historic Use	RAC
Ammunition Demolition Activity (UMAD-148)	1950-1994 Military Munitions Response Program (MMRP) Closed	1,741.04	Undeveloped	OB/OD Burial Pits	1
Drill and Transfer Site (UMAD-119)	1984-1985 Closed	6.08	Undeveloped	Munitions were drilled, drained, and decontaminated; agent waste placed in holding tanks	NA
Explosive Washout Lagoons (2) (UMAD-023 and -024)	1955-1965 Closed	1.63	Undeveloped	Bomb washout effluent treatment	NA
GB Bomb Disassembly Area (UMAD-039)	1965-1970 Closed	34.19	Undeveloped	Drain and disassemble bombs with GB	NA
Gravel Pit Disposal Area (UMAD-108)	1940-1969 Closed	1.63	Undeveloped	Burial Pits GB and VX decontamination solution disposal	NA
QA Function Range (UMAD-001-R-01)	1945-1975 MMRP Closed	391.75	Undeveloped Falls within safety arc of chemical demil Incinerator project	R&D Small Arms Rifle Range	3
TOTAL ACREAGE		2,176.32			

Source: Range Inventory Report 2003.

The two ranges identified during the inventory include the ADA and the Drill and Transfer Site (Study Site 49). A geophysical survey was completed that identified all possible MEC locations. Cleanup of MEC is ongoing, as the future land use has yet to be finalized. The Drill and Transfer Site

(Study Site 49) was used between 1984 and 1985 to dismantle and dispose of leaking chemical munitions. Drained chemical agents were stored in holding tanks. This site was investigated in the 1990 Enhanced Preliminary Assessment (PA) and no contamination was detected

The four MEC (UXO-DMM-MC) sites identified in the CTT are the Explosives Washout Lagoons (EWL, Study Site 4), the GB Bomb Disassembly Area (Study Site 9), the Gravel Pit Disposal Area (Study Site 33), and the Quality Assurance (QA) Function Range (Study Site 39). EWL Site 4 is approximately 1.63 acres in size and was used from 1955 to 1965 to collect liquid waste from the Explosives Washout Plant. Ordnance were disassembled and the explosive residuals removed via the use of water or steam cleaning. Remediation is currently complete for the soil contamination under IRP, but is ongoing for contamination found in the groundwater. The GB Bomb Disassembly Area (Study Site 9) is located east of the ADA and was used from 1965 to 1970 to disassemble conventional munitions, on a concrete pad, under a metal pavilion. This site was investigated during the 1992 RI and it was determined that no additional response was necessary under IRP. The Gravel Pit Disposal Area (Study Site 33) is located in the central portion of UMCD, and it was reported that VX decontamination solution was disposed of here. Soil samples collected during the 1992 Remedial Investigation determined no form of agent or degradation product was present in the soil, and thus no response was necessary under IRP. The QA Function Range (Study Site 39) is located in the northeast corner of UMCD. From 1945 to 1975 this site was used as a rifle and pistol range, and from 1945 to 1970 flares, photoflash grenades, and mines were tested in the southern portion of the site. A geophysical survey of the site was conducted and remedial actions (RA) have been completed. No Further Action at the Quality Assurance (QA) Function Range (Study Site 39) is deemed necessary. Study Site 39 will continue to be included in the five-year review process to ensure the remedy remains protective of human health and the environment.

3.4 Installation Utilities

The following sections describe the utility systems at UMCD, including water, wastewater treatment, sewage treatment, septic tank and drain field, storm water, electrical, and heating systems.

3.4.1 Water Systems

There are seven on-site deep wells installed at UMCD from the basalt aquifers. Wells 1 and 2 are inoperable and are located in the Administration Area. Well 3 located between I Block and G Block supplies water to the tank behind Building 655, located in K Block. Wells 4 and 5 (both 600 feet deep) serve the Administration Area and the west area. The north area, the location for the UMCDF, is supplied from Wells 6 and 7 (709 and 679 feet deep, respectively). Analytical data show that the water is of excellent quality in all of the operational wells.

Groundwater occurs beneath UMCD in a number of distinct hydrogeologic settings, in a series of relatively deep confined basalt aquifers and in a highly productive permeable unconfined aquifer beneath and to the south and east of UMCD (extending off-post) referred to as the Ordnance Gravel. The unconfined aquifer at UMCD consists of the alluvial deposits and the weathered surface of the Elephant Mountain Member basalt, and is overlain by approximately 50 to 120 feet of unsaturated alluvial sand and gravel. Therefore, ambient depth to groundwater ranges from 50 to 120 feet below ground surface, and varies by such a wide range due to elevation differences of ground surface at the site. The saturated thickness of the alluvial aquifer, particularly in the area of the former explosives washout plant, is approximately 15 to 35 feet. Groundwater levels in the alluvial aquifer have been strongly influenced by irrigation pumping and other artificial causes.

Groundwater levels in the Ordnance Aquifer have shown a net annual increase since the initiation of artificial recharge activities and reduced pumping in the 1970s. More recent data has suggested approximately stable overall groundwater levels since about 1990, notwithstanding seasonal fluctuations. Even so, the recent stabilized groundwater levels are on the order of 10 to 14 feet lower than they were before 1960 (based on Wozniak et al. 1995; IRZ Consulting, LLC. 2009).

From 1990 to 1993, 62 groundwater monitoring wells were installed throughout the facility, as part of the RI. Investigative and characterization activities subsequent to the RI have added numerous additional wells to further characterize site conditions. To date, there have been a total of 120 groundwater monitoring wells installed at the facility. Data obtained from these wells suggest that the natural direction of groundwater flow at UMCD is northward, toward the Columbia River. However, irrigation pumping of the shallow alluvial aquifer causes groundwater in the south and central part of UMCD to flow to the south during the summer and fall *(*Earth Technology Corporation 1994*).*

3.4.2 Wastewater Treatment

Wastewater produced at UMCD is treated by the sewage treatment plant and septic tanks and drain field systems located throughout the facility. UMCD operates these systems in accordance with one National Pollutant Discharge Elimination System (NPDES) permit and two water pollution control facilities permits issued by ODEQ. NPDES permits are required by Oregon for the discharge of wastewater to the ground in order to prevent discharges to surface waters and to protect groundwater from contamination.

3.4.2.1 Sewage Treatment Plant

UMCD operates the sewage treatment plant under NPDES Permit Number 102031, which expires February 28, 2015. Domestic wastewaters in the Administration Area, as well as all steam-cleaning wastes, are run through an oil separator and then routed to the sewage treatment plant located in the south-central part of the facility. The wastewater treatment process consists of an Imhoff tank, standby Imhoff tank, sludge drying bed, and tile-field percolation system. The sewage treatment plant is permitted to discharge an average daily flow of no more than 30,000 gallons per day (gpd). All wastewater gets dissipated by evapotranspiration and controlled seepage to prevent surfacing of wastewater on the ground surface, the creation of odor or other nuisance conditions, and loading of nutrients or organics on the land. No direct discharge to waters of the state is permitted. UMCD is required to monitor the sewage treatment plant effluent and report results to ODEQ on a quarterly basis for the following parameters: biochemical oxygen demand, total suspended solids, nitrate, and nitrite.

3.4.2.2 Septic Tanks

Twenty-three other areas at UMCD have septic tank-leach field systems. Only 15 of these tanks appear active. The tanks are fed by concrete sanitary sewer pipes that range in size from 4-inch-diameter to 8-inch-diameter. UMCD operates the septic tank systems and leach fields in accordance with the ODEQ NPDES Permit Number 101456 *(*Earth Technology Corporation 1994; NUS Corporation 1987; ODEQ 2006a*).*

UMCDF holds NPDES Permit Number 101456, which expires February 2013. The permit pertains to the disposal of domestic wastewaters through sewage treatment systems, including two septic tanks, two dosing tanks, and two drain fields (average flow 21,500 gpd) at the UMCDF; a septic tank and drain field (average flow 210 gpd) at Building 402; a 1,500 gallon septic tank, dosing chamber, and three drain fields (average flow 5,100 gpd) at the Building 655 change house; a drain field (average flow 13,000 gpd per 10-hour shift) at the Building 655 laundry wastewater system; and at least 20 septic tank and drain field systems of various sizes throughout the facility. All wastewater associated with these systems must be dissipated by subsurface soil absorption, and no discharges to state waters is permitted. UMCD is required to monitor the facilities and report to ODEQ on a quarterly basis the following parameters: daily flow rate, Nitrate-N, Nitrite-N, Total Kjeldahl Nitrogen, and Ammonia-N.

3.4.3 Stormwater

Stormwater runoff is minimal at UMCD because of the small amount of precipitation and very permeable soils. UMCD Administration Area storm sewer stormwater is carried by gravity to an outfall west of the sewage treatment plant. The outfall is to an open ditch, where it is allowed to percolate into the ground. Natural surface drainage channels control any stormwater runoff that accumulates.

The central part of UMCD lacks any well-defined drainage pattern. The minimal runoff generated in this area generally flows into the numerous shallow depressions found in the flat and gently rolling topography in the area. The most significant of these depressions are located at the base of the west-facing bluff of the Coyote Coulee. Several of the buildings located at the top of the bluff have drainage going into these depressions.

Surface runoff in the area east of Coyote Coulee is toward the southern boundary into a shallow, elongated depression running parallel to the Union Pacific Railroad and Interstate Highway 84 *(*Earth Technology Corporation 1994, 1995*).*

3.4.4 Electrical Systems

UMCD obtains electrical power from Umatilla Electric Cooperative, a local electric company. There are approximately 16 miles of overhead distribution lines, 6 miles of underground lines, and 350 transformers. Except for lines running to the UMCDF, all of the distribution systems located on the facility are owned by the U.S. Government. UMCD is currently exploring how to excess the power grid to the Umatilla Electric Cooperative for BRAC land transfer and the development of utility easements *(*UMCD Personal Communication 2009-10*).*

3.4.4.1 Emergency Generators

Fixed-in-place standby duty generators supply full load power to the services and buildings connected to them. The generators range from 50 to 750 kilowatts and run on diesel fuel. The Administration Area has a very large capacity emergency backup generator. In addition, Building 32, the UMCDF, K Block, and Wells 6 and 7 each have their own backup generators.

3.4.5 Heating Systems

UMCD uses a variety of heating systems, including electric resistance heating, heat pumps, propane fired boiler, natural gas fired boilers, and electric hot water boilers.

3.5 Environmental Setting

UMCD is located in northeastern Oregon, approximately five miles west of Hermiston, six miles southwest of Umatilla, and three miles south of the Columbia River, in both Umatilla and Morrow counties. The surrounding land use is primarily rural and agricultural (Earth Technology Corporation 1994).

3.5.1 Climate

UMCD is influenced by the air from the Pacific Ocean, so the area enjoys a moderate temperature range with highs in the summer reaching 100°F. Unusual temperatures tend to occur when air from the Pacific is hindered by slow-moving, high-pressure systems over the interior of the State. Predominating, stagnant, high-pressure systems in the north or east in the summer or early fall can result in dry and hot southerly air in the region surrounding UMCD. It is this southerly air that increases the risk of wildfires. The lowest temperatures in the winter tend to occur when high-pressure systems in central Canada force cold air down and southwesterly across the Rockies and into the Columbia Basin.

UMCD, therefore, is characterized as a semi-arid cold desert climate with significant variation in temperature between summer and winter. Seasonal temperatures at UMCD average 75° F in summer and 35° F in winter. The maximum recorded temperature was 113° F in 1982, and the minimum recorded temperature was -31° F in 1985 (Dames and Moore 1990). Average annual precipitation is 8.85 inches, 60 percent of which occurs between November and March. Annual snowfall is approximately 10 inches, with the majority of this falling between December-March. Although summer precipitation is unusual, when it does occur, it is usually in the form of thunderstorms, which can sometimes cause flash flooding.

Wind in the UMCD vicinity tends to be channeled by the Columbia River system. Channeling of winds along the Columbia River valley, in conjunction with a prevailing westerly wind direction in the area, results in a prevailing west-southwest wind at UMCD. A minor, secondary peak in wind direction can occur from east-northeast, due to drainage of cold air down the river valley during night and early morning hours (Earth Technology Corporation 2002).

3.5.2 Topography

The portion of Oregon within an approximate 50-mile radius of UMCD includes parts of two geomorphic regions, the Deschutes-Umatilla plateau and the Blue Mountains. Elevations on UMCD range from 400 to 677 feet above sea level. The north, west, and central portion of UMCD is generally flat to very gently rolling. A prominent surface feature, the Coyote Coulee, is a valley that cuts across the facility along a north 30 degrees east axis. The coulee is exceptional in size and is likely due to extraordinary river discharge during prehistoric catastrophic floods. The western edge of Coyote Coulee slopes at 5 to 10 percent. The eastern edge is an escarpment that rises 60 to 90 feet at a 30 to 45 percent slope. West of Coyote Coulee, the land surface consists largely of rolling hills. East of Coyote Coulee, the land slopes gently (Earth Technology Corporation 1994, 1995).

3.5.3 Demographics and Land Use

Towns near the UMCD include Umatilla, Hermiston, and Irrigon, Oregon, located 4, 6, and 12 miles from the site, respectively. UMCD is located approximately three miles south of the Columbia River and the border with Washington State. Nearby towns in Washington include Kennewick, Pasco, and Richland at approximately 22, 23, and 25 miles away, respectively. In 2005, within a 20-mile radius from UMCD, there was an estimated population of 53,318, which increases seven-fold with a radius of 50 miles. The majority of the population in the surrounding area of UMCD is within the age bracket of 21 to 64 years of age. This age distribution is consistent within a 50 to 150-mile radius.

The majority of the area surrounding UMCD is rural, agricultural cropland, paper pulp orchards, and pastures. Land use for the areas immediately adjacent to the installation is zoned agricultural (Umatilla and Morrow counties). In recent years, local farmers and businesses have diversified the land use to include food processing. Important agricultural products include wheat, fruit, timber, and cattle. Major employers in the region include JM Manufacturing, Gilroy Food, and Boise Cascade (Site Assessment Report 2006*)*.

3.5.4 Geology and Soils

Basaltic lava flows of the Columbia River Group, Miocene, and Pliocene in age and approximately 10,000 feet thick, underlie all of the lowlands areas and form the down-warped bedrock surface of the Dalles-Umatilla Syncline. The three uppermost basalt flows and interbeds are part of the Saddle Mountain Formation and include, from youngest to oldest, the Elephant Mountain Member, the Rattlesnake Ridge Interbed, the Pamona Member, the Selah Interbed, the Umatilla Member and the Mabton Interbed. UMCD is near the base of the south flanks of this broad syncline. The underlying basalt is composed of layers of separate basaltic lava flows, each of which is as much as 100 feet thick. Dense, hard olivine basalt at the base of each layer grades upward to softer, vesicular, and scoriaceous zones at the top. Some interlayers of clay, or clay and tuffaceous sand, up to 100 feet thick, are present in the group.

Below 751-foot elevation, which includes the entire UMCD, the basaltic bedrock is generally covered with as much as 200 feet of Pleistocene alluvial deposits. These surface deposits are generally permeable silts, sands, and gravels, with some cobbles to the west of Coyote Coulee. Much coarser permeable deposits containing considerable quantities of boulders occur along the east wall of the Coulee and toward the east side of the installation.

Soils at UMCD consist of sandy loam and coarse sand developed primarily from the alluvial deposits. The soils have been modified by wind action. The upper eight inches of soil consist of a noncalcareous, loose, fine to medium-loamy sand. The 8 to 32-inch depths consists of fine-to-medium sand, which overlies eight inches of sand containing no organic matter. Below 40 inches, the soil consists of gravel and gravelly sand with varying amounts of cobbles *(*Earth Technology Corporation 1994*)*.

3.5.5 Water Resources

There are no surface water bodies on the installation; all waters infiltrate into the desert soils before running off onto lower surrounding lands. Because of the minimal amount of precipitation and very permeable soils at UMCD, there is little surface runoff. The closest surface water sources are the Columbia River, located three miles north of the site, and the Umatilla River, located approximately two miles to the east.

The central part of UMCD lacks any well-defined drainage pattern. The minimal runoff generated in this area generally flows into the numerous shallow depressions found in the flat and gently rolling topography in the area. The most significant of these depressions are located at the base of the west-facing bluff of Coyote Coulee. Several of the buildings located at the top of the bluff have drainage going into these depressions. Surface runoff in the area east of Coyote Coulee is toward the southern boundary into a shallow, elongated depression running parallel to the Union Pacific Railroad and Interstate Highway 84 *(*Earth Technology Corporation 1994, 1995*).*

Groundwater occurs beneath the UMCD in a number of distinct hydrogeologic settings, in a series of relatively deep confined basalt aquifers and in a highly productive permeable unconfined aquifer to the south of UMCD (extending off-post). The unconfined aquifer at UMCD consists of the alluvial deposits and the weathered surface of the Elephant Mountain Member basalt, and is overlain by approximately 20 to 125 feet of unsaturated alluvial sand and gravel. Depth to groundwater ranges from 60 to 100 feet below ground surface. Three municipal water systems – Hermiston, Umatilla, and Irrigon – draw from groundwater within a 4-mile radius of UMCD. Approximately 1,500 wells were identified within this 4-mile radius, the majority of which are used for domestic and irrigation water. The Columbia River is a major source of potable and irrigation water in the region, and is used for recreation, fishing, and the generation of hydroelectric power. The Umatilla River is a tributary to the Columbia River, and its principal use is for irrigation *(*USACE 2010*).*

UMCD is located within the Oregon Water Resources Department (OWRD) Ordnance Gravel Critical Groundwater Area (CGA). These areas are designated critical by the state. If there is documented overdraft of the groundwater resources due to irrigation and other basin practices, pumping could be curtailed. This has adversely impacted the economies of Umatilla and Morrow counties. In response, the OWRD, working in conjunction with other state agencies and local planning groups, has proposed a project to increase water availability in the Ordnance Gravel CGA, as well as in two CGAs adjacent to UMCD. The plan evaluates pumping water from the Columbia River during available months for storage in the CGA aquifer for later use, during seasonal higher water demand. This proposed plan is economically feasible and is expected to bring vast benefits on a regional and national scale *(*IRZ Consulting LLC 2009*).*

3.6 Cultural Resource Summary

UMCD encompasses 19,728 acres of land. An archaeological sample survey of 12.2 percent of the facility was completed in 1995. Additionally, other small surveys have been done in conjunction with previous construction projects. There have been communications with the Oregon State Historic Preservation Officer (SHPO) to discuss potential for future archeological surveys. An insignificant scatter of prehistoric flake tools near Coyote Coulee, as well as shell and lithic remains, has been reported in the sand dunes in the northeastern portion of the base. This is consistent with the results of archeological, ethnohistoric and historic research which all indicate that UMDA was the scene of low intensity land uses. Otherwise, there are three recorded archeological sites at UMCD: a pre-World War II dump site and two wagon train trails that are spurs of the historic Oregon Trail. A wagon trails study was completed by the Bureau of Land Management Oregon office.

A historic buildings and structures study conducted by the Army in 1984 concluded that Building 1 (the headquarters building) and 2 (the firehouse) were eligible for listing in the National Register of Historic Places as being of local architectural significance. Aside from these two buildings, the remaining structures at UMCD were recommended ineligible in historic property evaluations. In 1988, the SHPO found that the UMCD met Criterion A for its association with national defense efforts, and Criterion C for architectural merit, and is considered eligible for listing in the National Register as a Historic District. Additional consultation with the SHPO is needed for the remaining historic properties to determine if they are eligible for listing on the National Register. In an April 2010 letter to the UMCD cultural resource manager, the associate deputy Oregon SHPO outlined the additional work that is necessary at the facility for Section 106 compliance for closure and land conveyance. This is currently being processed by the BRAC offices.

In 2000, USACE, Fort Worth District, completed a national historic context for World War II era Army ammunition storage magazines. The objective of the document was to present the themes and events that influenced the construction, modification, and use of ammunition storage magazines during World War II and during the mobilization effort prior to this war. In addition to context, the document presents a classification system for all ammunition storage magazines and a discussion of National Register eligibility requirements. The study recommends that those installations with the most comprehensive array of the various magazine designs may be eligible for inclusion in the National Register.

In 2002 report entitled *Installation Cold War Inventory and Assessment, Umatilla Chemical Depot, Hermiston, Umatilla and Morrow Counties, Oregon* ("Cold War Report") was competed for the U.S. Army Material Command. The study concluded that no listed historic properties are present at the installation. However, the UMCD does have two National Register eligible buildings – Building 1 (Headquarters) and Building 2 (Firehouse). A MOA with the Oregon SHPO was prepared in 1989 for the remodeling of Building 1.

3.7 Site Maps

The site maps are available within Appendix G. The 12 maps included are:

- Figure 1 Umatilla Chemical Depot Vicinity Map.
- Figure 2 Installation Building Map with Numbered Study Sections (I through VIII).
- Figure 3 Administration Area and Building Map.
- Figure 4 Installation Building Map with Numbered Study Sections (I through VIII) and Numbered Study Sites.
- Figure 5 Administration Area Building Map with Numbered Study Sites.
- Figure 6 Installation Building Map with Current & Historic Transformer, AST, & UST Locations.
- Figure 7 Administration Area Building Map with Current & Historic Transformer, AST, & UST Locations.
- Figure 8 Installation Building Map with Current AST, UST & Propane Tank Locations.
- Figure 9 Installation Building Map with ECP Property Categorization.
- Figure 10 Administration Area Building Map with ECP Property Categorization.
- Figure 11 Installation Water Right & Jurisdictional Overlay Over Aerial Photo.
- Figure 12 Depot Plan District- Comprehensive Plan

3.8 Geographic Information System (GIS)

UMCD has limited Geographic Information System (GIS) historical maps in their database; however, mapping capabilities are in place. Systems are managed by Risk Management Directorate under the CMA.

4. ENVIRONMENTAL CONDITIONS OVERVIEW

This section provides the results of the 2010 ECP assessment, including all database, record, and document searches and reviews. Known past environmental conditions and current environmental issues of concern are summarized in the following sections.

4.1 Environmental Permits and Licenses

This section discusses the environmental permits and licenses held by UMCD and UMCDF. Included in this section are RCRA status, solid waste permits, UST/AST permits, NPDES permits, drinking water and air permits, Nuclear Regulatory Commission (NRC) licenses, and other permits/licenses. The current EPA hazardous waste permit, specified in the next paragraph, lists all environmental permits, licenses, and notifications for UMCD.

4.1.1 Resource Conservation and Recovery Act (RCRA) Permit Status

A RCRA hazardous waste permit application consists of two parts, parts A and B. Part A is consistent with 40 C.F.R. 270.13 and includes both the RCRA Subtitle C Site Identification Form and the Hazardous Waste Permit Information Form. Part B is consistent with 40 C.F.R. 270.14 and contains detailed, site-specific information submitted in a narrative format.

Currently, UMCD has one hazardous waste permit issued by the EPA, RCRA Permit Number OR6 213 820 917, for UMCD base-wide hazardous waste storage issued on 17 July 2012 and expires in ten years from the effective date of the permit. UMCDF has one hazardous waste permit issued by the EPA, Permit Number ORQ 000-009-431-01, which deals with hazardous waste storage and treatment at the UMCDF. It was renewed in September 2011 and expires on 20 September 2021.

UMCD is permitted to store containerized hazardous wastes in storage units located in three specified facilities within the site, however, UMCD is in the process of closing this permit. The K Block stored chemical agent-filled munitions and bulk items. All munitions related items were transfer to the disposal facility for processing and destruction via incineration. The J Block igloos stored agent-contaminated, containerized waste subject to a lower level of security. Building 203 stored containerized wastes generated from support activities that did not involve chemical agent operations, and have been transport to an off-site facilities for disposal *(*Permit, Module I, 17 July. 2011*).* All chemical agents were destroyed by 25 October 2011.

In accordance with the Memorandum of Understanding the BRAC Division and the Chemical Materials Agency (CMA) will manage and fund the closure of both the RCRA storage and the RCRA destruction permits. CMA will be responsible for the closure of the Umatilla Chemical Agent Demilitarization Facility (UMCDF). Once the UMCDF facility has been closed IAW with the terms of its contract and both RCRA permits have been closed, the real and personal property at the UMCDF site will be transferred to the BRAC Division for disposal IAW guidance set forth in the installation reuse plan.

4.1.1.1 Compliance Status with Regard to Permits

The ODEQ Office of Compliance and Enforcement monitors current UMCD and UMCDF permits to ensure that the facility is in compliance with all state and Federal environmental laws. ODEQ uses a variety of tools to monitor air, water, or solid waste permit compliance, such as inspections and investigation of complaints. If violations are found, ODEQ may proceed with informal enforcement actions in the form of Warning Letters and Pre-Enforcement Notices (PEN); prior to 2008, the enforcement actions were referred to as Notices of Noncompliance (NON). A Warning Letter is issued when the violation is not anticipated to be referred for further, formal enforcement, and a PEN is issued when further action is deemed necessary. A Notice of Violation (NOV) is issued when Warning Letters or PENs have failed to achieve compliance or satisfactory progress toward compliance. The NOV initiates formal administrative enforcement by inviting a request for further discussions, and provides information to the alleged violator for appeal. If the violator accepts ODEQ findings, a monetary penalty may be issued, with the amount depending on severity, frequency, and duration of alleged violations *(*ODEQ, Overview of the Enforcement Process Sept. 2005*).*

Because there is a UMCD permit and a UMCDF RCRA permit, violation notices are issued separately to UMCD or UMCDF. UMCD was issued three NONs or PENs, but none resulted in NOVs or monetary penalties. Since 1998, UMCDF has been issued 34 NONs or PENs, for issues ranging from failure to properly manage hazardous waste to exceedances in metals from air emissions. The 34 NONs or PENs violations have been associated with significant monetary penalties. Of the 34 NONs or PENs, 14 NOVs were issued, two of which were dropped after a successful appeal by UMCDF (UMCD Personal Communication 2009-10*).*

4.1.1.2 RCRA Permit 2011

The UMCD holds a RCRA permit for the storage of hazardous waste. A hazardous waste storage area was located at Building 203. The K Block igloos previously stored GB, VX, and HD. The J Block igloos previously stored hazardous wastes derived from the handling, maintenance, and disposal of chemical munitions. I Block igloos stored HD and was certified “clean closed” for RCRA in December 2009 by ODEQ. Section 4.3 provides a brief description of the facilities and activities that generate agent-related waste at UMCD as defined by the current RCRA permit (Earth Technology Corporation 1994; ODEQ 1997b, c; UMCD Personal Communication 2009-10*).*

4.1.1.3 Hazardous Waste Storage - RCRA Part B Permit

UMCD was issued an EPA RCRA Identification Number of OR6 213 820 917 on July 7, 1980 (expires 17 July 2022). UMCD finalized an installation Comprehensive Environmental Management Plan in July 1995. There were four hazardous waste accumulation points and one RCRA Part B permitted storage facility, Building 203. Domestic hazardous wastes are no longer produced at the installation.

Accumulation points at the installation consist of different sized containers, or drums, used to store various associated non-agent hazardous wastes, which are detailed below. Storage at the accumulation points is temporary and does not exceed 90 days from the time the waste begins to accumulate. Once full, the drums were transported to Building 203. Hazardous waste is transported off-site by a licensed hazardous waste contractor and disposed of though the DRMO at JBLM. UMCD stores limited quantities of hazardous materials and hazardous waste. Hazardous waste storage areas are detailed in the Hazardous Waste Management Plan (Earth Technology Corporation 1995; UMCD Archive Document 2005*).*

Basic Cleaning Chemicals

Household cleaners, solvents, alcohol, ink, and toner are stored in Buildings 4, 5, 6, 7, 18, 30, and 82. All chemicals are stored in closed, labeled, Flammable Materials Storage Lockers or cabinets.

Quantities of chemicals are typical of those found in commercial facility containers. Any spills would be on concrete floors and are cleaned up immediately. Spill kits or spill cleanup supplies are available in the buildings.

Paint and Paint Products

Small quantities (1 gallon or smaller containers) of latex paint, enamel paint, spray paint, primer, and paint thinner are stored in Flammable Materials Storage Lockers in Building 4 (Support Services). Building 5 (Garage) has similar paint products in containers as large as 5 gallons. Building 7 (Carpentry Shop) has a Flammable Materials Storage Locker containing quart or smaller containers of latex paint, aerosol paint, stain, varathane, and paint thinner. The Carpentry Shop maintains a 30-gallon drum of waste paint thinner and a 30-gallon drum of waste paint residue from punctured spray cans. The drums are sealed and stored inside the building on a concrete floor.

Machinery Maintenance Products

Machinery and vehicle maintenance products are stored at UMCD in containers up to 1 gallon in size and include cutting oil, lubricants, tool oil, starter fluid, brake fluid, brake cleaner, battery reconditioner, fuel and fuel additives, antifreeze, and WD-40™. Building 4 (Support Services) has a portable flammable materials cabinet that contains gallon or smaller containers of oils and lubricants. A spill kit is available to clean up minor leaks and spills. A Flammable Materials Storage Locker located in Building 5 (Garage) stores 1 gallon or smaller containers of vehicle maintenance products. Several spill kits are located in the building. Spills or leaks would be on concrete floors and are cleaned up immediately. Fifty-five-gallon drums of recycled antifreeze and POLs are stored on spill skids. Any leaks or spills would be contained in the spill skid.

Pesticides, Herbicides, and Rodenticides

Building 8 is the Pesticide/Herbicide/Rodenticide storage building. All chemicals are stored in locked rooms. In-service drums of liquids are stored in plastic containment trays or plastic spill containment tubs. A labeled spill kit containing floor dry, a shovel, a broom, and bleach is available in the room. The pesticide mixing room is bermed so all material would remain in the containment area in the event of a spill or leak. All mixing is done in this room. A labeled spill kit similar to the herbicide spill kit is available. All containers are triple rinsed and rinse water is reused. The rinsed empty containers are punctured and disposed of as solid waste or recycled as appropriate.

Batteries

Building 27 was the Battery Storage Building. Batteries for forklifts are stored on wooden pallets on a concrete floor. The smaller batteries for motor vehicles are stored on shelves. An elevated, bermed concrete area in the center of the building is used for storage of large-equipment batteries. Previously, floor drains in the elevated area directed spills and wash water to a 1500-gallon below-grade tank. Spills and wash water were previously neutralized with bicarbonate soda and lime, and then rinsed into the floor drains. In 2006 this 1,500-gallon tank was removed. A corrosive materials storage cabinet is used to store containers of battery acid. A spill kit containing bicarbonate soda is located near the storage cabinet. All corrosive materials spilled would be neutralized and contained within the building.

Boiler and Air Conditioning Chemicals

Building 9 is the Boiler and Air Conditioning Shop. Chemicals used in the boilers and air conditioners are stored here. The boiler chemical storage room contains 55-gallon plastic drums of sodium hydroxide, sulfite, Possca™, and Morpholine™. The drums are all seated in plastic secondary containment drums. During use, the chemicals are transferred to smaller transport containers that are taken to the boiler, triple-rinsed, and then the rinse water is added directly to the boiler.

Laboratory Chemicals

Building 656 was the monitoring facility that supports K Block activities. A Flammable Materials Storage Locker in this building contains solvents, acids, acetone, isopropyl alcohol, toluene, hexane, and propanol in 1 gallon or smaller containers. Acid and caustic spill cleanup kits are stored on top of the storage locker. Various chemicals and standards are stored in small quantities under fume hoods throughout the facility. Any spill would occur inside the building or inside the fume hood and would be cleaned up immediately *(*U.S. Army CMA 2004*).*

4.1.2 Solid Waste Permits

UMCD does not currently have a solid waste permit. The ODEQ Solid Waste Permit #320 was terminated and the site will transfer to the Clean-up Program for supervision of compliance with any applicable solid waste rules. Waste generated by UMCD is currently transported off-post for disposal at the Arlington, Oregon, hazardous waste landfill.

Six inactive landfills are located at the UMCD and make up the "Inactive Landfill" and the "Active Landfill" operable units. The one landfill designated as active is not active, but refers to the original distinction between the five inactive landfills located west of the Administration Area and the one formerly active landfill, located between D and E Igloo Blocks. A No Further Action (NFA) Record of Decision (ROD) has been signed for both the Inactive and the Active Landfill OUs *(*Earth Technology Corporation 1995; U.S. Army 1993; DERP 1993; UMCD Personal Communication 2009-10*).* As per a letter received from Oregon Department of Environmental Quality on 12 August 2011, the Solid Waste Permit No. 320 was terminated and the site transferred to the Environmental Cleanup Program as part of the BRAC closure.

4.1.3 Medical Waste

Over the history of UMCD's operation, a very small quantity of medical waste has been generated at the Occupational Health Clinic. This waste was sent to Fort Lewis, Washington for disposal. No medical waste was sent to the former "Active Landfill" at UMCD.

4.1.4 National Pollutant Discharge Elimination System (NPDES) Permits

UMCD has a NPDES Waste Discharge Permit issued by ODEQ. NPDES permits are required for "point source" discharges of pollutants to surface waters, according to the Federal Water Pollution Control Act (Clean Water Act) and Oregon law. NPDES Permit Number 200-J allows UMCD to discharge to the storm water pond: filter backwash, settling basin, and reservoir cleaning water that has been prepared to meet minimum dilution requirements as well as settleable solids and pH parameters. Other parameters stipulated in the permit pertain to the mixing zone limits, temperature management, and a treatment system for all reservoir cleaning water. Land application of filter backwash, settling basin, and reservoir cleaning water is permitted when UMCD obtains written approval from ODEQ and meets additional requirements outlined in the permit. In addition, flushing of raw water intakes after storm events and spring runoff are allowed. UMCD must monitor and report these activities to ODEQ according to sampling and frequency requirements outlined in the permit.

4.1.5 Drinking Water Permits

UMCD has two public drinking water systems. Both are non-transient, non-community systems, which are public water systems that regularly serve at least 25 of the same persons for more than six months per year. In both systems, water is obtained through groundwater wells and treated with gas chlorination.

The Oregon Department of Human Services Drinking Water Program assigned Public Water System (PWS) Identification Number OR4101136 to the system that serves the UMCD Administration Area. The drinking water system has the capacity to serve 25 residential connections and a population of 124. Currently there are no active potable wells in the Administration Area. PWS Identification Number OR4194664 refers to the water system that serves the northern portion of UMCD. The system has the ability to serve up to 10 residential connections and a population of 662 people. It consists of two active potable wells.

4.1.6 Air Permits

Historically, UMCD held an air emissions permit from 1974 through the mid-1990s under Oregon's Air Contaminant Discharge Permit (ACDP) Number 25-0024. ACDP Number 25-0024 was renewed in 1997 and significantly modified to incorporate regulations on the processes and activities associated with the UMCDF.

An important aspect of the UMCDF permitting process was the trial burn phase. During the trial burn operations, the performance of the various process units was evaluated during specified operating conditions. The results helped define the operating requirements for each unit. The performance of each unit had to meet the permit requirements before normal operations could commence. In addition, the emissions data collected during the trial burns was used to evaluate the validity of the emissions assumptions that were used in the pre-trial burn risk assessment *(*ODEQ 2002*)*.

UMCD renewed permit ACDP Number 25-0024 in 2002. Significant changes to the permit included an increase in plant site emission limits. Some of the increase was due to modifications made to the UMCDF that increased emissions. The rest of the increase was due to corrections made to the way the permit was composed to account for omitted and underestimated sources of emissions. The ACDP was renewed in 2005.

Subsequently, UMCD obtained an Oregon Title V Operating Permit (25-0024-TV-01) on October 30, 2009 (expires November 1, 2014), which is part of a relatively new program for major industrial sources of air pollution. Compared to the ACDP, the Title V Operating Permit contains more detail in the identification of emission units, it lists all applicable requirements, requires more monitoring, and has more detailed record-keeping requirements. Currently the UMCDF is in the process of being closed as all chemical munitions taken to this facility were destroyed by 25 October 2011.

4.1.7 Nuclear Regulatory Commission (NRC) Licenses

The UMCD did not have an individual NRC license but was covered in a broad scope by the TACOM NRC license (NRC License #21-32838-01 expires Dec 2019). A radiation survey on September 20th, 2012 came back with radioactivity in normal ranges according to the meters being used and therefore, coverage under the TACOM NRC license is no longer necessary. The locations tested were areas of past storage or suspected storage of radioactive materials and radiation meters including igloo A928 used by the State of Oregon Radiation Protection Services. The last 22 pallets of civil defense radiation meters were shipped on 20 September 2012 and the igloo was recommended for general use (Oregon Health Authority 2012). Following closure of the chemical agent demilitarization operation in October 2012, the alarms that contained radioactive sealed source material were shipped to an Army consolidation facility for future disposal. UMCD was authorized 54 M8A1s and 54 M22s. The M8A1s were replaced by the M22s. They were turned in after the M22s arrived at Umatilla Chemical Depot. The M22s were shipped to Pine Bluff Arsenal on 3 April 2012 as part of the BRAC process. UMCD has no radiological material at this point of time.

4.1.8 Other Permits/Licenses

Currently the UMCDF holds two ODEQ Underground Storage Tank (UST) Permits: Permit Numbers UST BECCB and BECCC. These permits are for two tanks located at the UMCDF incinerator. The tank associated with Permit Number BECCB is a 550-gallon diesel tank. It is located inside a double security fence at the Entry Control Facility (ECF) at the southwest corner of the UMCDF. The tank associated with Permit BECCC is a 4,000-gallon diesel tank that is located at the western UMCDF near the MDB.

4.2 Environmental Cleanup

This section includes previous and ongoing response actions as required by DoD policy and other applicable regulations. The following sections evaluate the current status of the IRP, the Military Munitions Response Program (MMRP), compliance cleanup, and previous environmental investigations.

4.2.1 Installation Restoration Program

From 1945 to the present, ordnance and other solid wastes generated at UMCD were burned, detonated, or otherwise disposed of at the ADA. Twenty sites were identified where these activities were conducted. It was determined that remediation was required. Groundwater contamination at UMCD with RDX and TNT, which are toxic nitrogen-based explosive constituents, resulted from rinse water from bomb washout operations into the washout lagoons. In addition, the sites contain unexploded ordnance as a result of ordnance disposal operations.

The facility was placed on the National Priorities List (NPL) in 1987 due to the contamination identified at the Explosive Washout Lagoons. The lagoon site is an area where conventional bombs were dismantled and washed out with water in the 1950s and early 1960s. Among the compounds washed out in the cleaning process were TNT and RDX *(*UCMD Info Sheet*).* A CERCLA cleanup project at UMCD has pioneered the use of microbes in cleaning up soils contaminated by explosive compounds. Bioremediation generally is used in oil-based contamination cleanups. However, in this case, the Army worked closely with EPA and others to develop a way for the microbes to work on soils contaminated by explosive residuals. The lagoon cleanup at UMCD represents the first use of composting and microbes to remediate explosive constituents at a CERCLA site.

The 1999 five-year review concluded that the selected remedies "did not result in hazardous substances remaining on-site above levels that allow for unlimited and unrestricted use" for the following OUs: Explosives Washout Lagoons Soils, Explosives Washout Plant, Deactivation Furnace Soils, Miscellaneous Sites, Active Landfill (hereafter referred to as the Landfill), and Inactive Landfills. The 1999 review further concluded that "no CERCLA Five-Year Review Requirements will apply" to the remedial actions undertaken at these OUs, and that these OUs did not "require any long-term management or review." The Miscellaneous Sites and the Landfill OUs, however, are addressed in this follow-up review because of changes in those OUs since the 1999 review.

For two other OUs, the Explosive Washout Lagoons Groundwater OU and Ammunition Demolition Activity (ADA) OU, the 1999 review concluded that remedial actions resulted "in hazardous substances remaining on-site above levels that allow for unlimited and unrestricted use," and that these OUs "will require long-term management or review," with reviews conducted at least every five years.

A second five-year review was completed in 2004. The second five-year review covered selected remedies for Operable Units (OUs) at UMCD as recommended from the first five-year review (September 30, 1999), and OUs with subsequent changes since the 1999 review (UMCD Archive Document 1999; USACE 2004).

On July 7, 2004, the Army and ODEQ remedial managers conducted a site visit, after which the Army, EPA, and ODEQ reviewed the remedies implemented for all nine operable units at that time. All remedies were found to be protective of human health and the environment and were operating and functioning as designed and no modifications were determined to be necessary. Therefore, the Army certified that the remedies implemented at UMCD remained protective of human health and the environment.

The third five-year review was completed in March 2010. A Focused Feasibility Study was completed on December 2011 for the Explosives Washout Lagoons Groundwater, recommending modification of the current remedy through expansion of the current pump and treat system followed by potential transition to full-scale bioremediation. As of September 2012, design for the expanded pump and treat system is complete and construction is expected to be complete in second quarter FY13. Future five-year reviews are necessary at the Explosives Washout Lagoons Groundwater OU and the ADA OU because contamination remains above levels that allow for unrestricted use and unlimited exposure. An update on the status of the Landfill OU is included in the third five-year review, due to changes at that OU *(*USACE 2010*).* Table 9, extracted from the third five-year review completed in March 2010, presents a chronology of site events at UMCD.

In March of 2012 the Umatilla restoration program underwent an Audit of Environmental Remediation of Chemical Demilitarization Base Realignment and Closure Sites. The Audit's conclusion was the Army generally had sufficient plans and resource estimates to clean up environmental contamination at UMCD. It was found that planning documents described cleanup strategies and identified sites that required cleanup to a more than adequate level. However there were two suggestions from the audit: (1) include major cost assumptions in the memorandums for record, so the reviewer of the estimate has the information needed to ensure that cost methodology and assumptions were reasonable; and (2) obtain supporting documentation for the cost elements to ensure the estimator can maintain an audit trail.

Table 9. Chronology of Site Events (1980 to 2012)

Event	Date
Initial discovery of problem or contamination RCRA Facility Assessment and Initial RI	Discovery: May 1, 1980 Preliminary Assessment/Site Investigation (PA/SI): December 1, 1982
NPL listing	August 21, 1987
Federal Facility Agreement signature	October 31, 1989
Expanded Remedial Investigation/ Feasibility Study conducted	1990 – 1993
ROD signatures	Lagoon Soils: September 25, 1992 Deactivation Furnace: December 31, 1992 Active Landfills; Inactive Landfills: August 10, 1993 Lagoon Groundwater; ADA; Washout Plant; Miscellaneous Sites: July 19, 1994 Site 39: May 2, 2005 Explosives Washout Plant OU: August 28, 1995 ADA Soils OU ESD: June 27, 2002
Remedial design start	Lagoon Soils: February 25, 1993 Deactivation Furnace: February 25, 1993 Active Landfills; Inactive Landfills: N/A Lagoon Groundwater: September 12, 1994 ADA Soils OU: September 2, 1994 Washout Plant: July 19, 1994 Miscellaneous Sites: September 2, 1994
Remedial design complete	Lagoon Soils: June 23, 1993 Deactivation Furnace: September 14, 1993 Active Landfills; Inactive Landfills: N/A Lagoon Groundwater: July 31, 1995 ADA Soils Tier 1: August 10, 1995 ADA Soils Tier 2: August 2002 Washout Plant: October 19, 1995 Miscellaneous Sites: August 10, 1995 Site 39: August 2008

Event	Date
Remedial action start	Lagoon Soils: September 23, 1993 Deactivation Furnace: October 26, 1993 Active Landfills; Inactive Landfills: N/A Lagoon Groundwater: December 30, 1995 ADA Soils Tier 1: September 30, 1995 ADA Soils Tier 2: January 8, 2002 Washout Plant: February 1, 1996 Miscellaneous Sites: November 6, 1995 Site 39: October 7, 2008
Construction dates (start/finish)	Lagoon Soils: November 1993/ May 1997 Deactivation Furnace: November 1993/ December 1997 Active Landfills; Inactive Landfills: N/A Lagoon Groundwater: January 1996/ December 1996 ADA Soils Tier 1: November 1995/ April 2000 ADA Soils Tier 2: February 2002/ August 2003 Washout Plant: February 1996/ April 1998 Miscellaneous Sites: November 1995/ December 1997 Site 39: October 2008/ November 2008
Final Remedial Action Reports	Lagoon Soils: September 28, 2001 Deactivation Furnace: September 28, 2001 Active Landfills; Inactive Landfills: N/A Lagoon Groundwater: RA Ongoing ADA Soils: February 2005 Washout Plant: September 28, 2001 Miscellaneous Sites: September 28, 2001 Site 39: August 2009
Remedial Action Operations	Lagoon Groundwater Expanded Pump and Treat System Design and Construction 2009
Five-Year Review (FYR) Report	First FYR: September 1999 Second FYR: October 2004 Third FYR: March 2010
ODEQ Cleanup Program Remedial Action Recommendation Report	Landfill: March 2005 (Draft version)
Pulse-pumping Optimization (start)	Lagoon Groundwater: February 2009
Explosives Washout Lagoons Focused Feasibility Study	December 2011
UMAD-149 Building Characterization Report (Building 608 Complex, Building 614 Complex, Building 622 Complex)	May 2012

4.2.2 Military Munitions Response Program (MMRP)

The National Defense Authorization Act of 2002 modified DERP to address MMRP. The Army's cleanup process follows the requirements of the NCP as promulgated under CERCLA and amended by the Superfund Amendment and Reauthorization Act (SARA). The MMRP was established to address UXO, discarded military munitions (DMM), and munitions constituents. The Ammunitions

Demo Area is the only current MMRP sites at UMCD *(*USACE 2009-10; UMCD Personal Communication 2009-10).

4.2.3 Compliance Cleanup

Compliance cleanup activities at UMCD are differentiated from CERCLA/IRP related actions because they are regulated under other statutes, such as RCRA Subtitle C and D, the Clean Water Act (CWA), and the Clean Air Act. Compliance activities can be divided into two categories: (1) operational or mission-related activities necessary for the normal operations of UMCD, and (2) closure-related activities necessary for base closure.

Removal of fallen friable asbestos tiles has occurred in two prior cleanups in the Building 100 area. Additional cleanups of fallen friable asbestos tiles will occur at some point in the future. The asbestos assessment survey described the asbestos remedial actions. Completed actions are described in Tables 3-3 and 3-4 and described the mission/operational-related and closure-related compliance projects for UMCD, which have been recreated in Table 10 *(*Earth Technology Corporation 1995*).*

Table 10. Mission/Operational-Related and Closure-Related Compliance Projects

Mission/Operational-Related Compliance Projects (Table 3-3 of BCP Report*)		
Project	**Status**	**Regulatory Program**
Hazardous Waste Disposal	Ongoing as required. Hazardous materials and SPCC Plan maintained.	SARA Title III and Facilities Management Regulations
Air Quality Permit	Facility boilers and generators are only units currently permitted.	State of Oregon Title V Clean Air Quality Act program
Solid Waste Disposal	Ongoing as required. Solid waste disposed of at off-site landfill.	State of Oregon Solid Waste Disposal permit closed
Wastewater Discharge Management	Permit may be required for discharge from ammunition demolition in ADA Area as required under new mission.	State of Oregon Pollutant National Discharge Pollution Elimination System permit program
Closure-Related Compliance Projects (Table 3-4 of BCP Report)		
Project	**Status**	**Regulatory Program**
Depot-wide Asbestos Removal	Friable ACM identified in the asbestos survey removed in fall of 1994. Additional ACM removed in fall 2011.	Clean Air Act/OSHA 29 C.F.R. 1910.1001/CERCLA
Deactivation Furnace Soils OU	Remediation of lead-contaminated soil is completed.	CERCLA/RCRA
Solid Waste Landfill	Landfill closed and permit terminated	RCRA, Subtitle D
Lead-Based Paint	Paint survey of lead-based paint conducted in FY 1995.	AR 200-1 and the U.S. Army Policy Memorandum "Lead-based Paint and Asbestos in U.S. Properties affected by Base Closure and Realignment," 15 November 1993
ADA Area OU	Remediation is continuing, ROD signed 1994, ESD Signed June 2002	CERCLA/RCRA
UST Management	Compliance activities continuing.	RCRA, Subtitle I
Radon Testing	Completed.	AR 200-1, Chapter 11; U.S. Army Radon Radiation Program

**Source: Earth Technology Corporation, 1995.*

4.2.4 Previous Environmental Investigations

The following section describes the major investigations conducted on the environmental condition of the UMCD facility. These investigations have led to most of the major work that has occurred on site and are presented in chronological order. Table 12 lists the results of the investigations.

4.2.4.1 Initial Installation Assessment

In accordance with the recommendation of the Commander, U.S. Army Depot Systems Command, UMCD was included in the Army's IRP in October 1978. The first component of the program was an Initial Installation Assessment (IIA) records search performed in December 1978. The primary purpose of the IIA was to assess the environmental quality of the UMCD facility with regards to hazardous and toxic materials and define any conditions that may adversely affect health and welfare or result in environmental degradation. Sources of information for the IIA included UMCD records, interviews with former and present employees, and contacts with other federal agencies. The Environmental Photographic Interpretation Center provided imagery analysis support, including a detailed historical analysis to identify possible areas of past use, storage, treatment, and disposal of potentially hazardous materials.

The IIA records review identified two major contaminated areas: the Ammunition Washout Facility and the burning, demolition, and burial sites within the ADA Area. The IIA highlighted contaminants of concern (COC) that included explosive wastes, rocket fuels, insecticides, and heavy metals, and identified the potential for migration of these contaminants to the groundwater. The IIA recommended that a contamination survey and assessment be conducted *(*Earth Technology Corporation 1994; IIA 1978*).*

4.2.4.2 Environmental Contamination Survey and Assessment

The contamination survey and assessment recommended by the IIA was completed in April 1982. This survey was conducted in two phases: exploratory and confirmatory. Soil and groundwater sampling was conducted at suspected contaminated areas. The survey concluded that the Explosives Washout Lagoons were the source of significant groundwater contamination. Additionally, the survey concluded that the groundwater plume was moving slowly, and upon reaching the installation boundary would be diluted. The survey identified several areas where there was significant soil contamination by explosive constituents, metals, and pesticides *(*Earth Technology Corporation 1994; Battelle, Pacific Northwest Laboratories 1982*).*

4.2.4.3 RCRA Facility Assessment

The RCRA Facility Assessment (RFA) was conducted in the fall of 1986. The RFA was conducted to evaluate areas of the UMCD where there had been known or suspected releases of hazardous waste, and to implement corrective actions as necessary. The RFA identified 30 SWMUs and included recommendations concerning the need for further action at each. The RFA recommended that 15 identified SWMUs and three unidentified, potential SWMUs be investigated further. Table 12 lists the SWMUs identified in the RFA and those that were recommended for further action *(*Earth Technology Corporation 1994; NUS Corporation 1987*).*

4.2.4.4 Enhanced Preliminary Assessment

The Enhanced Preliminary Assessment (PA) was conducted in 1990 for the U.S. Army Toxic and Hazardous Material Agency (USATHAMA; now Army Environmental Command [AEC]) under the BRAC program. The objective was to identify potential hazardous waste sites, buildings, tanks, and PCB transformer locations that might warrant further environmental characterization. The Enhanced PA identified 82 individual and multiple location sites (Study Sites) where past operations may have resulted in releases to the environment. Documentation was reviewed, interviews conducted with former and current employees, and additional aerial photography was located and analyzed. A visual site inspection was conducted, including land areas, buildings, and underground storage tanks. A total of 72 of the 82 Study Sites were recommended for further investigation based on evaluations of known and/or suspected releases, potential COCs, and potential migration pathways.

Additional historical information and aerial photography resulted in a number of additional sites identified for further investigation. Potential sources of contamination were identified at 41 existing buildings and the sites of 8 former buildings. Of these, further investigation was recommended for 26 existing buildings and the sites of 6 former buildings. Table 12 lists the Study Sites identified in the Enhanced PA and those that were recommended for further action. Over time, further investigation led to a total of 148 investigated sites and 11 OUs (expanded from the original 10 OUs) (Earth Technology Corporation 1994; Dames and Moore 1990). Later the 11 OUs were consolidated into 9 OUs.

4.2.4.5 Risk Assessment for Study Site 4 Explosives Washout Lagoons

USATHAMA conducted a risk assessment for Study Site 4, Explosives Washout Lagoons (EWL), in March 1992. The purpose was to address current and potential future health risks posed by the explosive contaminated soil and groundwater prior to remediation, and to identify safe residual explosive concentrations if soil remediation was determined to be necessary. The intention of the risk assessment was to address the extent to which the soil was affecting groundwater quality, not to assess remediation of the groundwater. Groundwater remediation assessment was to be addressed later in the installation-wide Human Health Baseline Risk Assessment (Dames and Moore 1993a).

Risk was calculated for three future land use scenarios: residential, light industrial, and military. Risk calculations accounted for four exposure pathways: soil ingestion, dust inhalation, dermal contact with soil, and ingestion of groundwater. Risks were evaluated for explosive constituents, primarily TNT exposure. The EPA target risk range used during the assessment was 10^{-4} to 10^{-6} for all pathways and future land uses. Results show that risk calculations fell either between or exceeded the EPA risk range for all pathways, except inhalation of dust for military use. Non-cancer hazardous indices exceeded 1 for soil ingestion and dermal contact with soil pathways for all future land use (Earth Technology Corporation 1994). Risk and hazard values were calculated based on groundwater ingestion for land use scenarios and receptor location near the EWL. Results showed the risk and hazard calculations exceeded the EPA risk range with hazard indices of 65 and 37 for residential and industrial use, respectively *(*Earth Technology Corporation 1994*).*

4.2.4.6 Feasibility Study for Study Site 4 Explosives Washout Lagoons Soils

A Feasibility Study (FS) was completed in December 1993 for Study Site 4, the EWL. This FS evaluated the potential alternatives for remediation of the explosive contaminated groundwater. All alternatives were evaluated for: (1) protection of human health and the environment, (2) compliance with appropriate state and Federal applicable, or ARARs, (3) long-term effectiveness, (4) reduction in toxicity, mobility, and volume of contaminants, (5) implementability, and (6) cost (Little 1993d). The FS provided a summary of the Remedial Investigation (RI) results, provided a summary of the baseline risk assessment, presented remedial objectives, and evaluated potentially viable technologies for groundwater remediation. Basic components of the remedial alternatives subjected to a detailed evaluation for the contaminated ground water at the Explosive Washout Lagoons included: No Action; Institutional Controls; treatment of the ground water by UV/Oxidation until the aquifer meets the preliminary remediation goals; treatment of the ground water by Granular Activated Carbon (GAC) until the aquifer met the preliminary remediation goals; treatment of the ground water by UV/Oxidation until the aquifer met a carcinogenic risk of 10^{-4} and a hazard index of 1; and treatment of the ground water by GAC until the aquifer met a carcinogenic risk of 10^{-4} and a hazard index of 1.

4.2.4.7 Remedial Investigation

An RI report was prepared in 1992. This RI documented the results of the field investigation of more than 50 Study Sites. A Human Health Baseline Risk Assessment and Ecological Assessment report were submitted concurrently with the RI report. The RI divided the UMCD into 10 OUs: the EWL and associated buildings, the Ammunition Demolition Activity OU, the Inactive Landfills, the Remote Munitions Disassembly Area, the Deactivation Furnace and Southwestern Warehouse Area, the Sewage Treatment Plant and Vicinity, the Active Landfill, the DRMO and other Administration Area sites, Chemical Agent/Agent Decontamination Solution Sites outside of the ADA area, and the Miscellaneous Sites. These designations do not follow CERCLA classification for OUs that require signed RODs.

No Further Action (NFA) was recommended at 16 sites. Additional investigation was suggested at 12 sites. At 30 of the sites, sufficient data was collected to evaluate potential risks associated with the detected contamination, and it was recommended that these sites proceed to an evaluation of remedial action alternatives. Table 12 lists the Study Sites identified in the RI and those that were recommended for further action *(*Earth Technology Corporation 1994; Dames and Moore 1992b*).*

4.2.4.8 Human Health Baseline Risk Assessment

A base-wide Human Health Baseline Risk Assessment was conducted by USATHAMA in August of 1992 as a part of the RI investigations. The objective was to characterize environmental contamination at the Study Sites in terms of potential impacts to human health under current and three potential land use scenarios. The 1992 Human Health Baseline Risk Assessment evaluated all risks and hazards for all currently exposed populations via all pathways. Current populations were found to not be at risk. Under the residential future land use scenario, 30 sites were found to have multiple pathway carcinogenic risk estimates within or exceeding the risk range of 1×10^{-4} to 1×10^{-6}, and 29 sites had noncarcinogenic hazard indices that exceeded 1. Preliminary remediation goals were developed for both soil and groundwater contamination at these sites.

The risk assessment determined that exposure of current populations through all pathways was below the EPA risk range and below a hazard index of 1. Although the risk assessment demonstrated that current exposed populations were not at risk, 30 UMCD sites were found to have carcinogenic risks associated with multiple exposure pathways, and 29 sites were found to have hazard indices for noncarcinogenic risks above 1 for the future land use scenario. The results of the risk assessment indicated that these sites could require remedial action *(*Dames and Moore 1993a*).*

4.2.4.9 Asbestos Assessment Survey

The asbestos assessment survey conducted in August 1992 presented the results of an evaluation of 289 buildings at UMDC suspected to have ACM. The report did not evaluate individual igloos; rather, a representative number of igloos were sampled, and it is assumed that all of the igloos were constructed of similar materials. Additionally, the report did not cover buildings in secured areas or those constructed after August 1992, notably the UMCDF and associated buildings. The report was divided into a base summary and an individual building report. The base summary described the scope, methodology, and suspected ACM areas. The individual building report detailed the materials sampled, the results, and recommended remedial actions.

Results of the survey found ACM in 121 buildings, 37 of which were damaged to an extent greater than 10 percent, and 15 that were damaged to an extent of between 3 and 10 percent. Fifty-two buildings were significantly damaged, but only in isolated areas, such as attics and crawl spaces. Based on these findings, ACM removal was recommended in 58 buildings at UMDC, and included buildings that were in isolated areas of the installation or that were inactive buildings. The recommended ACM removal actions at all 58 buildings were accomplished during the fall of 1994 *(*Dames and Moore 1992a; Earth Technology Corporation 1995*).*

4.2.4.10 Supplemental Remedial Investigation

A Supplemental Remedial Investigation (SRI) report was prepared in September 1993 to provide information on: (1) 13 additional site areas, (2) areas of Site 12 (Inactive Landfill), and (3) 79 PCB transformer areas that were not included in the RI report. The purpose of the SRI was to document the results of the field investigations, such as the monitoring well installation, sampling of soil and groundwater, reporting of sample chemical analyses, aquifer testing, and other field activities. This documentation helped to present site-specific physical characteristics and to verify and characterize any contamination present at the SRI sites and transformer locations.

Seven sites were recommended for No Further Action, including: the Inactive Landfill, four sites located within the former DRMO area, one site in the Deactivation Furnace and Southwestern Warehouse Area, and one site located in Igloo Block C. Eight sites were recommended for further evaluation of remedial action alternatives. Those sites were located in: the PCB transformer areas; Igloo Block C; Igloo Block H; the area north of the Explosives Washout Area; the area north of the Sewage Treatment Plant; the area east of the ADA near the northern installation fence boundary; the Deactivation Furnace Area; and the former DRMO areas. PCB transformer locations recommended for further evaluation were located throughout the installation. Table 12 lists and describes the SRI Study Sites *(*Earth Technology Corporation 1994; Dames and Moore 1993c*).*

4.2.4.11 Supplementary Baseline Risk Assessment

A Supplementary Baseline Risk Assessment was conducted in conjunction with the SRI. For this assessment, the analytical results from samples collected were used to calculate risk at the sites investigated. Risks and hazard indices were calculated for currently exposed populations via all exposure pathways. Calculations of less than 10^{-6} and hazard indices of 1 or less were determined to have no risk. Five land use scenarios were used: light industrial, military, construction, agricultural, and recreational. The SRI determined that 10 sites and 73 of the 79 PCB transformer sites did not contain COC and thus required no risk calculations. Using the most conservative residential future land use scenario, the risk calculations determined that three sites had calculations in excess of 10^{-6}, one of which had a hazard calculation greater than 1; six transformer locations had calculated risks of 7×10^{-6}, due to the presence of PCB Aroclor 1260. None of the supplementary sites had concentrations that resulted in unacceptable exposure levels for residential future land use. For current land use conditions, all calculated risks were below the EPA risk range, and hazard indices were less than 1.

4.2.4.12 Underground Storage Tank Investigation Report

An Underground Storage Tank (UST) Investigation Report was conducted in June 1995 for the USAEC in support of the DoD BRAC program. The objective was to evaluate whether any USTs had leaked or were leaking their contents, and what effect such leakage might have on the surrounding soil and groundwater. The report presented results of the field investigation, which included (Dames and Moore 1995):

- Identifying the presence of USTs via geophysical survey.
- Identifying the contents of the USTs including chemical analyses of unknown substances.
- Performing leak testing to determine tank integrity.
- Conducting soil, soil gas, groundwater sampling and/or monitoring well installation.
- Evaluating the data generated during the investigation.

Thirty tanks were evaluated for potential leakage. Twenty-one tanks met the state tightness criteria and required no immediate action. Two tanks failed the leak tests (UST 2 and UST 12) and were removed under the State of Oregon regulations. Results for tightness tests for seven of the tanks (USTs 17, 18, 20-23, and 25) were inconclusive. The results for these seven tanks were inconclusive because the fuel product in the tanks exhibited unstable temperature readings, which did not allow proper calibration of the testing equipment. Due to these inconclusive results, soil samples were collected for six of the seven tanks. Soil sampling at UST 17 could not be obtained because of security regulations involving the tank's location in the K Block. Analytical results for all tests are available in the 1995 UST Investigation Report (Dames and Moore 1995). A summary of results for the seven inconclusive tanks are found in Table 11.

Table 11. Summary of Tank Test Results for the Seven Inconclusive UMCD USTs

UST	Soil Samples	Conclusions / Recommendation
17	No	Recommendations for UST 17 were that UMCD should collect several soil samples adjacent to UST 17, the tank/pipeline juncture, and the pipeline to evaluate the potential for contamination. Samples should be collected from a depth of approximately 10 feet near the tank and 6.5 feet near the pipeline. The samples should be analyzed for TCL VOAs, TCL BNAs, and TPHs.
18	Yes	Tank leak test results were inconclusive. No TCL VOAs were detected in soil at UST 18, and TPHs and one TCL BNA were detected in only one sample, each at low concentrations. Because the potential for contamination at this tank is low, no immediate action was recommended for UST 18.
20	Yes	Tank leak test results were inconclusive. TPHs were detected at low to high concentrations in soil at UST 20, indicating that fuel stored in this tank has leaked to the surrounding soil. Therefore, it was recommended that UST 20 be excavated and removed, and that the contaminated soil surrounding the tank be excavated and properly disposed.
21-23	Yes	Tank leak test results for USTs 21, 22, and 23 were inconclusive. No TCL VOAs, TCL BNAs, or TPHs were detected in soil at the tanks. No immediate action was recommended for USTs 21, 22, and 23, because the potential for contamination was

UST	Soil Samples	Conclusions / Recommendation
		found to be low.
25	Yes	Tank leak test results for UST 25 were inconclusive. Petroleum hydrocarbons were detected in only one soil sample, at a low concentration. Because the potential for contamination was found to be low, no immediate action was recommended for UST 25.

Notes: BNAs = Base-neutral and acid extractable organics
TCL =Target Compound List
TPHs = Total Petroleum Hydrocarbons
VOAs = Volatile Organic Analytes
Source: Dames and Moore 1995

For the seven tanks with the inconclusive results and the two tanks that failed testing, a total of 151 soil samples were collected from 35 borings drilled adjacent to the tanks and fuel supply lines. These samples were analyzed for volatile organic compounds (VOC), total petroleum hydrocarbons (TPH), and base-neutral and acid extractable organics (BNAs).

The results of the geophysical survey indicated the presence of USTs was unlikely at 10 UST locations, potential at 3 UST locations, and likely at 1 UST location. No Further Action was recommended at the 10 locations where USTs were unlikely, and excavation was recommended for the remaining geophysical locations.

The analytical results of the soil gas survey at 17 sites indicated that soil contamination at sites 73 and 74 was potentially significant. It was recommended that soil samples be collected from borings to confirm contaminant concentrations. The remaining soil gas sites contained low to trace concentrations of VOCs, and thus NFA was necessary *(*Earth Technology Corporation 1994; Dames and Moore 1995*).*

4.2.4.13 Radon Screening of Buildings

Two radon gas surveys were conducted and reported in August 1993, including a 12-month survey from August 1990 to August 1991, and a 90-day survey from January 1993 to April 1993. In total, radon levels in 252 separate buildings and structures at UMCD were evaluated. Based on survey results and in accordance with EPA guidelines, the report recommended that NFA was necessary in 121 buildings where radon gas concentrations did not exceed the detection limit of 0.5pCi/L. Seven of the 84 igloos that were subject to the 90-day test had radon gas concentrations ranging from 4.1 to 16.9pCi/L. Of these seven igloos, three were located in Block D, three located in Block E, and one in Block H. No action was recommended for these seven igloos, based on the fact that these igloos were not occupied. The survey found that Building 1 displayed radon concentrations slightly above the recommended value of 4pCi/l. The short-term survey for Building 415 displayed radon concentrations that ranged from 1.1 to 5.1pCi/L. The report recommended that mitigation measures be considered for Building 1 and Building 415 *(*Dames & Moore 1993b*).*

A follow-up document in 1993 showed that to mitigate effects from radon, employees had been moved so that Building 415 was not occupied on a routine basis. Building 1 was still occupied on a routine basis, and therefore actions to reduce radon levels to less than or equal to 4 pCi/l was to be accomplished by installing an exhaust fan in the mail room, where radon concentration exceeded the EPA limit. An exhaust fan was installed in Building 1 to reduce the radon level (UMCD Personal

Communication 2009-10; UMCD Archive Document 2002; Umatilla Depot Activity [UMDA] Radon Program 23 June 1993).

4.2.4.14 Focused Feasibility Study for Explosives Washout Lagoons Groundwater

A Focused Feasibility Study (FFS) was completed in December 2011 for the EWL. The FFS was prepared to evaluate potential alternative groundwater treatment technologies, since continuous operation of the pump and treat system had become less effective at removing explosives contaminant mass and reducing explosives contaminant concentrations. The FFS addressed the remaining contamination of groundwater at the EWL; developed objectives for groundwater remediation; and identified, developed, screened, and evaluated groundwater remedial action alternatives. The alternatives presented in the FFS were: (1) Continued Pump and Treat, (2) Pump and Treat Expansion, (3) Bioremediation, and (4) Pump and Treat Expansion and Bioremediation.

Table 12. Remedial Investigation Study Sites at UMCD and the Recommendations for Further Action

Study Site Number	**SWMU Name**	**Description[1]**	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
1	Deactivation Furnace	Located in the southwest corner of the property, it was used to deactivate small munitions. Refer to Section 4.2.5.3 for further information	Y	Y	N	---	ROD signed December 1992
2	Storage Igloos	1001 steel reinforced-concrete, earth-covered structures are found throughout the facility and were used as storage for various munitions and wastes. Refer to Section 4.11 for further information.	N	N	Y	---	No Further Action (NFA) based on no occupancy of storage igloos, per the 1993 Radon Survey
3	Hazardous Waste Storage Facility	The Hazardous Waste Storage Facility, Building 203 is located in the southwestern, 200 Series SW Warehouse Area and is wood framed constructed, with a metal roof and siding, and a concrete floor. Refer to Section 4.1.1.2 and 4.1.1.3 for further information.	N	Y	N	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
4	Explosives Washout Lagoons	These are two large infiltration lagoons for liquid wastes from bomb and munitions washing operations from the Explosives Washout Plant. Refer to Sections 4.2.5.2 and 4.2.5.6 for further information.	Y	Y	Y	---	Remedial Actions Operations ongoing; ROD signed September 1994
5	Explosives Washout Plant (Building 489)	The Explosives Washout Plant was a two-story metal and concrete building used to wash explosive constituents out of bombs and munitions. Refer to Section 4.2.5.1 for further information.	Y	Y	Y	---	Remedial actions complete per ROD signed June 9, 1994
6	Sewage Treatment Plant	Located in the south central part of the facility, the Sewage Treatment Plant treated domestic sewage wastes from the Administration Area. Refer to Section 3.4.2.1 for further information.	Y	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Description[1]	Recommended Further Action				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
7	Aniline Pit	The Aniline Pit was a 40 ft x 40 ft fenced area within the ADA. Refer to Section 4.2.5.1 for further information.	N	Y	N	---	NFA per ADA ROD, signed June 10, 1994
8	Acid Pit	Located in the ADA, the Acid Pit is a small limestone-lined, metal grating-covered pit that was used for the dumping of acid wastes. Refer to Section 4.2.5.7 for further information.	Y	N	E	---	NFA per ADA ROD, signed June 10, 1994
9	GB Bomb Disassembly Area	The GB Bomb Disassembly Area was used to disassemble GB nerve agent. Refer to Section 4.2.5.3 for further information.	N	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
10	Blister Agent HD Storage Area	Blister Agent HD Storage Area is an open gravel strip of ground approximately 100 ft wide by 2,000-3,000 ft long used to store 1-ton containers of blister agent HD. Refer to Section 4.2.5.3 for further information.	Y	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
11	Active Landfill	The Active Landfill covers approximately 5 acres and was used from 1968 until 1997 for the disposal of domestic and construction wastes generated at UMCD. Refer to Section 4.2.5.4 and 4.9.1 for further information.	Y	Y	Y	---	Semi-annual groundwater monitoring currently being conducted; NFA per ROD signed March 1993
12	Inactive Landfill	The Inactive Landfill is divided into six cells and is located in the southern portion of the UMCD. Approximate dates of operation were from the 1940s until 1968, though small sections of the inactive landfill continued to receive small amounts of waste into the early 1980s. Refer to Sections 4.2.5.5 and 4.9.2 for further information.	Y	Y	E	N	NFA per ODEQ/US Army SRI findings-ROD signed March 1993

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
13	Smoke Canister Disposal Area	The Smoke Canister Disposal Area is a ridge of dirt approximately 150 ft long by 30 ft wide by 6 ft high, located in the ADA, and contained burned debris from smoke canister burning operations. Refer to Section 4.2.5.7 for further information.	N	Y	E	---	NFA per ADA ROD, signed June 10, 1994
14	Flare and Fuse Disposal Area	The Flare and Fuse Disposal Area is located in the ADA, and consists of a 30 ft by 50 ft by 6 ft high mound containing soil and burned reside, though no actual burning was reported to have taken place. Refer to Section 4.2.5.7 for further information.	N	Y	E	---	NFA per ADA ROD, signed June 10, 1994
15	TNT Burn Area	The TNT Burn Area is an open gravel area within the ADA approximately 1 acre in size and was used to dump and burn TNT containing sludges and dunnage wastes. Refer to Section 4.2.5.7 for further information.	N	Y	E	---	Contaminated soil remediated per June 10, 1994 ADA ROD
16	Open Detonation (OD) Pits	Located throughout the ADA, several areas where shallow pits were used for the detonation of various convention munitions. Refer to Section 4.2.5.7 for further information.	N	Y	E	---	RA pending, UXO clearance per June 10, 1994 ADA ROD
17	Above Ground OD Area	The Above Ground OD area was used for the detonation of decontaminated M55 rockets and M23 land mines. Refer to Section 4.2.5.7 for further information	N	Y	E	---	Contaminated soil remediated per June 10, 1994 ADA ROD
18	Dunnage Pits	The Dunnage Pits, located in the ADA, were two trenches, approximately 350 ft by 30 ft by 8 ft deep, which were used for the disposal and burning of dunnage and possibly liquid wastes. Refer to Section 4.2.5.7 for further information.	Y	Y	Y	---	NFA per ADA ROD, signed June 10, 1994

Study Site Number	**SWMU Name**	**Description¹**	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
19	Open Burning (OB) Trenches	This area was a series of Open Burning Trenches located near the Dunnage Pits within the ADA. Refer to Section 4.2.5.7 for further information.	Y	Y	Y	---	Contaminated soil remediated per June 10, 1994 ADA ROD
20	Open Burning (OB) Area	Several Open Burning Areas were noted during the RFA within the ADA. Refer to Section 4.2.5.7 for further information.	N	N	---	---	1994 ROD states that risks and hazards indices for this site are within or below the acceptable cancer risk range or non-cancer level for future light industrial users ---
21	Missile Fuel Storage Areas	This area consisted of three metal sheds used to store missile fuel components. Refer to Section 4.2.5.7 for further information.	N	Y	N	---	NFA per ADA OU ROD, signed June 10, 1994
22	Defense Reutilization Marketing Office (former DRMO) area	The former DRMO area was a large, fenced area, approximately 1 acre in size, located between the electrical shop and Building 17. It was used to store various scrap or salvage material until it was taken off the site.	N	Y	Y	---	Contaminated soil remediated per June 30, 1994 Misc. Sites OU ROD
23	Building 5 Waste Oil Tank	A 500-gallon underground concrete tank was located outside of the maintenance garage in Building 5. It was used for temporary storage of waste oils prior to their removal. Refer to Section 4.4.2 for further information.	Y	---	---	---	Per ODEQ, contaminated soil may remain in place until access to it improves.

Study Site Number	SWMU Name	Description[1]	Recommended Further Action				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
24	Building 10 Waste Oil Tank	A 500-gallon underground steel or concrete tank was located outside of Building 10. It was used for temporary storage of waste oils from locomotive maintenance. Refer to Section 4.4.2.	Y	---	---	---	NFA per 1992 ODEQ letter
25	Metal Ore Piles	The Metal Ore Piles consisted of three piles of chromium ore located near the southern boundary of the K-Block igloos. Refer to Section 4.2.5.9 for further information.	N	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
26	Metal Ingot Stockpile	The Metal Ingot Stockpiles consisted of several lead and aluminum ingots stacked in piles in an open-air storage area approximately 1 acre in size. Refer to Section 4.2.5.9 for further information.	Y	Y	E	---	Contaminated Soil remediated under June 30, 1994 Misc ROD
27	Pesticide Storage Building (Building 8)	Building 8 was an enclosed building that stored a minimum supply of pesticides in two bermed compartments. Refer to Section 4.2.5.9 for further information.	N	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
28	Fuel Burning Area	This area was an open gravel area where missile fuel burning was conducted inside a portable furnace. Refer to Section 4.2.5.7	N	Y	---	---	The Enhanced PA recommended NFA.--
29	Septic Tanks*	19 septic tanks were identified during the RFA. Refer to Section 3.4.2.2 for descriptions.	Y	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
30	Storm Sewer Tile Field	The Storm Sewer Tile Field was apparently located in the area of the treatment plant. Refer to Section 4.2.5.9 for further information.	Y	Y	Y	---	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	**SWMU Name**	**Description[1]**	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
31	Pesticide Pits	A row of existing pits at this site may have been used to dispose of or burn pesticide solution and general debris, or to detonate munitions. Refer to Section 4.2.5.7 for further information.	---	---	E	---	Contaminated soil remediated per June 10, 1994 ADA OU ROD
32	Open Burning Trays	These two trays located on the ADA grounds were used to burn explosives propellant powder. Refer to Section 4.2.5.7 for further information.	---	---	N	---	NFA per June 10, 1994 ADA OU ROD
33	Gravel Pit Disposal Area	This site is located to the east of F Block. A former UMCD employee indicated there may have been an incident of GB/VX decontamination solution disposal at the site in the late 1960s. Refer to Sections 4.2.5.9 and 4.9.3 for further information.	---	Y	---	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
34	Paint Spray and Shot Blast Areas	Located in the southwestern portion of UMCD, these areas were used for temporary painting and shot-blasting activities. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
35	Malathion Storage Leak Areas	Former UMCD employees reported that a shipment of leaking 5-gallon insecticide (malathion) containers was stored on the gravel to the north of Building 108. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
36	Building 493 Paint Sludge Discharge Area	Building 493 was used to conduct spray-painting operations in wet spray booths that had drains that collected paint sludge and solvents. In addition, brass cleaning solution containing cyanide was reportedly disposed of in these drains. The drain pipes discharged to the coulee to the northwest of Building 493. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	Contaminated soil remediated per June 30, 1994 Misc. Sites OU ROD.

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
37	Building 131 Paint Sludge Discharge Area	According to a former employee, a depression west of Building 131 was used to collect discharges from spray-painting operations formerly conducted in Building 131. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
38	Pit Field Area	This site consists of numerous pits that were most likely used to detonate or dispose of ordnance materials, but former employees had no recollection of the use of this area. Refer to Section 4.2.5.7 for further information.	---	---	E	---	NFA per ADA OU ROD, signed June 10, 1994
39	QA Function Range	The QA Function Range is located in the northeast corner of UMCD and occupies approximately 600 acres. The central portion of the site served as a rifle and pistol range. The southern portion of the site, east of the coulee, served as a QA testing area for flares, photoflash grenades, and mines.	---	Y	E	---	Remedial Action Complete per May 2005 ROD; NFA recommended per After Action Report, August 2009 (Bay West, Inc., 2009)
40	Jeep Storage Area	This area was located in the Deactivation Furnace area and was used, at least in 1989 and 1990, to temporarily store used jeeps prior to servicing. Refer to Section 4.2.6 for further information.	---	Y	---	---	The Enhanced PA deemed the associated risks no greater than any other parking lot.
41	GB/VX Decontamination Solution Burial Areas	Former employees indicated that decontamination solutions from a leaking GB bomb brought onsite in the early 1960s may have been disposed of in one of these two areas. Refer to 4.2.5.7 for further information.	---	---	E	---	NFA per ADA OU ROD, signed June 10, 1994

Study Site Number	SWMU Name	Description[1]	Recommended Further Action				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
42	Former Underground Storage Tank (UST) Locations (Administrative Area)	Eleven USTs were formerly located in the Administration Area near the base gas station in the south-central portion of the UMCD. Refer to Section 4.2.4.13 for further information.	---	Y	---	---	NFA recommended per 1995 UST Invest Report.
43	Former Gas Station/Possible UST Location (Central UMCD Grounds)	A gasoline station was once located in the central portion of UMCD, at the intersection of Rim and Center Roads. A UMCD employee recalled that USTs were formerly located at this site. Refer to Section 4.4.1 for further information.	---	Y	---	---	NFA recommended per 1995 UST Invest Report.
44	Road Oil Application/Disposal Sites	Site 44 includes areas I and II. The first area reportedly experienced road oil disposal and possible spills (mid-1950s through the mid-1960s), road oil and tar drum storage (late 1940s), oil changing activities including draining waste oil directly into the soil (late 1940s), and storage of 50 to 60 transformers containing PCB-contaminated oil. The second area experienced a spill of hardened road oil material, occupying approximately 100 square feet. Refer to Section 4.2.5.9 for further information.	---	Y	Y	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
45	Building 612 and Building 617 Boiler Discharge Areas	Buildings 612 and 617 are boiler houses that have blow-down effluent locations that discharge onto soils. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
46	Railcar Unloading Area	Coal and/or ore was reportedly stored here in the 1950s and possibly early 1960s, and brass bullets were unloaded from railcars here in the late 1960s and early 1970s. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
47	Boiler/Laundry Effluent Discharge Site	A metal trough was used to discharge effluent during blow-down of the plant boilers as well as laundry operations involving clothes contaminated with explosive residuals. From the trough, the effluent was then discharged into a rock-lined pit. Refer to Section 4.2.5.9 for further information.	---	Y	Y	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
48	Pipe Discharge Area	The large Imhoff tank associated with the Sewage Treatment Plant discharges through a pipe that ends in a long ravine approximately 25 feet deep. Refer to Section 4.2.5.9 for further information.	---	Y	Y	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
49	Drill and Transfer Site	As part of a 1984 program to dispose of leaking chemical munitions, munitions were drilled, emptied, and decontaminated at this site. Refer to Section 4.2.5.9 for further information.	---	N	---	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
50	Railroad Landfill Areas	This site consists of two areas, one north of the railroad tracks and one all along the southern boundary of the railroad classification yard. Refer to Sections 4.2.5.9 and 4.9.4 for further information.	---	Y	Y	---	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	SWMU Name	Description[1]	Recommended Further Action				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
51	Large Open Areas (Vicinity of EWL)	Study Site 51, known as the Northern Large Storage Area, is located northeast of the Explosives Washout Lagoons and northwest of Rim Road and the C-Block igloos. The area has been used as a gravel borrow pit by UMCD contractors. Low levels of metals and SVOCs were detected in the samples from the two locations. VOCs were not detected in the samples. Based on these results, no further removal actions were deemed necessary *(*USACE 1997; UMCD BRAC letter 1997*).*	---	N	---	---	NFA
52	Coyote Coulee Discharge Area	These three gullies are presumed to be the result of liquid discharges from the various operations in the Explosives Washout Plant area. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
53	Building 433 Collection Sump/Cistern and Disposal Area	Building 433 is used as an oil-fired boiler house and restroom facility. The sump/cistern south of the building may have been used as a septic tank, but this is uncertain. Refer to Section 4.2.5.9 for further information.	---	Y	E	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
54	Possible Disposal Pit Location	A small pit may have once been briefly used to dispose of unknown items. No sampling occurred at this site during the RI because it could not be located.	---	Y	---	---	The Enhanced PA recommended no further investigation was necessary.
55	Trench/Burn Field	From 1950 to 1965, this site contained several rows of trenches where it is assumed that ammunition demolition or disposal activities may have been conducted. Refer to Section 4.2.5.7 for further information.	---	---	E	---	NFA per ADA OU ROD, signed June 10, 1994

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
56	Munitions Crate Burn Area	This area was reportedly used to burn empty wooden crates from munitions, and it is assumed that ammunition demolition or disposal activities may have been conducted at this site. Refer to Section 4.2.5.7 for further information.	---	---	E	---	NFA per ADA OU ROD, signed June 10, 1994
57	Former Pit Area Locations	This site consists of three areas of the ADA grounds where the soil is disturbed and in the form of trenches or pits. It is assumed that ammunition demolition or disposal activities may have been conducted at this site. Refer to Section 4.2.5.7 for further information.	---	---	E	---	NFA per ADA OU ROD, signed June 10, 1994
58	Borrow/Burn/ Disposal Area	Located in the ADA, historical photographs indicate that this site may have been a borrow site and/or a burning site at one time. It is assumed that ammunition demolition or disposal activities may have been conducted at this site. Refer to Section 4.2.5.7 for further information.	---	---	N	---	NFA per ADA OU ROD, signed June 10, 1994
59	GB/VX Decontamination Solution Disposal Areas	This site consists of two areas of the ADA grounds where former employees indicated that GB/VX decontamination solutions were disposed of on the ground in the early 1960s on at least two occasions. Refer to Section 4.2.5.7 for further information.	---	---	N	---	NFA per ADA OU ROD, signed June 10, 1994
60	Active Firing Range	Located on the ADA grounds, this site includes an active rifle and machine gun range and an active pistol range used by the National Guard since the early 1980s. Refer to Section 4.2.5.7 for further information.	---	---	N	---	NFA per ADA OU ROD, signed June 10, 1994
61	Open Paint Spray Areas	These areas were reportedly used in the 1950s and 1960s to conduct outdoor spray-painting. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
62	Paint and Solvent Disposal Area	This area is located along the Coyote Coulee north of the Explosives Washout area. During interviews given during the investigations for the RI, UMCD employees reported disposal of paint and solvent waste generated from a building formerly located east of the disposal location. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings.
63	Pier 836 Chemical Solution Disposal Area	Former employees reported that a laboratory trailer was set up in this area in the early 1980s to perform analyses on samples suspected to contain GB or VX agents, and some types of solution were spilled in the area around the trailer. Refer to Section 4.2.6 for further information.	---	Y	---	---	NFA per ODEQ/US Army SRI findings
64	Leaking Railcar Shipment Inspection Area	In the vicinity of the Sewage Treatment Plant, this area is approximately 1,000 ft long, extending from the main classification yard, turning eastward into a narrow ravine. During the 1990 RI interviews, UMCD employees reported shipments arriving by railcar that were leaking or suspected of leaking were taken to the end of the rail line in the ravine to be inspected. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings
65	Waste Paint and Solvent Disposal Area (Building 608)	During the 1990 RI interviews, employees reported that paint and solvents from Building 608 were disposed of on the soil covering the bunker storage areas north of the building. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings

Study Site Number	**SWMU Name**	**Description[1]**	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
66	Brass, Copper, and Steel Storage Area	This site is located near the railroad tracks south of Igloo Block H. Aerial photographs and UMCD employees report that copper, brass, and steel were stored at this site after being unloaded from the railcar (1992 RI of Dames and Moore). Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings
67	Building 439 Brass Cleaning Operations Area	The cleaning of brass shells with a solution referred to as "Wedac" took place within and around Building 493 in the 1960s. Refer to Section 4.2.6 for further information.	---	Y	N	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
68	UDMH Operations Area (Building 129)	Located within the Deactivation Furnace and Southwestern Warehouse Area, Building 129 was used to conduct stability test of UDMH and, potentially, red fuming nitric acid. Waste materials from the testing operations were drained through lead-lined pipes into a lime pit. Refer to Section 4.2.6 for further information.	---	Y	---	N	NFA per ODEQ/US Army SRI findings
69	Skunk Works Area	Located within the Deactivation Furnace and Southwestern Warehouse Area, this area was reported to be used for cleaning of copper and brass cartridges in hydrochloric acid baths and WEDAC solutions, which were then either dumped at this site or burned at the ADA grounds. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings

Study Site Number	SWMU Name	Description[1]	Recommended Further Action				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
70	Wood Preserving Solution Spill Area	Located within the former DRMO area and Administration Area, unconfirmed reports indicate that several hundred gallons of wood preservative solution pentachlorophenol (PCP), and, potentially, chromated copper arsenate and creosote may have been spilled or dumped in this area. Refer to Section 4.2.6 for further information.	---	Y	---	N	NFA per ODEQ/US Army SRI findings
71	Possible Fire Training Pits Area	Pits were dug here and filled with flammable liquids such as solvents or oils to conduct fire-training exercises periodically from the 1940s to the 1970s. Refer to Section 4.2.6 for further information.	---	Y	---	---	NFA per ODEQ/US Army SRI findings
72	Vehicle Storage Area	Old vehicles were reportedly stored here and leaks of fuel, oil, and battery acid may have occurred in this area. Refer to Section 4.2.6 for further information.	---	Y	---	---	NFA per ODEQ/US Army SRI findings
73	Diesel Fuel Spill Location	Former employees reported that in 1955 a spill of approximately 800 gallons of diesel fuel occurred on the soils in the area that is now covered with the concrete pad. Refer to Section 4.4.1 for further information.	---	Y	---	---	UST investigation report recommended remediation of soil. Refer to Section 4.4.1 for details on Site 73.

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
74	Oil/Fuel Transfer Station (Building 23)	Building 23 and the areas surrounding it have been used to transfer oil and fuel from incoming railcars to vehicles or storage tanks at UMCD since the early 1940s. Refer to Section 4.4.1 for further information.	---	Y	---	---	Passive Soil Gas Survey Conducted during the 1995 UST Investigation found contamination at the surface likely a result of surface spills rather than a leaking UST.
75	Battery Acid Collection Sump (Building 31)	Located within the former DRMO area and Administration Area, it has been reported that a concrete sump existed along the exterior of Building 31 that collected acid from a drain in the maintenance area. Refer to Section 4.2.6 for further information.	---	Y	---	N	NFA for surrounding soil per SRI findings. Bldg 27 is the battery shop and sump was removed previously.
76	Photographic Chemical Disposal Area (Building 54)	Located within the former DRMO area and Administration Area, Building 54 was reportedly used as a film developing laboratory and darkroom. It was reported during the 1990 RI site visit that approximately 50 to 100 gallons of film developing solutions were disposed of on the soil west of the building from the mid-1940s to early 1950s. Refer to Section 4.2.6 for further information.	---	Y	---	N	NFA per ODEQ/US Army SRI findings

Study Site Number	**SWMU Name**	**Description[1]**	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
77	Paint Storage and Disposal Area (Area 304)	Located within the former DRMO area and Administration Area, paints, solvents, oils, photographic solutions, and antifreeze solutions were stored and disposed of in an area located within and surrounding Building 30A storage shed. Refer to Section 4.2.6 for further information.	---	Y	---	E	NFA per ODEQ/US Army SRI findings
78	Buildings 608 and 614 Heat Exchange Systems	Buildings 608 and 614 are heated with a closed heat exchange system consisting of ethylene glycol solution that runs through a holding tank and piping located beneath the floor. Refer to Section 4.2.6 for further information.	---	Y	---	---	NFA per ODEQ/US Army SRI findings
79	Malathion Spray Areas	Located in the northeast corner of Igloo Block C, this area is reported to have been sprayed with the insecticide malathion during a commercial over-flight operation near UMCD. Refer to Section 4.2.6 for further information.	---	Y	---	N	NFA per ODEQ/US Army SRI findings
80	Disposal Pit and Graded Areas	Portions of this site were located in the ADA area. There is some chance that that the pit remaining at the eastern end of the site may have been used to dispose of liquid waste materials. Refer to Section 4.2.5.9 for further information.	---	Y	N	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
81	Former Raw Material Storage Locations	This site is located in the ADA and consists of two locations, I and II, where raw materials, possibly coal or ore, were stored in the 1940s and 1950s. Refer to Section 4.2.5.9 for further information.	---	Y	N	---	NFA per Misc. Sites OU ROD, signed June 30, 1994

Study Site Number	**SWMU Name**	**Description**[1]	**Recommended Further Action**				
			RFA	Enhanced PA	RI	SRI	Final Action or Determination
82	Former Gravel Pit/Disposal Location	Historic aerial photographs indicate that this site was a gravel pit (1992 RI of Dames and Moore). A 1990 investigation found asbestos-containing building siding. Refer to Sections 4.2.5.9 and 4.9.5 for further information.	---	Y	N	---	NFA per Misc. Sites OU ROD, signed June 30, 1994
83	Leaking Drum Storage Area	Located within the former DRMO area and Administration Area, the area consisted of a fenced yard west of Building 39 and south of Building 23, which was used to store drums containing the degreasing solvent methyl isobutyl ketone (MIBK). Refer to Section 4.2.6 for further information.	---	---	---	N	NFA per ODEQ/US Army SRI findings

N/A	PCB Transformer Locations	According to UMCD records, there were 239 transformers on post. All 239 transformers were tested for PCBs in 1989. 173 of the 239 transformers on the property were in use at the time of the SRI; the remaining were removed and disposed of off-post. 50 of the 66 transformers removed were replaced with transformers containing less than 50 parts per million (ppm) PCBs. The SRI focused its investigation on 79 transformers where the PCB concentration was greater than 10 ppm. Refer to Section 4.5 for further information.	---	---	---	Y	NFA per ODEQ/US Army SRI findings at transformer locations 162,163, 164, 197, and 198.

1. Generalized locations of the study sites can be found in Figure 4 & 5 Appendix G.

Notes:
NUS Corporation1987. RCRA Facility Assessment, UADA, Hermiston OR, Prepared for the USEPA, June 1987.
Dames and Moore 1990. Enhanced Preliminary Assessment for Umatilla Depot Activity, Prepared for the U.S. Army Toxic and Hazardous Materials Agency, April 1990.
Dames and Moore 1992b. Remedial Investigation Report for the Umatilla Depot Activity, Hermiston, Oregon. Prepared for the U.S. Army Toxic and Hazardous Materials Agency, August 1992.
Dames and Moore 1993c. Supplementary Remedial Investigation Report, Umatilla Depot Activity, Hermiston, Oregon. Prepared for the U.S. Army Environmental Center Command, September 1993.
N = No Further Action Required
Y = Additional Study Recommended
E = Evaluate Potential Risks (No additional sampling is recommended)

4.2.5 Operable Units (OU) under Federal Facility Agreement (FFA)

The CERCLA remedial activities at UMCD were divided into nine Operable Units (OUs) that have signed RODs (U.S. Army 1992). These OUs and their respective ROD dates are listed below, and are explained in detail in the following sections.

OPERABLE UNIT	ROD DATE	
1. Explosives Washout Lagoons (EWL) Soils*	September 1992	
2. Deactivation Furnace*	December 1992	
3. Active Landfill**	August 1993	(U.S. Army 1993)
4. Inactive Landfill*	August 1993	(DERP 1993)
5. Explosives Washout Lagoons (EWL) Groundwater	July 1994	
6. Explosives Washout Plant*	July 1994	
7. Ammunition Demolition Activity (ADA)	July 1994	
8. Miscellaneous Sites*	July 1994	
9. Site 39: Quality Assurance Function Range	May 2005	(Defense Environmental Restoration Board 2005)

Notes: * OUs that do not require long-term management or review by EPA or ODEQ as determined in the 1999 Five-Year Review *(*UMCD Archive Document 1999*).*

** Applicable ODEQ regulations govern closure and post-closure.

As described in Section 4.2.4.7, the 1992 RI (Dames and Moore 1992b*)* previously designated OUs; however, the OU classification system used within the 1992 RI did not require each OU to have a signed ROD.

4.2.5.1 Explosives Washout Plant Operable Unit

The ROD-designated Explosives Washout Plant, which recovered explosive residuals from munitions as detailed in Section 3.3.2.8, contributed soil and groundwater contamination to the environment. In addition, the plant itself, including Building 489 and the explosives wash water sump, was contaminated with explosive residues. Wipe samples collected from Building 489 contained the explosive constituents TNT, 1,3,5-TNB, RDX, and HMX up to 17.6 ug/cm^2. Aqueous sump samples contained the same explosive constituents as the building wipe samples, with total explosive constituent concentrations ranging from 33.4 to 95.5 ug/L. The same explosive constituents were detected within the sludge/sediment of the sump, ranging from 400,000 ug/g to 710,000 ug/g. Following the environmental investigation studies, a Human Health Baseline Risk Assessment (Dames and Moore 1993a) and FS (Little 1993a) were conducted for the Explosives Washout Plant OU. These evaluations were conducted to define remediation goals and criteria and to identify, evaluate, and provide the basis for selection of remediation alternatives for mitigating explosive constituent contamination at the OU. The Army, EPA, and ODEQ selected a cleanup remedy for the site as documented in the ROD (U.S. Army 1994), and as modified in the Explanation of Significant Differences (ESD) (U.S. Army 1995).

The ESD was written primarily to document the change from a combined solvent wiping and hot gas decontamination procedure to a safer and more cost effective flaming procedure, and to allow complete demolition of the plant instead of partial demolition and reuse. The major components of the implemented remedy for the remediation of the Explosives Washout Plant OU were:

- Clean out and disposal of explosive waste sludge/sediment and contaminated washout water from the washout water sump.

- Decontamination by flaming and landfill disposal of the concrete washout water sump.
- Pretreatment of the Explosives Washout Plant process equipment (i.e., high pressure water washing, paint removal by grit blasting [except asbestos-insulated piping], removal of asbestos insulation, and cleanup of animal waste droppings).
- Treatment by flaming of galvanized steel siding, aluminum siding, concrete, and process equipment.
- Removal and disposal of the process equipment.
- Complete demolition of the plant building.

The Explosives Washout Plant remediation was completed in 1998, and the plant has been closed out. Soil and groundwater contamination related to former activities at the plant are discussed in Sections 4.2.5.2 and 4.2.5.6.

4.2.5.2 Explosives Washout Lagoons Soils Operable Unit

The ROD-designated Explosives Washout Lagoons site was divided into two OUs, soils and groundwater, to facilitate early remediation of the soil. This section discusses soil contaminated with explosive residual compounds associated with the former washout lagoons.

The native soils beneath the two unlined lagoons that received discharge water from the Explosives Washout Plant were contaminated via leaching of explosive residuals from the lagoon water. The Explosives Washout Lagoons Soils OU addressed contaminated soils beneath the lagoons, principally within the unsaturated zone. Each lagoon was rectangular in shape and was created by excavation within the native sandy-gravelly soil. The north lagoon measured 80 by 39 feet, while the south lagoon was 80 by 27 feet. Both were six feet deep. The depth from the bottom of the lagoons to groundwater generally varied from about 45 to 50 feet (U.S. Army 1992). Because groundwater percolation under the influence of gravity in the unsaturated zone is downward, and accounting for minor lateral spreading owing to dispersive forces, the lateral extent of the affected soil was not much greater than the lagoon dimensions themselves.

Based on initial investigations and results of the lagoons and underlying soil as detailed in the installation RCRA Facility Assessment (NUS Corporation 1987), the Explosives Washout Lagoons were formally listed on the NPL in FR Vol. 52, No. 140 p 27620-27642 July 22, 1987. This required that the lagoons' sites be investigated in accordance with the CERCLA process.

A RI of the entire UMCD installation, including the lagoons, was initiated in 1990 to determine the nature and extent of contamination and to identify alternatives available to clean up the facility (U.S. Army 1992). Soil samples were collected from numerous soil borings drilled beneath and surrounding the lagoons to determine the vertical and horizontal extent of soil contamination. The contaminants most frequently detected in the soil were TNT, RDX, HMX, 1,3,5-TNB, and 2,4-DNT; however, TNT and RDX were the contaminants most often found and in the highest concentrations. Initial TNT and RDX contaminant concentrations in the Explosives Washout Lagoons Soils OU ranged from 100 to 2,000 parts per million (ppm) from ground surface to a depth of 3.5 feet. At depths below 3.5 ft, concentrations were generally less than 30 ppm. TNT concentrations exceeding 2,000 ppm were found in the top inch of soil, with a maximum of 88,000 ppm detected (U.S. Army 1992*).*

The remedy selected for implementation under the ROD included excavation of soil beneath the lagoons having TNT or RDX concentrations greater than 30 ppm each. The total quantity of excavated soils was 10,969 cubic yards. The excavated soil was biologically treated on site via composting (mixing with organic amendments such as vegetable waste, straw, manure) until TNT and RDX concentrations declined to 30 ppm or less (U.S. Army 1992). The remedial action was completed by May 1997, and the Explosives Washout Lagoons Soils OU was closed out. The final upper confidence level of explosive constituents in the treated soil (compost) was 3.84 ppm for TNT and 3.78 ppm for RDX. The extremely low remaining concentrations of TNT and RDX in the treated soil allowed for reuse for onsite vegetative landscaping restoration instead of simply backfilling the lagoons with the treated soils (U.S. Army 1997b).

4.2.5.3 Deactivation Furnace Operable Unit

The ROD-designated Deactivation Furnace OU is located in the southwestern corner parcel of the UMCD installation. This OU consists of the two former buildings associated with the Deactivation Furnace and the surrounding 8-acre area deemed contaminated from air pollution that accumulated during the life of the Deactivation Furnace. Contaminated soils were treated and buildings and related structures were demolished and removed from the site.

The two former buildings associated with the Deactivation Furnace consisted of concrete floored structures with dimensions of 25 x 50 ft and 15 x 40 ft (with the larger building being roofless). A concrete slab totaling approximately 2,500 square feet surrounded the buildings. This slab was centralized within a 270 x 190 foot area that consisted of a gravel hardstand cover that was 2 to 6 inches thick. Surrounded by natural soil, the hardstand was used as the parking and service area for furnace operations. Additional access to the site included two railroad lines that extended north and south of the site and converged along the western fringe of the gravel hardstand before continuing south as one line.

The Deactivation Furnace was described as an Explosive Waste Incinerator and was designated as Ammunition Peculiar Equipment 1236 in the inventory of U.S. Army Armament Munitions and Chemical Command. The Deactivation Furnace was used for the routine incineration of unserviceable or obsolete conventional munitions up to 50 caliber, comprising Class A and B Explosives (reactive wastes such as detonators) and Class C Explosives (non-reactive wastes such as small arms ammunition). Examples of incinerated material include cartridges, mines, boosters, primers, fuses, grenades, charges, detonators and propellant, and explosive and/or pyrotechnic wastes from recoverable metal.

The Deactivation Furnace was operated from the late 1950s to November 1988. During operation, munitions were fed into the retort through a conveyor belt system with standard operating temperatures of 1200 to 1500 °F. Exhaust gases were uncontrolled for the first 10 years of operation, before the addition of a cyclone and baghouse air pollution control system was implemented in the 1960s. This initial air pollution equipment was replaced between 1975 and 1980. Residual ash from the Deactivation Furnace baghouse and cyclone was placed in disposal bags and temporarily stored in Building 203 (RCRA-permitted hazardous waste storage facility at UMCD), followed by transportation to a final storage location at the RCRA-permitted hazardous waste disposal facility in Arlington, Oregon.

The following is a summary of the studies, sampling events, and decisions of relevance to the Deactivation Furnace OU. UMCD was initially included in the Army's IRP in 1978, which led to limited soil and groundwater sampling. This was followed by an RCRA Facility Assessment in 1987 (*NUS Corporation, 1987*). Deactivation Furnace soils were sampled in 1988 by Weston, Inc., under an Initial Remedial Investigation (RI), and showed high bulk metal concentrations. In compliance with 40 C.F.R. 265.11 (Closure Performance Standard), an RCRA closure plan was developed by UMCD and was approved in amended form by ODEQ in October 1990. This closure plan called for the dismantling and removal of the furnace and related structures along with all soils contaminated by furnace emissions from past operations.

An RI and FS of all UMCD installations expanded the initial estimate of contaminated soil in 1990. An expanded RI in 1990 and 1991, performed by Dames and Moore under direction of the USATHAMA, analyzed additional soil samples, including samples from the Deactivation Furnace drainage sump, for metals, explosive constituents, and other compounds. In June 1991, USACE, Seattle District, performed a Phase I Supplemental RI to analyze soil samples for total lead concentrations and eight RCRA metals.

A Phase II Supplemental RI performed by USACE, Seattle District in 1992 analyzed shallow soil composite samples. Dames and Moore prepared a Remedial Investigation Report, a Human Health Baseline Risk Assessment, and an Ecological Assessment Report for the Umatilla Depot Activity, Hermiston, Oregon, in 1992. In addition, an FS for the Deactivation Furnace Soils OU was prepared by USACE, Seattle District, and Ecology and Environment, Inc. in 1992. The RIs and FS performed at the OU determined that the following 12 metals exceeded soil background concentrations established for the chemical depot for the Deactivation Furnace OU: antimony, arsenic, barium, beryllium, cadmium, copper, lead, nickel, potassium, silver, thallium, and zinc. Organic contaminants were not detected in the soils, except for a minor concentration of total 2,4-DNT (1.36 milligrams per kilogram [mg/kg]) recorded within the top three inches of sediments within the Deactivation Furnace drainage collection sump. Metals showed increased soil concentrations downwind of the Deactivation Furnace, predominantly to the northeast, with some remote locations found to be highly contaminated within the top three inches of soil.

In July of 1992, the Deactivation Furnace was decontaminated and removed from the site and disposed or salvaged as nonhazardous solids waste during an RCRA closure action. During the RCRA closure action, hazardous waste (e.g. baghouse ash and rinse water) was disposed at the RCRA-permitted hazardous waste treatment, storage, and disposal (TSD) facility in Arlington, Oregon.

Results of extensive soil sampling and chemical testing were presented in an August 1992 FS report prepared by USACE, Seattle District and submitted for regulatory review. This was followed in November and December 1992 with a Phase III Supplemental RI sampling program to further characterize soil contamination within the furnace drainage collection sump and to evaluate the performance of X-ray fluorescence (XRF) testing equipment for field screening of soil lead concentrations. A ROD was listed on December 1992 describing the Stabilization/Solidification (S/S) method to be used for contaminated soil treatment and to specify limits for metals cleanup. In February and March 1993, Round I and II Design-Phase Sampling was completed, and was followed by the production of Fact Sheet #1 in June 1993.

Subsequent site decontamination included railroad rails, tie plates, spikes, and ties that were removed and cleaned as part of the site remediation and restoration. Railroad track ballasts (consisting mostly of imported gravel and basalt cobble) were found to be contaminated with lead, and were remediated along with contaminated native soils and hardstand. Railroad cross ties were analyzed for metals and organic compounds by Toxicity Characteristic Leachate Procedure (TCLP) extraction procedures and were found to be nonhazardous. The ties were surficially decontaminated and salvaged for the U.S. Government.

The 1992 ROD called for all site soils greater than 500 mg/kg lead to be removed and treated by S/S. Soil remediation to this level was designed to make the site acceptable for potential future residential use. This health protection goal was designed to protect 95 percent of future children, assumed to be exposed to soil in a residential setting, from exceeding blood lead levels of 10 micrograms of lead per deciliter of blood. An assessment concluded that a remedial action goal based on lead would be sufficient for cleaning up the site's other 11 contaminants to their respective background concentrations or to levels that would pose no significant risk to human health and the environment.

The soil requiring excavation and treatment by S/S was completed in two tiers, the first with the objective of reducing the mean concentration of lead contamination (at the 95 percent upper confidence limit) to below 500 mg/kg, and the second to remove all soil above 500 mg/kg lead. Under Tier I work, approximately 6,100 cubic yards of surficial soils required excavation and treatment by S/S at the furnace site. For Tier II, an additional 405 cubic yards of soil required excavation.

Excavated soils were sized through screening, with the oversize being crushed and subjected to S/S treatment. Treated soils were required to pass the TCLP performance standard for lead leachate of 5 mg/L as designated in the ROD. Solids that passed the Land Disposal Restrictions were disposed of in the on-site RCRA act Subtitle D landfill (UMCD Active Landfill). Solidified soils that failed TCLP were excavated, crushed, reprocessed by S/S, and retested until they passed.

A UST identified as UST 87 was previously located within the Deactivation Furnace OU. The 1,000-gallon tank was installed in the 1950s to store No. 2 diesel and was used to fuel the Deactivation Furnace. UST 87 was removed from the ground in December of 1994. Soil samples from the tank pit and stockpiles were analyzed and found to contain less than 50 ppm TPH, or less than 10 percent of the soil matrix cleanup level for the site. There were no detectable Benzene, Toluene, Ethyl Benzene, and Xylenes (BTEX) compounds. The tank shell was cut, cleaned, and disposed of as scrap in Portland, Oregon. The tank excavation was backfilled with clean soil and regraded to original conditions.

In February 1995 the project was considered physically complete. On-site disposal of the solidified material is expected to provide effective, long-term controls for inhalation exposure and direct contact/ingestion exposure at the site. The excavation and S/S remedy provided permanent solutions to the soil contamination at the Deactivation Furnace OU. Because no hazardous substances remain in the soils above health-based levels, a five-year review does not apply to this OU, according to the ROD. The Deactivation Furnace OU is closed out.

Other Miscellaneous Site OUs are present near the Deactivation Furnace OU and are discussed in further detail within Sections 4.2.5.9 and 4.2.6.

4.2.5.4 Active Landfill Operable Unit

The 1992 ROD-designated Active Landfill OU as a 5-acre solid waste disposal area located in the northeastern portion of UMCD, approximately one-half mile east of the topographic feature known as Coyote Coulee. Although known as the Active Landfill to distinguish from other disposal areas, this landfill was closed in 1997. The landfill is located between areas known at UMCD as storage Igloos Blocks E and D. The disposal area of this landfill consisted of a depression approximately 50 feet deep, which was a former gravel pit. Materials disposed of at the site include garbage, demolition debris, asbestos from brake linings, dried sludge from the sewage treatment plant, possibly ash from the Deactivation Furnace, and sludges that contained explosive residuals (U.S. Army 1993).

The Army operated the landfill from 1968 to 1997. ODEQ issued a landfill permit to the Army in 1979, and the permit was renewed in 1982. Municipal wastes from the UMCD facility, including debris generated by maintenance such as clearing and renovation activities, were disposed of at the site and covered by soil on a weekly schedule. The extent of activity at UMCD was significantly reduced over the last 20 years, with a corresponding reduction in the volume of material placed in the landfill until its closure (USACE 2004).

The peak work force at UMCD existed when the landfill was first opened. During the Vietnam Conflict, approximately 1,000 people were employed at UMCD. However, by 1970 the work force began to decline, and by 1987 the work force had fallen to three military and 250 civilian employees. The landfill ceased receiving municipal waste on October 3, 1993, but continued to receive treated soil from remediation of the Deactivation Furnace OU, Miscellaneous Sites OU, and the Ammunition Demolition Activity OU (USACE 2004). The landfill was capped and closed in accordance with ODEQ Solid Waste Regulations in November 1997.

An RI was conducted in 1992, with groundwater sampling activities performed at 10 adjacent monitoring wells. Analyses performed on the groundwater samples include: Target Analyte List (TAL) inorganics (which includes metals, non-metallic elements, and cyanide), VOCs, semi-volatile organic compounds (SVOCs), pesticides, PCBs, explosive constituents, and nitrate/nitrite. The RI results found elevated nitrate/nitrite and selenium levels, which are believed to be unrelated to landfill activities.

The ROD selected No Action as the remedy for the Active Landfill OU (U.S. Army 1993). This selection was based on information generated during the RI, which indicated that the OU did not pose an unacceptable threat to human health and/or the environment. Under a future residential land use scenario, the potential carcinogenic risks and non-carcinogenic hazard quotient due to ingestion of groundwater at the Active Landfill OU were 5×10^{-5} and 2.0, respectively. The landfill was closed and capped in accordance with RCRA requirements and a closure permit was issued by the State of Oregon in August 2000. Closure requirements for the landfill were taken in accordance with the State of Oregon permit requirements.

Groundwater monitoring of the landfill was initiated in October 1996 and continued until 2010. The monitoring was to determine if releases from the landfill contents were evident and could impact groundwater quality. Monitoring was conducted in accordance with the Environmental Monitoring Plan approved by ODEQ in July 1997 (U.S. Army 1997a) and updated and approved in February 2007. With the exception of selenium, the results from the sampling have been compared to the Table 1, 2, and 3 values from the Oregon Administrative Rules, Department of Environmental Quality 340 Groundwater Quality Protection (OAR 340-040). For selenium, the results have been compared to a risk-based level of 50 ug/L established by the ODEQ Cleanup Department in January 2003 (ODEQ 2003). Selenium has exceeded 50 ug/l historically at three wells (11-1, 11-2, MW-34), however, all three of these wells are considered hydraulically side-gradient and are not the result of contaminants leaching from the landfill.

Monitoring was discontinued after ODEQ concurred with a technical l review of the many years of monitoring data. In that review, the data were assessed in light of: contaminant source, fate, and transport considerations according to guidance from40 CFR 258.50 (b)(2). The review is recorded in an Oct 22, 2010 USACE memo. A letter from the Oregon Department of Environmental Quality terminated the Solid Waste Permit No. 320 associated with this landfill and transferred the site to the Environmental Cleanup Program. USACE and ODEQ agreed to terminate groundwater monitoring. Since the portion of UMCD that contains the landfill is proposed for wildlife habitat, this could eliminate direct exposure to humans from groundwater with appropriate deed restrictions.

4.2.5.5 Inactive Landfill Operable Unit

The ROD-designated Inactive Landfill OU addresses six discrete former disposal areas totaling an area of approximately 300,000 square feet, or approximately 8 acres, and is located west of the Administration Area. The six inactive landfills include: the Northern Inactive Landfill (NIL), the Northern Inactive Landfill Extension (NILE), the Southern Inactive Landfill (SIL), the Southern Inactive Landfill Extension (SILE), the Western Inactive Drum Site (WIDS), and the Southeastern Inactive Landfill (SEIL). The SIL and NIL, the larger cells of the OU, were originally gravel pits and were converted to landfills when mining operations ceased.

Disposal into these landfills occurred from about the early 1940s into the mid-1980s, though reports are that most of the disposal activity ceased in the 1960s when the Active Landfill opened. Materials disposed of at the landfills were reportedly nonhazardous waste, such as demolition debris, base municipal garbage, asbestos from brake linings, and potentially ash from the Deactivation Furnace; though no official records were kept.

During the RI conducted in 1992, soil and groundwater samples were collected around the inactive landfill areas and analyzed for explosive constituents, nitrite/nitrates, metals, VOCs, SVOCs, pesticides, PCBs, and cyanide. This extensive list of analytes was established because a variety of compounds may have been disposed of at the landfills. Low concentrations of metals, nitrite/nitrates, trace concentrations of pesticides, and one PCB compound was found in some soil samples. The concentrations were below health-based cleanup goals, and are not a concern. Groundwater analytical results show concentrations similar to naturally occurring background levels of vanadium and arsenic. Slightly elevated levels of nitrite/nitrates were found in some groundwater samples but were attributed to off-site agricultural sources.

The Baseline Risk Assessment was conducted during the RI (1992) to identify contaminants found at background concentrations as well as compounds attributed to the landfill. Risks were calculated for future residential land use; risk for current land use was not calculated, as access to the site is restricted. Exposure pathways calculated were for residents living on-site, including ingestion of drinking water or crops grown at the site, contaminated irrigation water, and dermal contact from showering. Results of the risk assessment determined that the landfills do not pose an unacceptable risk to human health. Noncarcinogenic hazard index calculations were slightly above 1 due to the presence of the naturally occurring arsenic. Removal of arsenic from the calculations generated a hazard index of below 1.

The ROD for the Inactive Landfill OU at UMCD was issued in March 1993. The No Further Action remedy was selected. This remedy was based on the RI findings that the current use and potential future residential land use do not result in any unacceptable risk to public health or the environment. The site is not subject to the five-year review process. The Inactive Landfill OU is closed out *(*DERP 1993; UMDA EPA announcement Aug. 1992; Dames and Moore 1992b*).*

4.2.5.6 Explosives Washout Lagoons Groundwater Operable Unit

The ROD-designated Explosives Washout Lagoons (EWL) site was divided into two OUs, soils and groundwater, to facilitate early remediation of the soil. This section discusses groundwater contaminated with explosive constituents associated with the former washout lagoons.

The EWL Groundwater OU addresses contamination in groundwater caused by past waste disposal at the lagoons, plus contamination above the water table but below the depth to which soil was excavated and treated under the EWL Soils OU. See Section 4.2.5.1 for a description of the former Explosives Washout Plant OU, and Section 4.2.5.2 for a description of the Explosives Washout Lagoons Soils OU, which both contributed to the groundwater contamination. The lagoons leached explosive constituents contaminated process water down through the native permeable soils into groundwater. The depth from the bottom of the lagoons to groundwater generally varied from 45 to 50 feet. Once the explosive constituents reached groundwater, they formed dissolved-phase contaminant plumes originating beneath the lagoons and dispersing laterally and vertically within the unconfined, alluvial aquifer, primarily due to the advective and dispersive forces acting on groundwater.

The groundwater contamination was isolated to the unconfined (alluvial) aquifer. The alluvial aquifer consists of highly productive permeable sand and gravel. At the EWL, the saturated thickness of the entire unconfined aquifer ranges from approximately 15 to 35 feet. Elephant Mountain Member basalt bedrock underlies the alluvial aquifer and is much less capable of storing and transmitting significant quantities of groundwater compared to the alluvial aquifer.

The natural groundwater surface exhibits a very flat gradient and seasonal reversal in flow direction due to recharge from agricultural canals in the spring and pumping from agricultural wells in the summer and fall. In the summer and fall, flow direction is generally to the east and south as irrigation pumpage off the UMCD peak. During the winter and early spring, when irrigation withdrawals are at a minimum, groundwater flows to the northwest toward the Columbia River.

Several soil and groundwater investigations were conducted at the Explosives Washout Lagoons from 1981 to 1994. A RI of the entire UMCD installation, including the lagoons, was initiated in 1990 to determine the nature and extent of contamination and to identify alternatives available to clean up the facility (U.S. Army 1992). An original network of 30 groundwater monitoring wells was used to identify and map groundwater contamination. A total of 78 monitoring wells are used to map groundwater contaminant concentrations in the area of the Explosives Washout Lagoons. COCs identified in groundwater were TNT, 1,3,5-TNB, DNB, NB, 2,4-DNT, 2,6-DNT, tetryl, RDX, and HMX. The most common contaminant was RDX, with concentrations ranging from below detection limit (< 0.556 μg/L) along the plume perimeter to 6,816 μg/L. RDX, the most mobile contaminant, had the largest plume at approximately 350 acres, all of it contained within the UMCD facility boundary (USACE 2004). TNT, being more soluble than RDX but having less affinity to desorb from soil, had the second largest plume.

Remedial Action Criteria were established in the ROD for the Explosives Washout Lagoons Groundwater OU based on ARARs (e.g., Maximum Contaminant Levels [MCL], Lifetime Health Advisories [HA]) or risk-based levels that provide a carcinogenic protection of l x 10^{-6} or a noncarcinogenic hazard quotient of 1). These criteria are:

CONTAMINANT OF CONCERN (COC)	REMEDIAL ACTION CRITERIA (ug/L)	BASIS
1,3,5-TNB	1.8	Risk-based
DNB	4.0	Risk-based
TNT	2.8	Risk-based/HA
2,4-DNT	0.6	Practical Quantitation Limit [PQL]
2,6-DNT	1.2	PQL
HMX	350	HA
RDX	2.1	PQL/HA

Following the recommendation from the 1993 Feasibility Study for Groundwater at EWL (Little 1993d), the selected remedial action for the EWL Groundwater OU was extraction of the contaminated groundwater, followed by granular activated carbon (GAC) treatment and reinfiltration of the treated groundwater back into the aquifer.

The major components of the remedy were:

- Extraction of the groundwater from an estimated three extraction wells over an estimated 10 to 30-year period.
- Treatment by GAC to meet performance standards based on the groundwater cleanup levels.
- In-situ flushing of subsurface soils beneath the lagoons with all or part of the treated groundwater for an estimated period of one year.
- Up-gradient reinfiltration of the treated groundwater that does not go to the Explosives Washout Lagoons and all the treated water after the in-situ soil flushing is completed.
- Testing of the spent GAC to determine RCRA characteristic hazardous waste status.
- Off-site thermal treatment and disposal of explosive constituent-contaminated GAC to the level specified in the Remedial Design (RD) (off-site thermal treatment will comply with the NCP Off-Site Rule).
- Monitoring of groundwater contamination to determine the effectiveness of the remedial action and to determine when the groundwater cleanup levels have been attained.
- Institutional controls (IC) on the contaminated groundwater to prevent the use of the groundwater until the groundwater cleanup levels are met.

The RDX plume has the maximum extent of explosive groundwater contamination. The remaining explosive constituent-related contaminants are much less mobile than RDX and have smaller, more localized plumes.

Three extraction wells pumping at 1,300 gallons per minute (gpm), one treatment plant consisting of four 20,000-pound GAC filters, and three infiltration fields were constructed in November 1995. The groundwater treatment system began operating in January 1997 and has been in operation to the present day. The extraction and treatment system operated continuously (except for periodic maintenance and occasional unplanned down time) until February 2009, at which time the system began operating under a pulse-pumping scheme to evaluate whether cycling the extraction off and on could increase system efficiency. Spent GAC has been periodically sent off-site for thermal regeneration treatment. The objective of the remediation is to restore the unconfined aquifer to its beneficial use by reducing the concentrations of COCs to less than the cleanup levels specified in the ROD within 10 to 30 years.

The soil flushing component of the remedy, where unsaturated contaminated soils beneath the lagoons were flushed with clean water that were not excavated and treated as part of the EWL Soils OU, began in 1998 and was completed in 2000.

The continual operation of the pump and treat plant started in 1996 through December 2008. Approximately 6.5 billion gallons of contaminated groundwater were treated and approximately 13,128 pounds of explosive residuals were removed by the treatment system. The rate of removal of explosive constituents from treated groundwater has steadily decreased over time. The explosive constituent removal rates and concentrations have leveled off since about 2004 and have not met ROD remediation levels. The pulse-pumping evaluation was a modification to the system operational strategy allowed in the ROD for optimizing system efficiency.

In 2009, SCS prepared a pulse pumping evaluation report documenting the system performance under the pulse pumping operational mode (SCS 2009). The report concluded that although short-term contaminant removal rates were improved approximately by a factor of two, the overall contaminant mass projected to be captured over an operational year declined (relative to a continuous operational mode) and was concluded to not be an efficient remediation technique.

The ability of the groundwater treatment system to meet the ROD cleanup requirements was questioned by stakeholders, since the pump and treat system had become less effective at removing explosives contaminant mass and reducing explosives contaminant concentrations. Therefore, a Focused Feasibility Study for Groundwater at EWL was completed in December 2011, recommending expansion of the current pump and treat system combined with bioremediation. These treatability studies included the application of nutrient amendments (including lactose, ethanol, emulsified oil, and corn syrup) to promote the natural microbial degradation of the contaminants of concern. Expansion of the existing pump and treat system includes installation of two additional extraction wells. During the initial stages of the recommended remedy, pilot studies will be implemented in the former explosives washout lagoons area, applying carbon substrate to the subsurface and encouraging biodegradation. Expansion of the pump and treat system is a modification to the system allowed in the ROD.

4.2.5.7 Ammunition Demolition Activity (ADA) Operable Unit

The ROD-designated ADA OU is a 1,750-acre area located in the northwestern corner of UMCD. From 1945 to 1992, the ADA was used by the Army to dispose of ordnance by burning, detonation, dumping, or burial. Activities were conducted at a number of locations throughout the ADA. Soil contamination exists at 20 sites within the ADA. In addition, ADA activities resulted in the presence of quantities of munitions and explosives of concern (MEC) at locations across the entire ADA.

An extensive sampling and analysis program was initiated at the ADA as part of the RI (Dames and Moore 1992b). The RI included an assessment of soil contamination at each of the 20 ADA OU Study Sites as well as an overall assessment of potential groundwater contamination beneath the ADA. Future residential use of the ADA was viewed as unlikely, due to the presence of MEC in unknown quantities at unknown depths and locations throughout the ADA. Table 13 lists all 20 ADA Study Sites and briefly describes the contamination and results of the RI. Sites that were determined to need further investigation and remediation are described below.

Table 13. ADA Remedial Investigation Study Sites as Described in the ROD

Study Site Number	Site Name	Description
7	Aniline Pit	The Aniline Pit was a 40 ft x 40 ft fenced area within the ADA. During the period in which the pit was used, aniline was reportedly hauled to this unit and dumped. During the RI, four soil samples were collected and analyzed for aniline, nitrobenzene, and N, N-dimethlyaniline; one sample was analyzed for TAL inorganics, TCL VOAs and BNAs. No significant levels of inorganics were detected and no organics were detected. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
8	Acid Pit	The Acid Pit is a small limestone-lined, metal grating-covered pit that was used for the dumping of acid wastes. The Acid Pit was located within the ADA. It is reported that 300 to 400 20-gallon barrels of acid were disposed in the pit over the time span in which it was in use. During the RI, five soil samples were collected from one 10-foot boring and analyzed for cyanide; one sample was analyzed for VOAs. Two rounds of groundwater samples were also collected from two wells. Results demonstrate that cyanide was not detected in any of the soil samples, low concentrations of chloroform was detected in one sample, and four unknown VOA TICs and four unknown BNA TICs were detected at low combined concentrations. A previous investigation found copper, chromium, and lead concentrations below background levels established at the time, but when compared to the RI background levels, these compounds slightly exceeded comparison criteria. Groundwater data found low levels of VOA and BNA TICs, and possibly nitrate/nitrite in one sample. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
13	Smoke Canister Disposal Area	The Smoke Canister Disposal Area is a ridge of dirt approximately 150 ft long by 30 ft wide by 6 ft high, located in the ADA. The area contained burned debris from smoke canister burning operations. During the RI, 18 soil samples were collected from 3 test pits and analyzed for TAL inorganics, explosive constituents, nitrite/nitrite; and one sample from each pit was analyzed for TCL VOA and BNA. Two rounds of groundwater samples were collected from one well. Elevated levels of mainly metals were detected in all test pits, a few VOAs and BNA TICs and 2,6-DNT were detected at low levels. No COCs were detected in groundwater. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
14	Flare and Fuse Disposal	The Flare and Fuse Disposal area is located in the ADA and consists of a 30 ft by 50 ft by 6 ft high mound containing soil and burned reside, though no actual burning was reported to have taken place. During the RI, 12 soil samples were collected from two test pits and analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite; one sample from each pit was analyzed for TCL VOAs and BNAs. Results indicate isolated soil contamination by some metals and nitrates. Barium, chromium, potassium, silver, and zinc were detected exceeding background levels in the top 6 feet of soil. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

Study Site Number	Site Name	Description
15	TNT Burn Area	The TNT Burn Area is an open gravel area within the ADA approximately 4.4 acres in size. This area was used to dump and burn TNT-containing sludges and dunnage wastes. During the RI, 14 soil samples were collected from 2 test pits and analyzed for TAL inorganics, TCL VOA and BNAs, explosive constituents, and nitrate/nitrite. Two new monitoring wells were also installed and two rounds of groundwater samples were collected. Soil samples show elevated concentrations of metals and moderate levels of 2,4,6-TNT, HMX, and RDX. Cleanup activities are described below.
16	Open Detonation (OD) Pits	Located throughout the ADA, several areas of shallow pits were used for the detonation of various conventional munitions. These pits vary in diameter and depth. Pits were arranged in rows with about 8 to 12 pits spaced approximately 100 ft apart. A few pits contained miscellaneous dunnage metal, glass bottles, and acid carboy caps. During the RI, 45 soil samples were collected from 10 test pits and analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite. One soil sample from each pit was also analyzed for TAL VOA and BNAs. Three monitoring wells were installed and two rounds of groundwater samples were collected. Elevated levels of metals and some explosive constituents were detected in some of the test pit soil samples. Analytical results suggest that groundwater does not appear to be impacted by past operations. In the 1994 ROD it states that risks and hazards indices for this site are within or below the acceptable cancer risk range or non-cancer level for future light industrial users.
17	Above Ground OD Area	The Above Ground OD Area covers approximately 2.3 acres and was used for the detonation of decontaminated M55 rockets and M23 land mines. They were detonated in a horizontal steel tub that ran through the center of a 5 ft by 5 ft by 4 ft high gravel-filled metal bin. During the RI, four soil samples were collected from the area around the concrete pad that contained the gravel-filled bins and were analyzed for explosive constituents, nitrate/nitrite, and TAL metals. Eleven metals were detected above background levels in one or more of the samples, and low to moderate levels of three explosive constituents were detected in one or more samples. Cleanup activities are described below.
18	Dunnage Pits	The Dunnage Pits are located in the ADA (approximately 6.5 acres) and were two trenches, approximately 350 ft by 30 ft by 8 ft deep, used for the disposal and burning of dunnage and possibly liquid wastes. Base personnel interviewed during the RFA stated that waste solvents, oils, and paint strippers had been disposed of in the trenches. During the RI, 28 soil samples were collected from 6 test pits. Two monitoring wells were installed and two rounds of groundwater samples were collected. All samples were analyzed for TAL inorganics, TCL VOAs, BNAs, pesticides/PCBs, explosive constituents, and nitrate/nitrite. Results indicate that soil from two of the pits had low levels of aluminum, magnesium, manganese, nickel, potassium, silver, and zinc, but these were confined to surface soil. No explosive constituents, VOAs, BNAs, or pesticides/PCBs were detected. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

Study Site Number	Site Name	Description
19	Open Burning (OB) Trenches	This area was a series of open burning trenches located near the dunnage pits within the ADA (approximately 50 acres). There were approximately eight trenches that were laid out parallel to each other and were approximately 10ft wide by 100 ft long, with depths not exceeding 1 ft. During the RI, 44 soil samples were collected from 10 test pits and analyzed for TAL metals, explosive constituents, and nitrate/nitrite. One sample from each pit was analyzed for TCL VOAs and BNAs. Three monitoring wells were installed and two rounds of groundwater samples were collected. Results from soil samples indicate high levels of metals and explosive constituents, mainly in the shallow soil, and likely due to past incomplete burning operations of debris and waste. Cleanup activities are described below.
20	OB Areas	Several Open Burning Areas were noted during the RFA within the ADA. The areas were characterized by burnt soils with little to no vegetation and metal scraps on the ground. These areas are included as an SWMU, as the waste material burned could not be verified.
21	Missile Fuel Storage Area	This area consisted of three metal sheds used to store missile fuel components. Each shed was constructed of steel beams and metal siding and were open at the base with open eaves for ventilation. Sizes ranged from 325 to 1500 square ft. During the RI, nine soil samples were collected from four test pits in the floor and the entrance to existing and former shed and from a test pit in the graded area. All soil was analyzed for aniline, nitrobenzene, N,N-dimethylaniline, and nitrate/nitrite. One sample from the test pit near the west fence was analyzed for TAL inorganics TCL VOAs, BNAs, pesticides/PCBs, and explosive constituents. Results indicate no explosive constituents contamination, nitrate/nitrate slightly above background, and low levels of one VOA and BNA TIC and three unknown BNA TICs. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
28	Missile Fuel Burning Area	The Missile Fuel Burning Area is located in the ADA near the east-central portion of the grounds. During the 1990 Enhanced PA, UMCD employees reported that RFNA fuel was burned in a portable kiln in this area. One soil sample was collected from an unknown location at Site 28 and analyzed for nitrate, aniline, nitrobenzene, N,N-dimethylaniline; results display low concentrations of nitrate. Due to the fact that the RFNA was burned in a portable kiln, any contamination was limited to spills while filling the kiln and would be localized in the near surface soil below the gravel. The Enhanced PA recommended NFA.

Study Site Number	Site Name	Description
31	Pesticide Pits	A row of existing pits at this site may have been used to dispose of or burn pesticide solution and general debris, or to detonate munitions (approximately 36 acres). A torpedo burn area is located north of the pits, and the area south of the pits once contained numerous pits that are now graded over. During the RI, 35 soil samples from 8 test pits were collected from areas where existing or suspected pits were located, and 1 sludge sample from an existing pit was sampled. Three monitoring wells were installed and two rounds of groundwater samples were collected. All samples were analyzed for TAL inorganics, TCL VOAs, BNAs, pesticides/PCBs, explosive constituents, and nitrate/nitrite. Soil and sludge analytical results identified 12 metals that were detected above the comparison criteria, occurring primarily in the shallow soil, but with some isolated pockets of contamination at depth. Low concentrations of explosive constituents were detected at two test pits, and the sludge sample and five pesticides were detected in two test pits. Analytical results suggest that groundwater does not appear to be impacted by past operations. Cleanup activities are described below.
32	OB Trays	These two trays located on the ADA grounds were used to burn explosives propellant powder. The northern tray area also included an operation in which cartridges were flashed with diesel fuel. During the RI, eight surface soil samples from the edges of the gravel pad were collected and analyzed for TAL metals, TCL VOAs, explosive constituents, and nitrate/nitrite. Results indicated high levels of aluminum, antimony, barium, copper, lead, magnesium, potassium, silver, and zinc above background concentrations. In addition, low levels of 2,4-DNT and nitrate/nitrite were detected. Cleanup activities are described below.
38	Pit Field Area	This site consists of numerous pits that were most likely used to detonate or dispose of UMCD ordnance materials, but former employees had no recollection of the use of this area. 50 soil samples were collected from 10 test pits and were analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite. One soil sample from each pit was submitted for TCL VOAs and BNAs. In addition, four new monitoring wells were installed and two rounds of groundwater samples were collected. Results show that limited localized contamination from some metals and a few explosive constituents are present, and are limited to the shallow soil, though isolated contamination exists at depths of 10 feet. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
41	GB/VX Decontamination Solution Burial Areas	Former employees indicated that decontamination solutions from a leaking GB bomb brought on-site in the early 1960s may have been disposed of in one of these two areas. During the RI, ten soil samples were collected from two test pits in the suspected burial areas. In addition, one monitoring well was installed and two rounds of groundwater samples were collected from this and two additional wells. All samples were analyzed for IMPA, EMPA, TAL organics, TCL VOAs and BNAs, explosive constituents, and nitrate/nitrite. All samples were also screened for GB and VX. Slightly elevated concentrations of antimony to depths of 10 feet were detected in one test pit and slightly elevated levels of several metals were detected from the second pit. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site Number	Site Name	Description
54	Possible Disposal Pit Location	A small pit may have once been briefly used to dispose of unknown items. During the aerial photographic analysis done for the Enhanced PA, an area resembling a dark pit can be discerned, though the photo examined was of very poor quality. In the subsequent 1956 aerial photo, the area is no longer discernible. Based on the limited time this was seen in the historical photographic analysis and the complete lack of nearby landmarks or surface expressions to identify the pit's precise location, the Enhanced PA recommended no further investigation was necessary. No sampling occurred at this site during the RI because it could not be located.
55	Trench/Burn Field	From 1950 to 1965, this site contained several rows of trenches where it is assumed that ammunition demolition or disposal activities may have been conducted. During the RI, 12 soil samples were collected from three test pits and analyzed for TCL VOAs and BNAs. Two rounds of groundwater samples were also collected from one existing well. Groundwater was also analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite. Analytical results indicate low levels of silver, arsenic, and magnesium slightly exceeding the background comparison criteria, and low levels of two explosive constituents were detected at one pit. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
56	Munitions Crate Burn Area	This area was reportedly used to burn empty wooden crates from munitions, and it is assumed that ammunition demolition or disposal activities may have been conducted at this site. During the RI, six soil samples were collected from three backhoe excavations and analyzed for TAL inorganics, TCL VOAs and BNAs, explosive constituents, and nitrate/nitrite. Results indicate limited contamination from metals in two of the three pits. Aluminum, magnesium, potassium, beryllium, and calcium were detected at levels slightly exceeding background. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
57	Former Pit Area Locations	This site consists of three areas of the ADA grounds where the soil is disturbed and in the form of trenches or pits. It is assumed that ammunition demolition or disposal activities may have been conducted at this site. During the RI, 80 soil samples were collected from 17 test pits constructed in three old pit fields and were analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite. One sample per test pit was also submitted for TCL VOAs and BNAs. Five monitoring wells were installed and two rounds of groundwater samples were collected from these and three additional wells. Groundwater was also analyzed for the above compounds. Location I samples displayed low to moderate levels of mercury, potassium, zinc, calcium, magnesium, copper, and silver near the surface at one or several of the test pits. Location II samples displayed slightly elevated concentrations of mercury and nickel and low levels of explosive constituents. Location III samples displayed slightly elevated concentrations of copper, silver, zinc, mercury, and potassium above background concentrations and was limited to the surface. Analytical results suggest that groundwater does not appear to be impacted by past operations. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.

Study Site Number	Site Name	Description
58	Borrow/ Burn/ Disposal Area	Located in the ADA, historical photographs indicate that this site may have been a borrow site and/or a burning site at one time. It is assumed that ammunition demolition or disposal activities may have been conducted at this site. During the RI, four soil samples from two backhoe excavations were collected and analyzed for TAL inorganics, TCL VOAs and BNAs, explosive constituents, and nitrate/nitrite. No metals were detected at levels above background conditions in any of the samples. No nitrate/nitrite, explosive constituents, VOAs or BNAs was detected. One unknown BNA TIC was detected at low levels. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
59	GB/VX Decontamination Solution Disposal Areas	This site consists of two areas of the ADA grounds where former employees indicated that GB/VX decontamination solutions were disposed of on the ground in the early 1960s on at least two occasions. During the RI, ten surface and subsurface soil samples were collected from two test pits and two new monitoring wells were installed. Two rounds of groundwater samples were collected from the wells. All samples were analyzed for IMPA and EMPA, and the soil samples were also screened for GB and VX. Analytical results show no detectable concentrations of IMPA or EMPA in any samples. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, noncarcinogenic hazard level, and action level for lead at this site.
60	Active Firing Range	Located on the ADA grounds, this site includes an active rifle and machine gun range and an active pistol range used by the National Guard since the early 1980s. Bullets that miss the targets land in open areas. During the RI, three shallow soil samples were collected and analyzed for TAL metals, explosive constituents, and nitrate/nitrite. Metals were detected in the sample, but at levels below the comparison criteria. The 1994 ROD states that potential risks associated with exposure to soil contamination by future residents are within or below the acceptable carcinogenic risk range, non-carcinogenic hazard level, and action level for lead at this site.

NOTE - Several of the locations in the table are not found on Fig 4 Appendix G

Based on the results of the RI, five locations were identified where soil levels exceeded the risk-based levels (based on an anticipated future industrial land use scenario), where metals and explosives residues were found. These five locations are Study Sites 15, 17, 19, 31, and 32. The remaining 15 sites had soil carcinogenic and noncarcinogenic risk levels below a level of concern. No significant COCs were identified in ADA groundwater.

The selected remedy for the ADA OU in the June 1994 ROD had components for soil contamination and MEC clearance. The remedy to clean up soil contamination associated with the ADA was excavation, on-site S/S treatment, and on-site disposal of the treated soils in the UMCD Landfill. Soil remediation criteria for the specific metals and explosives constituent established in the ROD are listed in Table 14.

Table 14. Contaminant of Concern Cleanup Level (mg/kg)

Contaminant	ROD Cleanup Level	ESD Cleanup Level Goal (Site 19)
Antimony	820	--
Arsenic	15	--
Barium	860	3,300(a)
Beryllium	8.1	--
Cadmium	28	213(b)
Chromium	40	--
Cobalt	25	--
Lead	500	--
Thallium	160	--
RDX	52	19(b)
1,3,5-TNB	2.3	25(a)
TNT	23	49(b)
2,4-DNT	1.9	2.7(b)

Notes: (a) Ecological cleanup goal from the Ecological Risk Assessment.
(b) Human Health cleanup goal from the ESD.

Cleanup steps designated in the ROD included excavation of approximately 14,000 cubic yards of soil at ADA Sites 15, 17, 19, 31, and 32, with MEC removed from these sites during excavation as necessary to permit safe excavation and access. The ROD specified that the safety and environmental risks due to the presence of MEC be quantified and reduced in two phases, a Phase I surface clearance and a Phase II subsurface clearance. Phase I consisted of a metallic object survey over the entire ADA to better estimate the quantity of metallic debris to be removed to clear the ADA of MEC. Concurrently with the survey, a "visual sweep" over the entire surface of the ADA was done to locate and remove objects identifiable as MEC. This surface clearance was initiated in November 1996 and was completed in February 1997.

Phase II MEC clearance activities were dependent upon the future use selected for the ADA. As part of the BRAC process, future use for the ADA was decided by the Army, the State of Oregon, and the local community in July 2010. The ADA site falls within the boundaries of the Military Training zone, but it has been noted that it has the potential for industrial use. Therefore BRAC, USACE, EPA, and ODEQ have agreed that additional Phase II MEC clearance activities will be conducted to the depth of four (4) feet below ground surface and to full depth of all trenches (not expected to exceed 20 feet bgs). In accordance with the ROD, Phase II MEC clearance activities were initiated within 15 months after the final land use and disposal decision was made for the ADA by the Umatilla Army Depot ReUse Authority (UMADRA); the contract for Remedial Design/ Remedial Action regarding MEC removal was awarded in September 2012. Upon completion of the Phase II MEC clearance actions, appropriate institutional controls will be applied to the ADA to permanently limit the use of, and access to, the ADA. These institutional controls will be consistent with the final use selected for the area and the degree to which MEC was successfully cleared. Possible controls could include deed restrictions and/or maintenance of existing fencing and security.

In August 1995, the remedial design for soils was completed for the ADA, the Miscellaneous Sites OU, and the Deactivation Furnace OUs. The original remedial construction activities were conducted between June 1996 and August 1997. Treatment of contaminated soil was done from November 1995 to August 1997, utilizing a mobile on-site S/S system. The remedial action contractor was required to develop a mix design that would concurrently stabilize both metals and explosive constituents to a TCLP level such that the treated soil would not be characterized as an

RCRA hazardous waste and could be safely disposed of in the UMCD Landfill. Any soil meeting the TCLP goals would not require treatment and would go directly to the landfill. Sampling and analysis demonstrated that each batch of material sent to the landfill met the leachate performance goals. The treated soil TCLP leachate criteria for the COCs in the ADA OU are shown in Table 15.

Table 15. Contaminant of Concern Toxicity Characteristic Leaching Procedure (TCLP) Leachate Level

Contaminant	TCLP concentration (mg/L)
Antimony	1.0
Arsenic	5
Barium	100
Beryllium*	0.1
Cadmium	1
Chromium	5
Copper*	140
Lead	5
Nickel*	10
Silver	5
Zinc*	1100
1,3,5-TNB*	0.18
2,4-DNT*	0.13
RDX*	0.2
TNT*	0.2
HMX*	40

Note: *Not subject to TCLP leachate standards under 40 CRF 261.24.

From November 1996 to April 1997, an Engineering Sampling Analysis was conducted for the ADA area (Earth Technology Corporation 1998). The objective was to evaluate potential ordnance and explosives risk and to present alternatives to reduce potential risk to MEC to the property owners following base closure. The entire ADA grounds, except for 40 acres in the northwest corner, were geophysically mapped, and approximately 282 MEC items were recovered, predominantly from the demolition pits and burn trays. Based on the results, a risk evaluation was prepared using management alternatives for NFA, IC, and implementation of clearance actions commensurate with the anticipated land use specified in the ROD.

On June 27, 2002, an ESD was published for Site 19 in the ADA. The ESD addressed the additional soils for remediation; the costs associated with the additional soils; updated cleanup levels based on revised exposure assumptions (elimination of troop training due to post-closure under BRAC); and off-site treatment and disposal due to closure of on-post landfill. The remedial action for the additional soils remediation was completed in January 2003.

Existing wells in the ADA have been frequently sampled by ODEQ as a part of the ongoing monitoring for the Lower Umatilla Basin (LUB) Groundwater Management Area (GWMA). In 2001 and 2003 several wells in the ADA displayed low-level concentrations for perchlorate. The report that followed in May 2006 found that low-level perchlorate contamination was widespread throughout the LUB. The concentrations averaged 2.57 ug/L in the basin and 3.86 ug/L at the ADA wells sampled in 2003. Sources of the perchlorate in the LUB remain unknown, but the 2006 report listed naturally occurring caliche geologic deposit as a potential natural source. It listed potential manmade sources such as: historic use in the basin of Chilean caliche as a nitrate fertilizer, incomplete combustion of ordnance in UMCD's ADA, activities at the Boardman Bombing Range, Boeing's Jet Engine Test Facility located in the basin, and the use of sodium hypochlorite as an industrial sanitizing solution and a bio-fouling inhibitor in drip irrigation systems. The report concluded that, based on the current data, there does not appear to be a single source for the widespread occurrence of low-level concentrations of perchlorate in the groundwater in the LUB *(*ODEQ 2006b*).*

4.2.5.8 Study Site 39: Quality Assurance Function Range Operable Unit

After the first five-year review *(*UMCD Archive Document 1999*),* concerns were raised by UMCD about one of the 32 Miscellaneous Sites where ordnance had been used. Site 39, the former Quality Assurance Function Range, is a 640-acre rectangular parcel of land located outside the northerly boundary of the UMCD. The site was acquired by the Army for use as a QA function range for various types of conventional weapons, munitions, and related materials.

Mitigation of the MEC was completed by November 2009. On 30 November 2010 USACE Seattle, on behalf of USACE Huntsville, submitted an explosive safety submission for no further action and No DoD Action Indicated (NDAI) at this operable unit to the Department of Defense Explosive Safety Board (DDESB). On 16 March 2011, as stated in a memorandum received from the DDESB, the NDAI was accepted and concluded remedial actions at Study Site 39 (Bowling 2011).

The history of Study Site 39 begins as a part of the Miscellaneous Sites OU and was later designated as a distinct OU. The 1990 RI initially identified Miscellaneous OU Study Site 39 as a potential munitions area of concern, and in 1996 a surface clearance of MEC was performed on 345 acres of the site. In 1999, an Engineering Evaluation/Cost Analysis (EE/CA) was conducted to characterize the presence, nature, and distribution of MEC below ground surface. A Digital Geophysical Mapping database of metallic anomalies existing bgs was produced. Approximately 25 percent of these anomalies were investigated further via excavation. The results of the investigation verified the potential for MEC to exist below the ground surface.

Based on these investigations, the BRAC cleanup team determined that MEC potentially existed on approximately 176 acres of the 640-acre site. In May 2005, a ROD for Study Site 39 was issued. The issuance of a ROD for Study Site 39 caused the site to become an OU separate from the Miscellaneous Sites OU (Defense Environmental Restoration Board 2005). The selected remedy for the impacted area of Site 39 was a clearance of MEC to a depth of two feet in the Rifle Range Area (107 acres) and in the Test Pad Area (68 acres), and to a depth of six feet in the Test Pit Area (1 acre). It included sifting the soil to a depth of two feet in the vicinity of three former QA function test pads, where a high density of geophysical anomalies was found. The selected remedy for the remaining 464 acres of the site was No Further Action, as there was no documented historical use or physical evidence of QA function munitions testing for this area.

The remedy included a series of Land Use Controls (LUC) to be implemented during clearance, post-clearance, and post-transfer of property. The LUCs implemented subsequent to transfer of the entire 640 acres are deed notifications, with separate deed notifications for the remediated 176 acres. Notifications for the 464 acres indicate the area is not suspected of containing MEC, but is adjacent to an area used for munitions testing. For the 176 acres, notifications explain the history of the former QA Function Range, the results of previous investigations and clearance activities, and agencies to be contacted in the event that MEC is found.

Study Site 39 remedial action (RA) work was conducted from October 2008 through November 2009. The major components of the remedy for the identified 176 acres included:

- The reacquisition of anomalies identified during the EE/CA in the Test Pad, Rifle Range, and Test Pit areas.
- Excavation and clearance of geophysical anomalies to a depth of 2 feet in the Test Pad and Rifle Range areas and to a depth of 6 feet in the Test Pit.
- Removal and screening of soil in the vicinity of three former QA function test pads.
- Backfilling and restoration of excavated areas with native grass.
- Collection and recycling of metallic (cultural) debris found during excavations and soil screening; disposition of Material Documented as Safe (MDAS).
- The disposal by detonation of Material Documented as Explosive Hazard (MDEH) found during the clearance of the anomalies.

During the remediation, three items were determined to be MDEH. They were: (1) fragments containing TNT from M2 anti-personnel mines; (2) a ground signal flare, M52A1; and (3) ground signal smoke, M129A1, candle, and fin assembly. These items were detonated on 19 November 2009. In total, 860 pounds of cultural debris and 388 pounds of munitions debris were certified as MDAS.

Based on the findings during the RA, it was concluded that there is a low potential for encountering MEC at Study Site 39 and that no further removal action is necessary. Study Site 39 will be subject to the CERCLA five-year review process for UMCD, as needed, to ensure the final remedial actions remain protective of public health, safety, and the welfare of the environment.

4.2.5.9 Miscellaneous Sites Operable Unit

The ROD-designated Miscellaneous Sites OU consists of 32 sites that were identified as actual or possible locations of Army activities; Table 16 lists the Study Site numbers, names, and general descriptions. The Miscellaneous Sites served a wide variety of specific functions, including sewage treatment and storm water discharge, munitions disassembly, Defense Reutilization Marketing Area (recycle materials stockpile), storage of raw materials, metal ingot storage, pesticide storage, paint spray and removal areas, paint sludge discharge areas, boiler/laundry wastewater discharge areas, disposal pits, and hazardous waste storage. The types of contaminants include organic compounds, metal salts, and pesticides (through application or disposal). No groundwater contamination was found, but soil contamination was identified at some sites and was remediated by solidification/stabilization and disposed in the UMCD active landfill from November 1995 to September 1997. For more information, see the discussion following Table 16. The Miscellaneous Sites OU was closed out as the ROD recommended No Further Action for all sites (Army 1994).

Table 16. Miscellaneous Sites OU Names and Descriptions as Described in the ROD

Study Site Number	Site Name	Description
3	Hazardous Waste Storage Facility (Building 203)	A portion of Building 203 housed hazardous wastes that were stored in 55-gallon drums, such as baghouse dust, battery acid, and oil. 24 PCB transformers were temporarily stored here. Drums of Agent Orange were reportedly stored here and had leaked onto the concrete floor and were flushed out with water onto the soil. No record for such a spill exists. 4 shallow soil samples were collected during the RI and analyzed for 2-4-D, 2,4,5-T and 2,3,7,8-TCDD. Analytical results did not detect any of the aforementioned analytes, thus NFA necessary.
6	Sewage Treatment Plant	Plant used to treat domestic wastewater generated in the Administration Area. UMCD employees reported that the Sewage Treatment Plant Tile Field was sprayed with herbicides to control the growth of weeds. In a previous investigation by Battelle in 1981, one composite borehole sample from a 5 to 7.5-ft depth contained 300 ug/L DDT. During the 1992 RI, 18 subsurface soil samples were collected from five 10-foot borings and analyzed for TAL inorganics, Target Compound List (TCL) VOAs, TCL BNAs, TCL pesticides/PCBs, and explosive constituents. Three samples were analyzed for nitrate/nitrite. Results of the chemical analyses indicate elevated levels of silver and low levels of organic constituents at the near surface of the tile field. Concentrations exceeding the comparison criteria for metals, nitrate/nitrite, and low levels of DDT were reported for the samples from the sludge drying bed. See Table 9-2 in the RI for analytical results. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
9	Remote Munitions Disassembly	Located just east of the ADA, this area was used primarily to disassemble conventional munitions (including very large bombs) and may have also been used to drain and disassemble VX or GB agent-containing bombs. Reportedly, a leaking agent-containing bomb was drained in the 1960s. Six shallow soil samples were collected and analyzed for IMPA and EMPA, breakdown products of GB and VX, TAL metals, explosive constituents, and nitrate/nitrite. Results indicate low levels of several metals (antimony, cadmium, chromium, silver, and zinc) and low concentrations of two explosive constituents. IMPA and EMPA were not detected in the samples collected. See Table 7-1 in the 1992 RI for analytical results. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.

Study Site Number	Site Name	Description
10	Former Blister Agent HD Storage Area	North of K Block, Site 10, is a strip of ground formerly used to store 1-ton containers of blister agent HD. Some containers stored here reportedly leaked HD agent on to the gravel and surface soil. Historic aerial photographs show six storage locations, and a triangular shaped pit about 300 feet south of the storage area (1992 RI of Dames and Moore). Spill cleanup residues were reportedly buried at this location. During the 1992 RI, one near-surface soil composite sample from each of the six storage areas, and five samples from a test pit to 10 feet were collected. Samples were analyzed for thiodiglycol, HD, GB, and VX. Test pit samples were also analyzed for IMPA, EMPA TCL VOAs, explosive constituents, and TCL, BNA. Low levels of antimony were detected from one composite soil samples and one test pit sample. One trace VOA was detected from one test pit sample. No thiodiglycol, IMPA, EMPA, HD, GB, VX, TCL BNA, or explosive constituents were detected in any of the soil samples. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
22	Former DRMO Area	The site is used to store scrap and salvage materials for reuse or sale. Contamination was detected from this site and remediated per the 1994 Misc. Sites ROD (refer to discussion below).
25 (I)	Metal Ore Piles Location I	Location I consisted of two former metallurgical-grade chromium ore piles located to the southeast of Building 200 in the Deactivation Furnace area. Piles were in direct contact with soil. During the 1992 RI, six shallow soil samples were collected around the base and in the center of the piles. The soil was analyzed for TAL metals. Results indicated a number of TAL metals, though only one was at concentrations slightly above the comparison criteria. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
25 (II)	Metal Ore Piles Location II	Location II consisted of three former metallurgical-grade chromium ore piles located south of K Block in the north-central portion of UMCD. The piles were in direct contact with soil and were located around the railroad tracks on the K and J-Block boundary. During the 1992 RI, nine shallow soil samples were collected at the base and the centers of the former piles. The samples were analyzed for TAL metals. Results indicate low levels of nickel at two of the former ore piles south of the tracks. Thallium was detected at levels slightly exceeding background in a pile north of the tracks. 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.

Study Site Number	Site Name	Description
26	Metal Ingot Stockpiles	This site is located east of Building 200 in the Deactivation Furnace area. The piles consisted of 6-foot-high stacks of aluminum, lead, and zinc ingots in direct contact with the soil. During the 1992 RI, six shallow soil samples were collected, two samples at each of the three types of stockpile; two samples were hand augered and collected from a depth of 0-18 in. Samples were analyzed for total aluminum, zinc, and lead. Results indicate that one sample had an elevated level of lead and four samples had levels of zinc exceeding background concentrations. No levels of aluminum in excess of background levels were detected in any of the samples. Samples were then analyzed for TCLP lead and results demonstrated that lead is not sufficiently leachable. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk rage, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
27	Pesticides Storage Building	This is a small building in the central portion of the Administration Area used to store pesticides, paint, and solvent wastes. An AST once existed outside that collected water from an inside sink drain. During the 1992 RI two shallow soil samples were collected by hand auger, adjacent to the AST, to determine if spills or leaks ever occurred near the tank drain. Samples were analyzed for TCL BNAs, VOAs and pesticides, and TAL metals. Results indicate concentrations of zinc two times the comparison criterion. Low concentrations of three BNAs (fluoranthene, phenanthrene, and pyrene, common PAHs) were detected from one sample and pesticide DDT was detected in both samples. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
29	Septic Tanks	Sixteen active (including two at the sewage treatment plant) and seven inactive septic tanks are/were located throughout UMCD that may have received contaminated waste water specific to the buildings they served. See discussion below for further information.
30	Storm Water Discharge Area	Storm water from the Administration Area discharges to a small ditch at this site. Two shallow soil samples, near the pipe discharge point and within the small ravine, were collected and analyzed for oil and grease, TAL metals, TCL VOAs, BNAs, pesticides/PCBs, explosive constituents, and nitrate/nitrite. Results near the discharge point displayed elevated levels of several metals, and low concentrations of several VOAs, BNA Tentatively Identified Compounds (TICs), pesticides and oil and grease. No VOAs or BNAs were detected. Results from the ravine sample display elevated concentration of zinc and silver. No explosive constituents, VOAs, BNAs, or PCBs were detected. Low concentrations of pesticides DDD, DDE, and DDT were reported, as well as an elevated level of oil and grease. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range, noncarcinogenic hazard levels, and action levels for lead at this site, and recommended NFA.
33	Gravel Pit Disposal Area	This gravel pit may have been used to dispose of decontamination solutions for chemical agents. Refer to Section 4.2.5.9 for further information.

Study Site Number	Site Name	Description
34	Paint Spray and Shot Blast Areas	Portable shot blast machine and open-air spray paint operations were conducted in Areas 2000 and 2001. Eight shallow soil samples from the two areas were composited, and one sample from the suspected shot blast residue from area 2001 was collected. Samples were analyzed for VOAs, BNAs, metals, explosive constituents, oil and grease, and nitrate/nitrate. Chromium, zinc, TCL BNAs, BNA TICs, and 13 unknown TICs, oil, grease, and total petroleum hydrocarbons were also detected.
35	Malathion Storage Leak Area	A shipment of leaking insecticide containers was received in the late 1970s. Nine surface and subsurface soil samples were collected and analyzed for TCL pesticides and malathion. Subsurface samples were collected at intervals 0-2, 2-4, and 4-6 feet bgs from three borings around Building 108. Samples from the boring located ~75 ft NE of the building detected low levels of pesticides DDE and DDT at the surface and DDT at the 4-ft sample. Samples from the boring located ~75ft N of Building 108 contained DDE and DDT at the surface and 2-ft samples, and chlordane at the 4-ft samples. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
36	Building 493 Paint Sludge	Paint sludge, solvents, and possibly other wastes discharged into the coulee near Building 493. Located to the north of the Explosives Washout Plant (Building 489), former employees reportedly used this building for spray paint operations. Five samples were collected during the RI and sampled for explosive constituents, TAL metals, TCL VOAs and BNAs, and nitrate/nitrite. Results indicate low to high levels of metals in three of the sample locations. Metals in excess of the comparison criteria included chromium copper, silver, zinc, and cadmium. See discussion below for the remedy chosen under the 1994 ROD.
37	Building 131 Sludge Discharge Area	According to a former employee, a depression to the west of the building was used to collect paint sludge and solvents. A wooden conduit and metal pipe may have transferred paint sludge and waste material from Building 131. Four shallow soil samples were collected from the discharge area and metals and wooden conduits and analyzed for TCL VOAs and BNAs, and TAL metals. Concentrations of cadmium, zinc, barium, chromium, and mercury were elevated above the comparison criteria. A low level of TCL BNA and BNA TICs was also detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
44 (I)	Road Oil Application Site Location I	This is an area of approximately 100 square feet of hardened road oil material in the southwestern portion of UMCD. A tar-like blackish sand composed the first 1.5 feet of surface soil, and was noted during the RI to have a petroleum odor. One surface sample was collected from the material and analyzed for oil and grease, TCL VOAs, BNAs, and PCBs. Results indicate low levels of several VOAs, BNA TICs, and highly elevated levels of oil and grease. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.

Study Site Number	Site Name	Description
44 (II)	Road Oil Application Site Location II	This is a large area of hardened road oil material in the southwestern portion of the Administration Area. Four shallow soil samples from the general area, two composite samples of eight locations in the drum storage/oil change area, and one composite of three locations at the road oil transfer area were collected and analyzed for oil and grease, TCL VOAs, BNAs, and PCBs. Results show moderate to high levels of oil and grease contamination in much of the shallow soil at Site 44 Location II. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
45	Building 612 & 617 Boilers	These are two boiler houses located in the northwestern portion of UMCD, with boiler blow-down discharged to soils. Two shallow soil samples were collected at each of the boiler discharge areas and analyzed for TAL metals and TCLP. Iron, copper, nickel, and zinc were detected above comparison criteria. A TCLP analysis of silver was conducted and determined no leachable silver was detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
46	Railcar Unloading Area	This area near the railroad tracks in the southwest portion of UMCD was used for coal or ore storage from at least 1949 to the early 1960s. Former employees also report that the area was used for unloading brass bullets. Three shallow soil samples were collected off the edge of the three sides of the concrete pad where the coal and ore was reportedly stored and analyzed for TAL metals, TCL BNAs, and TCLP analysis. Copper, silver, and zinc were detected in each sample. TCLP analyses for lead and silver were performed on two samples. TCLP results indicate no leachable silver. Leachable lead was present in both samples, but at levels well below the comparison criteria. Nine BNAs and ten BNA TICs were detected. Most of the BNAs were PAHs or alkanes. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.

Study Site Number	Site Name	Description
47	Boiler/Laundry Effluent	Boiler blow-down and laundry wastewater were discharged to a rock-lined trough. Laundering of clothes contaminated with explosive constituents took place at Building 486, and effluent from the laundry was discharged into this trough. Seven near-surface and 15 soil samples from two deep borings were collected, and four monitoring wells were installed. Two rounds of groundwater samples were collected from the four monitoring wells. All samples were analyzed for TAL inorganics TCL VOAs BNA, pesticides/PCBs, explosive constituents, and nitrate/nitrite. Deep soil boring samples were collected at 2, 4, 6, 100, and 115 feet and 2, 6, 20, 40, 50, 70, 100, 110 feet. Results from the both borings detected low levels of mercury in samples collected at the surface and 2 feet bgs. Results from surface samples found high concentrations of antimony, cadmium, copper, lead, magnesium, nickel, and zinc. Nitrate/nitrite moderately above background, one known and six unknown BNA TICs, and five pesticides/PCBs (DDD, DDE, DDT, and PCB 1260) were detected. Groundwater samples detected antimony, vanadium, one explosive constituent from one well, and two unknown VOA TICs. It was not known whether the constituents are related to Site 47 or the nearby Site 4. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
48	Pipe Discharge Area	An 8-inch diameter pipe from the sewage treatment plant Imhoff tank discharges into a long ravine. Discharge has not been used since the 1970s. Three shallow soil samples were collected at the pipe discharge, in the center of the ravine and ~150 feet from the discharge and analyzed for TAL inorganics, TCL BNAs, VOAs, pesticides/PCBs, and explosive constituents nitrate/nitrite. Results indicate that cadmium, copper, mercury, silver, zinc above the comparison criteria and nitrate/nitrite, three pesticides (DDD, DDE, and DDT), five unknown BNA TICs were detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
49	Drill and Transfer Area	This is a 3-acre site north of the K Block where chemical munitions were drilled, emptied, and decontaminated. Four shallow soil samples were collected in the "hot zones" where the munitions were emptied on exposed soil, and analyzed for IMPA, EMPA, HD, GB, and VX. Results demonstrate no detectable concentrations of any of the explosive constituents or breakdown products. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
50	Railroad Landfill Areas	These two railroad landfills are located in the south-central portion of UMCD, one located north of the railroad tracks and one south of the railroad classification yard. Please refer to Section 4.2.5.9 for further information on Site 50. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.

Study Site Number	Site Name	Description
52	Coyote Coulee Discharge Gullies	Three discharge flumes are located along the Coyote Coulee near the Explosives Washout Plant (Building 489). Gullies may have been the original effluent discharge channels for the washout plant in the 1940s. Eight shallow soil samples were collected at the head of the gully and one at down-gradient and analyzed for TCL VOAs and BNAs, TAL inorganics, explosive constituents, and nitrate/nitrite. Results indicate several metals and low levels of two explosive constituents were detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
53	Building 433 Collection Sump/Cistern and Disposal	Building 433 was used to collect boiler blow-down fluids. One shallow soil and one surface water sample was collected at the disposal area and analyzed for oil and grease, TCL PCBs, VOAs, BNAs and TAL inorganics. Results indicate nickel and potassium slightly exceeding the comparison criteria, and low levels of several BNAs and BNA TICs and elevated level of oil and grease were detected in the soil. 14 TAL metals were detected in the sump surface water sample. 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
67	Building 493 Brass Cleaning Operations Area	Site 67 is south of Building 493, where brass shells were cleaned with cyanide-containing solutions. One monitoring well was installed and two rounds of samples were collected and analyzed for TAL inorganics, explosive constituents, and nitrate/nitrite. Eight soil samples were collected from a soil boring and were analyzed for TAL organics. Results from soil samples indicate silver at 8 feet bgs, and calcium at 19 feet bgs, above comparison criteria. The calcium may reflect changes in soil lithology. In the groundwater samples, only vanadium was detected above the comparison criteria. Vanadium is naturally occurring in the groundwater at UMCD. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
80	Disposal Pit and Graded Area	This is a former disposal area located between Eleventh Street and the boundary of the Ammunition Demolition Area. Employees interviewed during the RI did not recall any operations of disposal activities at the site. Four soil samples were collected from a test pit at 2.5, 5, 7.5, and 10 feet bgs and analyzed for TAL inorganics, TCL VOAs and BNAs, explosive constituents, nitrate/nitrite, analine, nitrobenzene, and N,N-dimethylaniline. A very low level of one VOA (chloroform) was detected, and very low levels of one VOA TIC and one unknown and one known BNA TIC were detected. No constituents detected were of potential concern. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.

Study Site Number	Site Name	Description
81 (I)	Former Raw Materials Storage Location I	These are areas in the southwestern warehouse area of UMCD where materials, such as coal and ore, were stored in direct contact with soils. Four shallow soil samples were collected from each of the former storage sites and analyzed for TAL metals. No metals above the comparison criteria were detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and noncarcinogenic hazard levels and action levels and recommended NFA.
81 (II)	Former Raw Materials Storage Location II	These are areas in the southeastern corner of Igloo Block H where raw materials were stored in direct contact with soils. Two shallow soil samples were collected and analyzed for TAL metals. No metals above the comparison criteria were detected. The 1994 Misc. Sites ROD states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk and non-carcinogenic hazard levels and action levels and recommended NFA.
82	Former Gravel Pit/Disposal Location	This is a former gravel pit that appears to contain asbestos-containing transite siding wastes. Refer to Section 4.2.5.9 for further information on Site 82.

For generalized locations refer to Figures 4 & 5 Appendix G

Most of the Miscellaneous OU Study Sites are clustered in the southwestern or southern portions of the UMCD. The southwestern cluster of sites centers on warehousing, railroad unloading, and stockpiling activities. The southern sites include the administrative areas as well as support activities such as sewage treatment and storm water discharge. The remaining Miscellaneous Study Sites are spread throughout UMCD and relate to a variety of support facilities for mission activities.

An extensive sampling program was conducted as part of the Remedial Investigation to assess soil contamination at each of the 32 sites, as well as potential groundwater contamination beneath these sites (1992). Groundwater was not found to be affected by past activities at the Miscellaneous Sites and required no cleanup under this OU.

Miscellaneous Sites OU Septic Tanks

At Site 29, Septic Tanks, 51 soil samples were collected from test pits in the tile drain fields of the septic tanks at buildings 417, 419, 420, 486, 622, and 655. No investigations were conducted at the other 16 septic tanks because no evidence existed that suggested they received any potential contamination. Samples were analyzed for TAL inorganics, explosive constituents at Bldg. 417; TAL metals, VOAs, BNAs, explosive constituents and nitrate/nitrite at Bldg. 419; nitrate/nitrite, sulfate, lead and pH at Bldg 420; TAL metals, explosive constituents, nitrate/nitrite at Bldg. 486; TAL inorganics, BNAs, explosive constituents, IMPA, EMPA and nitrate/nitrite at Bldg. 622; VOAs, BNAs, explosive constituents, thiodiglycol, IMPA, EMPA, nitrate/nitrite, and sulfide at Bldg 655 tank 1; and TCL VOAS, BNAs, TAL inorganics, explosive constituents, thiodiglycol, IMPA, EMPA, nitrate/nitrite and sulfide at Bldg 655 tank 2. Septic liquids and sludge were also analyzed. Test pit samples were collected from depths of 2.5, 5, 7.5 and 10 feet. Two borings were drilled at Bldg 419.

Results for the soil sampled at the septic tanks are as follows:

Bldg 417: Results for the samples collected at Building 417 indicate silver was detected at a level above background from the 2.5-foot sample from one test pit, but no explosive constituents or elevated levels of nitrate/nitrite were detected.

Bldg 419: Soil analytical results indicate chromium, nickel, and zinc were detected at levels exceeding the comparison criteria at a depth of 2.5 feet at one boring. No explosive constituents, VOAs, or BNAs were detected. Silver was detected in both test pits at a 5-foot depth, and in one pit at the 7.5-foot depth. No other metals or nitrate/nitrites were detected at levels above the comparison criteria. No explosive constituents, VOAs, or BNAs were detected.

Bldg 420: Results from the soil samples collected from the two test pits indicate that the surrounding soil in the tile field from the tank at Bldg 420 did not contain elevated levels of lead or nitrate/nitrite.

Bldg 486: Results from Bldg 486 indicate that one sample had slightly elevated levels above the comparison criteria for cadmium at the 7.5-foot depth. No other metals or nitrate/nitrites exceeded comparison criteria, and explosive constituents were not detected.

Bldg 622: Eight soil samples from two test pits at Bldg 622 were collected. One concentration of silver slightly exceeded comparison criteria. Low levels of BNA, one known TIC (2-butoxyethanol), and two unknown TICs were detected in the two test pits from 2.5-foot, 7.5-foot, and the 10-foot depth, respectively.

Bldg 655 Tank 1: Results from Bldg 655 tank 1 showed elevated concentration of silver at the 5-foot sample, one low-level VOA was detected in the 2.5-foot sample, and several unknown BNA TIC. No explosive constituents, BNAs, GB, VX, HD or degradation products IMPA, EMPA, or thiodiglycol were detected in these samples.

Bldg 655 Tank 2: Four soil samples from one test pit were collected at Bldg 655 tank 2. One sample detected elevated levels of manganese and sulfide above the comparison criteria. No VOAs, explosive constituents, or BNAs were detected. No HD, GB, thiodiglycol, IMPA, or EMPA was detected in on-site screening of soil.

The 1994 ROD, Miscellaneous Sites OU, states that the potential risks associated with exposure to soil contamination by future residents are within or below acceptable carcinogenic risk range and noncarcinogenic hazard levels for the contamination found at the septic tank tile fields and recommended No Further Action (NFA).

Based on the results of the soil analysis at the remainder of the sites investigated during the RI, two sites, Site 22 (the former DRMO area) and Site 36 (Building 493 Paint Sludge Discharge Area), had soil contamination sufficiently elevated to require remediation. The other 30 remaining sites had acceptable levels of carcinogenic and noncarcinogenic risk for a future residential land use scenario and did not require remediation. The COCs at Site 22 and Site 36 were lead, cadmium, and chromium. The remedy selected to clean up soil contamination associated with Sites 22 and 36 was S/S treatment and on-site disposal of the treated soil in the UMCD Landfill. After award of the remediation contract for the Miscellaneous Sites, UMCD requested that surface soil at Site 26, the Metal Ingot Stockpile Area in the Deactivation Furnace area, be sampled, analyzed, and treated if necessary. Soil sampled during the RI was found to contain elevated levels of lead and zinc from the years of ingot storage.

Cleanup activities for Study Sites 22, 26, and 36 were carried out from November 1995 to September 1997. A total of 1,923 cubic yards of soils containing lead greater than 500 mg/kg, and cadmium and chromium levels greater than the concentrations corresponding to a hazard quotient of 1 (127 mg/kg, and 40 mg/kg, respectively) were treated. A total of 444 cubic yards of contaminated soil were excavated from Site 22, 1,305 cubic yards of contaminated soil were excavated from Site 26, and 174 cubic yards of contaminated soil were excavated from Site 36. The soil treatment resulted in meeting the TCLP criteria (1.0 mg/L, 5.0 mg/L, and 5.0 mg/L for cadmium, lead, and chromium, respectively) necessary for the treated soil to be placed in the UMCD Landfill. Based on a bulking factor of 1.61 for treatment additives, a total of approximately 3,110 cubic yards of treated soil from the Miscellaneous Sites were disposed of at the Active Landfill (Site 11).

4.2.6 Other Investigation Study Sites

Table 17 below lists the other Study Sites originally investigated in the 1990 Enhanced PA (Dames and Moore 1990) and investigated further in the 1993 Supplementary Remedial Investigation (SRI) (Dames and Moore 1993c). The SRI determined that NFA is required at each of the Study Sites listed below.

Table 17. Other Investigation Study Sites Determined NFA by the 1993 SRI

Study Site Number	Site Name	Description
40	Jeep Storage Area	This area was located in the Deactivation Furnace area and was used at least in 1989 and 1990 to temporarily store used jeeps prior to servicing. The Enhanced PA deemed the associated risks no greater than any other parking lot.
61	Open Paint Spray Areas	These areas were reportedly used in the 1950s and 1960s to conduct outdoor spray-painting. Paint and solvent spills and shot blast waste disposal may have occurred there. During the SRI, five shallow soil samples were collected near Igloos C-1188 – C-1190 and in a pit southwest of C-1188 and analyzed for TAL metals, TCL VOAs and BNAs. Silver was detected in concentrations exceeding the comparison criteria in two samples. Five BNA TICs were detected in low concentrations from one sample.
62	Paint And Solvent Disposal Areas	This area is located along the Coyote Coulee north of the explosive washout area. In interviews given during the investigations for the RI, UMCD employees reported disposal of paint and solvent waste generated from a building formerly located east of the disposal location. During the SRI, five soil samples and one soil sample were collected from a test pit located in the southern and northern disposal areas, respectively, and analyzed for TCL VOAs and BNAs and TAL metals. In the southern area, silver and zinc were detected in excess of their comparison criteria. Low concentrations of two BNAs and three BNA TICs (DDD, DDE, and DDT) were found. In the northern area, copper and zinc exceeded the comparison criteria.

Study Site Number	Site Name	Description
63	Pier 836 Chemical Solution Disposal	Former employees reported that a laboratory trailer was set up in this area in the early 1980s to perform analyses on samples suspected to contain GB or VX agents, and some types of solution were spilled in the area around the trailer. The Enhanced PA determined that potential contaminants of concern include GB, VX, IMPA, and EMPA, and further investigation of the soil and groundwater was recommended. However, during the SRI work plan, Site 63 was reevaluated and determined not to require further investigation.
64	Leaking Railcar Shipment Inspection Area	In the vicinity of the Sewage Treatment Plant, this area is approximately 1,000 feet long, extending from the main classification yard, turning eastward into a narrow ravine. During the 1990 RI interviews, UMCD employees reported that shipments arriving by railcar that were leaking or suspected of leaking were taken to the end of the rail line in the ravine to be inspected. During the SRI, ten shallow soil samples were collected and analyzed for TCL VOAs BNA, and pesticides, and TAL metals, TPHs, IMPA, EMPA, thiodiglycol, and explosive constituents. Four were collected from the former work areas and six were collected from the ravine where railcars may have been rinsed. Antimony was detected in all four samples from the work area, while copper, iron, silver, and zinc were only detected in one. Very low concentrations of one unknown VOA and five BNAs (PAHs) were detected. In the ravine samples, antimony, copper, silver, and zinc exceeded comparison criteria. Several low concentrations of VOA and BNA TICs and TPHs were detected.
65	Waste Paint and Solvent Disposal Area	During the 1990 RI interviews, employees reported that paint and solvents from Building 608 were disposed of on the soil covering the bunker storage areas north of the building. This area is located east of the ADA, near the installation fence boundary, north of Badger Road. During the SRI, four near-surface soil samples were collected and analyzed for TCL VOAs and BNAs and TAL metals. Results indicate that mercury and zinc were detected in one sample above their respective comparison criteria.
66	Brass Copper and Steel Storage Area	This site is located near the railroad tracks south of Igloo Block H. Aerial photographs and UMCD employees report that copper, brass, and steel were stored on the soil at this site after being unloaded from the railcar (1992 RI of Dames and Moore). Three shallow soil samples were collected and analyzed for TAL metals and TCLP. Silver was detected above the comparison criteria in all samples. TCLP analyses were performed and silver was not detected; barium was below the regulatory level.
68	UDMH Operations Areas (Building 129)	Located within the Deactivation Furnace and Southwestern Warehouse Area, Building 129 was used to conduct stability tests of UDMH. RFNA may also have been tested. Waste materials from the testing operations were drained through lead-lined pipes into a lime pit. During the SRI, five soil samples were collected from a test pit at 0, 2.5, 5, 7.5, and 10 feet bgs and analyzed for nitrate/nitrite, pH, and lead. Results indicate that no contaminants were detected at concentrations expected to be of concern.

Study Site Number	Site Name	Description
69	Skunk Works Area	Located within the Deactivation Furnace and Southwestern Warehouse Area, this area was reported to be used for cleaning of copper and brass cartridges in hydrochloric acid baths and WEDAC solutions, which were then either dumped at this site or burned at the ADA grounds. Six soil samples were collected from three borings in the gravel area northwest of the site; 12 near surface soil samples from other site areas were composited into three samples; a new monitoring well was installed with soil samples being collected at various intervals until the water table was reached; and two rounds of groundwater samples were collected. All soil and groundwater samples were analyzed for TAL inorganics, chloride, and pH; groundwater was also analyzed for nitrate/nitrite. Silver was detected in all soil samples above the comparison criteria. In the groundwater, 10 TAL metals were detected; two at concentrations above their respective comparison criteria (selenium and vanadium), and three that do not have comparison criteria (calcium, magnesium, and potassium). Past activities at Site 69 do not appear to have impacted the soil or groundwater.
70	Wood Preserving Solution Spill Area	Located within the Administration Area, unconfirmed reports indicate that several hundred gallons of wood preservative solution pentachlorophenol (PCP), and potentially chromated copper arsenate and creosote, may have been spilled or dumped in this area. During the SRI, 16 soil samples were collected and composted into 4 samples, two samples were collected east of the scrap pile, two monitoring wells were installed, and two rounds of groundwater samples were collected. All samples were analyzed for PCP, TCL BNAs, TPHs, chromium, copper, and arsenic. All soil samples were also analyzed for dioxins, and groundwater was also analyzed for nitrate/nitrate. Two soil samples beneath the scrap pile were also analyzed for TAL metals. Results indicate that the soil at the site has not been impacted by past activities. Low concentrations of TPH were detected in the first round of groundwater samples. One very low concentration of BNA TIC was detected in one well also from the first round of sampling.
71	Possible Fire Training Pits Areas	Pits were dug here and filled with flammable liquids such as solvents or oils to conduct fire-training exercises periodically from the 1940s to the 1970s, though a historical aerial photographic analysis conducted during the Enhanced PA did not indicate such pits present. The PA recommended additional investigation; however, the SRI work plan reevaluated the site and determined it was not necessary.
72	Vehicle Storage Area	Old vehicles were reportedly stored here and leaks of fuel, oil, and battery acid may have occurred in this area. During the Enhanced PA, no signs of environmental degradation were present, and it was determined that no environmental risks greater than with any other parking lot exists. No further investigation was necessary.

Study Site Number	Site Name	Description
75	Battery Acid Collection Sump (Building 31)	Located within the Administration Area, it has been reported that a concrete sump existed along the exterior of Building 31 that collected acid from a drain in the maintenance area. Periodic overfilling of the sump was a potential source for soil contamination. During the SRI, five soil samples were collected from a test pit dug near the northwest corner of Building 31, where the sump reportedly existed, four soil samples from two test pits were located near the existing concrete sump and one surface water sample and one sediment sample from inside the existing sump were collected. Soil from the former sump area was analyzed for lead, pH and sulfate. Soil around the northeast side of the building and the surface water and sediment sample were analyzed for TAL metals, pH, and sulfate. Lead concentrations collected from the test pit northwest of the building were less than comparison criteria, no sulfates were detected, and pH levels were neutral to basic. 17 TAL metals were detected from one or more samples near the existing sump, but were below comparison criteria, no sulfate was detected, and pH was basic. Results indicate that soil was not impacted by battery acid.
76	Photographic Chemical Disposal Area (Building 54)	Located within the Administration Area, Building 54 was reportedly used as a film developing laboratory and darkroom, located within the boundaries of Site 44. It was reported during the 1990 RI site visit that approximately 50 to 100 gallons of film developing solutions were disposed of on the soil west of the building from the mid-1940s to early1950s. During the SRI, three near surface soil samples were collected and analyzed for TAL inorganics. 17 TAL metals were detected at levels below comparison criteria.
77	Paint Storage Area (Area 304)	Located within the Administration Area, paints, solvents, oils, photographic solutions and antifreeze solutions were stored and disposed of in an area located within and surrounding Building 30A storage shed. During the SRI, four near surface soil samples were collected and one monitoring well was installed and soil samples were collected at various intervals. Groundwater was sampled for two rounds. All samples were analyzed for TCL VOAs and BNAs, TAL inorganics, and TPHs. Groundwater was also sampled for nitrate/nitrite. From 0-2 ft bgs, silver was detected slightly above the comparison criteria for one sample. Acetone was also detected. Mercury and nickel concentrations slightly exceeded comparison criteria at the 60 ft bgs depth. This is not considered to be site related. Low concentrations of chloroform and hexane were found at the 4-ft and 80-ft depth, respectively. Groundwater results indicate that manganese and vanadium concentrations slightly exceeded comparison for one round of sampling and may be naturally occurring. Nitrate was also detected slightly exceeding comparison criteria. Other than silver in the soil, it appears that past disposal activities have not impacted the site.
78	Buildings 608 and 614 Heat Exchange System	Buildings 608 and 614 are heated with a closed heat exchange system consisting of ethylene glycol solution that runs through a holding tank and piping located beneath the floor. There is a possibility that leaks may have caused contamination of the soil. In November 1989, the ethylene glycol solution was sampled and found BTEX, targeted and nontargeted BNA, sulfide and barium, lead, and silver. Soil and groundwater surrounding the building was not sampled. The Enhanced PA recommended further investigations to include the soil and groundwater, but the SRI work plan determined this was not necessary.

Study Site Number	Site Name	Description
79	Malathion Spray Areas	Located in the northeast corner of Igloo Block C, this area is reported to have been sprayed with the insecticide malathion during a commercial over-flight operation near UMCD. The spraying reportedly killed a significant amount of vegetation. Two previous investigations detected the presence of malathion, but displayed significant decreasing concentrations. During the SRI, 16 soil samples were collected and composited into four samples and analyzed for malathion and TCL pesticides. None of the samples collected contained detectable levels of either TCL pesticides or malathion.
83	Leaking Drum Storage Area	Located within the Administration Area, this area consisted of a fenced yard west of Building 39 and south of Building 23, and was used to store drums containing the degreasing solvent MIBK. The SRI historic aerial photographs indicate that drums may have been stored here as far back as 1949. During the SRI, 10 soil samples were collected from two 10-foot borings and analyzed for TCL VOAs. Low concentration of acetone was detected from the 2-foot sample from one boring. Also, low concentrations of 2-ethyhexanol was detected at the surface, and at 4 and 6-foot samples from the second boring.

4.2.7 Five-Year Reviews

The following sections summarize the findings from the three five-year reviews that have been conducted on the CERCLA sites present at UMCD.

4.2.7.1 First Five-Year Review, September 1999

Protectiveness of each OU was evaluated in the September 30, 1999 Five-Year Review *(*UMCD Archive Document 1999*)*. The 1999 review concluded that for the Explosives Washout Lagoons Soils, Explosives Washout Plant, Deactivation Furnace Soils, Miscellaneous Sites, Active Landfill (hereafter referred to as the Landfill), and Inactive Landfills OUs, the selected remedies "did not result in hazardous substances remaining on-site above levels that allow for unlimited and unrestricted use."

The 1999 review further concluded that "no CERCLA Five-Year Review Requirements will apply" to the remedial actions undertaken at these OUs, and that these OUs did not "require any long-term management or review." However, for the Landfill OU, the 1999 review recognized that ODEQ Solid Waste Regulations governing closure and post-closure, including groundwater monitoring, did apply. For the remaining two OUs identified at that time, the Explosives Washout Lagoons Groundwater OU and the Ammunition Demolition Activity OU, the 1999 review concluded that the remedial actions taken at these OUs resulted "in hazardous substances remaining on-site above levels that do not allow for unlimited and unrestricted use" and that these OUs "will require long-term management or review," with reviews conducted every five years. Finally, since the 1999 review, issues were raised associated with munitions and explosives of concern at Study Site 39 in the Miscellaneous Sites OU.

The following paragraphs describe progress and changes since the 1999 initial five-year review at the two OUs requiring follow-up reviews, and at two other OUs, Miscellaneous Sites and the Landfill, where follow-up review was not required but changes have occurred.

Explosives Washout Lagoons Groundwater OU

Since the initial five-year review, several changes occurred at the Explosives Washout Lagoons Groundwater OU project. Three additional groundwater monitoring wells were installed in the eastern portion of the site in 2001 and 2003. These wells were installed to better define the plume boundary in this area and to confirm contaminant capture.

In 2000 and 2001, several attempts were made to update and recalibrate a numerical flow and contaminant transport model developed for the design of the Explosives Washout Lagoons Groundwater OU. The recalibrated model provided better agreement with actual data, and suggested that contaminant cleanup will occur approximately 26 years after system startup.

As a follow-up to numerical model recalibration, an independent effort was made to apply optimization-simulation techniques to the fate and transport model. This work indicated that cleanup times could be significantly reduced by various operational modifications. One of the suggested changes was to eliminate injection in the northernmost infiltration field (IF-1). This recommended adjustment was implemented in April 2002. From that time to the present, the infiltration water that would have been piped to IF-1 from the treatment plant has been diverted to the two other infiltration fields. Gradually, this operational modification has produced positive results, including additional reductions in total plume extent and the size of areas with the highest contaminant concentrations.

Ammunition Demolition Activity OU

During the course of original remedial action at the Ammunition Demolition Activity (ADA) Soils OU, additional areas of contaminated soil beyond the quantities identified in the ROD were found near two burn trenches (Study Site 19). Some of the additional soils were excavated, treated, and land-filled on-site under the original remedial action contract. However, due to funding limitations, the work could not be completed under the original contract. In addition, during a field investigation in 2000, 10 stained soil sites were discovered throughout the ADA by a metallic object survey and subsequent visual characterization and subsurface geophysical mapping.

During the time period between the original remedial action and the field investigations, the on-post landfill at UMCD was closed, thus eliminating the on-site treatment and disposal provisions of the ROD. Therefore, a revision to the selected remedy was needed to address the additional contaminated soils at Study Site 19. In June 2002, these changes in the selected remedy were approved by the Army and EPA and published in an Explanation of Significant Differences (ESD) to the ROD (U.S. Army 2002).

The ESD presented four significant differences to the remedy outlined in the ROD. The ESD incorporated updated information that: (1) revised the contaminants and cleanup levels; (2) changed the on-post treatment/disposal requirement for Study Site 19 to off-post treatment and disposal; (3) updated the cost estimate; and, (4) reduced the final volume of soil requiring excavation due to the revised cleanup criteria. The ESD applied only to the remedial activities at Study Site 19. It specified the excavation of additional soils from Study Site 19, off-post treatment by S/S as needed to meet treatment standards, and disposal in an off-post landfill.

The major elements identified in the ESD were:

- Revised exposure assumptions.

- Allowing for off-post S/S treatment to meet leachability goals, and off-post disposal at a permitted treatment, storage, and disposal facility.
- The estimated additional volume of soil needing excavation, treatment, and disposal decreased (from 5,177 cubic yards to 1,127 cubic yards).
- Cleanup levels for barium, cadmium, 2,4,6-trinitrotoluene, RDX, 2,4-dinitrotoluene, and 1,3,5-trinitrobenzene were changed based on revised exposure scenarios and updated toxicity information (see Table 14).

In 1995 through 1997, surface clearance of MEC under Phase I was conducted throughout the ADA. Approximately 6,900 recovered MEC items were thermally treated via open detonation from either surface clearance of MEC or MEC recovered from soil sifting operations at the five chemically contaminated soil sites. Approximately 350,000 pounds of MEC-related scrap was transported off-site for recycling. Upon completion of soil sifting operations and surface clearance, subsurface geophysical mapping was conducted over 97 percent of the ADA. Subsurface mapping detected 212,000 buried anomalies (MEC or MEC-related scrap).

The additional remedial action elements of work identified for soil cleanup at Study Site 19 were the excavation of approximately 1,250 cubic yards of contaminated soil. UXO clearance personnel identified and removed MEC and Materials Potentially Presenting an Explosive Hazard (MPPEH) debris from Study Site 19 prior to surveyors setting sampling grids. UXO personnel then monitored the soil excavation activities. Stockpiled excavated material was tested, and approximately 330 cubic yards required treatment/stabilization off-site prior to disposal at an approved waste facility. Approved amendments were added to the soil to produce stabilized material. The soil was treated and then tested in accordance with the leachability requirements listed in Table 15.

4.2.7.2 Second Five-Year Review, October 2004

The purpose of the second Five Year Review was to determine whether the remedial actions selected in the Records of Decision (RODs) for the eight Operable Units (OUs) at Umatilla Chemical Depot (UMCD) remain protective of public health and the environment and are functioning as designed. The start of construction of the Washout Lagoons Soils OU (June 20, 1994) triggered the periodic (five year) review requirement, with the first five year review completed on September 30, 1999. The second five year review was a follow-up to the September 30, 1999 five year review. The scope covers selected remedies for the OUs recommended for further five year reviews in 1999, as well as those OUs where subsequent five year reviews were not required but where there were changes since the 1999 review. The OUs addressed in the second five year review include: Explosive Washout Lagoons Groundwater OU; Ammunition Demolition Activity OU; Landfill OU; and Site 39 in the Miscellaneous Sites OU.

ADA OU

Additional field investigations were performed at the ADA in 2000 to characterize the extent of metal and explosive residue contamination at the 10 stained soil sites identified during ordnance remediation activities in 1988. The data from the locations where there were detections are summarized in Table 18. Bolded values are those exceeding the comparison criteria or action levels established in the ADA June 1994 ROD. The data from these investigations indicate that TNT, barium, cadmium, and lead soil concentrations were found above the action levels set in the ADA 1994 ROD, and TNT and lead concentrations were above the action levels set in the Study Site 19 2002 ESD. The actions required by the ESD were performed from July 2002 to October 2002. The final inspection for the soil remedial activities was performed in October 2002. A Final Remedial Action report for the ADA Soils OU was completed on 14 Feb 2005.

Table 18. Results from 2000 Soil Sampling for ADA Stained Soil Sites

Stained Soil Site ID	TNT (field)	RDX (field)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead
Action Levels mg/kg (from the ADA 1994 ROD)	23	52	820	15	860	8.1	28	40	25	500
Range of Detected Concentrations (mg/kg)										
0608	12.4	4.6	ND	3.5-4.6	120-140	0.12-0.19	ND	16-19	8.9-9.6	4.1-5.1
0613P	2.6	ND	ND	2.6-3.9	100-340	0.098	1.3-2	14-21	8.5-12	4.6-6.4
0808	**55-959.8**	4.1	1.2-2.9	4.1-5.2	91-**1500**	0.11-0.12	0.64-**160**	12-20	7.8-9.2	**830-2900**
0809	ND	3.0-4.2	ND	3.5-4.4	88-110	0.11-0.17	0.13	17-27	8.3-11	4.4-9.4
0834P	21.6--**31.1**	10.2-10.7	ND	2.2-2.6	140-190	0.073-0.11	2-9.8	11-20	8.3-8.6	7.3-9.4
1009	2.3	ND	ND	4-5.5	95-120	0.13-0.19	0.47-0.59	17-23	9.5-10	5.9-27
1604	ND	ND	0.36-2.9	ND	59-71	0.11-0.15	0.2	6-7.8	5.8-7.8	4.5-44
1605	6.5	7.7	74	5.7	390	0.085	2.9	22	9.1	**5000**

Notes: Bolded values are those exceeding the comparison criteria or action levels established in the ADA June 1994 ROD

ND = Non-detect

In addition to the identification and cleanup of contaminated soils at Study Site 19, the 1994 ROD specified that the safety and environmental risks due to the presence of MEC were to be quantified and reduced in two phases: Phase I, with surface MEC clearance and a determination of subsurface anomalies; and Phase II, with subsurface MEC clearance. In addition to these phases, there have been several MEC clearances associated with the soil investigative and remediation activities. These clearances and the Phase I and II work are described below.

In the course of conducting the soil investigations, clearance of MEC was performed to ensure safe access by personnel collecting chemical samples. Approximately 80 MEC items were found, as well as an extensive amount of inert metal debris. The total area cleared during the RI investigation was small (less than 100 acres) compared to the entire ADA, but involved the area's most likely to have MEC. Because the clearance included only a small area, the total quantities, locations, and depths of MEC in the ADA were not well defined during the RI.

Ordnance identification and clearing activities were performed during the summer 2002 excavation and remediation of soils at Study Site 19. Although no MEC was encountered, a total of 829 pounds of MPPEH scrap was inspected, certified as explosive-free, and transported for disposal.

A Phase II MEC activity will be conducted in accordance with the following activities (contract awarded September 2012):

- Preparation of a remedial design (RD) document to include all components of the Phase II remedial action, including subsurface clearance of MEC, long term operations and maintenance (O&M), institutional controls, and five-year review requirements.
- The joint Army, EPA, and ODEQ decision on whether any MEC clearance is necessary and, if so, the appropriate depths of the MEC clearance and the associated long-term maintenance requirements.
- Initiation of the MEC Phase II remedial action within 15 months of the final land use decision and appropriate institutional controls applied to the ADA.
- Transfer of land in accordance with the provisions of CERCLA Section 120(h) and all associated EPA and DoD criteria and guidance related to Federal property transfers under BRAC.

Miscellaneous Sites OU

After the First Five-Year Review (USACE Archive Document 1999), concerns were raised by UMCD about one of the 32 Miscellaneous Sites, Study Site 39 (the former Quality Assurance Testing Range where ordnance was used). Study Site 39 is a 640-acre rectangular parcel of land located outside the northerly boundary of the UMCD. The site was acquired by the Army for use as a quality assurance (QA) function range for various types of conventional weapons, munitions, and related materials. Chemical weapons were never tested at Study Site 39; only conventional munitions items such as ground signal flares, photo flash grenades, illumination and smoke canisters, and mines were tested. Testing of munitions at Study Site 39 occurred from the late 1940s through the mid-1970s.

A 100 percent surface clearance was conducted by UXB International, Inc., in 1996. Over 600 pounds of scrap were removed during the clearance, with two MEC items (an M16 mine and a ground signal) and five ordnance-related items (inert components of five ground signals) found. UXB found no indication of subsurface ordnance based on instrument-aided visual inspection.

A subsequent 100 percent geophysical mapping, along with a 100 percent visual surface clearance, including brush clearing, was performed in the summer of 2001. The sampling was performed using a Multisensor Towed Array Detection System to map relatively level areas of the site, and a dual towed EM-61 to map steep areas. The purpose of the geophysical mapping was to identify anomalies that could potentially represent buried MEC. In the fall of 2002 a thorough investigation of 840 geophysical anomalies began.

An intrusive investigation of these anomalies resulted in the retrieval of four MEC items, 342 MPPEH items, 479 non-MPPEH items, and 66 no-finds (false positives). Based on the locations of the ordnance that was found, the project team defined three areas of concern (AOC): (1) the Test Pad Area (68.5 acres), (2) the Rifle Range Area (106.9 acres), and (3) the Test Pit Area (0.8 acres). The Army prepared an EE/CA recommending No Further Action (NFA) on the 464 acres outside the three identified AOCs, and a subsurface clearance to two feet in depth for the 176 acres included in the three AOCs. EPA concluded that the EE/CA contained sufficient information and analysis of alternatives to be equivalent to an RI under CERCLA *(*USACE 2004*).*

The final ROD was released in May 2005. The selected remedy for Study Site 39 included a response action consisting of a MEC clearance to a depth of two feet in the Test Pad Area and Rifle Range Area, and a MEC clearance to a depth of six feet in the Test Pit Area. Total MEC clearance acreage was 176 acres. For the remaining 464 acres, these areas had no documented historical use of QA function testing activities or physical evidence of munitions testing. As such, the 464 acres are not considered to potentially contain MEC, and the selected remedy is NFA *(*Defense Environmental Restoration Board 2005*).*

Landfill OU

The Landfill received stabilized (treated) soils from the Deactivation Furnace, ADA, and Miscellaneous Sites OUs. In order to receive this additional solid waste, ODEQ upgraded the solid waste permit and requirements to reflect an RCRA Subtitle D operating landfill. After consolidating this waste in the Landfill, a Subtitle D compliant landfill cap was installed in 1997. The ODEQ issued Solid Waste Disposal Site Closure Permit Number 320 dated August 15, 2000.

Quarterly monitoring of the groundwater has continued since October 1996, according to the Environmental Monitoring Plan approved in July 1997 (U.S. Army 1997a). The results are reported to ODEQ in semi-annual and annual reports, which compare the data, with the exception of selenium, to values from the Oregon Administrative Rules, Department of Environmental Quality 340 Groundwater Quality Protection (OAR 340040). Selenium is compared to 50 μg/L, which is the risk-based level established by ODEQ in January 2003 *(*ODEQ 2003). Selenium results from 2003 widely ranged from upgradient wells (3.7 to 8.3 ug/L) to 115 ug/L in cross gradient well 11-2. Selenium concentration exceedences of the 50 ug/L Federal drinking water criteria have occurred since October 1990 at well 11-2 and MW-34 (USACE 2003). There was no definitive temporal trend found during sampling in selenium data for 2009 since concentrations rose at four wells, dropped at two wells, and remained the same at five wells (USACE 2010). In accordance with ODEQ Permit 320 (2010), the Army is in the process of revising the existing Environmental Monitoring Plan (U.S. Army 1997a).

4.2.7.3 Third Five-Year Review, March 2010

The third Five-Year Review for the UMCD was completed in March 2010 and received final regulatory concurrence and signature on July 30, 2010. The third Five-Year Review covered UMCD environmental CERCLA sites that had not been completely closed out, including the Explosives Washout Lagoons (EWL) Groundwater OU, the ADA OU, Miscellaneous Sites OU including Study Site 39, and the Landfill OU. The EWL Groundwater OU and the ADA OU were included because these sites have had remedial actions that resulted in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure. The Miscellaneous Sites OU and the Landfill OU, although determined not to fall within the purview of the five-year review reporting, were included because of changes or updates regarding those OUs since the Second Five-Year Review in 2004. The following conclusions regarding protectiveness were made in the third Five-Year Review.

The groundwater extraction and treatment remedy at the EWL Groundwater OU is operating and is expected to be protective upon completion. Remedy completion is not expected to occur before real property transfer for all or portions of the UMCD. In the interim, prohibition on the use of groundwater will be required until cleanup levels in groundwater are achieved for RDX and TNT.

The ADA OU remedy is protective of human health and environment in the short-term because controls are in place to prevent exposure to the remaining MEC on site. However, to be protective in the long-term, additional actions are required. Future land use decisions will dictate what specific follow-on remedial action will be required. If complete MEC removal is not undertaken, land use restrictions may be required.

The remedy at Miscellaneous Sites OU, Study Site 39, is protective of human health and the environment because all media preventing unlimited use and unrestricted exposure have been removed. At the time of property transfer of this site, deed notification will be required to inform the new owner that the property was used for testing of munitions.

The remedy at the Landfill OU currently protects human health and the environment because all landfill-related, anthropogenic COCs that pose risk are below regulatory levels; although selenium in groundwater is elevated, there is currently no complete exposure pathway. For the remedy to be protective in the long-term, deed restrictions may be required preventing disturbance of the landfill cap and cover, and preventing use of groundwater resources within and down gradient from the elevated selenium once the property is transferred from Army ownership *(*USACE 2010*).*

4.3 Storage of Hazardous Substances

The UMCD has a total of 105 agent-related hazardous waste storage facilities permitted under RCRA. UMCD has 90 unused storage igloos in the K Block and 14 unused igloos in the J Block, originally holding approximately 12 percent of the country's chemical weapons stockpile. and the remaining unit in Building 203 for non-agent related hazardous waste. UMCD uses two 90-day storage areas and several satellite accumulation sites to temporarily store hazardous wastes outside of the permitted storage units. The following sections provide additional information on each unit.

A variety of activities involving the handling of non-agent hazardous substances and generation of listed hazardous wastes have occurred at UMCD through its history. These activities include fuel oil storage and distribution, motor pool and service station operations, munitions renovation, and ammunition maintenance. These activities generated waste petroleum, oil, and lubricants (POL), battery acid, solvents, paints, and pesticides. Renovation of conventional munitions generated hazardous wastes, including red fuming nitric acid, aniline, explosive contaminated rinse water, and solvents. Other wastes generated included expired ordnance and ordnance propellant.

Hazardous substance surveys of the installation were completed during the Enhanced Preliminary Assessment and Community Environmental Response Facilitation Act (CERFA) investigations. There are no extremely hazardous substances as specified in SARA, Title II, Section 302, present at the installation. UMCDF maintains or utilizes sufficient quantities of hazardous chemicals to require reporting under SARA Title III, Section 312, Tier Reporting, or SARA Title III, Section 313, Toxic Chemical Release Form R reporting.

The UMCD maintains Material Safety Data Sheets for all hazardous chemicals on the installation, and spill response equipment is present. Hazardous substance notifications have been submitted to local emergency response agencies, and spill response has been coordinated with the UMCD Fire

Department located on the installation *(*Earth Technology Corporation 1995*).* RCRA Permit 2005 is the most recent document that describes the current buildings where hazardous wastes are stored.

4.3.1 Past Storage of Hazardous Substances – Agent Related

The Umatilla Chemical Agent Demilitarization Facility (UMCDF) completed disposal of the Umatilla Chemical Depot stockpile of chemical munitions six months ahead of the international treat deadline on Oct. 25, 2011, when the last mustard ton container was processed through the Metal Parts Furnace. The chemical operations phase lasted just over seven years, since operations commenced on Sept. 7, 2004. The GB campaign was completed on July 8, 2007. The VX campaign was completed on Nov. 5, 2008. A total of 220,604 munitions and 7,434,780 lbs. (3,717.4 tons) of chemical agent were destroyed.

Closure work is under way and will include dismantling or demolition of the areas of the plant exposed to chemical agent, which includes the Munitions Demilitarization Building, the lab and the pollution abatement system. All other buildings and utilities will remain available for reuse.

Previous activities in the following buildings at UMCD used to generate agent-related wastes when handling or sampling agents and agent-contaminated systems and components. Much of this waste was stored in three blocks of storage igloos located on site. Storage igloos are semi-circular, steel reinforced concrete structures that are approximately 26 feet wide by 60 or 80 feet long, and are 12.5 feet high. The igloos are equipped with one door that is approximately 4.5 feet wide by 8 feet high, and are equipped with two vents in the front door and a stack in the rear of the igloo. All igloos are covered with dirt, keeping the inside temperature at 60 to 70°F year round, which helped to maintain safe storage conditions. I-block stored blister agent, mustard (HD), while K-block stored HD, as well as the nerve agents, VX and Sarin (GB). UMCD and UMCDF generated agent related waste while managing and disposing of agents. This waste was stored in J-block igloos. Agent-related wastes that were generated from the handling, sampling, or monitoring of the chemical agents were marked as 3X wastes based on the degree of exposure to agent *(*UCMD Info Sheet 11/8/07; ODEQ 1997b, c).

The following summary of descriptions is from RCRA Permit 2005 *(*ODEQ 1997b, c*)* which is now outdated as all chemical agents were destroyed*.* Table 24 provides a complete listing of all hazardous materials that were stored at UMCD.

4.3.1.1 Igloo Block K

Chemical munitions and bulk chemical agents were stored in K-Block igloos. The chemical munitions associated with the 90 igloos in this block were designated as chemical agent munitions and bulk items and munitions were managed as wastes under OAR 340-101-0030. All blister agent HD, and GB and VX nerve agents have been destroyed at the UMCDF and are no longer stored at UMCD. Blue band tubes (BBTs) were used for chemical agent detection from approximately 1972 into the early 1990s. A primary component of the BBT is mercuric cyanide. From 1972 until 1982, if agent was not detected, the common practice was to bury the tubes in shallow hole outside of the K-block igloo and outside the south man door of building 659 (if agent was detected they were managed as agent related waste). Additional information regarding the generation and disposal of the BBTs is being collected by CMA. To date, five drums containing only BBTs have been identified in the secondary waste database. Further research in the matter is being conducted by CMA including sampling in the K-block area.

4.3.1.2 Igloo Block J

J-Block igloos include 58 designated storage igloos that stored all 3X agent-related wastes that were generated from stockpile maintenance operations in K and I Block, as well as the UMCDF disposal activities. 48 J-blocks igloos were used for storage of agent related waste for UMCD and UMCDF. The agent related waste in the J-block igloos included personal protective equipment, carbon filters, spent decontamination solution, maintenance equipment and tools. Waste in J-block was either incinerated at the UMCDF, or disposed through DRMO (for UMCD waste), or a permitted hazardous waste disposal facility (for UMCDF). Table 24 provides a complete listing of all hazardous materials that were stored at UMCD.

4.3.1.3 Igloo Block I

I-Block igloos are located near the center of the UMCD, and include 30 individually operated storage units previously permitted to store only HD chemical agent-filled bulk items in accordance with 40 C.F.R. 264, subpart EE, as amended and adopted by OAR 340-104-1201. According to the written records at UMCD, I-Block igloos were originally used to shelter explosive components and conventional munitions. In March 2002, chemical agent HD was moved from Building 659 to 24 I-Block igloos, Number I-1699 through I-1722; but six of the igloos were never placed into service. In late 2006, the igloos were emptied and all agents were transferred to the K-Block storage facility to increase storage security and operational efficiency. During its operational history, no HD liquids were ever discharged to the floor of the storage unit *(*Panamerican Consultants 2002*).*

In March 2007, UMCD submitted an RCRA closure plan for the I-Block storage facility. This plan presented a methodology and schedule for completion of closure activities. In accordance with 40 C.F.R. 264, and OAR 340-100 through 340-106, to close the igloos it must be demonstrated that the need for future maintenance will be minimal and that any post-closure escape of hazardous wastes or their constituents, leachate, runoff, or decomposition products to ground or surface water or the atmosphere is controlled, minimized, or eliminated to the extent necessary to protect human health and the environment. This was done by field activities that consisted of waste removal and cleaning of the igloos, the wipe sampling of all clean surfaces, and evaluation of the analytical data presented in a work package for closure decision analysis to ODEQ. I Block was RCRA closed as of December 2009. See Appendix H for regulatory closure letters related to this Site *(*I-Block Storage Facility Project Closure Plan 2007)*.*

4.3.1.4 Building 656 K Block Monitoring Branch

Building 656 is the monitoring facility that supported K-Block activities. Hazardous wastes generated from Building 656 included agent-related decontamination and laboratory wastes, such as chemical agent standards, and personal protective equipment. Non-agent related laboratory wastes, such as solvents, acids and plastics, were stored here. There was a satellite accumulation site for those hazardous wastes.

4.3.2 Storage of Hazardous Substances – Non Agent Related

As of 1 August 2012 the UMCD is no longer an active Army installation and is being managed by the Army BRAC office. The Oregon Army National Guard anticipates receiving 7,500 acres of the 17,000+ UMCD installation as a Intermediate Training Center for DoD. Until such transfer of ownership occurs, the Army BRAC office assumes responsibility of all non-agent related hazardous substances. This, according to the BRAC Environmental Coordinator, takes the manifesting of such accumulation points out of scope for this ECP. The information presented in this section should serve as a historical record of where Hazardous Substances were recorded during the original 2010 ECP. This is not intended to serve as an indication of what is onsite during this 2012 update.

Building 2 Fire Department

The fire department and RIM offices were located in Building 2 in the Administration Area and contain insignificant quantities of hazardous materials including linseed oil, paint cans, tool oil, lubricants, and aerosol paints stored in flammable materials storage lockers. Absorbent spill socks were installed on the fire trucks *(*U.S. Army CMA 2004*).*

Building 4 Public Works Directorate

Building 4 is located in the Administration Area and supports the UMCD Public Works. Flammable materials such as paint, tool oil, paint thinner, and sealants ranging from quart to gallon containers were kept in a non-flammable storage locker. Building 4 contained storage cylinders of compressed gasses, such as acetylene and oxygen. Other items stored in the Building 4 satellite accumulation site awaiting transport to Building 203 include mercury-containing fluorescent light tubes. Any spills would occur inside the locker or on concrete and would be immediately cleaned up.

Building 5 Vehicle Maintenance Facility

Building 5 is located in the Administration Area and was a fully equipped maintenance and repair facility supporting the UMCD vehicles on base that actively generate waste. While currently unoccupied, the building maintained three satellite accumulation sites. Materials that were stored in flammable materials storage lockers included paint, thinners, aerosols, starter fluid, brake fluid, brake cleaner, lubricants, battery reconditioner, fuel additives and conditioners, petroleum products, and other household items. The Central Shop Area contained gear oils and motor oils in 55-gallon drums. Waste paint thinner and paint sludge were contained in 30-gallon containers inside 85-gallon overpacks. Recycled and new antifreeze was kept in 55-gallon drums. Gallon bottles of windshield washer fluid and diesel fuel conditioner were kept in the shop. An oil-water separator is installed outside the building to collect discharge from the wash bay however, the wash bay is not active. Any spills would occur inside the locker or on concrete and would be immediately cleaned up. A spill kit is available in the building *(*U.S. Army CMA 2004; ODEQ 1997b, c*).*

Building 7 Carpentry Shop

Building 7, located in the Administrative Area, is 3,600 square feet and maintained four satellite accumulation sites. The building actively generates wastes and is permitted for the storage of paint, aerosols, stains, lubricants, paint thinner, varnish, alcohol, glue, adhesive, and sealants. The facility maintains paint thinner, aerosol paint, and pesticide containers in 55-gallon drums and three 35-gallon drums for paints and cutting oil *(*U.S. Army CMA 2004; ODEQ 1997b, c*).*

Building 8 Pesticide/Herbicide Storage and Mixing Operations

Building 8 is located in the Administration Area. Products used in this building included herbicides, pesticides, rodenticides, and mixing operations. Liquid herbicide in 2.5-gallon plastic containers was kept inside containment trays. The pesticides were kept in a locked storage room and are in single-use containers or small containers up to a 50-pound bag size. Mixing is done inside a bermed area. Rodenticides are kept in small containers in the building. Containers of 5 percent bleach are mixed in 20-gallon containers in the mixing room *(*U.S. Army CMA 2004*).*

Building 9 HVAC and Boiler Shop

Building 9 is located in the Administration Area and is the Boiler and Air Conditioning Shop. Chemicals used in the boilers and air conditioners were stored here. The boiler chemical storage room contains 55-gallon plastic drums of sodium hydroxide, sulfite, Possca™, and Morpholine™. The drums are all seated in plastic secondary containment drums. During use, the chemicals are transferred to smaller transport containers that are taken to the boiler, triple-rinsed, and the rinse water is then added directly to the boiler. Three 50-pound recovery tanks of Freon R-22 and R-12, along with small quantities of lubricating oils, are kept inside the locked shops.

Building 11 Medical Clinic, Chemical Protection Equipment (CPE) and Tool Crib

Building 11 is a 33,150 square-foot facility located in the Administrative Area and houses the tool crib, offices, medical clinic, chemical protection equipment (CPE) protective mask fit area, and mail room. Small amounts of waste are infrequently generated here, and include expired acids and batteries, and, on a rare occasion, chemicals such as formaldehyde. A flammable materials storage locker held alcohol, ink, solvents, acetone, toner, sealants, and insecticides in gallon or smaller containers. Any spills would occur inside the cabinet or on concrete and be immediately cleaned up. If waste is generated it is immediately transferred to Building 203 for storage.

Building 27 Battery Shop

Building 27 is located in the Administration Area. Activities in the Battery Shop included handling acidic electrolyte solutions. Spilled materials from electrolyte-handling activities were previously drained to an underground collection tank via a pipe from a floor drain installed in the battery-charging platform. Access to the collection tank was through a manhole located approximately 20 feet to the southwest of the front entrance to the building. The 1,500-gallon circular collection tank was enclosed inside a concrete vault, and was accessible on all sides. The tank was previously inspected and the liquid in the tank was tested for acidity and neutralized whenever the tank was used. In 2006, this tank was removed and the drain was grouted. Any current spills would be immediately cleaned up *(*U.S. Army CMA 2004*).*

Building 115 Oregon National Guard

The Oregon National Guard operated a Satellite Accumulation Site for hazardous waste generated at this site. Wastes generated here were managed and disposed of by the Oregon National Guard.

This facility includes:

- Company Supply and Administration (8,940 sq. ft)
- Open bay barracks (570 beds including classrooms and laundry)
- Dining facilities (200 people per company) (13,500 sq. ft Consolidated Dining Facility)
- ID Processing Center (1,044 sq. ft)
- Field Maintenance Shop (6,144 sq. ft. building plus vehicle parking area)
- M1 Abrams Tank Simulation Conduct of Fire Trainer (SIMCOFT) Facility
- Range Operations building (2,508 sq. ft.)
- Ammunition Holding Area

- Small Arms Live-Fire Range Complex
- Tank Crew Proficiency Course (TCPC) (2 miles by 1 mile)
- Mobile Conduct of Fire Trainer Pad (M-COFT)
- Helipad
- Fuel Storage and Issue Point
- Supporting Infrastructure including Utilities and Roadways

Building 203 Hazardous Waste Storage Facility

The HWS facility is a 3,600 square-foot section in the northeast corner of Building 203. The HWS is designed to hold 660 55-gallon drums of wastes and has a secondary containment that is sufficient for this volume of waste. As a small quantity generator, UMCD historically never generated much hazardous waste and what waste that was generated was disposed through the DRMO at JBLM.

4.4 Petroleum and Other Products

USTs and ASTs have historically been utilized for the storage of petroleum products at UMCD. A UST survey was completed in 1993. EPA has delegated management of the UST program to the State of Oregon. All UST closure and investigation activities at UMCD have been conducted under the Oregon UST program *(*Earth Technology Corporation 1995*).*

4.4.1 Spills Released or Disposal

Multiple petroleum release incidents of both large and small scale have been documented in historical records. According to OAR 340-142-0050(1c), oil spills occurring on the surface of the land and not likely to escape into waters of the state must be reported if the quantity of oil spilled is greater than or equal to one barrel (42 gallons). Therefore, the only records of releases smaller than 42 gallons are internal UMCD memorandums, and they indicate that the following incidents occurred:

March 21, 1991 – Approximately 40 gallons of diesel fuel were spilled over an 8 by 16 foot area in the POL yard. The spill occurred on an asphalt/concrete surface, and no fuel escaped into the sounding soils. Spill residue was swept up and contained in a 55-gallon drum for disposal. *(*Daugherty 1991*).*

January 11, 1992 – A broken hydraulic line on an M1 Tank resulted in 3 to 5 gallons of hydraulic oil spilling just southwest of Building 27, in an area near the National Guard IMCOFF site. The spill occurred on a gravel/soil surface. The top 6 inches of soil was excavated to plastic-lined 55-gallon drums, which were placed in Building 115 for temporary storage *(*Daugherty 1992*).*

December 21, 1992 – An undocumented quantity of diesel fuel was spilled at the oil pad in K Block. Three cubic yards of soil were removed and placed in the landfill *(*Del Grosso 1992*).*

June 13, 2003 – A tote fell off of a forklift near Igloo J-1729, causing the seal to break and spilling tetrachloroethylene (PCE). Approximately 3 gallons spilled in the truck, 2 gallons to the pavement, and 3 to 4 ounces to the ground next to the pavement. The Hazmat team responded to the scene and performed cleanup operations. All contaminated material was bagged and drummed per procedure *(*Thurman 2003*).*

ODEQ records indicate that one incident occurred involving the release of greater than 42 gallons of petroleum to the surface of the ground. On February 21, 1993, an overfill of UST 37, located between Buildings 4 and 5, released approximately 75 gallons of heating oil on the snow covered, frozen soil. The spill was reported to ODEQ, which assigned the Incident Spill Report Number 93-2836. All snow, soils, and rocks were removed and containerized the same day. *(*McDune, William D. "Spill Report #93-283, clean up report of Heating Oil #5" 2 March 1993 Memorandum*.)*

Based on accounts given by former UMCD employees, petroleum spills may have occurred at UMCD that were undocumented. Such spills have been discovered via the various environmental investigations throughout the history of UMCD. Examples of these are at former UST location 100, Study Site 73 Diesel Fuel Spill Location, and at Study Site 74/UST 102, the Oil/Fuel Transfer Station (Building 23). The following paragraphs describe the evidence for such undocumented spills.

Former UMCD employees interviewed during the 1990 Enhanced PA describe UST 100 as a diesel tank formerly located below Building 29. During field reconnaissance, no surficial evidence of a current or former tank was found, and no historical documents were found detailing the installation and removal of this tank. During the 1995 UST investigation, Dames and Moore conducted a soil gas survey in and around the vicinity of the reported location. The results indicated low to moderate concentrations underneath the eastern quarter and slightly south of the building, well east of where UST 100 was reportedly located. These results were not indicative of an underground point source, but rather are localized at the surface. Based on these results, four borings were drilled. Soil samples were collected at 2.5, 5, 7.5, and 10-foot depths and analyzed for Total Petroleum Hydrocarbons (TPH), TCL VOAs, and TCL BNAs. TPH was detected in high concentrations in all four borings drilled, at shallow depths. No TPH was detected below 2.5 feet, indicating that contamination may be due to a surface spill rather than a leaking tank. The UST Investigation Report recommended that the soil at the eastern quarter of the building be excavated and disposed of properly. No immediate action was recommended at UST 100.

Study Site 73 is located in the Administration Area and is a former gas station. Former USTs 42 and 43 were located here and were used to supply fuel to base vehicles. UST 65 was reportedly located immediately west of USTs 42 and 43. During the 1990 Enhanced Preliminary Assessment, a former UMCD employee reported that around 1955 a spill of 800 gallons of diesel fuel occurred. This spill occurred around the area where the USTs were located. No documentation exists on this spill. An active soil gas survey was conducted during the UST investigation to evaluate the potential of contamination around the three USTs. Fifty-seven samples were collected in a 25-foot rectangular grid and analyzed for BTEX, Total Volatile Hydrocarbons (TVHCs), TCL VOAs, TCL BNAs, and TPH. Three soil borings were drilled and samples were collected at 2.5, 5, 7.5, and 10-foot intervals. Soil gas samples were generally low, but a ubiquitous presence of BTEX across the site indicated soil contamination. Contaminant concentrations in the soil samples were low to moderate and decreased significantly with depth. This suggests that the contamination may be a result of surficial spill and not from an underground tank. It was recommended that the soil west of UST 42 and 43 be remediated. During the removal of these USTs in 2000, 130 cubic yards of Petroleum Contaminated Soil (PCS) was removed and analyzed for Total Petroleum Hydrocarbons-Hydrocarbon Identification (TPH-HCID). Results revealed that contaminant concentrations in soil were below the most stringent cleanup standards. The excavation was backfilled with the PCS in accordance with ODEQ UST Cleanup Policy No. 550, for reuse of petroleum contaminated soil. It is unclear whether the excavation included the area where UST 65 was reportedly located *(*Dames and Moore 1990, 1995*).*

Study Site 74 is known as the Fuel Oil Transfer Station, where various types of oil and fuel were transferred from railcars to vehicles or storage tanks over a period of 50 years. It is assumed that localized spillage has occurred throughout the historic usage of Study Site 74, though the precise location of these spills is unknown and undocumented. During an aerial photographic analysis during the UST investigation report, darker toned soil appears throughout the historic photos. A passive soil gas survey was conducted throughout the site in a 50-foot rectangular grid. Passive samples were collected from a depth of 1 foot and analyzed for BTEX, PCE, and Trichloroethylene (TCE). Based on these results, three 10-foot borings were drilled and the soil was sampled at 2.5, 5, 7.5, and 10-foot depths. Results of the passive soil gas sampling indicated moderately elevated ion counts for BTEX in areas east and west of Building 23, near the railroad tracks and north of UST 102. Low to high ion counts for PCE were detected in the eastern and northeastern quarter of the site, likely a result of operations at Building 10. And a third area of potential contamination exists in the eastern quarter of the survey, near Building 10. Soil samples detected contamination at the surface, likely a result of surface spills rather than a leaking underground tank *(*Dames and Moore 1990, 1995*).*

UST 102 was located south of Building 23 at Study Site 74. This tank was a 12,000-gallon fuel oil tank believed to be installed around 1941, as an AST in its location appears on construction drawings. In 1995, a geophysical and soil gas survey was conducted to precisely locate the tank and determine its condition. A geophysical anomaly was identified to be the tank. Twenty-nine soil gas samples were collected in a rectangular grid around the location of the anomaly and analyzed for BTEX, TVHC, carbon dioxide, and methane. Low levels of benzene, toluene, and TVHCs were detected southeast of the tank, and not from the samples closest to the tank. Based on these results, three soil borings in the vicinity of the elevated soil gas samples were drilled to a depth of 10 feet. Soil samples were collected at 2.5, 5.0, 7.5 and 10-foot bgs and analyzed for TCL VOAs, TCL BNAs, and TPH. Low concentrations of several BNAs and TPH were detected in limited locations. It was concluded that the low levels of organics around in the vicinity of the tanks does not appear to be associated with the buried UST. The tank was later removed in 1993 by Martech USA Inc.

Site 43 is located in the central portion of UMCD at the intersection of Rim and Center Roads. During the 1995 UST investigation, several current and former UMCD employees recall that four USTs (UST 59 through 62) were located at the site, though no surficial evidence existed that suggested the USTs were present at the time of investigation. A geophysical and soil gas survey was conducted to determine the presence of USTs and whether soil contamination existed. Twenty-five soil gas samples were analyzed for BTEX and TVHC. Results indicate trace concentrations of benzene, toluene, xylene, and TVHCs. The report determined that these concentrations do not represent a significant point source like a leaking UST, but suggest minor surface spillage or the introduction of asphalt constituents *(*Dames and Moore 1990, 1995*).*

4.4.2 Historic and Current Petroleum Storage

In 1989, USACE conducted an investigation to identify USTs present on the UMCD facility. The objective was to evaluate the condition of the USTs and evaluate if further remedial action was necessary. During the investigation the USTs were assigned Other Regulated Underground Material (ORUM) designations; in total, 83 ORUMs were inventoried and compiled into a database that included tank size, installation date, and contents, if known. Of the 83 inventoried, 19 were identified as septic tanks, one was identified as a water tank, and one was identified as a manhole cover. The remaining 62 ORUM locations were petroleum-containing USTs. During the Enhanced PA of 1990 (Dames and Moore 1990), 33 additional tanks were identified and inventoried. In 1992, Dames and Moore conducted a field reconnaissance, in support of an underground storage tank investigation. The intent was to field-locate and map the USTs, identify any additional tanks, and gather information for a UST investigation. Dames and Moore identified six additional tanks not previously identified, and one underground piping structure, listed as a tank. This brought the total number of known USTs at UMCD to 102.

Due to the ORUM designation in the original investigation of USTs, septic and water tanks, and the subsequent discovery of additional USTs at UMCD, the ORUM numbering system was not continued. Additional USTs were numbered sequentially. Thus, it is found that ORUM and UST numbers are not always the same. Due to this confusion, and the changing of state reporting requirements throughout UMCD operation, the historical record of UST removal is not complete. This section describes the existing record of USTs and associated removal and confirmation soil sampling at UMCD.

In addition, confusion arises when examining Study Sites 23 and 24 at Building 5 and Building 10, Waste Oil Tanks, and Study Site 42, the Former UST Locations. Study Sites 23 and 24 were originally identified in the 1987 RCRA Facility Investigation (NUS Corporation 1987); Study Site 42 was first identified in the 1990 Enhanced PA (Dames and Moore 1990), which included 10 USTs in the Administration Area. Further confusion arises in the 1994 CERFA report (Earth Technology Corporation 1994), which labels these tanks as UST 44 and UST 55, respectively, while Table 3-5 in the 1995 BCP Report (Earth Technology Corporation 1995) lists Study Sites 23 and 24 as UST 44 and 45, respectively. During the 1995 UST Investigation (Dames and Moore 1995), both USTs had been removed, as it states that UST 44 was formerly located at Building 5 (Study Site 23), and UST 45 was formerly located at Building 10 (Study Site 23).

According to UMCD officials, UMCD currently has a total of five USTs that include two regulated USTs within the UMCDF, two unregulated USTs within the K Block (one oil-water separator), and one unregulated UST within the Administration Area (oil-water separator). The two permitted and active USTs that are located in the UMCDF have current ODEQ permits. The unregulated USTs include a 4,000 gallon diesel tank in the K Block, a currently unused oil-water separator within the K Block, and a currently unused oil-water separator within the Administration Area (Section 4.4.2.2).

All known former USTs are summarized in Table 19, and the most recent UST inventory at UMCD as of September 2002 is listed in Table 20. All other USTs not listed in Table 20 have been decommissioned and/or removed. A partial list of former ASTs is summarized in Table 21, and the most recent AST inventory at UMCD as of September 2002 is listed in Table 22. All other ASTs not listed in Table 22 have been decommissioned and/or removed. See Appendix G Figures 7 and 8 for a map with current and former UST and AST locations. Note that the locations of the USTs and ASTs within the UMCDF are not shown in these figures.

The following section describes the chronology of historic petroleum storage and UST removal, and also presents the current petroleum storage at the base.

4.4.2.1 Underground Storage Tanks (USTs)

In 1992, Pegasus Environmental Management Service, Inc. removed five USTs (UST 41, 44, 45, 46, and 56, and an unnamed AST near Building 8 containing pesticides), removed one AST, and installed tank leak detection at two USTs (UST 42 and 43). This event generated an ODEQ petroleum release number of 30-91-0200. When the tanks were removed, soil sampling was used to locate pockets of PCS above cleanup levels at three sites. Corrective action reduced the levels of contamination to below cleanup levels at all sites except at Building 5 (UST 44), as further excavation at this site would have compromised the structural integrity of the building. In a letter dated November 4, 1992, ODEQ informed USACE that no further action was required at all sites investigated, with the exception of Building 5 (UST 44). ODEQ stated that they will allow contaminated soil to remain in place until such time that the access to the soil improves. When such a time arises, the U.S. Army must finish characterizing the extent of the release and proceed with cleanup as necessary. Building 5 is still in place.

In 1992, Martech USA Inc. removed five USTs from UMCD, 1,000-gallon tanks identified as ORUM 5, 7, and 34; one 500-gallon tank identified as ORUM 75 (UST 56), and an unnumbered 500-gallon tank identified as "airport runway tank." ORUMs 5, 7, and 34 stored diesel #3 fuel, ORUM 75 reportedly contained either gasoline or diesel fuel, and the airport runway tank stored diesel #2 fuel. ORUMs 5, 7, and 34 were installed in 1945 and inactivated in 1984. ORUM 75 was installed sometime between 1950 and 1960 and was inactivated in 1984. The installation and inactivation of the airport runway tank is not known. Tanks were removed using standard practices; no field evidence of contamination was found. Soil samples were collected from the sides and bottom of each tank basin. ORUMs 5, 7, and 34 were analyzed by EPA method 5030/8015 for Total Petroleum Hydrocarbons-diesel (TPH-d), EPA method 8010 for halogenated solvents, EPA method 8020 for BTEX, and EPA method 7421 for lead. Soil samples from ORUM 75 and the airport runway tank were analyzed as for the aforementioned tanks except EPA method 5030/8015 was used for Total Petroleum Hydrocarbons-gasoline (TPH-g) rather than TPH-d. Results displayed low levels of TPH-d from ORUM 5, 7, and 34; and low levels of toluene at two samples from ORUM 34, one sample at ORUM 7, and one sample from ORUM 75. Low levels of lead were detected in all four samples from ORUM 75 and one sample from the airport runway tank. Based on these results, NFA was recommended.

In 1993, Martech USA Inc. removed 19 USTs. Analytical results for samples taken from the excavations were only available for four sites (ORUM 36, 38, 80, and 102). These results indicated that the soil was not contaminated above cleanup level, and NFA was recommended for the sites. There was insufficient data to consider NFA for the 15 other sites.

Foss Environmental Services Company removed UST 87 and UST 20 in 1994. UST 87 was a 1,000-gallon tank installed in the 1950s to store diesel #2 fuel used to fire a furnace at a munitions deactivation building. Soil sampling at this site indicated that TPH contamination was below regulated levels, and clean soil was backfilled into the excavation. UST 20 was a 10,000-gallon tank that was actively being used for storage of No. 5 heating oil at Building 37 in the Administration Area. This site was over-excavated, sampled, and found to be free of petroleum contamination. Petroleum contaminated soil was discovered beneath piping at the east end of the excavation, but was not removed due to the danger of damaging a water line.

In March 1995, the Shannon and Wilson Team completed an Engineering Analysis for Repair and/or Replacement of 18 UST Upgrades. The Team evaluated three upgrade options for each UST, including upgrading the existing UST in place, removing and replacing the existing UST with a new UST, and removing and replacing the existing UST with a new AST. The preferred option for each tank was determined based on field visits, interviews with base personnel, and review of available records.

Dames and Moore prepared an Underground Storage Tank Investigation Report in June 1995 (Dames and Moore 1995). The objective of the investigation was to evaluate whether any USTs have leaked or were presently leaking and what effect that leakage might have on the surrounding soil and groundwater. Sixty-six USTs were included in the investigation. Five inactive tanks (USTs 92, 93, 96, 98, and 101) with unknown contents were sampled. Tank leak testing was conducted on

30 active USTs. Twenty-one of the thirty tanks leak-tested met Oregon State tightness criteria and required no immediate action. Two of the thirty tanks tested failed the leak tests and seven had inconclusive results; one tank could not be leak tested. If the test determined that a tank was leaking or if the test was inconclusive, potential soil contamination was investigated by analyzing soil samples near the tank. Geophysical surveys were conducted to evaluate the presence of 20 USTs that were reported by former or current UMCD personnel. Active soil gas surveys were conducted at 17 locations where USTs were reported to exist, and a passive soil gas survey was conducted at Site 74. The soil gas surveys indicated potentially significant soil contamination at sites 73 and 74, and the remaining 15 sites contained insignificant contamination or low concentrations not anticipated to be a concern. Shallow soil borings were completed to confirm potential soil contamination at inactive UST sites that had significant soil gas contamination, or at active UST sites that failed the leak test or had inconclusive results. The results of all of the sampling methods ultimately helped determine whether the analyzed tanks had leaked and how the surrounding media was affected.

In July 1995, Foss Environmental Services removed 11 heating oil USTs: 9, 11, 13, 14, 21, 22, 23, 25, 32, 33, and 93 (Foss Environmental Services 1995a). Two additional tanks that were removed (tanks 94 and 97) were found to be "blow-down" structures related to a boiler and air compressor system at Building 433. Petroleum-contaminated soil was present at all but UST 93 as a result of spills around the fill pipes or leaks from damaged piping. After excavation, soil samples were collected, and if laboratory analysis indicated the presence of TPH contamination above cleanup levels, further over-excavation and sampling occurred until such contamination was removed. Confirmation samples collected at each excavation confirmed all petroleum-contaminated soil had been removed at each tank site. Excavations were backfilled with clean soil.

A discrepancy was identified during the historical documentation review between USTs 92 and 93. The contents of UST 92, adjacent to the south side of Building 486, were sampled when the tank was identified in the 1992 UST investigation report. The report recommended that this UST be cleaned out and closed according to ODEQ tank closure procedures. UST 93, identified in the investigation report as a vented sump, was constructed of concrete. Later, during the 1995 tank removal by Foss, UST 93 is identified as a tank and not as a sump, and the report describes the decommissioning and removal process. Both the UST 92 and the sump (UST 93) are assumed to have been removed from this location.

In 2000, AGI Technologies removed two 50,000-gallon USTs from the Administration Area, on the northwest side of the intersection of D Street and Elm Street. Records indicate that the two tanks were installed in 1990. No UST numbers are cited in the document, but based on size and location of the tanks it is believed that they correspond to USTs 42 and 43. One of the tanks stored unleaded gasoline and the other stored diesel. As mentioned in Section 4.4.1, during decommissioning of the tanks, approximately 130 cubic yards of soil was removed and sampled, and analysis indicated that petroleum hydrocarbons were present, but at concentrations below cleanup level. This was assigned ODEQ Petroleum Release Number 30-00-0001. During excavation activities it was determined that groundwater was not impacted and that no significant future threat to groundwater exists. ODEQ determined no further action was necessary. ODEQ has listed the status of this release as closed (AGI Technologies 2000).

Dames and Moore prepared the Final Site Closure Report in March 2000 *(*Dames and Moore 2000*).* This involved investigation of 18 former UST locations: 15 sites for which no soil analysis results were reported by Martech in 1993 (UST 2, 2b, 12, 24, 35, 37, 39, 40, 47, 48, 49, 50, 54, 55, and 77), two sites (UST 75 and 41) for which the samples were analyzed for the incorrect petroleum hydrocarbon range, and one site (UST 80) for which the analytical results were difficult to interpret. Results of the field and laboratory investigations of soil at the former UST locations indicated that petroleum hydrocarbon contamination was not present above cleanup levels. Low levels of diesel or motor oil range hydrocarbons were detected in two subsurface soil samples at UST 2 and UST 80; however, both detections were below cleanup levels. Based on these results, Dames and Moore considered no further investigation at any of these former UST locations to be necessary. It was recommended that UMCD proceed with the final closure of all 18 sites.

As seen in Table 19, UMCD currently has a total of five USTs that include two regulated USTS within the UMCDF, two unregulated USTs within the K Block, and one currently unused oil-water separator within the K Block (see Section 4.4.2.2). The two regulated tanks within UMCDF correspond to ODEQ permit numbers BECCB and BECCC; it does not appear that a corresponding UMCD UST number has been assigned. The two regulated underground storage tanks are used for the storage of diesel. These include a 550-gallon tank that is located within the security fence at the ECF, and the 4,000-gallon tank that is located at the MDB, which is used in support of the backup generator.

Both of the active regulated USTs at the UMCDF are constructed of double-walled fiberglass. The tanks are equipped with an interstitial leak monitoring and detection system that monitors the space between the tank walls. The tank fill connection has a locking cap, a 20-gallon spill container and an overfill prevention valve to prevent spills during filling. Tank inspections and an inventory tracking system will provide evidence of potential leaks. Piping is double walled and slopes toward the tank *(*U.S. Army CMA 2004*).*

Table 19. List of Former Underground Storage Tanks (UST) Located at UMCD

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
1	ORUM 001	201	Inactive, Not Present or Removed	ADMIN	1945	1,000	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
2	ORUM 002	2	REMOVED 1993	ADMIN	1945	1,000	**F**	Not reported	4	2000 closure report from ODEQ	Contents of ORUM 002 diesel, ORUM 002b unknown. Tanks are associated by close proximity. Motor oil in one sample detected, at 41 ppm, well below 500 ppm cleanup level. Other three samples were non-detect (ND).
	ORUM 002b	2	REMOVED 1993	ADMIN	1945	65	--	Not reported			
3	ORUM 003	7	Inactive, Not Present or Removed	MAINT	1945	1,000	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
4	ORUM 004	10	Inactive, Not Present or Removed	MAINT	1945	1,000	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation. According to UMCD officials, this tank is either inactive or removed.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
5	ORUM 005	18	REMOVED 1992	ADMIN	1945	1,000	--	--	4	No Further Action recommended by contractor	Former diesel #3 tank; confirmation samples analyzed for TPH-d, EPA 8010 for halogenated solvents, BTEX, and EPA 7421 total Pb. Low levels TPH-d; ND in all other samples.
6	ORUM 006	30	Inactive or Removed	MAINT	1945	1,000	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
7	ORUM 007	32	REMOVED 1992	ADMIN	1945	1,000	P	--	4	No Further Action recommended by contractor	Former diesel #3 tank; confirmation samples analyzed for TPH-d, EPA 8010 for halogenated solvents, BTEX, and EPA 7421 total lead. Low levels TPH-d in three samples and low level toluene in one sample. ND in all other samples.
8	ORUM 008	33	Inactive, Not Present or Removed	ADMIN	1945	1,002	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
9	ORUM 009	416	REMOVED 1995	MAINT	1945	3,000	P	18*10*14	6	ODEQ has decommissioning documentation, recommends no further action (stored heating oil – exempt)	Former diesel tank; PCS excavated during 1995 UST removal. ND in all confirmation samples.
10	ORUM 010	419	Inactive, Not Present or Removed	MAINT	1945	1,002	P	--	--		Former diesel tank; passed a tank leak test conducted during the 1995 UST investigation.
11	ORUM 011	612	REMOVED 1995	MAINT	1945	15,194	--	Not Reported	6	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	One sample detected low levels of TCL BNA TICs, well below regulatory levels. PCS excavated during UST removal. ND in all confirmation samples.
12	ORUM 012	617	REMOVED 1993	AMMO	1945	2,500	**F**	10*18*8.5	3	2000 closure report from ODEQ	East of Building 617; former diesel tank; ND in all three samples.
13	ORUM 013	208	REMOVED 1995	AMMO	1945	1,000	P	21*16*18	11	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	PCS excavated during UST removal. ND in all confirmation samples.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
14	ORUM 014	622	REMOVED 1995	AMMO	1965	1,000	P	7*12*8	6	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	PCS excavated during UST removal. ND in all confirmation samples.
15	ORUM 015	654	Inactive, Not Present or Removed	CHEM	1982	4,006	P	--	--		Passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
16	ORUM 016	655	Inactive, Not Present or Removed	CHEM	1982	6,008	P	--	--		Passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
17	ORUM 017	660	Inactive, Not Present or Removed	CHEM	1965	10,310	**I**	--	--		Former diesel tank. No samples collected during UST invest. due to the tank being located in the K-Block. Report recommended upon removal of tank, soil needs to be evaluated for PCS. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
18	ORUM 018	28	Inactive, Not Present or Removed	ADMIN	1946	15,194	**I**	--	4		Former diesel tank. Four soil samples collected during UST invest.; low levels of TPH and TCL BNA were detected in one of the four samples. No immediate action was recommended. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.
19	ORUM 019	28	Inactive, Not Present or Removed	ADMIN	1945	8,000	P	--	--		Former heating oil tank. Passed a tank leak test conducted during the 1995 UST investigation. No information on its current status was found. According to UMCD officials, this tank is either inactive or removed.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
20	ORUM 020	37	REMOVED 1994	MAINT	1945	10,529	**I**	Not Reported	5	March 1995 notes additional work needed for a clean site closure	Former heating oil tank. Four soil samples collected during UST investigation; TPH detected from 36.5 to 13,900 mg/g in all samples. Tank was removed Dec. 14-16, 1994, and PCS was identified and removed. Three excavation and one stockpile confirmation soil samples were analyzed for TPH-HCID with EPA method 418.1 TPH follow-up. Low levels of TPH were detected from floor and stockpile sample, below the 500 ppm cleanup level. One soil sample was taken beneath piping contained 1350 ppm TPH. Soil was not removed due to presence of water and steam utilities.
21	ORUM 021	31	REMOVED 1995	MAINT	1945	15,194	**I**	39*23.5*15	4	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	ND results in the two soil samples collected during UST Invest. PCS excavated during UST removal. ND in all confirmation samples.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
22	ORUM 022	31	REMOVED 1995	MAINT	1945	12,088	**I**	61*14*16	7	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	ND results in the three soil samples collected during UST investigation; USTs 22 and 23 were removed together. PCS excavated during UST removal. ND in all confirmation samples.
23	ORUM 023	31	REMOVED 1995	MAINT	1945	12,088	**I**	61*14*17	4	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	ND results in the 3 soil samples collected during UST investigation; USTs 22 and 23 were removed together. PCS excavated during UST removal. ND in all confirmation samples.
24	ORUM 024	131	REMOVED 1993	MAINT	1945	15,194	P	Not Reported	3	2000 closure report from ODEQ	East of building 131; heating oil; ND in all three samples.
25	ORUM 025	433	REMOVED 1995	AMMO	1945	15,194	**I**	Not Reported	6	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	Former heating oil tank. PCS excavated during UST removal. ND in all confirmation samples.
26	ORUM 026	154	Inactive, Not Present or	ADMIN	1945	675	P	--	--		Former diesel tanks; all passed a tank leak test conducted during

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
27	ORUM 027	158	Removed	ADMIN	1945	675	P	--	--		the 1995 UST investigation. No information on the tanks' current status was found. According to UMCD officials, these tanks are either inactive or removed.
28	ORUM 028	164	Inactive, Not Present or Removed	ADMIN	1945	675	P	--	--		
29	ORUM 029	168		ADMIN	1945	675	P	--	--		
30	ORUM 030	35		ADMIN	1945	375	P	--	--		
31	ORUM 031	55		ADMIN	1945	1,000	P	--	--		
32	ORUM 032	116	REMOVED 1995	MAINT	1945	1,000	P	18*9*9	8	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	PCS excavated during UST removal. ND in all confirmation samples.
33	ORUM 033	129	REMOVED 1995	MAINT	1945	1,000	P	17*8.5*8.5	6	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	PCS excavated during UST removal. ND in all confirmation samples.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
34	ORUM 034	34	REMOVED 1992	ADMIN	1945	1,000	--	--	4	No Further Action recommended by contractor	Former diesel #3 tank; Confirmation samples analyzed for TPH-d, EPA 8010 for halogenated solvents, BTEX, and EPA 7421 total Pb. Low levels TPH-d in three samples and low levels toluene in two samples. ND in all other samples.
35	ORUM 035	105	REMOVED 1993	MAINT	1945	1,000	--	15*20*15	3	2000 closure report from ODEQ	North of northeast corner of building; diesel; ND in all three samples.
36	ORUM 036	106	REMOVED 1993	MAINT	1945	10,310	--	Not Reported	4	No Further Action recommended by contractor	South of southwest corner of building; former diesel fuel #2 tank. Confirmation soil samples were analyzed for TPH, EPA 8010 for halogenated solvents, BTEX and total Pb. Results show ND in all samples collected.
37	ORUM 037	115	REMOVED 1993	MAINT	1945	10,310	--	Not reported	2	2000 closure report from ODEQ	Heating oil tank (possibly Bunker C) located east of 115. ND in both samples collected.
38	ORUM 038	117	REMOVED 1993	MAINT	1945	10,310	--	Not Reported	4	No Further Action recommended by contractor	Northwest of Building 117, former heating oil tank. Confirmation soil samples were analyzed for TPH, EPA 8010 for halogenated solvents, BTEX and total Pb. Results show ND in all samples collected.
39	ORUM 039	486	REMOVED 1993	AMMO	1945	25,049	--	8*18*15.5	4	2000 closure report from ODEQ	North of Building 486; heating oil (possibly Bunker C); ND in all four samples collected.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
40	ORUM 040	130	REMOVED 1993	AMMO	1945	1,000	--	8*13*8	3	2000 closure report from ODEQ	West of Building 130; former diesel tank. In one sample there was an initial HCID detection, but ND upon fractionation; ND in remaining two samples.
41	ORUM 041	Airport	REMOVED 1992	ARPRT	1945	10,310	--	8*13*7	6; 3	ODEQ has decommissioning documentation, recommends no further action (stored heating oil – exempt)	South of airstrip; conflicting accounts on whether this was a gasoline or a diesel tank. In 1992 during the tank removal, six samples collected and analyzed for TPH-g, BTEX and Lead. Three samples detected ~50 ppm TPH-g. Additional PCS was removed and the site was closed via Nov. 4, 1992 ODEQ letter. During the 2000 investigation Dames & Moore identified the tank as former diesel tank, collected three samples and analyzed them for NW TPH-HCID. Results were ND.
42	ORUM 042	Fuel Yd	REMOVED 2000	Site 73 Diesel Fuel Spill Location	1984	50,750	--	85*50*20	6	2000 removed and tested AGI show compliance with ODEQ Soil Matrix Cleanup criteria	UST 42 & 43 were removed in the same excavation. They were located north of Building 6, at Site 73. Eleven confirmation samples were collected; six for the tank excavations and five for the associated pipeline

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
43	ORUM 043	Fuel Yd	REMOVED 2000	Site 73 Diesel Fuel Spill Location	1984	50,750	--	85*50*20	6	2000 removed and tested AGI show compliance with ODEQ Soil Matrix Cleanup criteria	excavation leading to the dispenser island, and analyzed for TPH-HCID, all excavation samples were also fractionated for TPH-d and TPH-g. Results indicate ND for all confirmation soil sampling. (AGI Technologies, 2000)
44	ORUM 044	5	REMOVED 1992	Orig. Sites 23 and 24; became a part of Site 42	1948	500	--	Not Reported	Not Reported	Requires further action after Bldg 5 is removed	Former waste oil tank; samples were analyzed for TPH, BTEX, PCBs, VOCs, and TCLP metals. Approximately 65 cubic yards were removed, however due to accessibility issues contamination was left in place under the building 5 and around the vehicle wash rack. See Section 4.4.1 for further information.
45	ORUM 045	10-Sep	REMOVED 1992		1942	1000	--	Not Reported	2	ODEQ letter states No Further Action required - Nov 4, 1992	Former waste oil tank; two confirmation soil samples were collected after excavation of the tanks and analyzed for TPH (EPA method 8015 modified), BTEX, PCBs and TCLP metals. Low levels of barium were detected, all other metals and all other analytes were ND.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
46	ORUM 046	24	REMOVED 1992	MAINT	41	140	--	Not Reported	2	ODEQ letter states No Further Action required - Nov 4, 1992	Former gasoline tank; two excavation bottom confirmation samples were collected and analyzed for TPH-g, BTEX and Lead. TPH-g was detected at 140 and 144 ppm, above the established 80 ppm clean up. BTEX and Lead were ND. The additional PCS was removed and site was closed via Nov. 4 1992 ODEQ letter.
47	ORUM 047	9-160	REMOVED 1993	AMMO	1950	110	--	5*6*2	3	2000 closure report from ODEQ	At SW corner of Building 160; gasoline; initial HCID detection of diesel range - ND upon fractionation DRO analyses; ND in remaining samples.
48	ORUM 048	135	REMOVED 1993	AMMO	1948	110	--	5*8*3.5	3	2000 closure report from ODEQ	At SE corner of Building 135; gasoline; ND in all three samples.
49	ORUM 049	133	REMOVED 1993	AMMO	1946	110	--	Not Reported	4	2000 closure report from ODEQ	South of Building 133; gasoline; ND in all eight samples.
50	ORUM 050	133	REMOVED 1993	AMMO	1943	110	--	Not Reported	4	2000 closure report from ODEQ	SW of Building 133; former gasoline tank; confirmation soil samples collected and analyzed for HCID were ND.
51	ORUM 053	51	REMOVED 1993	ADMIN	1945	1,000	--	Not Reported	4		Former diesel fuel tank, confirmation soil samples were analyzed for TPH, EPA 8010 for halogenated solvents, BTEX and total Pb.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
52	ORUM 054	104	REMOVED 1993	MAINT	1945	1,000	--	10*15*7	3	2000 closure report from ODEQ	NE corner of Building 104 (foundation); diesel; confirmation soil samples analyzed for HCID. ND in all three samples.
53	ORUM 055	448	REMOVED 1993	AMMO	1945	1,000	--	12*18*7	4	2000 closure report from ODEQ	South of the foundation remains of Building 448; diesel; ND in all four samples.
54	ORUM 056	656	REMOVED 1992	CHEM	1984	1,000	--	--	--		Former Laboratory Rinsate tank; found empty during removal, no petroleum was thought to have ever been stored in this tank. No visual or olfactory signs of contamination were found during excavation. Tank was removed and replaced with an underground holding tank.
55	ORUM 074	617	REMOVED	AMMO	1945	unk	--	--	--		Historical record unclear if tank held gasoline or diesel fuel #2. Tank is estimated to have been removed between 1989-1995, though a record of removal was not found. 1989 inventory displays tank as inactive and not used since 1984; the 1995 UST investigation report Table A-1 in Appendix A, displays tank as recently removed.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
56	ORUM 075	457	REMOVED 1992	AMMO	1950	4,000	--	10*17*7	4	ODEQ letter states No Further Action required - Nov 4, 1992	North of Road G, across from Building 457; unknown contents thought to contain either gasoline or diesel. Confirmation samples analyzed for TPH-g, EPA 8010 for halogenated solvents, BTEX, and EPA 7421 total Pb. Low levels of toluene in one sample and low levels of lead in all four samples detected, ND in remaining samples.
57	ORUM 077	419	REMOVED 1993	AMMO	1945	500	--	14*5*5*6	4	2002 closure report ODEQ	South of Building 419; diesel; ND in all four samples
58	ORUM 078	654	Unknown	CHEM	1982	unk	--	--	--		UST 58 has been removed. 1995 UST investigation report, Table A-1 in Appendix A, states this tank was used for the storage of "chemical decon" and is listed as "active." This table also lists UST 95 as being ORUM 078, suggesting this is the same tank.
59	ORUM 080	Old Fuel Yd	REMOVED 1993	Site 43 Former Gas Station-Possible UST locations	1945	3,000	--	Not Reported	2	No Further Action recommended by contractor	North of Building 53; diesel; D(x) at concentration of 75 ppm, well below 500 ppm cleanup level; ND in other sample.
60	ORUM 081	Old Fuel Yd	Not Present or Removed	Site 43 Former	1945	3,000	--	--			A soil gas survey conducted as a part of the 1995 UST

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
61	ORUM 082	Old Fuel Yd		Gas Station-Possible UST locations	1945	3,000	--	--			investigation indicated that only trace concentrations of benzene, toluene, xylenes, and/or TVHCs at 11 locations were detected. Results reflect either local surface spillage of oil or fuel, or USTs located here did not leak sufficient quantities.
62	ORUM 083	Old Fuel Yd			1945	3,000	--	--			
63	--	27	REMOVED 2006	ADMIN	1980s	500	--	--	--		There is confusion as to its size, location, and use of UST 63. In the 1989 UST inventory this tank is listed as a sewage tank at Building 457. As noted in the 1995 UST Investigation report, Table A-1 in Appendix A, this tank was used for the storage of "battery acid" and is listed as "active," but no mention is made of this tank in the body of the report. In 2006, administrative email correspondence exists in the public record regarding the removal of a 500-gallon battery acid tank at Building 27, but makes no mention of this tank as "UST 63". It is assumed the tank removed is UST 63.
64	--	84	Not Present or Removed	ADMIN		900	--	--	--		Results from geophysical survey conducted during UST Investigation show no presence of UST 64.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
65	--	Fuel Yd	Not Present or Removed	ADMIN		800	--	--	--		During 1990 Enhanced Preliminary Assessment, it was reported that UST 65 was located west of USTs 42 and 43. Results from geophysical survey conducted during UST Invest show no presence of UST 65.
66	--	7	Removed	Site 42 Former UST locations ADMIN AREA	1950s	700	--	--	59		A soil gas survey conducted as a part of the 1995 UST investigation indicated that only trace concentrations of benzene, toluene in three locations and TVHCs in nine locations were detected. Results reflect either local surface spillage of oil or fuel or USTs located here did not leak sufficient quantities;
67	--	7	Removed		1950s	10,500	--	--			
68	--	7	Removed		1950s	10,500	--	--			
69	--	10	Removed		1950s	10,000	--	--			
70	--	Near D Street	Removed		1950s	10,000	--	--			
71	--	Near D Street	Removed		1950s	10,000	--	--			
72	--	Near D Street	Removed		1950s	10,000	--	--			
73	--	Near D Street	Removed		1950s	10,000	--	--			
74	--	Near D Street	Removed		1950s	10,000	--	--			
75	--	Near D Street	Removed		1950s	10,000	--	--			
76	--	Near 77	Not Present or Removed	ADMIN	1950s	600	--	--	16		Geophysical and soil gas survey for USTs 76 and 77 conducted

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
77	--	Near 77	Not Present or Removed	ADMIN	1950s	800	--	--			during the UST investigation indicate USTs unlikely present at this location. Trace volatiles detected in soil gas samples, however, not indicative of a point source.
78	--	28	Not Present or Removed	ADMIN	1950s	500	--	--	--		1995 UST investigation indicates UST 78 is an above ground tank. The 1992 Field Sampling Plan by Dames and Moore states that around 1982 an AST holding oil for road application was removed; no record exists of this removal. It also states that the AST was replaced with the boiler blow-down tank listed in the 1995 report. The current status of this AST is unknown, as it is not listed in the most recent AST survey (Table 22).
79	--	54	Not Present or Removed	ADMIN	1950s	1,000	--	--	16		Geophysical and soil gas survey conducted during UST investigation detected strong anomaly which could be a UST present. Trace volatiles were detected; however, no significant soil contamination present to indicate the possible UST as a source of contamination.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
80	--	53	REMOVED 1993	ADMIN	1950s	1,000	--	Not reported	20		Trace volatiles detected in soil gas samples during UST investigation, not indicative of UST having been a contaminant point source.
81	--	52	REMOVED 1993	ADMIN	1950s	1,000	--	--	10		Trace volatiles detected in soil gas samples during UST investigation, not indicative of UST having been a contaminant point source.
82	--	36	REMOVED 1993	ADMIN	1950s	800	--	--	19		Trace volatiles detected in soil gas samples during UST investigation, not indicative of UST having been a contaminant point source.
83	--	18	REMOVED 1993	ADMIN	1950s	1,000	--	--	--		1995 UST investigation indicates UST 83 is the same as UST 05.
84	--	5	Not Present or Removed	ADMIN	1950s	3,000	--	--	18		Geophysical and soil gas survey for UST 84 conducted during the UST investigation indicate UST unlikely present at this location. Trace volatiles detected in soil gas samples, however, are not indicative of a UST as a point source.
85	--	31	Not Present	ADMIN	1950s	500	--	--	--		1995 UST investigation indicates UST 85 is a steam condensation tank.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
86	--	Near 66	Not Present or Removed	ADMIN	1950s	3,000	--	--	24		Geophysical and soil gas survey for UST 86 indicate UST is unlikely to be present. Steel underground vault found. Trace volatiles detected in soil gas samples, however, are not indicative of a UST point source.
87	--	Deact, Furnace Building 52/206	REMOVED 1994	AMMO	1950s	1,000	--	18*12*10	7		Four of seven samples detected TPH below regulatory limits. No Further Action required.
88	--	Between Blocks J and G	Not Present or Removed	AMMO	1950s	500	--	--	60 soil gas samples collected at two sampling grid		Geophysical and soil gas survey was conducted during the UST investigation. Results for geophysical survey indicate USTs unlikely present in reported location. Three depressions and buried concrete were observed south of reported UST locations. Two sampling grids set up around reported location and surface depressions. Five of the 60 soil gas samples detected trace concentrations of benzene, toluene and TVHCs. Concentrations are not indicative of widespread contamination from a UST point source.
89	--	Between Blocks J and G	Not Present or Removed	AMMO	1950s	500	--	--			
90	--	Between Blocks J and G	Not Present or Removed	AMMO	1950s	500	--	--			

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
91	--	Explosive Washout	Not Present or Removed	AMMO	1950s	250	--	--	20		Geophysical and soil gas survey was conducted during the UST investigation. Results for the geophysical survey indicate UST is unlikely present. Trace volatiles detected at 3 of the 20 soil gas samples collected. Concentrations are not indicative of widespread contamination from a UST point source.
92	--	486	REMOVED	AMMO	1950s	1,000	--	--	--		The UST investigation report has UST 92 as inactive and UMCD had determined it to be removed. Dames and Moore therefore did not include it in the investigation. No records were found documenting the removal of this UST, though according to UMCD officials, the tank is either inactive or removed.
93	--	Explosive Washout	REMOVED 1995	AMMO	1950s	600	--	Not Reported	4	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	PCS not encountered during UST removal. ND in all confirmation samples.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
94	--	433	REMOVED 1995	MAINT	1950s	500	--	Not Reported	3	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	During the 1995 tank removal by Foss Environmental, Tank 94 turned out to be a blow-down vessel associated with a boiler system. The vessel and associated PCS was removed. ND in all confirmation samples.
95	--	654	---	CHEM	1960s		--	--	--		The 1995 Underground Storage Tank Investigation Report Table A-1, Appendix A indicates UST 95 is ORUM 78. This ORUM number is also listed for UST 58, suggesting the two tanks are the same.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
96	--	Airport	REMOVED -	ARPRT			--	--	1 (tank content)		Tank 96 was discovered in 1992 during a field investigation adjacent to the former airfield. No previous information was found in the records. It appeared to be associated with a water pressure tank. Odorless, colorless liquid was found in the tank, and was sampled for VOAs, BNA, metals, Pesticides, PCBs, TPH, and nitrate/nitrite. Results found elevated concentrations of iron, lead, and manganese. Investigation recommended tank be cleaned out and closed. Current status of tank is unknown, but according to UMCD officials, this tank is either inactive or removed.
97	--	433	REMOVED 1995	MAINT		165	--	40*20*21	6	ODEQ has decommissioning documentation, recommends No Further Action (stored heating oil – exempt)	A former condensate "blow-down" tank, it was exposed at surface and installed vertically in the ground with no bottom. Visible oily soil and sludge were revealed in the excavation. 250 cubic yards of soil were removed. Results for excavation confirmation soil samples ORTPH-HCID were ND. Excavation was backfilled with clean material.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
98	---	486	REMOVED 1995	AMMO			---	---	2		UST 98 was a sump in the floor of building 486. Sludge in sump was analyzed and results detected 23 metals, nitrate/ nitrite, TPHs, three TCL Pesticides, one PCB and low levels of one explosive constituent.
99	---	113	Not Present or Removed	AMMO			---	---	20		Geophysical and soil gas survey was conducted during the UST investigation. Results for the geophysical survey indicate UST unlikely present. Trace volatiles detected at 2 of the 20 soil gas samples collected. Concentrations are not indicative of widespread contamination from a UST point source.
100	---	29	Inactive, Not Present or Removed	ADMIN			---	---	---		No documentation on the tank installation or removal was found. During the UST investigation, no surficial evidence exists of a present or former tank. According to UMCD officials, this tank is either inactive or removed. See Section 4.4.2 for further details on UST 100.

UST No.	ORUM Tank ID[a]	Building No. or Area	Current Status	Locale	Year Install	Est. Vol (gal)	Leak Test	Excavation Dimensions (ft)	Samples	Closure/ Status	Notes
101	---	419	Unknown	AMMO			---	---	3		Not an actual tank, but a 1-inch pipe that ran from Building 419 out 50 feet, which was filled with oil from a boiler located within the building. Three soil samples collected from three borings did not detect any VOA, BNA or TPHs. NFA is necessary.
102	---	S. of Building 23	REMOVED 1993	ADMIN		12,000	---	---	29 soil gas, 10 soil samples from 3 borings		Significant concentrations of TVHCs and toluene detected in one soil gas sample SE of the tank and a ubiquitous presence of contaminants in remaining samples. Contamination is shallow, indicating it is not from a leaking tank. See Site 74 and Section 4.4.2 for further information.
NA	NA	Airport Runway Tank	REMOVED 1992	Airport Runway		500	---	---	4		Former diesel tank; no field evidence of leak. Confirmation samples analyzed for TPH-g, EPA 8010 for halogenated solvents, BTEX, and EPA 7421 total Pb. Low levels of Pb detected in one sample, ND in remaining samples.

Notes: [a] Tanks were assigned ORUM numbers in the 1989 *Underground Storage Tank Inventory*. More recent documents use the UST numbers.

Refer to Figures 7 & 8 Appendix G for approximate locations.

ADMIN = Administration Area; MAINT = Maintenance Area; AMMO = Ammunition Storage Areas;

CHEM = Chemical Agent Storage Areas; ARPRT = Airport; FUEL YD = Fuel Yard,

P = Passed; F = Failed; I = Inconclusive, ODEQ = Oregon Department of Environmental Quality

4.4.2.2 Oil-Water Separators

No oil-water separators are currently in use at UMCD. Oil-water separators installed on-site include: K Block refueling station, Building 5, and the Motor Pool. The previous uses of oil-water separators are described below *(*UMCD Personal Communication 2009-10*).*

K Block Refueling Station

The K Block contains an oil-water separator that is still present on site but was not used. The Refueling Station at K Block is located northeast of Building 656, and supports vehicles and equipment involved in transporting munitions to the demilitarization facility operations. The refueling facility consists of a sloping concrete pad where fuel transfer operations occur. There are no fuel tanks or fuel storage at the refueling station; all fuel transfers are accomplished via tanker truck. The concrete pad slopes to a drainage inlet. Previously, liquids entering the drainage inlet flowed by gravity to a buried oil-water separator, located northwest of the fueling pad. This previously used oil-water separator was designed to operate at a maximum flow rate of 120 gallons per minute (gpm) and provide storage for 500 gallons of removed oil. The system was designed with secondary containment to accommodate the maximum total system capacity. Oil level in the oil chamber was indicated locally at the oil-water separator. A manhole with a watertight cover provided access to the oil storage compartment to facilitate periodic removal of accumulated waste oil. After removal of the oil, wastewater from the oil-water separator drained to a storage tank and finally to a plastic leaching chamber *(*U.S. Army CMA 2004*).*

Vehicle Maintenance Shop

The previous use of an underground oil-water separator located south of Building 5 at the Vehicle Maintenance Shop consisted of a three-chambered tank that collected wash water from the steam-cleaning bay inside of the building. The floor drain was equipped with a basket that trapped the majority of solids. Wash water flowed to the oil separator, where further settling of solids occurred and oil was removed from the effluent. This material remained in the waste oil compartment until it was pumped out for off-site disposal. The tank was cleaned approximately every year or year and a half. The outlet from the separator was believed to drain into the storm drain. This oil-water separator UST is currently present at UMCD but is no longer in use *(*U.S. Army CMA 2004*).*

Table 20. Most Recent Underground Storage Tank Inventory (9/2002)

Location	Tank ID	Material Stored	Vol (gals)	Tank Material	Tank Size	Secondary Containment	Overfill Protection	Corrosion Protection	Pressure Testing	Leak Detection
Bldg. 655; K-Block	A655	Diesel	4,000	Fiberglass	6’ 3” (dia.) x 19’ 9”	Double-walled	Locking cap, 20-gal spill container and overfill prevention valve.	N/A	Annual	Leak detection monitoring in annular space; auto gauging.
UMCDF (MDB)-regulated	OIL-TANK-101	Diesel	4,000							
UMCDF (ECF)-regulated	ECF-TANK-101	Diesel	550	Fiberglass	Unk	Double-walled	Locking cap, 20-gal spill container and overfill prevention valve.	N/A	Annual	Leak detection monitoring in annular space; auto gauging.
K-Block-not used	Oil-Water Separator				Not Used					
Bldg. 5 - not used	Oil-Water Separator			Steel	Not Used	System is three-chambered unit. Oil in wash water is trapped in waste oil compartment and pumped out periodically.	Oil-free water downstream of oily waste separator flows to storm drain.			

4.4.2.3 Above Ground Storage Tanks (ASTs)

AST compliance programs are conducted under U.S. Army regulation 200-1; Federal requirements including 40 C.F.R. Parts 100, 112, and 116; and Oregon State oil pollution prevention regulations. A historic map of the UMCD shows the approximate location of 50 former ASTs (Appendix G, Figure 6). A second document further describes the detail of 38 historic ASTs at the UMCD and is presented in Table 21. Currently, there are 16 active ASTs at UMCD. Most of the tanks are used for storage of propane, diesel fuel, fuel oil, and used oil. Table 22 shows the most recent AST inventory as of September 2002, includes information from the Spill Prevention, Control, and Countermeasures (SPCC) Plan, and tabulates the location, size, and contents of these ASTs. Figure 8 in Appendix G shows the location of the 16 active ASTs. These ASTs are managed in compliance with the installation SPCC Plan and applicable regulations *(*Earth Technology Corporation 1995*).*

Table 21. Partial Record of Historic Above Ground Storage Tank (AST) Inventory

Location	Quantity	Volume (Gallons)	Description
Building 2	1	1000	diesel tank
Building 5	1	280	oil tank
Building 5	1	250	diesel tank (steam cleaner)
Building 18	2	285	diesel tanks (connected together)
Building 24	1	20	gasoline tank (well house)
Building 24	1	50	propane tank
Building 27	2	500	propane tanks
Building 28	1	1000	propane tank
Building 37	1	1000	propane tank
Building 52	1	500	propane tank
Building 58	1	285	diesel tank (generator)
Building 419	1	1000	propane tank
Building 422	1	285	diesel tank
Building 433	1	500	propane tank
Building 612	1	500	propane tank
Building 621	1	500	propane tank (well house)
Building 653	1	285	diesel tank (generator)
POL Yard	1	500	propane tank
POL Yard	1	1000	propane tank
5th Ave Housing	17	285	diesel tanks

Source: UMCD Archive Document, 1994.
Refer to Figures 6, 7, & 8 Appendix G for approximate locations

An inventory of ASTs used for storage of petroleum products at UMCD was conducted in July 2001. Sixteen ASTs are located throughout the facility, most of which are in the Administration Area. Table 22 provides the most recent AST inventory, including those used for storing diesel fuel, fuel oil, used oil, and motor oil. The ASTs range in size from 275 gallons to 15,000 gallons. UMCD utilizes above ground fuel storage tanks throughout the facility for storage of diesel fuel, gasoline, heating oil, and other petroleum products. The five AST categories are: supervaults, self-contained tanks in generator units, large volume double-walled tanks, steel tanks in containment structures, and older steel tanks on supports with no containment. Miscellaneous POL storage containers include drums and mobile tanker trucks. Several of the older steel tanks are certified empty and are scheduled to be removed *(*U.S. Army CMA 2004*).* This action is still pending.

Supervaults

There are three 1000-gallon Supervault tanks at the facility; two are located in the Administration Area, and one is located in the I Block. A Supervault containing fuel oil is located east of Building 28, the steam heating plant. A Supervault containing used motor oil is located south of Building 37. The used oil is burned in the boiler-steam heating plant (Building 37) to supply heat to Building 4. The third Supervault is located east of Building 457 in the I Block. It contains fuel for the backup diesel generator. The Supervaults are double-walled tanks, with a steel inner tank encased in 6 inches of concrete and enclosed by a steel secondary containment tank. The tanks are located on concrete pads to provide stability. The secondary containment tank exceeds 110 percent of the primary tank volume, so no external secondary containment is necessary. The tanks are equipped with leak detection tubes, level gages, and overfill pans surrounding the fill pipes *(*U.S. Army CMA 2004*).*

Generator Tanks

UMCD utilizes five self-contained diesel powered backup generators. These stand-alone power generators have diesel fuel tanks ranging in size from 500 gallons to 650 gallons. Two generators are located in the Administration Area, near Buildings 32 and 57. The third generator provides backup power for water wells 6 and 7 and is located near Building 618. Two other generators at the UMCDF and within the K Block (near Building 660) are also present in the UMCD. The generators are situated on concrete pads with protective barriers where necessary. The fuel tanks are located inside the generator housing and are equipped with locking fill pipes. Another generator tank is used to fill the day tank for the emergency generator, and consists of a double-walled, 10,000-gallon diesel AST located in the K Block, northwest of Building 660, the security building at the entrance to the K Block. The tank is constructed of two steel tanks with 4 inches of concrete between them, and is equipped with a locking fill pipe. The AST feeds by gravity through a strainer and solenoid valve to a day tank for the emergency generator; it does not have a pump for fueling directly from the tank. The generator uses very little fuel; consequently, it is rarely necessary to refill the tank *(*U.S. Army CMA 2004*).*

Large-Volume Double-walled Tanks

There are three large-volume, double-walled ASTs; two that are used for vehicle fueling at UMCD, and a third that is used to fill the day tank for the emergency generator. The fueling area at Building 6 in the Administration Area is a fenced, locked fuel yard that contains a 10,000-gallon diesel AST and a 15,000-gallon gasoline AST, which were both installed in 2000. The tanks are seated on a concrete pad with protective barriers and are equipped with shut-off valves and reverse flow valves to prevent overfill. Underground piping with cathodic protection leads from the tanks to the fuel pumps at Building 6. The fuel pumps are not manned, but can only be activated with access cards.

A similar double-walled, 10,000-gallon diesel AST is located in the K Block, northwest of Building 660, the security building at the entrance to the K Block. The tank is constructed of two steel tanks with 4 inches of concrete between them and is equipped with a locking fill pipe. The AST feeds by gravity through a strainer and solenoid valve to a day tank for the emergency generator; it does not have a pump for fueling directly from the tank. The generator uses very little fuel; consequently, it is rarely necessary to refill the tank *(*U.S. Army CMA 2004*).*

Steel Tanks in Containment Structures

Two fuel oil ASTs are located outside of Buildings 401 and 403 in the standard magazine area, which is north of the administration area. These tanks are used to supply heating oil to the buildings currently being utilized by Washington Demilitarization Company Operations. The tanks are nearly identical and are constructed of single-walled steel with a 2000-gallon capacity, an overfill containment pan on the fill pipe, and a level indicator gauge. The tanks are seated in 2,240-gallon capacity, curbed, concrete containment structures with no drainage outlets. There is no potential for spills or discharges from the containment area and any precipitation that collects will evaporate before it overflows the structure *(*U.S. Army CMA 2004*).*

Steel Tanks on Supports

Five single-wall steel tanks without containment structures are located at UMCD. These tanks are all relatively small (between 275 and 300 gallons) and elevated on supports so spills or leaks can be easily detected. The tanks are described below.

- A 275-gallon diesel fuel tank is located outside the south side of Building 5. This tank supplies fuel to the steam cleaner located inside the building. A major spill from this tank would drain to the underground oil-water separator at Building 5. The underground oil-water separator is no longer in use. A spill kit is located inside the building for cleanup of leaks and/or overfills.
- A 300-gallon tank containing motor oil is located inside Building 5. In the event of a tank failure, the contents would flow into the floor drain in the steam-cleaning bay and into the oil-water separator. A spill kit is available inside Building 5 for cleanup of leaks and/or overfills.
- A 275-gallon diesel tank is located next to Building 58 (generator shed located southwest of Building 5) and is used to supply fuel to the Administrative Area backup generator. A spill kit is available inside the adjacent Building 5 for cleanup of leaks and/or overfills.
- A 275-gallon diesel tank is located near Building 653 (backup generator for Building 656, K-Block laboratory). The tank is on a concrete pad and has a locked fill pipe. A spill kit is located inside Building 656.
- The single-walled tanks listed above do not have secondary containment structures to adequately hold the contents of the tank. Consequently, weekly inspections are conducted and spill kits and absorbent materials are readily available but these would only contain a very small spill *(*U.S. Army CMA 2004*).*

Boiler Day Tank

A 100-gallon steel single-wall day tank provides fuel directly to the boiler in Building 37. The tank is located on the south side of the building. Relief and overfill protection are provided by return piping from the tank to the 1,000-gallon Supervault supply tank *(*U.S. Army CMA 2004*).*

Miscellaneous Petroleum, Oil, and Lubricants (POL) Storage

Petroleum products primarily related to vehicle servicing and maintenance are stored in steel drums in several locations in the administration area at UMCD. Table 23 provides a complete inventory of POL storage and containment measures.

Building 5 maintains an inventory of motor oil, hydraulic oil, gear oil, lubricating oil, transmission oil, grease, and used oil. Most of the products and waste materials are stored in 55-gallon drums. Figure 4.1 in the Hazardous Waste Management Plan provides a drawing of Building 5 showing POL storage locations. The drums are located inside the building on spill skids. Spill kits are available in the building for cleanup of minor leaks and spills. Any larger spills, such as a complete drum failure, would be contained within the building and would eventually drain to the steam-cleaning bay and finally into the oil/water separator *(*UMCD Archive Document 2005*).*

Building 82 (POL storage building) is a small shed located outside the southwest corner of Building 5. It is currently used to store empty hydraulic oil and motor oil drums. Any product drums stored in the building will be stored on spill skids. Spill kits are maintained in Building 5 for any minor spills on the concrete floor of Building 82.

Motor oil may be stored in Building 6, generally in two 55-gallon steel drums. Empty drums are transferred to Building 5 or 82.

Two mobile tanker trucks, each supporting a 1000-gallon diesel fuel tank, are used to fuel stationary equipment, agent transport equipment, and other equipment that cannot be filled at Building 6. The two mobile tanker trucks are stored across from Building 11. Spill kits are available on each truck. There are also five diesel portable double-walled steel tanks. These portable tanks have indicators that show if there is a leak between the double walls and are kept in the K Block for heating the igloos *(*U.S. Army CMA 2004*).*

Table 22. Most Recent Above Ground Storage Tank Inventory (9/2002)

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 5 Motor Pool, Vehicle Maintenance Facility	Steel, single wall	275	Diesel	No containment tank or structure. Will drain to triple-chambered oil-water separator. Spill kit inside Bldg. 5.	N/A	None	Tank outside, south of Bldg. 5. Steel tank on supports.
Bldg. 5	Steel, single wall	300	Motor Oil	Tank inside building. Will drain to floor drain in steam cleaning bay to oil-water separator. Spill kit inside Bldg. 5.		None	
Bldg. 6 Fueling Facility	Steel, double wall	10,000	Diesel	Double wall tank on concrete pad. Spill kit in Bldg. 6.		Shut off valve on line to prevent overfill, reverse flow valve. Emergency shutoff on pump.	Inside locked fenced area. Protective barriers to prevent collision.
Bldg. 6 Fueling Facility	Steel, double wall	15,000	Gasoline	Double wall tank on concrete pad. Spill kit in Bldg. 6.		Shut off valve on line to prevent overfill, reverse flow valve. Emergency shutoff on pump.	Inside locked fenced area. Protective barriers.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg 457, I-Block	Steel, double wall, concrete (Supervault)	1,000	Fuel Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅ 1240 gal.)	Has a 16-gallon overfill pan that encapsulates fill pipe.	Fuel for backup diesel generator.
Bldg. 28 Steam Heating Plant	Steel, double wall, concrete (Supervault)	1,000	Fuel Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅ 1240 gal.)	Has a 16-gallon overfill pan that encapsulates fill pipe.	Located on concrete pad east of Bldg. 28. Fuel for boiler to provide steam heat to Bldg. 11.
Bldg. 32 Operations Center	Steel tank supports generator	650	Diesel	Self contained diesel generator above fuel tank. On concrete pad with protective barriers. No containment structure. Locking fill pipe access through generator panel access.		None	Tank for power generator located west of Bldg. 32.
Bldg. 37 Boiler-steam heating plant	Steel, double wall, concrete (Supervault)	1,000	Used Motor Oil	Dual-walled tank. Primary steel tank encased in 6 inches of concrete inside a steel secondary containment tank. Leak detection tube and level gauge.	Over 110% (≅ 1240 gal.)	Overfill pan that encapsulates fill pipe.	Tank stores used oil generated at the maintenance facility and supplies fuel for the steam heating plant at Bldg. 4.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 37 Boiler-steam heating plant day tank	Carbon Steel	100	Used Motor Oil	Boiler day tank relief valve discharges to 1,000 gal used oil storage Supervault on south side of building. Piping trench collection of spills is directed to concrete floor sump.		Relief valve to storage tank (1,000 gallon Supervault).	
Bldg. 57 Telephone Equip. Bldg.	Steel, contained in generator	500	Diesel	Self contained diesel generator above fuel tank. On concrete pad. No containment structure. Locking fill pipe access through generator panel access.			Tank for power generator, located east of Bldg. 57.
Bldg. 58	Steel, single wall	275	Diesel	None. Spill kit in Bldg. 5.	N/A	None	Outdoor fuel tank for backup generator in Bldg. 58.
Bldg. 401 Magazine Washington Demil Corp. Operations	Steel, single wall	2,000	Fuel Oil	Curbed concrete containment structure with volume of 2240 gallons. No drainage from curbed area.	Over 110% ≅ 2,240 gal	Overfill containment pan on fill pipe, level indicator gauge.	Tank outside on the east side of Bldg. 401.
Bldg. 403 Magazine Washington Demil Corp. Operations	Steel, single wall	2,000	Fuel Oil	Curbed concrete containment structure with volume of 2240 gallons. No drainage from curbed area.	Over 110% ≅ 2,240 gal	Overfill containment pan on fill pipe, level indicator gauge.	Tank outside on the east side of Bldg. 401.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Bldg. 656/653 K Block Monitoring Branch generator building	Steel, single wall	275	Diesel	Single wall steel tank on supports. Concrete pad. No containment structure. Spill kit in Bldg. 656.		Lock on fill pipe. No overfill pan.	Tank for generator in Bldg. 653, backup power for Bldg. 656.
Bldg. 660 Security Bldg. inside entrance to K-Block	Steel, dual wall, concrete lined	10,000	Diesel	Double walled concrete lined tank on concrete pad.		Lock on fill pipe.	North of Bldg. 660. Fuel gravity feeds to the emergency generator tank feed pump in Bldg 660.
Between wells 6 and 7	Steel, contained in generator	540	Diesel	Self-contained diesel generator above fuel tank. On concrete pad. No containment structure. Locking fill pipes located below generator inside access panel.		None	Located west of Bldg. 618. Tank for power generator.
Mobile Tanker Truck	Steel tank on truck	1000	Diesel	Spill kit on truck.			Truck at vehicle storage facility- across from Bldg. 11.
Mobile Tanker Truck	Steel tank on truck	1000	Gasoline	Spill kit on truck.			Truck at vehicle storage facility- across from Bldg. 11.

Location	Tank Material	Volume (gallons)	Material Stored	Secondary Containment		Overfill Protection	Notes
				Type	Vol		
Five portable double-walled steel tanks	Steel tank	-	Diesel	Double walled.			Have indicators that shows if leaking between double walls. Kept in K-Block for heating igloos.

Refer to Figure 8 Appendix G for approximate locations

Table 23. Other Petroleum, Oil, Lubricant Above Ground Storage (9/2002)

Location	Material Stored	Volume (gallons)	Container Materials	Secondary Containment	Notes
Bldg. 5 Maintenance Shop, Southwest shop area	-Used Oil -Motor Oil -Hydraulic Oil -Gear Oil -Transmission Oil -Grease	10- & 55-gallon drums or 120-lb. buckets	Steel drums- liquids Buckets- grease	Drums are inside the maintenance building and stored on spill skids. Spill kits are maintained in the building for cleanup of minor spills.	Any spill or leak would occur on concrete and would remain inside Bldg. 5. Quantities may vary depending on maintenance activities, purchasing.
Bldg. 82 POL storage building	Empty drums of lubricating oil and hydraulic oil	55-gallon drum	Steel	Any product drums would be stored on spill skids or in plastic drum overpacks. Empty drums on concrete floor.	Located outside the SW corner of Bldg. 5.
Bldg. 6	Motor Oil	55-gallon drums	Steel	No spill containers	Empty drums are stored in Bldg. 5 or 82.

4.5 Polychlorinated Biphenyls

An initial inventory of transformers began with a June 1989 study in which all 239 of the transformers at UMCD were sampled and tested for PCBs. Analyses of dielectric fluids collected from the transformers were performed by two laboratories for each transformer. In cases where different analytical results were achieved by the two laboratories, the higher of the two values was reported. The dielectric fluid in 79 transformers was found to have a PCB concentration greater than 10 parts per million (ppm), EPA's PCB cleanup level for soil under the Toxic Substances Control Act (52 FR 10688, April 2, 1987). Although transformers with less than 50 ppm PCBs are considered non-PCB transformers, the report notes that maintaining transformers with less than 10 ppm PCBs is advantageous (e.g. spills of dielectric fluid with PCB concentrations <10 ppm are not likely to contaminate soil above the 10 ppm PCB cleanup level for soil) (Dames and Moore 1993c*).*

The Supplementary Remedial Investigation (SRI; report date 1993) identified 61 transformers (out of the 79 with PCB concentrations greater than 10 ppm) that were determined to be leaking or to have leaked in the past. The SRI field investigation included a field survey to observe transformer locations, soil sampling at each transformer site where leakage was known or suspected to have occurred, and wipe sampling collected from selected stained transformer pads and wooden frames. Results of the soil analyses indicated that only PCB 1260 was detected in five of the 63 soil samples; however, all detected concentrations were below the comparison criterion of 10 μg/g. Similarly, PCB 1260 was detected in the wipe samples. Seven of the 25 samples collected contained this contaminant, but all detected concentrations were below the comparison criterion of 0.1 $\mu g/cm^2$. Therefore, PCBs were not considered to be a concern at any of the sampled transformer locations. Additional information, including the location and dielectric fluid PCB concentration for each transformer, as of February 1992, can be found in Table 24 below *(*Dames and Moore 1993c*).*

Table 24. Transformers with PCB Concentrations Greater than 10 ppm

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
8	In Use	N 604	1X57	pole	5.0	7.0	Yes	06-19-89	20
18	In Use	611	1X82	pole	10.0	5.0	No	06-19-89	13
21	Replaced	Well #6	1X93	pole	25.0	20.0	No	06-19-89	56
22	Replaced	Well #6	1X93	pole	25.0	20.0	Yes	06-19-89	60
23	Replaced	Well #6	1X93	pole	25.0	20.0	No	06-19-89	51
24	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	98
25	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	68
26	Replaced	Well #7	1X97	frame	37.5	25.0	No	06-19-89	86
32	In Use	W 204	2X21	pole	10.0	14.5	Yes	06-19-89	13
40	Replaced	E 200	2X44	pole	10.0	10.5	Yes	06-19-89	58
42	Replaced	E 200	2X44	pole	10.0	10.5	Yes	06-19-89	365
46	Replaced	E 201	2X51	pole	25.0	20.0	Yes	06-19-89	634
48	Replaced	E 202	2X54	pole	10.0	10.5	Yes	06-19-89	96
50	Removed	200 Pier	2X67	pole	25.0	20.0	Yes	06-19-89	56
51	Removed	200 Pier	2X73	pole	25.0	30.0	Yes	06-19-89	265
58	Replaced	E 131	2X99	frame	37.5	31.0	Yes	06-19-89	244
59	Replaced	E 131	2X99	frame	75.0	50.0	Yes	06-19-89	400
62	In Use	E 122	2X112	pole	37.5	25.0	Yes	06-19-89	12
63	In Use	E 118	2X118	frame	15.0	23.0	Yes	06-19-89	15
64	In Use	E 118	2X118	frame	15.0	23.0	Yes	06-19-89	15

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
66	In Use	Substation	2X116B	pad	37.5	35.0	No	06-19-89	25
69	Replaced	E 116	2X122	pole	25.0	22.5	Yes	06-19-89	67
86	Removed	SW Pier 28	4X7	pole	15.0	16.0	Yes	06-20-89	330
89	In Use	E 457	4X33	pole	25.0	15.0	No	06-20-89	13
90	Replaced	S Well #3	4X39	pole	5.0	15.0	No	06-20-89	112
92	Removed	W Pier 32	4X47	pole	5.0	6.5	Yes	06-20-89	61
95	Replaced	NW 427	4X60	pole	5.0	7.5	Yes	06-20-89	69
119	Removed	W Pier 10	4X158	pole	5.0	12.0	Yes	06-21-89	132
123	Removed	W Pier 13	4X178	pole	5.0	12.0	Yes	06-21-89	239
124	Removed	N R-52	5X4	pole	1.5	3.5	Yes	06-20-89	222
136	Removed	SW 11	5X86	pole	10.0	15.0	No	06-20-89	16
137	Removed	SW 11	5X86	pole	10.0	15.0	No	06-20-89	15
141	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	174
142	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	133
143	Replaced	Swim Pool(38)	5X103	pole	25.0	25.0	Yes	06-20-89	158
156	Removed	NE 417	5X222/223	frame	25.0	30.0	Yes	06-21-89	137
157	Removed	NE 417	5X222/223	frame	15.0	16.0	Yes	06-21-89	80
158	Removed	NE 417	5X222/223	frame	25.0	30.0	Yes	06-21-89	173

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
159	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	140
160	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	250
161	Removed	Substation	5X495B	pad	50.0	37.0	Yes	06-21-89	150
162	In Use	E 493	5X493B	pad	50.0	30.0	No	06-21-89	20
163	In Use	E 493	5X493B	pad	50.0	30.0	No	06-21-89	21
166	Replaced	W 419	5X419B	pole	15.0	20.0	Yes	06-21-89	250
168	Replaced	W 419	5X419B	pole	15.0	20.0	Yes	06-21-89	210
175	In Use	N 54	5X54B	pole	10.0	15.0	Yes	06-20-89	12
177	In Use	W 33	5X283	pole	100.0	35.0	No	06-20-89	23
179	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	422
180	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	391
181	Replaced	M Substation	5X14B	floor	333.0	178.0	Yes	06-20-89	379
182	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	317
183	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	348
184	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	363
185	Replaced	M Substation	5X14B	floor	75.0	54.0	Yes	06-20-89	280

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
186	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	229
187	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	190
188	Replaced	M Substation	5X14B	floor	24.0	28.0	Yes	06-20-89	279
196	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	139
197	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	146
198	Replaced	Substation N 11	5XPDO	pad	25.0	26.0	Yes	06-20-89	182
200	Replaced	Substation	5X31B	pad	75.0	50.0	No	06-20-89	532
201	Replaced	Substation	5X31B	pad	75.0	50.0	No	06-20-89	436
202	In Use	Substation	5X31B	pad	75.0	50.0	No	06-20-89	19
203	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	633
204	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	143
205	Replaced	Substation	5X31B	pad	50.0	40.0	Yes	06-20-89	156
206	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	337
207	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	260
208	Replaced	Well #1	5X24B	floor	50.0	40.0	Yes	06-20-89	377
209	Replaced	Well #1	5X24B	floor	10.0	11.0	Yes	06-20-89	1348
210	In Use	Well #2	5X25B	floor	37.5	25.0	Yes	06-20-89	11
211	Replaced	Well #2	5X25B	floor	37.5	25.0	Yes	06-20-89	230

UMDA Number	Status 2/92	Location of Operation	Pole Number/ Building	Mount	Kilovolt-Ampere (kVA) rating	Volume (gallons)	Leaked	Dielectric Fluid Sampling Date	Dielectric Fluid PCB Concentration (ppm)
213	Replaced	Well #2	5X25B	floor	10.0	11.0	Yes	06-20-89	178
225	Removed	Parade Grounds	5XPG	Under-ground vault	25.0	20.0	Yes	06-20-89	160
226	Removed and replaced by above ground vault	W 2	5X2B	Under-ground vault	10.0	15.0	Yes	06-20-89	300
228	Removed and replaced by above ground vault	W 2	5X2B	Under-ground vault	10.0	15.0	Yes	06-20-89	309
229	Removed and replaced by above ground vault	N 15	5X15B	Under-ground vault	37.5	25.0	Yes	06-20-89	1105
231	Removed and replaced by above ground vault	NW 55	5X55B	Under-ground vault	25.0	20.0	No	06-20-89	17
237	Replaced	W Pier 15	7X3	pole	5.0	7.5	Yes	06-21-89	226

The Enhanced Preliminary Assessment (Dames and Moore 1990) reported that 25 transformers were found to have been taken off-line and were in storage in the Building 203 Hazardous Waste Storage Facility. All transformers stored in the building were found to contain PCBs in excess of 50 ppm. During a 1990 site reconnaissance, Dames and Moore observed appropriate use of containment and liners and no significant staining on the floor. In the 1993 Supplementary Remedial Investigation, it was stated that all units stored in the building had been removed and disposed of off-post according to regulatory requirements. The exact date that the 25 transformers were removed from Building 203 is not documented. Dames and Moore inspected Building 203 and collected a wipe sample from the only stain that was found. No PCBs were detected in the wipe sample. Therefore, PCBs are not expected to be a concern in this portion of Building 203 (Dames and Moore 1993c).

4.6 Asbestos-Containing Materials

An Asbestos Assessment Survey (Dames and Moore 1992a) was conducted to evaluate 289 buildings at UMCD with suspected asbestos containing materials (ACM). The survey results indicated that generally ACMs were in good condition and the risk of exposure to building occupants from ACM was low. Greater risk of exposure is expected for maintenance personnel who enter inactive buildings, or spaces not normally accessible.

Asbestos containing material was found in 121 buildings. Materials in 37 of these buildings were damaged greater than 10 percent, and in 15 additional buildings the damage was between 3 and 10 percent. Although 52 buildings included damaged or significantly damaged ACM, this material was predominantly located in unoccupied areas such as attic spaces, crawl spaces, or roofs. These areas were typically accessed only by maintenance staff.

Estimates of the cost to remove ACM was included in the 1992 report (Dames and Moore 1992a), and the cost to remove all known or assumed ACM was reported to be between $11.5 million and $22.75 million, based on individual unit costs. A decision algorithm developed as part of the survey was used to determine which buildings required asbestos abatement. Removal of ACM was recommended in 58 buildings. Since some of the areas included inactive buildings or areas that are not normally contacted, professional judgment was used by the inspectors to reduce the number of buildings to 32 (Dames and Moore 1992a).

In the years since the 1992 Dames and Moore Asbestos Assessment Survey was performed, some abatement and demolition activities have occurred (Dames and Moore 1992a). These asbestos removal activities are summarized in an Excel spreadsheet titled "Umatilla Chemical Depot Asbestos Inventory." The spreadsheet was created by UMCD personnel. The spreadsheet incorporates information from the 1992 survey as well as information pertaining to building demolitions and asbestos abatements since 1992. The information in the spreadsheet was field verified by UMCD personnel in September 2006. The spreadsheet identifies 40 buildings explicitly identified as having been demolished between 1992 and 2006 (dates for each building demolition are provided, if known, in the spreadsheet).

Comparison between UMCD's spreadsheet and the 1992 Dames and Moore Asbestos Assessment Survey shows generally good agreement (Dames and Moore 1992a). The 1992 survey effort omitted five buildings that are identified in the spreadsheet: Buildings 70, 438, 450, 454, and 681. Three of these (70, 438, 681) are reported in the spreadsheet to contain suspect materials which should be tested to confirm that they are ACM before disturbance. The other two buildings are considered low risk for ACM due to their age and construction (450 is a steel building constructed in 1984; 454 was constructed in 1998). The spreadsheet identifies the fire doors on the storage igloos as a suspect ACM. The fire doors were not inspected as part of the 1992 survey effort (Gillis 2006).

A visual site inspection at representative buildings for each major series (i.e. 100 series buildings, 200 series buildings, etc.) was conducted by USACE on September 22, 2009. A particular focus of the visit was to evaluate the condition of exterior ACM components of the buildings, such as cement asbestos board siding and asbestos containing roofing material.

Buildings in the 100 block are no longer in use and are in generally poor condition regarding paint, roofing, and siding. Strong winds occur regularly at the site, which tend to lift siding and roofing materials off of the buildings. Much of the siding and roofing is no longer on the buildings, such that there are holes in the roofing of some buildings. Some siding, roofing and debris were present around the 100 series buildings at the time of the site visit. From interviews with UMCD personnel, it was determined that in the past, two abatement projects have been performed in this area to remove blown-off roofing, siding, and debris from the ground. Another abatement project occurred in 2012 and the source for the debris, the 100 and 200 buildings, is in the planning stages for being demolished.

The 600 series buildings appeared to be abandoned and not well maintained. Building 608 was more closely inspected as part of the visual site inspection. Many of the windows were broken and the window caulking was deteriorated and scattered on the ground near the building. The window caulking is a suspect material that was not sampled in the 1992 survey *(*Dames and Moore 1992a*)*.

The rest of the buildings at UMCD appear to be more regularly used and in better condition. No further deterioration of exterior ACM was observed during the site visit.

4.7 Lead and Lead-Based Paint

A quantitative lead-based paint (LBP) survey was conducted at UMCD for the 1996 CERFA report. Lead-based paint was assumed to be present in buildings that were constructed prior to 1959. None of the storage igloos in Blocks A through K, the safehouses (700 series structures), or transfer depots (800 series structures) were included in the analysis for this CERFA report, as it was assumed that these structures were not painted. Former employees reported that the use of lead-based paint on interiors and exteriors of buildings ceased in the 1950s; therefore, lead-based paint would not likely be found on any building constructed after 1959 *(*Earth Technology Corporation 1994*)*.

A lead-based paint survey was conducted in 1996 at UMCD (Hart Crowser 1996). The survey results are summarized in Table 26 and 27 below. The survey tested painted surfaces in the interior and exterior of 246 buildings that were constructed before 1959. Generally, most buildings had at least one LBP surface, and most LBP surfaces were exterior. The survey noted chipped and damaged paint surfaces at interior and exterior locations for many buildings. The survey noted extensive weathering of LBP exterior surfaces, particularly on southern and western elevations of many buildings from sun exposure, as well as dust-laden winds which tend to damage peeling paint and cause it to fall to the soil adjacent to the buildings. Paint flakes were observed at the soil surface at many of these buildings. Soil was tested in 5 areas; 18 of 44 sample results were above 500 ppm lead which appeared to be limited to the first two inches of soil. A summary of lead soil data can be found below in Table 25, Soil Lead Data Report, and a summary of positive unsatisfactory condition for lead-based paint can be found below in Table 27 *(*Hart Crowser 1996*)*.

Table 25. Soil Lead Data Report (12/5/1996)*

Building	Sample Location	Sample Number	Subsample Number	Lead concentration (mg/kg)	Comment
9	8 ft. from bldg. 0-2 in. deep	9-8-1S	1	1100	0% moisture content, 2-point composite.
9	8 ft. from bldg. 0-2 in. deep	9-8-1S	2	910	Moisture content not measured. Duplicate.
30-A	0 ft. from bldg. 0-2 in. deep	30A-0-1S	1	400	5% moisture content.
53	0 ft. from bldg. 0-2 in. deep	53-0-1S	1	3800	8% moisture content.
53	0 ft. from bldg. 2-4 in. deep	53-0-2S	1	240	6% moisture content.
53	0 ft. from bldg. 2-4 in. deep	53-0-2S	2	280	6% moisture content. Duplicate.
53	5 ft. from bldg. 0-2 in. deep	53-5-1S	1	560	15% moisture content.
63	0 ft. from bldg. 0-2 in. deep	63-0-1S	1	140	9% moisture content.
63	0 ft. from bldg. 2-4 in. deep	63-0-2S	1	6.00	8% moisture content.
63	10 ft. from bldg. 0-2 in. deep	63-10-1S	1	17.0	7% moisture content.
63	5 ft. from bldg. 0-2 in. deep	63-5-1S	1	19.0	9% moisture content.
419	0 ft. from bldg. 0-2 in. deep	419-0-1S	1	590	7% moisture content.
419	0 ft. from bldg. 0-2 in. deep	419-0-1S	2	590	7% moisture content. Duplicate.
419	0 ft. from bldg. 2-4 in. deep	419-0-2S	1	95.0	7% moisture content.
486	0 ft. from bldg. 0-2 in. deep	486-0-1S	1	280	7% moisture content.
486	0 ft. from bldg. 2-4 in. deep	486-0-2S	1	64.0	11% moisture content.
486	10 ft. from bldg. 0-2 in. deep	486-10-1S	1	590	10% moisture content.
486	5 ft. from bldg. 0-2 in. deep	486-5-1S	1	4100	10% moisture content.
110	0 ft. from bldg. 0-2 in. deep	110-0-1S	1	1200	9% moisture content.
111	0 ft. from bldg. 0-2 in. deep	111-0-1S	1	20,000	9% moisture content. Paint chips, sand, and grit on floor.

Building	Sample Location	Sample Number	Subsample Number	Lead concentration (mg/kg)	Comment
111	3 ft. from bldg. 0-2 in. deep	111-3-1S	1	150	10% moisture content. 3-point composite.
111	3 ft. from bldg. 0-2 in. deep	111-3-1S	2	190	10% moisture content. Duplicate.
112	0 ft. from bldg. 0-2 in. deep	112-0-1S	1	2000	14% moisture content.
112	0 ft. from bldg. 2-4 in. deep	112-0-2S	1	210	5% moisture content.
112	10 ft. from bldg. 0-2 in. deep	112-10-1S	1	89.0	8% moisture content.
112	5 ft. from bldg. 0-2 in. deep	112-5-1S	1	240	6% moisture content.
113	0 ft. from bldg. 0-2 in. deep	113-0-1S	1	2000	32% moisture content.
113	15 ft. from bldg. 0-2 in. deep	113-15-1S	1	140	9% moisture content.
113	5 ft. from bldg. 0-2 in. deep	113-5-1S	1	240	8% moisture content.
119	0 ft. from bldg. 0-2 in. deep	119-0-1S	1	210	9% moisture content.
119	0 ft. from bldg. 2-4 in. deep	119-0-2S	1	54.0	6% moisture content.
119	10 ft. from bldg. 0-2 in. deep	119-10-1S	1	84.0	3% moisture content.
119	5 ft. from bldg. 0-2 in. deep	119-5-1S	1	88.0	3% moisture content.
119	5 ft. from bldg. 0-2 in. deep	119-5-1S	2	110	3% moisture content. Duplicate.
120	0 ft. from bldg. 0-2 in. deep	120-0-1S	1	620	18% moisture content.
120	5 ft. from bldg. 0-2 in. deep	120-5-1S	1	300	5% moisture content.
131	0 ft. from bldg. 0-2 in. deep	131-0-1S	1	11,000	7% moisture content.
131	0 ft. from bldg. 2-4 in. deep	131-0-2S	1	80.0	7% moisture content.
131	0 ft. from bldg. 2-4 in. deep	131-0-2S	2	97.0	7% moisture content. Duplicate.
131	10 ft. from bldg. 0-2 in. deep	131-10-1S	1	570	12% moisture content.
131	5 ft. from bldg. 0-2 in. deep	131-5-1S	1	790	11% moisture content.

Building	Sample Location	Sample Number	Subsample Number	Lead concentration (mg/kg)	Comment
160	0 ft. from bldg. 0-2 in. deep	160-0-1S	1	590	10% moisture content.
160	10 ft. from bldg. 0-2 in. deep	160-10-1S	1	49.0	4% moisture content.
160	10 ft. from bldg. 0-2 in. deep	160-10-1S	2	46.0	4% moisture content. Duplicate.
160	5 ft. from bldg. 0-2 in. deep	160-5-1S	1	48.0	6% moisture content.
820	0 ft. from bldg. 0-2 in. deep	820-0-1S	1	1100	4% moisture content.
820	0 ft. from bldg. 0-2 in. deep	820-0-1S	2	960	4% moisture content. Duplicate.
820	10 ft. from bldg. 0-2 in. deep	820-10-1S	1	33.0	1% moisture content.
606	0 ft. from bldg. 0-2 in. deep	606-0-1S	1	2000	11% moisture content.
606	0 ft. from bldg. 2-4 in. deep	606-0-2S	1	28.0	4% moisture content.
606	10 ft. from bldg. 0-2 in. deep	606-10-1S	1	27.0	20% moisture content.
606	5 ft. from bldg. 0-2 in. deep	606-5-1S	1	24.0	5% moisture content.

*Source: *Hart Crowser, 1996.*

Table 26. Lead-Based Paint Positive Unsatisfactory Condition Results (8/21/1996)*

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
2/Exterior	Door	1	>5.09 mg/cm^2	
3 A1/Exterior	Door (see comment)	1	2.11 mg/cm^2	Door-paint chips on ground.
4/Exterior	Various	5	>5.09 mg/cm^2	
5 /Maintenance Bay- 1	Wall	1	1.72 mg/cm^2	
7/Exterior	Various	4	>5.09 mg/cm^2	
10/Furnace Room – 1	Door Molding	1	2.12 mg/cm^2	
13/Loading Dock – 1	Loading Dock Bumper (see comment)	1	>5.09 mg/cm^2	Yellow bumper.
17/Stairway – 3, Storage – 1	Various	4	>5.09 mg/cm^2	
19/Exterior	Various	2	>5.09 mg/cm^2	
28/Mechanical – 1	Window Sash (int)	1	1.76 mg/cm^2	
30/Exterior	Loading dock bumper	2	2.63 mg/cm^2	Bumper mounted on outside bldg wall (Yellow). Bumper board on this ½ bldg (south) wall only.
31/Garage/Carport – 1	Walls	4	>5.09 mg/cm^2	Half wall studs at 3 of the sample locations.
32/Exterior	Register (Wall) (see Comment)	1	>5.09 mg/cm^2	2 ft x 2 ft louvered wall vent.
34/Porch – 1, Porch – 4	Floors	2	3.61 mg/cm^2	

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
53/Exterior, Stairway – 2	Various	5	>5.09 mg/cm^2	
54/Exterior, Stairway – 1	Various	11	>5.09 mg/cm^2	Wood siding beneath suspect asbestos siding.
70/Exterior	Various	9	>5.09 mg/cm^2	QC sample taken.
71/Exterior	Various	3	>5.09 mg/cm^2	
101/Exterior, Loading Dock – 1, Storage – 1	Various	16	>5.09 mg/cm^2	
102/Exterior, Loading Dock – 1	Various	6	>5.09 mg/cm^2	
103/Loading Dock – 1, Ramp – 1	Various	2	3.66 mg/cm^2	
105/Exterior, Loading Dock – 1, Ramp – 1	Various	28	>5.09 mg/cm^2	
106/Exterior, Loading Dock – 1	Various	21	>5.09 mg/cm^2	
107/Exterior, Loading Dock – 1	Various	24	>5.09 mg/cm^2	
108/Exterior, Stairway – 2	Various	39	>5.09 mg/cm^2	
109/Exterior	Various	21	>5.09 mg/cm^2	
110/Exterior, Loading Dock – 1	Various	25	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
111/Exterior, Loading Dock – 1	Various	15	>5.09 mg/cm^2	
112/Exterior, Loading Dock – 1	Various	32	>5.09 mg/cm^2	
113/Exterior, Storage – 1	Various	19	>5.09 mg/cm^2	QC sample taken.
114/Exterior	Various	33	>5.09 mg/cm^2	QC sample taken.
115/Exterior	Door	2	3.85 mg/cm^2	Same all sides, exterior rollup doors.
116/Exterior, Loading Dock – 1, Stairway – 2, Stairway – 3	Various	23	>5.09 mg/cm^2	
117/Exterior, Loading Dock – 2, Roof – 1, Storage – 1, Storage – 2	Various	89	>5.09 mg/cm^2	
118/Exterior, Loading Dock – 1	Various	67	>5.09 mg/cm^2	
119/Exterior	Various	39	>5.09 mg/cm^2	QC sample taken.
120/Exterior	Various	37	>5.09 mg/cm^2	
121/Exterior, Loading Dock – 1	Various	31	>5.09 mg/cm^2	
122/Exterior	Various	56	>5.09 mg/cm^2	
123/Exterior, Loading Dock – 2	Various	73	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
124/Exterior	Various	24	>5.09 mg/cm^2	
125/Exterior, Loading Dock – 2	Various	73	>5.09 mg/cm^2	
126/Exterior, Loading Dock – 1	Various	31	>5.09 mg/cm^2	
127/Exterior, Loading Dock – 2	Various	78	>5.09 mg/cm^2	
128/Exterior, Loading Dock – 1, Storage – 1	Various	40	>5.09 mg/cm^2	
129/Exterior, Loading Dock – 1	Various	8	>5.09 mg/cm^2	
130/Exterior	Doors and Jambs	12	>5.09 mg/cm^2	
131/Exterior	Doors	12	>5.09 mg/cm^2	
133/Exterior	Various	14	>5.09 mg/cm^2	
135/Exterior	Various	8	4.63 mg/cm^2	
139/Exterior	Various	9	>5.09 mg/cm^2	QC sample taken.
160/Exterior	Various	5	3.49 mg/cm^2	
161/Exterior	Various	4	2.97 mg/cm^2	
200/Exterior	Various	2	>5.09 mg/cm^2	
201/Exterior	Trim	1	>5.09 mg/cm^2	QC sample taken. Gutter board.
202/Exterior	Various	2	3.51 mg/cm^2	
204/Exterior	Various	2	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
205/Exterior, Storage – 1	Various	4	>5.09 mg/cm^2	
208/Exterior	Various	4	3.56 mg/cm^2	
415/Exterior, Office – 2	Various	3	3.90 mg/cm^2	
416/Exterior	Various	2	3.63 mg/cm^2	
417/Exterior, Storage – 2	Various	2	>5.09 mg/cm^2	
418/Bathroom – 1, Exterior	Various	2	>5.09 mg/cm^2	QC sample taken.
419/Exterior, Porch – 1	Various	5	>5.09 mg/cm^2	
420/Exterior, Stairway – 1	Various	4	>5.09 mg/cm^2	
421/Exterior	Various	4	>5.09 mg/cm^2	
422/Exterior	Various	3	>5.09 mg/cm^2	
423/Exterior	Various	2	>5.09 mg/cm^2	
424/Exterior	Various	3	>5.09 mg/cm^2	
425/Exterior	Various	7	>5.09 mg/cm^2	
426/Exterior	Various	4	>5.09 mg/cm^2	
427/Exterior	Various	4	>5.09 mg/cm^2	
431/Exterior	Various	4	>5.09 mg/cm^2	
433/Dressing Room – 2, Exterior	Various	4	>5.09 mg/cm^2	

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
434/Exterior	Various	3	>5.09 mg/cm^2	
442/Storage – 1	Door Molding	1	3.93 mg/cm^2	
486/Exterior	Door	1	2.99 mg/cm^2	
495/Electrical – 1, Exterior	Various	2	1.45 mg/cm^2	QC sample taken.
501/Exterior	Not Specified (See Comment)	1	>5.09 mg/cm^2	Clothes line pole.
506/Exterior	Door Threshold	1	1.47 mg/cm^2	
509/Exterior	Not Specified (See Comment)	1	>5.09 mg/cm^2	Clothes line pole.
605/Exterior	Trim, Upper (ext)	4	3.15 mg/cm^2	
606/Bathroom – 1, Entry/Foyer – 1, Exterior	Various	9	3.39 mg/cm^2	
00608/Hallway – 1	Wall	2	1.70 mg/cm^2	
613/Mechanical – 1	Not Specified (See Comment)	1	3.71 mg/cm^2	QC sample taken. Green metal base of pump.
00619/Exterior	Various	2	>5.09 mg/cm^2	
803/Loading Dock – 1, Ramp – 1	Various	2	>5.09 mg/cm^2	Concrete edge & 6-inch striping paint; All ramp components same yellow.
806/Exterior, Ramp – 1	Various	2	>5.09 mg/cm^2	All ramp components same yellow.
807/Ramp – 1	Porch Rail, cap (See Comment)	1	>5.09 mg/cm^2	All ramp components same yellow.

Building/Unit/Room	Component	Number of samples exceeding 1.0 (mg/cm^2)	Highest recorded lead value	Comment
808/Exterior, Loading Dock – 1, Ramp – 2	Various	4	>5.09 mg/cm^2	
809/Exterior	Siding	1	3.57 mg/cm^2	
810/Exterior, Loading Dock-1, Ramp – 1	Various	4	>5.09 mg/cm^2	
811/Exterior	Siding	1	2.77 mg/cm^2	
812/Exterior, Ramp – 1	Various	2	4.04 mg/cm^2	
813/Loading Dock – 1, Stairway – 1	Various	2	>5.09 mg/cm^2	
814/Loading Dock – 1, Stairway – 1	Various	2	>5.09 mg/cm^2	
817/Loading Dock – 1, Ramp – 2	Loading Dock Bumper	3	1.72 mg/cm^2	
818/Exterior, Loading Dock-1, Ramp – 1, Stairway – 1	Various	15	3.79 mg/cm^2	
819/Exterior, Loading Dock – 1, Ramp – 1, Stairway – 1	Various	9	>5.09 mg/cm^2	QC sample taken.
820/Exterior, Ramp – 1	Various	5	>5.09 mg/cm^2	

Building/Unit/Room	**Component**	**Number of samples exceeding 1.0 (mg/cm^2)**	**Highest recorded lead value**	**Comment**
823/Exterior, Stairway – 1	Various	2	>5.09 mg/cm^2	
825/Exterior, Loading Dock – 1, Stairway – 1	Various	5	>5.09 mg/cm^2	
826/Exterior, Loading Dock – 1, Ramp – 1, Stairway - 1	Various	8	>5.09 mg/cm^2	
827/Exterior	Siding	2	3.67 mg/cm^2	
828/Exterior	Siding	1	4.07 mg/cm^2	Painted sign on wall.
829/Exterior, Stairway – 1	Various	2	4.40 mg/cm^2	
830/Exterior, Ramp – 1	Various	2	>5.09 mg/cm^2	
831/Loading Dock – 1, Ramp – 1	Various	2	2.67 mg/cm^2	All ramp components have the same paint.
00833/Exterior	Siding	1	3.13 mg/cm^2	
834/Exterior, Stairway – 1	Various	2	>5.09 mg/cm^2	
9900/Exterior	Window Sill	1	2.06 mg/cm^2	

*Source: *Hart Crowser, 1996.*

During the September 22, 2009 visual site inspection, representative buildings from each series of buildings were inspected for the condition of exterior paint. Most surfaces in the administrative buildings and 400 series buildings were either unpainted or in generally good condition. Cracked paint and paint debris on the ground was observed at the 100 series buildings. Cracked and peeling paint was observed on buildings in the 200 and 600 series *(*UMCD Personal Communication 2009-10)*.*

4.8 Previously Stored Radiological Material

UMCD personnel, including the UMCD Radiological Protection Officer (RPO), the contractor RPO, and a mechanic involved in checking stored ICAM and M-22s stored at UMCD laboratories, were interviewed to obtain data on radioactive material storage and use. State of Oregon Radiation Control personnel were interviewed for data on the Naturally Occurring Radioactive Material (NORM) check sources in the survey meters stored by the state on-site. Personnel from USACE Rock Island District and Army Materiel Command (AMC) were interviewed by phone to determine updated license information and as a final check on any documentation of radioactive materials and sources at UMCD that might be filed off-site (UMCD Personal Communication 2009-10*).*

Previously stored radioactive materials at UMCD, per RPO of UMCD, were:

- NRC License #12-00722-06 (issued to Department of Army TACOM Life Cycle Management Command) allowed for the storage and use of Radioactive Sources at UMCD. All such materials have been removed from the UMCD and the NRC license was terminated on 29 Nov 2011.
- NORM was stored by the State of Oregon in Building (Igloo) A928 in the A Block and were used as test sources for radiac meters. This includes the calibrating samples to check the GM counters of either depleted uranium or radium with counted activities ranging from 0.1 microcuries to 4 nanocuries *(*Paul Frame, Oakridge, 1999 article on GD V-700 last updated 2007 and interview with Oregon State Radiation Control Officer*)*.
- 7 Cs-137 Gamma Ray sources were used as chute sensors for demilitarization of the M55 VX/GB rockets and were turned in December 2009 to OHMART Corporation. These were sent to OSA Global in Baton Rouge, Louisiana, in January 2010 for disposition and were controlled under contractor's NRC license # 36-27689-01.
- 68 M8 Alarms were turned in to Pine Bluff Arsenal in April 2009.
- 25 M22s were shipped to Pine Bluff Arsenal on 3 April 2012.

No known radioactive material is known to exist at UMCD.

4.9 Landfills

The following section describes all known areas used for disposal. Study Sites 11 (Active Landfill), 12 (Inactive Landfill), and 33 (Gravel Pit Disposal Area) are Operable Units (OU) under the FFA, with issued RODs; further information regarding these sites can be found in Section 4.2.5.

4.9.1 Study Site 11

The Study Site 11 is referred to as the Active Landfill, and is an OU under the FFA and has an issued ROD (U.S. Army 1993). Prior to its use as a landfill in approximately 1968, the site was the location of a gravel pit. This landfill does not accept waste, and groundwater monitoring of wells around the site is currently ongoing. The Oregon Department of Environmental Quality terminated the Solid Waste permit on 12 August 2011 and transferred this site to their Environmental Cleanup Program. In accordance with Subtitle D requirements (40 CFR 258.61 (c); EPA, 1991), the post-closure land use will not disturb the integrity of the final cover. This will be accomplished by land use restrictions included in the deed of sale. Under such restrictions, land use will probably be limited to fallow or grazing land. Agricultural use is not considered feasible, because cultivation activities and root systems would disturb the geomembrane, and irrigation would increase infiltration reaching the waste. These land use restrictions will remain in effect in perpetuity unless the waste is subsequently removed (40 CFR 258.60 (i); EPA, 1991). For further information on Study Site 11, Active Landfill, refer to Section 4.2.5.4.

4.9.2 Study Site 12

Similarly to Study Site 11, Study Site 12 is termed the Inactive Landfill OU and is composed of six discrete former disposal areas. This site is an operable unit under the FFA and has an issued ROD. For further information on Study Site 12, please refer to Section 4.2.5.5.

4.9.3 Study Site 33

Study Site 33 is located east of F-Block igloos, in the south-central portion of the UMCD. Historical aerial photographs reviewed during the Enhanced Preliminary Assessment show this area being used as a gravel pit, starting around 1949. Based on the photo review, the site potentially began accepting waste around 1971. A former UMCD employee reported that potential disposal of chemical agent GB and/or VX occurred during the 1960s, reportedly caused from the disassembly of a leaking bomb. The employee reported seeing white crystals surrounding the area of the disposal incident for approximately one year. During the assessment, a test pit was dug in the area of the suspected disposal site. Gas masks and metal debris were found shallow in the excavation. Soil samples collected were analyzed for HD, GB, and VX, as well as isopropyl methyl phosphonate (IMPA) and ethyl methyl phosphonate (EMPA), breakdown products of GB and VX. No agent or breakdown products were detected in any of the samples collected. The assessment determined that chemical agents were not disposed of at this location or were released in small quantities such that they would not pose an environmental risk. As seen in Table 3, the current status per the Resource Conservation and Recovery Act (RCRA) permit for Study Site 33 is NFA. No long-term monitoring is required for this site.

4.9.4 Study Site 50

Study Site 50 is known as the Railroad Landfill Areas, and is composed of two discrete areas, one approximately 30 by 800 feet and the other composed of laterally discontinuous sections. This site is located along the south central UMCD border, approximately 500 feet south-southeast of the sewage treatment plant. The landfill areas are topographic depressions on either side of the railroad spur. North of the railroad yard, the fill was limited to metal scrap materials, as indicated by rusty metal debris scatter. The area south of the rail yard was a “dry” landfill and consisted of construction debris, as indicated by abundant concrete fragment scatter.

During the RI, an aerial photographic analysis indicated that fill material may have been deposited from 1956 through 1970. Based on this, a variety of potential contaminants could be present in the landfill debris. Soil and groundwater samples were collected and analyzed for TAL inorganics, TCL VOAs, TCL BNAs, TCL pesticides/PCBs, oil and grease, explosive constituents, and nitrate/nitrites.

Low levels of oil and grease were detected in both the soil and groundwater, and low levels of one known and several unknown BNA TICs were detected. Low levels of RDX were detected in one groundwater sample, but not detected in the second round collected during the RI. It determined that due to low regional rainfall, groundwater flow direction reversals and low recharge rates and hydraulic gradients may prevent the migration of the contaminants. As seen in Table 3, the current status per the RCRA permit for Study Site 50 is NFA. No long-term monitoring is required for this site.

4.9.5 Study Site 82

Study Site 82 is a former gravel pit located immediately south of I-Block igloos. During the RI, an aerial photographic analysis indicated the site appeared to operate as a gravel pit until around 1956, when fill material may have been placed into the smaller pits. Striations on the fill give the appearance of worked material. During the 1990 field investigation for the RI, pieces of what appeared as asbestos-containing transite siding were noted, as well as recently disturbed soil. Shallow and test pit soil samples were collected for asbestos, TAL inorganics, TCL VOAs, TCL BNAs, explosive constituents, and nitrate/nitrite analyses. TAL inorganics were not detected in any sample and no explosive constituents, TCL VOAs, TCL BNAs, or nitrate/nitrate were detected above reporting limits. Asbestos was identified in a soil sample collected near the surface. While ACM was detected in soil at Study Site 82, the sampling did not indicate widespread surficial disposal of ACM. As seen in Table 3, the current status per the RCRA permit for Study Site 82 is NFA. No long-term monitoring is required for this site.

4.10 Gravel and Borrow Pits

Several gravel and borrow pits have been in use throughout the Depot's history. The known areas of former gravel pits that were subsequently used, or suspected to be used, for disposal include Study Sites 11, 33, 51, and 82.

Study Site 51, known as the Northern Large Storage Area, is located northeast of the Explosives Washout Lagoons (EWL) and northwest of Rim Road and the C-Block igloos. The area has been used as a gravel borrow pit by UMCD contractors. During a routine visit to the borrow pit by a UMCDF construction contractor, several old paint cans and other debris were uncovered during excavation. A distinct hydrocarbon odor was noted. ODEQ and UMCD representatives visited the site on October 16, 1997 and noted the deteriorated paint cans as well as what appeared as paint residue. The USACE field sampling team conducted a field investigation in which product and soil samples were collected and chemically analyzed from two zones where the debris and residue were located. Samples collected at each site were analyzed for EPA method 1311 for chromium, barium, cadmium, and lead, VOCs, and SVOCs. Low levels of metals and SVOCs were detected in the samples from the two locations. VOCs were not detected in the samples. Based on these results, no further removal actions were deemed necessary *(*USACE 1997; UMCD BRAC letter 1997*).*

An aerial photographic analyses conducted during the Enhanced Preliminary Assessment identified at least 12 locations that appeared to have gravel and borrow pit operations. These areas were assigned separate site numbers. Sites AX-40 through AX-43 and AX-45 through AX-47 are located in Enhanced Preliminary Assessment Area Five, while Sites AX-5 and AX-57 through AX 60 are located in Area Seven. The assessment determined that none of these gravel pits appear to have been used for waste disposal. For further information on these locations see the 1990 Enhanced Preliminary Assessment conducted by Dames and Moore for the U.S. Army Toxic and Hazardous Materials Agency (Dames and Moore 1990).

4.11 Explosive Contaminated Structures

Per communication with UMCD, all structures at UMCD have been abated and cleared of explosives contamination. However, UMCD indicated that vacuum lines are still present in some of the buildings and may contain explosive constituent contamination. These buildings include: (1) Building 608 and Baghouse 610, and (2) Building 614 and Baghouse 615. As of May 2012 all contaminant characterization of the buildings has been completed and a plan for remediation of explosives is being proposed.

4.12 Radon

The Enhanced Preliminary Assessment stated that there was a potential for naturally occurring radon to be present at UMCD (Dames and Moore 1990). A radon survey report was prepared in August 1993 under the 1988 BRAC program (Dames and Moore 1993b). Two surveys were conducted: A 12-month survey in 1991 and a 90-day survey in 1992-1993. The 1991 effort sampled 165 buildings (no results were available for Buildings 5 or 165). The 1993 survey consisted of sampling in 97 separate buildings, including 5 that were sampled in 1991. Only 10 percent of igloos in Blocks A through H and Block J were sampled because they were not inhabited. A total of 252 separate buildings and structures were considered.

No further action was recommended for 121 buildings that had no radon gas concentrations exceeding a detection limit of 0.5 pCi/L. Follow-up measurements were recommended for buildings that had concentrations close to 4.0 pCi/L. Seven of the 84 igloos subjected to 90-day radon testing had concentrations ranging from 4.1 to 16.9 pCi/L, which exceeded the EPA's high-risk level of 4.0pCi/L. Because the igloos are not routinely occupied spaces, no mitigation measures were recommended.

In addition to the seven igloos, samples from Buildings 1 and 415 had radon gas concentrations greater than 4.0 pCi/L. Mitigation measures were recommended and implemented for Building 1 since the basement is normally occupied (although currently unoccupied) and because the Oregon Health Division applies EPA criterion to both homes and workplaces *(*Earth Technology Corporation 1994*)*. Building 415 is abandoned so no measures were carried out.

Two rounds of testing were performed by Dames and Moore, Inc. to quantify the radon levels within buildings at UMCD. The first round was performed for a 12-month period at 160 buildings and the second round for a 90-day period at 97 buildings. There were five buildings that were sampled in both rounds, for a grand total of 252 individual buildings sampled for this survey. Eighty-four of the 252 buildings sampled were storage igloos. One hundred twenty-one buildings had radon concentrations below the detection limit of 0.5 pCi/L. Another 121 buildings had radon concentrations between 0.5 pCi/L and 3.8 pCi/L. Buildings 1, 5, and 415, plus seven igloos, had radon concentrations above 4.0 pCi/L. Because these buildings tested above 4.0 pCi/L, it was recommended that renovations be made to occupied buildings to reduce the accumulation of indoor radon gas *(*Dames and Moore 1993b*).*

4.13 Pesticides/Herbicides

Applicable regulations for pesticides and herbicides at UMCD are the Toxic Substance Control Act (TSCA) and the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Pesticide storage and handling is conducted in accordance with applicable regulations so that storage facilities with secondary containment are utilized, and so that wash waters are collected and properly disposed of by an off-site vendor *(*Earth Technology Corporation 1995*).*

Building 8 is the Pesticide/Herbicide/Rodenticide Storage Building. Products used in this building included herbicides, pesticides, rodenticides, and mixing operations. All chemicals were stored in locked rooms. In-service drums of liquids were stored in plastic containment trays or plastic spill containment tubs. A labeled spill kit containing floor-dry, a shovel, a broom, and bleach is available in the room. The pesticide mixing room is bermed so all material would remain in the containment area in the event of a spill or leak. All mixing is done in this room. All containers are triple rinsed and rinse water is reused. The rinsed empty containers are punctured and disposed of as solid waste or recycled.

Liquid herbicides are kept inside containment trays. Herbicides/fungicides used include granular weed killer, Glyfos Pro, Habitat, Agrisolutions Activate Plus, Induce Spray Adjuvant, and Razor Pro. Dynamark Blue Spray Indicator may be added to the mixing tank to add a visual indicator where the herbicides were sprayed – it is non-toxic. The pesticides are kept in a locked storage room and are in single-use containers or small containers up to a 50-pound bag size. Pesticides used include Contrac Blox, Gopher Mix, Maki, Max Force FC, Malathion, P7 565, Wasp Freeze, Poison Free Wasp & Hornet Killer, Mint Oil Poison Free, and, and Sprakil-13. A labeled spill kit similar to the herbicide spill kit is available *(*U.S. Army CMA 2004*).*

4.14 Biological and Cultural Resources

The following sections describe the biological and cultural resources that are found at UMCD.

4.14.1 Biological Resources

In general, the UMCD site supports large communities of shrublands, dominated by sagebrush and bitterbrush, with an understory of annual grasses and forbs; and grasslands, dominated by a mixture of native and exotic species such as Sandberg's bluegrass, cheatgrass (downy brome grass), and crested wheatgrass. The shrublands are found primarily in the eastern and southwestern portions of the site on soils with a higher silt content, and consequently a higher moisture capacity. UMCD probably contains the largest remnants of bitterbrush habitat in the Columbia Basin, as well as high quality needle-and-thread sandy grasslands. The central region of the site is dominated by the grasslands, which are intermixed with the shrublands in the eastern portions as well. Mixed communities, defined as areas wherein several vegetative communities are present and intermingled, and are primarily in the northwestern and northeastern portions of the site. Cheatgrass is a prevalent understory in many of the shrubland communities.

No Federally listed vascular plant species have been found on the grounds. However, crouching milkweed, or Columbia milk-vetch, an Oregon State (State) watch-list species, was discovered in several of the vegetative communities on the site. The species was found primarily in the less disturbed dry shrub and grassland communities in the eastern portion. It was documented in a disturbed crested wheatgrass community and in a bitterbrush-dominated community in the southwestern part of the installation.

Four plant species of concern were listed by the U.S. Fish and Wildlife Service (USFWS) as potentially occurring within the area: Northern wormwood, Laurence's milk-vetch, hepatic monkeyflower, and Columbia yellow-cress. Based on the habitat available at UMCD, Laurence's milk-vetch is the only USFWS listed plant species of concern that is likely to occur on the installation. State-listed candidates that may occur within the UMCD area include Laurence's milk-vetch and Douglas' milk-vetch.

In general, faunal species are consistent with what one would expect in Columbia Basin native shrub-steppe and grassland habitats: pronghorn, coyote, American badger, jackrabbits and cottontail rabbits, Swainson's and redtail hawks, burrowing owl, long-billed curlew, and many other species common to this habitat. The pronghorn herd is not free-ranging, as the UMCD's perimeter fence keeps it captive and water is provided. The lack of permanent surface water at UMCD precludes the occurrence of native fish species; however, mosquito fish are stocked in a storm water retention pond to eat mosquito larvae.

Umatilla Chemical Depot hosts several bird species that are on the Birds of Conservation Concern (BCC) 2002 list and/or the USFWS Focal Species List. The sage sparrow and the long-billed curlew merit special mention due to their specialized living requirements or their declining numbers throughout their range.

An Integrated Natural Resources Management Plan (INRMP) was completed for UMCD in 2007. The document was coordinated with USFWS, Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation *(*Gene Stout and Associates 1997*).*

4.14.1.1 Endangered Species

There are no threatened or endangered species currently recorded on UMDC grounds. There are several sensitive species potentially found on the site. Table 27 is from the INRMP and summarizes UMCD's potential sensitive species.

Table 27. Potential Sensitive Faunal and Floral Species at UMCD

Faunal and Floral Species of Special Concern Potentially Found on U.S. Army Umatilla Chemical Depot					
Common Name	**Scientific Name**	**Federal Status**	**BCC[a]** **FS[b]**	**State Status**	**Occurrence**
Reptiles and Amphibians					
Northern Sagebrush Lizard	*Sceloporus graciosus graciosus*	SoC		SV	Present
Birds					
Long-billed Curlew	*Numenius americanus*	None	BCR 9, R1, N FS	SV	Present
Bald Eagle	*Haliaeetus leucocephalus*	None		LT	Transient
Swainson's Hawk	*Buteo swainsoni*	None	BCR 9, R1, N	SV	Present
Ferruginous Hawk	*Buteo regalis*	SoC	BCR 9, N FS	SC	Present

Faunal and Floral Species of Special Concern Potentially Found on U.S. Army Umatilla Chemical Depot

Common Name	Scientific Name	Federal Status	BCC[a] FS[b]	State Status	Occurrence
Peregrine Falcon	*Falco peregrinus*	None	BCR 9, R1, N FS	LE	Transient
Sage Grouse	*Centrocercus urophasianus*	Candidate	BCR 9, R1, N	SV	Potential
Western Burrowing Owl	*Athene cunicularia hypugea*	SoC	BCR 9 FS	SC	Present
Lewis’ Woodpecker	*Melanerpes lewis*	SoC	BCR 9	SC	Present
Bank Swallow	*Riparia riparia*	None		SU	Present
Loggerhead Shrike	*Lanius ludovincianus*	None	BCR 9 FS	SV	Present
Grasshopper Sparrow	*Ammodramus savannarum*	None		SV	Present
Black-throated Sparrow	*Amphispiza bilineata*	None		SP	Present
Sage Sparrow	*Amphispiza belli*	None	BCR 9	SC	Present
Bobolink	*Dolichonyx oryzivorus*	None	FS	SV	Present
Tricolored Blackbird	*Agelaius tricolor*	SoC	BCR 9, N FS	SP	Transient
Mammals					
Western Small-footed Myotis	*Myotis ciliolabrum*	SoC		SU	Potential
Long-eared Myotis	*Myotis evotis*	SoC		SU	Potential
Long-legged Myotis	*Myotis volans*	SoC		SU	Potential
Townsend’s Big-eared Bat	*Corynorhinus townsendii*	SoC		SC	Potential
Pallid Bat	*Antrozous pallidus*	None		SV	Potential
White-tailed Jackrabbit	*Lepus townsendii*	None		SU	Potential
Washington Ground Squirrel	*Spermophilus washingtoni*	C		LE	Potential
Plants					
Laurence’s Milk-vetch	*Astragalus collinus var. laurentii*	SoC		ST	Potential
Douglas’ Milk-vetch	*Astragalus kentrophyta*	None		SC	Potential

Key: The full keys are provided for comparison purposes.

Federal and State:

LT: Listed Threatened. This category includes taxa listed as threatened by the USFWS under the Endangered Species Act.

C: Candidate species. This category includes taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened.

SoC: Species of Concern. This category includes taxa for which existing information may warrant listing, but for which substantial biological information to support a proposal rule is lacking.
BCC and FS are only for species identified through the Migratory Bird Program and do not have implications under ESA
State Protected: (State Protected List also includes the categories listed as State Sensitive.)

LE	Listed as an Endangered Species.
LT	Listed as a Threatened Species.
PE	Proposed as an Endangered Species.
PT	Proposed as a Threatened Species.
SC	Sensitive - Critical. Those species for which state listing as threatened or endangered is pending, or for which state listing as threatened or endangered may be appropriate if immediate conservation efforts are not taken.
SV	Sensitive - Vulnerable. Those species for which state listing as threatened or endangered is not believed to be imminent and could be avoided through continued or expanded conservation measures or monitoring.
SP	Sensitive - Peripheral or Naturally Rare. Those species that occur in the state at the edge of their distribution. Naturally rare species are species that have been present in low numbers in Oregon historically due to natural limiting factors.
SU	Sensitive - Undetermined Status. Those species whose status is unclear.

Source: Gene Stout and Associates, 1997

4.14.1.2 Wetlands

A National Wetlands Inventory was conducted on the UMDC grounds in June 2000, and no permanent, naturally occurring wetlands were found on the installation. There are, however, two small wet areas created by wildlife watering devices releasing water onto the land at these sites. Wetland vegetation can be found at these locations (Gene Stout and Associates 1997).

4.14.2 Cultural Resources

A number of archaeological surveys, historic contexts, and historic property inventories have been prepared for UMCD, including the Integrated Cultural Resources Management Plan. No prehistoric sites have been identified within UMCD to date, though two historic buildings and a 1930s dump, as well as an immigrant wagon trail, have been identified as eligible or potentially eligible for listing in the National Register of Historic Places (NRHP).

4.14.2.1 Prehistoric Resources

The UMCD is located within an area referred to as the Plateau Culture Area. The Plateau Area spans the lands drained by the Columbia and Fraser Rivers. Studies indicate that the Plateau culture has been stable for several millennia. Ethnographic place names and highly localized creation epics support archaeological evidence of long-term occupation by ancestral Salishan, Sahaptian, Athabaskan, Kootenai, and Cayuse peoples.

Plateau Culture is distinguished by a pattern of linear settlement along rivers and a diverse subsistence base which included use of riverine and terrestrial resources. Permanent winter villages had semi-subterranean earth lodges and were located along the rivers or at the conjunctions of tributaries. Seasonal camps were usually made up of mat covered lodges and located at higher elevations. Trade and kinship ties were widespread.

The UMCD is within the traditional territory of the Cayuse, Umatilla, and Walla Walla peoples. The advent of horse culture in the 1700s served to expand both trading links and political perspective. The political arena changed from an inward focus on the band or village to a regional focus as trade expanded. The expansion of trade also shifted the political balances in the regions, resulting in social conflict and warfare. Social stratification developed; horses became wealth. The Plateau people maintained their traditionally strong trade relations with the Northwest Coast, adding to these relationships new partnerships formed with the Plains peoples.

4.14.2.2 Historic Resources

The built environment of UMCD strongly expresses the facility's World War II and Cold War contributions.

UMCD's earlier historical and archaeological significance is associated with the native peoples who resided in the area, and with the early passage of white settlers along the Oregon Trail. During the early 1800s, the first white recordation of the area was undertaken by Lewis and Clark, who noted that the land was being used by Cayuse and Umatilla Indians. Historically, native use of the lands in the UMCD area was characterized by fishing, hunting, and foraging for food. Hunting for deer, elk, and other game took place throughout the region. Salmon fishing occurred on all major rivers and streams in the area.

A segment of an immigrant wagon trail believed to be a spur of the Oregon Trail survives on the property. Further National Register evaluation of this segment within the context of the Oregon Trail and western settlement is needed and will be evaluated in the upcoming NEPA document. Table 28 summarizes the historic era properties at UMCD.

Table 28. List of Historic Era Properties at Umatilla Chemical Depot

Field Number	Function	Age	Size	Condition	Report	National Register Eligibility
10-1 (OR-UM-16)	Dump	Historic ca. 1930-1940	16.4 x 23.0 ft	Good	Boreson, 1996	Appears ineligible; National Register Form Completed
11-1	Wagon Road	Historic ca. 1874	14 x 6,000 ft(a)	Disturbed	Boreson, 1996	Unknown
12-1	Wagon Road	Historic ca. 1861	26 x 1,200 ft(a)	Disturbed	Boreson, 1996	Unknown
Building #1	Administration Building	1941	NA	Good	Bldg. Tech., Inc., 1984	Yes
Building #2	Firehouse	1941	NA	Good	Bldg. Tech., Inc., 1984	Yes

Notes: (a) Portion of site within the surveyed parcel.
ca. = circa
ft = feet
NA = not applicable
National Register = National Register of Historic Places
Source: Tetra Tech, 1997.

4.14.2.3 Archaeological Sites

Research to date has identified the following ethnic groups, organizations, or activities associated with UMCD and its immediate vicinity: Italian prisoners of war; migrant farm workers from Haiti and Mexico; Civilian Conservation Corps laborers; sheep and cattle herders; Chinese miners and laborers; railroad workers; and Umatilla, Cayuse, Walla Walla, Warm Springs, Nez Perce, Yakama, and Colville people. Lewis and Clark reported a major village in the area that may be a "pre-Mazama" component. The area has been used or crossed by bands fighting in the Shoshone-Bannock Wars, by emigrant wagon trains, by European and Native American traders, by hunters and trappers, by herders, by railroads, and by farmers.

A limited archaeological survey of the larger area in 1987 resulted in the identification of one historic archaeological site and one prehistoric archaeological site. According to the report, the historic archaeological site is possibly associated with the Oregon Trail; 1861 and 1875 U.S. General Land Survey maps show an "Old Emigrant Wagon Road" crossing the northeastern corner of UMCD. An analysis of 1993 aerial photography appears to confirm the location of the trail (Dames and Moore 1992b). A 1983 survey recorded a surface scatter of lithic tools on the western rim of Coyote Coulee. The report authors determined that the scatter likely represented a hunting area. A 1996 report recorded two isolated finds – a mussel shell fragment and a basalt flake (Boreson 1996). The presence of the site is identified by isolated lithic flake tools scattered on the ground surface. The report concluded that the artifacts were used in conjunction with hunting at this location *(*Cooke et al. 1983*)*.

Permanent water sources, typically areas of high potential for cultural resources, are nonexistent within the UMCD, and surveys conducted prior to 1996 recorded very few cultural deposits. It may be that the extensive earth disturbing activities at the UMCD erased any evidence of these or other prehistoric or historic land use patterns. Although no prehistoric sites have been documented within the boundaries of UMCD, expected archaeological resources in the vicinity of the project area would include:

- Lithic scatters
- Campsites
- Food processing areas
- Hunting blinds
- Trail systems
- Rock shelters
- Cairns, rock walls, rock fences, or blinds
- Dumps
- Burials

4.14.2.4 Buildings/Structures

UMCD has 1,400 buildings and structures that are fifty years old or older. Inventory data for the World War II and Cold War eras is thorough and complete, and provides adequate information to assess the eligibility of historic properties for listing in the NRHP. In 1988, the Oregon SHPO confirmed that two buildings are eligible: (1) Headquarters Building, and (2) Firehouse. These buildings are presently maintained for their current use as UMCD's headquarters, and will remain in their current capacity. In order to fulfill Section 106 responsibilities, a historic preservation plan to include alternatives for adaptively using and maintaining these buildings should be developed in consultation with the Oregon SHPO if these properties are transferred to a non-federal entity.

Aside from these two buildings, the remaining structures at UMCD were recommended ineligible in historic property evaluations to the SHPO. Since the evaluations do not evaluated the UMCD as a potential historic district eligible under criterion A (as recommended by SHPO in 1989) as a significant regional component of WWII chemical weapons storage and American defense planning related to weapons procurement and availability, reconsideration of the previous determination may be appropriate. The depot was the Northwest's largest contributor to this facet of the wartime effort and Cold War period that followed, and had a dramatic impact on the economic base of surrounding communities. Regardless of the architectural humility of the igloos and associated facilities, the case may be made that the UMCD historic district is a significant regional expression of WWII and Cold War tactical weapons defense. Finally, Capehart-Wherry housing that existed at UMCD is addressed under a national Programmatic Agreement, which allows for their removal from the installation without further Section 106 consideration. The Capehart housing was removed in 1995.

4.14.2.5 Section 106 Consultation

UMCD is in formal consultation with the Federally recognized Confederated Tribes of the Umatilla Indian Reservation regarding archaeological and cultural properties. The cultural resources management plan calls for monitoring of activities conducted near archaeological sites to ensure no harm is posed to their integrity. However, aside from these provisions, full Section 106 consultation for all historic properties at UMCD is incomplete. In an April 2010 letter to the UMCD Cultural Resource Manager, the State of Oregon, Associate Deputy SHPO outlines the additional work that is necessary at the facility for Section 106 compliance for closure and land conveyance. UMCD is currently addressing the requirements outlined in the letter and will work with the State to obtain full Section 106 compliance for those properties that will be transferred out of federal ownership.

4.14.3 National Environmental Policy Act (NEPA)

In order to comply with NEPA for disposal of installation property, DoD must comply with regulations in 40 C.F.R. 1500-1508, developed by the Council on Environmental Quality (CEQ) and service-specific NEPA regulations. These regulations define the examination process for potential impacts to the environment in the disposal of the BRAC property to the public or private parties. The following sections describe the NEPA documentation done for UMCD to date.

An Environmental Assessment (EA) was completed in 1989 on the original BRAC (re-alignment) action. An EA is currently underway to incorporate the 2005 BRAC. This document is being coordinated through the Land Reuse Authority (LRA) and is dependent on the completed land reuse plan. The EA is currently evaluating NEPA as it pertains to the potential reuse of the property.

4.15 Applicable Regulatory Compliance Issues

The Army currently tracks issues concerning compliance with environmental laws and regulations through the Environmental Quality Report (EQR), and formerly used the Army Compliance Tracking System (ACTS). The installation is required to enter lawsuits, notices of violation, and warning letters into the system, and to track response actions. All issues listed in the system should be summarized in the ECP and attention should be called to any unresolved issues, as these may affect transfer of the facility.

4.16 Adjacent Properties

In order to identify potential off-site contamination sources for the UMCD facility, a records search of Federal and Oregon State databases was conducted as part of the 1994 CERFA report preparation (Earth Technology Corporation 1994). The results of the search are described in detail in Appendix B of the CERFA report. In addition, an Environmental Data Resources Report was compiled on May 14, 2010 and is summarized in Appendix B.

Key findings included:

- UMCD is included on the National Priorities List. No other NPL or CERCLA sites are located within a 1-mile radius of the facility.
- UMCD is included as a RCRA TSD facility. No other TSD sites are located within a 1-mile radius of the facility.
- UMCD is included as a RCRA large quantity generator (RCRA-LQG). No other RCRA-LQG sites are located within a 1-mile radius of the facility.
- UMCD is included in the RCRA conditionally exempt small quantity generators (RCRA-CESQG) list. No other RCRA-CESQG sites are located within a 1-mile radius of the facility.
- UMCD is included in the Leaking Underground Storage Tank Incident Report (LUST). There are three other LUST sites located within a 1-mile radius of the facility which include: Hermiston Gas & Deli-Time Oil (Cleanup Complete 3/10/1999), U.S. Army Umatilla Depot Activity, and Umatilla Electric CO-OP (Cleanup Complete 9/21/1990).
- UMCD is included in the Underground Storage Tank database (UST). There was one other UST site located within a 1-mile radius of the facility stated as J. Alyett.
- UMCD is included in the MANIFEST list associated with hazardous waste. There was one other site, Hermiston Generating Plant, located within a 1-mile radius of the facility that was included in the MANIFET list.
- No emergency response notification spills are reported within a 1-mile radius of the site.

During the 2009 VSI, the adjacent properties were observed from the automobile. Much of the properties are farms and are heavily irrigated.

4.16.1 Off-Post Sources of Contamination

As with perchlorate, described in Section 0, nitrate/nitrite contamination is common in groundwater of the Lower Umatilla Basin (LUB). In the 2003 ODEQ LUB Ground Water Management Area (GWMA) Synoptic Sampling Event Report, nitrate concentrations from groundwater samples collected basin-wide were compared to samples collected in 1992. The report determined that nitrate concentrations in the LUB GWMA increased between 1992 and 2003, with more than one-third of the 2003 samples analyzed exceeding the 10 mg/L nitrate drinking water standard. Off-post nitrate/nitrite sources of contamination have likely impacted UMCD. Off-site sources of nitrate/nitrite in the vicinity of UMCD include fertilizer application/irrigation, livestock feedlots, fertilizer manufacturing (southwest of the installation), and private septic systems. Pesticide and herbicide use is likely due to the large amount of off-site agriculture. The report recommended that best management practices be continued and expanded in the basin to reduce the nitrate loading to the groundwater *(*ODEQ 2006b*).*

4.16.2 Crop Cultivation

Nitrate fertilizers are used on many of the crops grown in the irrigated areas surrounding UMCD. Nitrate leaching rates from soil to groundwater are likely to be high, and historical nitrate application rates are likely to have been much higher in the past than in recent years. It is estimated that 40 to 60 pounds of nitrates per acre per year may have leached into groundwater from the late 1960s to 1975. The Agricultural Extension Service at Hermiston, Oregon provided information on crops and nitrate application ranges, and the information is summarized in the CERFA report (Earth Technology Corporation 1994).

4.16.3 Potato Processing

Lamb-Weston of Hermiston operates a potato processing plant east of UMCD and disposes of process wastewater by irrigation of two areas. One area (1.5 square miles) is just east of the northeast corner of UMCD; the second area is approximately 1 mile south of the southeast corner of UMCD. Process wastewater from the plant is discharged first into a holding pond and then is used for irrigation. In the area east of UMCD, nitrate and groundwater elevations are being monitored by 10 wells located within and at the boundaries. Six of the ten wells had nitrate/nitrite levels generally above 10,000 ug/L during the period November 1986 to January 1991.

4.16.4 Livestock Farming

A hog feedlot was operated immediately south of the UMCD Administration Area until 1987. Operations began around 1965 based on signs of animals in 1965 aerial photographs. This farm corralled up to 20,000 hogs. Concentrations of farm animals are potential sources of nitrate due to their wastes *(*Earth Technology Corporation 1994*).*

4.17 Identification of Uncontaminated Property

In April 1994, The Earth Technology Corporation prepared a Community Environmental Response Facilitation Act (CERFA) report for the Umatilla Chemical Depot as a result of the 1988 BRAC Realignment (Earth Technology Corporation 1994). At that time, they determined that the total BRAC property acreage at UMCD was 16,433 acres. Approximately 11,467 acres of the 16,433 acre property had no history of CERCLA-regulated hazardous substance or petroleum product release, disposal, or storage. Approximately 2,647 acres of the facility were identified as CERFA parcels with qualifiers. Approximately 2,319 acres were identified as CERFA disqualified parcels. No areas of the facility were to be retained by the Federal Government or were to be transferred by deed *(*Earth Technology Corporation 1994*).*

The total area classified as Condition Type 1 in this ECP is 13,641 acres. This type is an area or parcel of real property where no release or disposal of hazardous substances or petroleum products or their derivatives has occurred, including any migration of these substances from adjacent properties. This property includes mostly grassy shrubland adjacent to the igloo blocks. These findings are based on review of historic UMCD documents, observations during site visits, interviews, and analysis of aerial photographs. A summary of ECP parcel designations can be found in Table 1 (Executive Summary), in Section 5, and visual displays of uncontaminated parcel properties are found on Figures 9 and 10 in Appendix G. As seen in Figures 9 and 10, the results of this ECP found that each of the eight Study Sections at UMCD have at least some non-Condition Type 1 classified areas.

4.18 Identification of Remaining Property

Table 29 lists the non-condition Type 1 property at UMCD and an estimate of the acreage associated with each site. Approximate areas of Study Sites and buildings have been included in Table 29; however, it is beyond the scope of the ECP to provide a comprehensive survey of the entire site. Information pertaining to parcel designation can be found within Tables 30 and 31. Tables 30 and 31 list the summary of the 2010 ECP findings for buildings, Solid Waste Management Units (SWMU) and former Investigation Sites. Flaking LBP and non-friable ACM are excluded from the ECP categorization process. LBP is likely in or on buildings built prior to 1959 and it is possible to find LBP in or on buildings built after this date. ACM is likely in or on buildings built prior to 1989 but it is possible to find ACM in buildings built after this date. All chemical agents were removed by 25 October 2011.

Table 29. Non-Condition Type 1 Property

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
I	1(5)X	All ADA grounds (not including ECP Parcel Designations 3, 8, 11, 14) (1670 acres)	5
I	2(5)HR,X	Site 58 Borrow/Burn/Disposal Area (3.5 acres)	5
I	3(5)HR,X	Site 19 Open Burning Trenches (49.5 acres)	5
I	4(3)HR	Site 57 Former Pit Area Locations (17.23 acres)	3
I	5(5)HR,X	Site 18 Dunnage Pits (6.3 acres)	5
I	6(5)HR,X	Site 56 Munitions Crate Burn Area (1.6 acres)	5
I	7(5)HR,X	Site 15 TNT Burn Area (4.6 acres)	5
I	8(5)HR,X	Site 55 Trench/Burn Field (8.6 acres)	5
I	9(5)HR,X	Site 13 Smoke Canister Disposal Area Site 17 Above Ground OD Area (1.7 acres) Total parcel acreage (28.37 acres)	5
I	10(6)HR,X	Site 59 GB/VX Decontamination Solution Disposal Area (3.2 acres)	5
I	11(5)HR,X	Site 32 Open Burning Trays (1.4 acres)	5
I	12(5)HR,X	Site 14 Flare and Fuse Disposal Area (55.5 acres) Site 38 Pit Field Area Total parcel acreage (132.74 acres)	5
I	13(6)HR,X	Site 16 Open Detonation Pits (61.0 acres)	5

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
I	14(5)HR,X	Site 31 Pesticide Pits (33.9 acres)	5
I	15(6)HR,X	Site 28 Fuel Burning Area (2.5 acres)	5
I	16(6)HR,X	Site 21 Missile Fuel Storage Area (39.3 aces) Site 80 Disposal Pit and Graded Areas (7.5 acres)	5
I	17(5)HR,X	Site 60 Active Firing Range (17.7 acres)	5
II	18(6)A	Building 202 (2.0 acres)	6
II	19(3)A,L,HS,HR,PS	Southwestern Warehouses (10 acres) Site 69 Skunk Works Area	3
II	20(4)HR,HS,PR,PS	Site 1 Deactivation Furnace (1.2 acres) Site 25A Metal Ore Piles (3.3 acres) Site 26 Metal Ingot Stockpile (11.0 acres) Site 44B Road Oil Application/Disposal Building 210 (0.3 acres)	4
II	21(6)A,L,HR,HS,PS	Building 100 Warehouses (12.7 acres) Site 35 Malathion Storage Leak Area (2.18 acres) Site 37 Building 131 Paint Sludge Discharge Area (0.5 acres) Site 46 Railcar Unloading Area (1.2 acres) Site 68 UDMH Operations Area (Building 121) (0.33 acres)	6
II	22(6)A,L,PS	Building 101 and Adjacent UST (0.3 acres)	6
II	24(3)HR,PS,RAD	Site 81 Former Raw Material Storage Locations and adjacent AST and RAD air monitoring station (6.7 acres)	3
II	25(4)HR,PR	Site 34 Paint Spray and Shot Blast Area (1.2 acres)	4
VII	26(3)PS,RAD	Building 24 and adjacent UST (0.03 acres)	3
III	27(7)R	Building 619 (0.02 acres)	7
III	28(6)A,HR,PS	Buildings 614 through 617 (0.4 acres)	6
III	29(2)PS	Building 670 and adjacent AST	2
III	30(6)A,HR,PS	Buildings 601 through 605 (0.6 acres) Site 9 GB Bomb Disassembly Area (23.0 acres)	6

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
III	31(6)A,HR,PS	Buildings 609, and 610 (0.2 acres) Site 45B Building 612 and 617 Boiler Discharge Areas (2.7 acres) Site 65 Waste Paint and Solvent Disposal Area (Building 608) (0.5 acres)	6
III	32(7)A,PS	Northern fenced portion of Block-I Igloos & USTs and ASTs near NE corner (139.1 acres)	7
III	33(2)PS	Buildings 426, 455 and associated USTs Total parcel acreage (4.56 acres)	2
III	34(3)HR	Site 82 Former Gravel Pit/Disposal Location (15.0 acres)	3
III	36(3)HR,HS,PS	Site 81-2 Former Raw Material Storage Locations (2.0 acres) Site 66 Brass, Copper and Steel Storage Area (1.4 acres)	3
VI	37(2)PS	Former ASTs along Juniper Road (2.25 acres)	2
V	38(6)A	Building 825 (0.04 acres)	6
V	39(2)PS	Former ASTs near Building 825 (1.28 acres)	2
IV	40(7)A,L,R,HS,HR,PS,PR	All K-Block land, Igloos and associated former USTs and ASTs (514.5 acres)	7
IV	41(3)HR	Site 10 Agent H Storage Area (8.6 acres)	3
V	42(7)A,L,R,HS,HR,PS	UMCDF (63.2 acres)	7
V	43(3)HR	Site 51 Large Open Areas (vicinity of Coyote Coulee) (22.9 acres) Site 62 Paint and Solvent Disposal Area (1.3 acres)	3
VIII	44(2)PS	Site 43 Former Gas Station/Possible UST Location (Central UMCD Grounds) (38.6 acres)	2
V	45(5)A,L,R,HR,PS,PR, RAD	Site 4 East Washout Lagoons (1.6 acres) Site 5 East Washout Plant (Building 489) (0.3 acres) Explosive Washout Lagoons Groundwater Plume (350.5 acres)	5
VII	46(6)A,PS	Former USTs along Birch Road (1.9 acres)	6

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
VII	47(7)A,R	Building 421 (0.03 acres)	7
VII	48(2)PS	Former AST location East of Rim Road South (0.72 acres)	2
VI	49(3)HR	Site 33 Gravel Pit Disposal Area (2.6 acres)	3
VI	50(3)HR	Site 64 Leaking Railcar Shipment Inspection Area (6.4 acres) Total parcel acreage (43.7 acres)	3
VI	51(3)HR,PR	Site 6 Sewage Treatment Plant (0.4 acres) Site 30 Storm Sewer Tile Field (0.6 acres) Site 48 Pipe Discharge Area (16.6 acres)	3
VI	52(3)HR,PR	Site 50 Railroad Landfill Areas (53.4 acres)	3
VIII	53(2)PS	Former Airfield UST (1.50 acres)	2
VIII	54(2)PS	Former UST Southeast of Airfield (1.22 acres)	2
VIII	55(3)HR	Site 61 Open Paint Spray Areas (21.7 acres)	3
VIII	56(3)HR	Site 35 Malathion Storage Leak Area (2.2 acres)	3
VIII	57(7)R	All Block D Igloos (12.76 acres)	7
VIII	58(3)HR	Site 11 Active Landfill (20.48 acres)	3
VIII	59(7)R	All Block E Igloos (6.25 acres)	7
VIII	60(4)HR,X	Site 39 QA Function Range (281.1 acres)	4
VII	61(3)HR	Site 70 Wood Preserving Solution Spill Area (0.9 acres)	3
VII	62(3)HR,PS	Site 77 Paint Storage and Disposal Area (Area 304) (0.1 acres)	3
VII	63(3)HS,PS	Buildings 27 and 30A (0.1 acres)	3
VII	64(6)A,PS	Building 30 (0.45 acres)	6
VII	65(2)PS,PR	Building 42 (0.52 acres)	2
VII	66(3)HS,PS	Site 75 Battery Acid Collection Sump (Building 31) (0.57 acres)	3
VII	67(6)A,HS,PS, PR	Buildings 5, 37 and associated former USTs (1.09 acres total)	6
VII	68(4)A,PS	Site 42 Former UST Locations (Administrative Area) (3.0 acres) Buildings 6,7,8, and 10 (0.4 acres)	4

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
VII	69(3)HR,HS,PS,PR	Site 42A Former UST Locations (Administrative Area) (3 acres) Buildings 21 (0.04 acres), 24 (0.03 acres), 46 (0.02 acres)	3
VII	70(2)PS	Former UST near intersection of Fir and D St. (0.03 acres)	2
VII	71(2)PS	Building 29 (0.07 acres)	2
VII	72(4)A	Building 4 (0.34 acres)	4
VII	73(4)A,PS	Building 18 (0.36 acres)	4
VII	74(2)PS	UST NE of Building 17 (0.03 acres)	2
VII	75(3)HS,HR,PS,PR	Site 22, the former DRMO area Buildings 42 and 77 (6.6 acres)	3
VII	76(6)A,HS	Building 11 (0.79 acres)	6
VII	77(6)A,PS	Building 36 and 53N (0.32 acres)	3
VII	78(6)A,PS	Building 53S (0.16 acres)	6
VII	79(3)A,HS,HR,PS,PR	Site 44 Road Oil Application/Disposal Sites Site 76 Photographic Chemical Disposal Area (Area 304) (0.1 acres) Buildings 3 (0.11 acres), 28 (0.05 acres), 54 (0.17 acres) Total parcel acreage (39.12 acres)	3
VII	80(4)A,HS,HR,PS	Building 2 (0.16 acres)	4
VII	81(2)PS	USTs of Building 41 (0.07 acres)	2
VII	82(7)A,R,PS	Building 57 (0.09 acres)	7
VII	83(4)A,PS	Building 51 (0.08 acres)	4
VII	84(7)R	Building 73 (0.03 acres)	7
VII	85(7)R	Building 55G (0.02 acres)	7
VII	86(2)PS	Building 55 (0.07 acres)	2
VII	87(3)HS,HR	Former PCB Transformer Vault (0.02 acres)	3
VII	88(6)R,PS	Building 1 (0.26 acres)	6
VII	89(7)R,PS	Building 35 (0.06 acres)	7

Study Section Numbers	ECP Parcel Designation	Study Site Name	Condition Type
VII	90(3)HR,PS	Buildings 15 and 16 (0.1 acre) Former PCB Transformer Vault (0.37 acres)	3
VII	91(7)A,R	Building 70 (0.05 acres)	7
VII	92(6)A,PS	Building 32 (0.19 acre)	6
VII	93(3)HR	Former PCB Transformer Vault (0.07 acres)	3
VII	94(2)PS	Building 33 (0.14 acres)	2
VII	95(4)A,PS	Building 34 (0.10 acres)	4
VII	96(7)R	Building 71 (0.06 acres)	7
VII	97(2)PS	Buildings 38 and 40 (0.26 acres total)	2
VII	98(2)PS	Former USTs around 5th Avenue (2.01 acres)	2
III	100(2)PS	Buildings 613, 618, and 621 (14.09 acres total)	2

Notes:

A = Asbestos

X = Unexploded Ordnance

HR = Hazardous Substance Release

R = Radon

PR = Petroleum Release

L = Lead Based Paint

RAD = Radionuclides

HS =Hazardous Substance Storage

PS = Petroleum Storage

Refer to Figure 9 & 10 Appendix G

A total of 100 parcels were originally identified and classified into one of seven ECP area condition types excluding type one. Some of the original 100 were dropped as certain areas became accessible. Each parcel was assigned a unique parcel identification number, an ECP Condition type in parentheses, and the type of release or environmental issue that is known or suspected for that parcel. Additional information regarding the unique parcel identification numbers within this ECP can be found in Section 4.18, Section 5.1, and in Appendix G, Figures 9 and 10 (Installation and Administration Area Building Map with ECP Condition type).

5. SUMMARY OF ENVIRONMENTAL CONDITION OF PROPERTY (ECP) REPORT

As stated in Section 1.0, the purpose of this updated ECP report is to determine the environmental conditions of properties being considered for disposal. The content is specified in AR 200-1 and is dependent on the nature of the transaction and the proposed transferee/lessee. Transfers or leases between the Army and non-Federal entities require an ECP Report. The following sections summarize the findings of the ECP Report. Included in the summary is a description of the ECP Condition type of the parcels classified based on the findings.

5.1 CONCLUSIONS

Conclusions were based on the available sources of information concerning both past and present uses of the property. Information included readily available data associated with past environmental investigations, adjacent property types, aerial photography, UMCD and other Oregon State and Federal partner personnel interviews, and ongoing response actions. Included in this research were records concerning any discharges of hazardous materials, leaks of storage tanks, dumping, content of known landfills, and the historic storage of chemical agent, conventional munitions, and petroleum products.

The VSIs were conducted on September 22 and October 23, 2009 to field-verify information produced in the document review and to identify potential environmental concerns. The VSIs involved a driving tour of the facility and its perimeter, as well as a systematic survey by vehicle and on foot through each section of the property. The VSI and interview process included inquiries regarding known or potentially unknown areas on UMCD lands which are or may be a future area of concern, and the request for records and other support detailing the environmental condition of UMCD.

Specific areas of UMCD have been classified into parcels of ECP Condition types as defined by the ASTM D-5746-98, *Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Facilities (*ASTM 2002*)*. A total of 100 parcels were identified and classified into one of seven ECP area condition types. Each parcel was assigned a unique parcel identification number, an ECP Condition number in parentheses, and the type of release or environmental issue that is known or suspected for that parcel. The following section details the ECP Condition types as defined by ASTM D-5746-98.

5.1.1 Environmental Condition of Property (ECP) Condition Type 1

ECP Condition Type 1 is defined as "an area or parcel of real property where no release or disposal of hazardous substance or petroleum products or their derivatives has occurred (including no migration of these substances from adjacent properties" (ASTM 2002). At UMCD this consists of 13,641 acres of undeveloped property. This primarily consists of undeveloped land, outside igloo storage areas, and areas outside of those that served as ammunition demolition or munitions disposal, disassembly, or washing. ECP Condition Type 1 is defined in white on Figures 9 and 10 of Appendix G.

5.1.2 Environmental Condition of Property (ECP) Condition Type 2

ECP Condition Type 2 is defined as "an area or parcel of real property where only the release or disposal of petroleum products or their derivatives has occurred" (ASTM 2002). At UMCD this consists of 37 acres of land and 18 parcels. ECP Condition Type 2 is defined in blue on Figures 9 and 10 of Appendix G.

5.1.3 Environmental Condition of Property (ECP) Condition Type 3

ECP Condition Type Condition 3 is defined as "an area or parcel of real property where release, disposal or migration or some combination thereof of hazardous substances has occurred, but at concentrations that do not require removal or remedial action" (ASTM 2002). At UMCD this consists of 267 acres of land and 24 parcels. ECP Condition Type 3 is defined in yellow on Figures 9 and 10 of Appendix G.

5.1.4 Environmental Condition of Property (ECP) Condition Type 4

ECP Condition Type 4 is defined as "an area or parcel of real property where release, disposal or migration, or some combination thereof, of hazardous substances has occurred, and all remedial action necessary to protect human health and the environment have been taken" (ASTM 2002). At UMCD this consists of 300 acres of land and 9 parcels. ECP Condition Type 4 is defined in green on Figures 9 and 10 of Appendix G.

5.1.5 Environmental Condition of Property (ECP) Condition Type 5

ECP Condition Type 5 is defined as "an area where release, disposal, or migration, or some combination thereof, of hazardous substances has occurred, and removal or remedial actions, or both, are underway but all required actions have not yet been taken" (ASTM, 2002). At UMCD this consists of 2022 acres of land and 6 parcels. ECO Condition Type 5 is defined in orange on Figures 9 and 10 of Appendix G.

5.1.6 Environmental Condition of Property (ECP) Condition Type 6

ECP Condition Type 6 is defined as "an area where release, disposal, or migration, or some combination thereof, of hazardous substances has occurred, but require remedial actions have not yet been initiated" (ASTM 2002). At UMCD this consists of 51 acres of land and 28 parcels. ECP Condition Type 6 is defined in Red on Figures 9 and 10 of Appendix G.

5.1.7 Environmental Condition of Property (ECP) Condition Type 7

ECP Condition Type 7 is defined as "areas that are unevaluated or require additional evaluation" (ASTM 2002). At UMCD this consists of 736 acres of land and 15 parcels. ECP Condition Type 7 is defined in brown on Figures 9 and 10 of Appendix G.

Table 30. Summary of ECP Findings for Buildings

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
QA-1XXX	Unknown	Unknown		IV		A						
1	Headquarters	1942	Admin Area	VII	General Purpose Admin	Y	Y	Y				
2	Fire Dept/ Security	1941	Admin Area	VII	Fire Station	Y	Y					Y
3	Police Headquarters	1942	Admin Area	VII	Police Headquarters	N	Y					
4	Machine Shop	1942	Admin Area	VII	Machine Shop	Y	Y					
5	Garage	1942	Admin Area	VII	Garage	Y	Y				Y	
6	Motor Fuel Station	1942	Admin Area	VII	Motor Fuel Station	Y	Y					
7	Carpenter Shop	1942	Admin Area	VII	Carpenter Shop	Y	Y					
8	Pest Control Building	1942	Admin Area	VII	Pest Control Building	Y	Y					
9	Housing Warehouse	1942	Admin Area	VII	Housing Warehouse	A	Y					
10	Locomotive House	1942	Admin Area	VII	Locomotive House	Y	Y					
11	Dispensary	1942	Admin Area	VII	Dispensary	Y	Y					Y
12	Recycle	1953	Admin Area	VII	Recycle	N	Y					
13	Loading Platform near Building 18	1941	Admin Area	VII	Loading Platform near Building 18	N						
14	Transformer House	1942	Admin Area	VII	Substation Building/Switching Station	Y	Y					Y
15	Equipment Storage Shed (adjacent to Building 17)	1942	Admin Area	VII	Family Quarters	N	Y					Y
15A	Housing	Unknown	Admin Area	VII	Family Quarters	Y						
15B	Housing	Unknown	Admin Area	VII	Family Quarters	Y						

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
16	Shed	1942	Admin Area	VII	Family Quarters	N	Y					
16A	Housing	Unknown	Admin Area	VII	Family Quarters	Y						
16B	Housing	Unknown	Admin Area	VII	Family Quarters	Y						
17	Inert Storage Warehouse	1942	Admin Area	VII	General Purpose Warehouse	Y	Y					
18	Warehouse Office	1942	Admin Area	VII	Warehouse Office	Y	Y					
19	Inert Storage Warehouse	1942	Admin Area	VII	Inert Storage Warehouse	Y	Y					
22	Storage Shed	1960	Admin Area	VII	Demolished		Y					
23	Pump and Sand Dryer House	1941	Admin Area	VII	Pump and Sand Dryer House	Y	Y					Y
24	Pump House, Well No. 1	1941	Admin Area	VII	Pump House, Well #1	Y	Y					Y
25	Water Treatment Building (Chlorine)	1941	Admin Area	VII	Water Treatment Building	Y	Y					Y
26	Motor Truck Scale House	1941	Admin Area	VII	Vacant	Y	Y					
26A	Archery Range	1981	Admin Area	VII	Derelict	N						
27	Battery Shop	1942	Admin Area	VII	Battery Shop	N						
28	Boiler House, Building #11	1942	Admin Area	VII	Boiler House (Building #11)	Y	Y					
29	Supply Shed (adj. To Building 4)	1953	Admin Area	VII	Supply Shed		Y					
30	Box and Crate Shop	1942	Admin Area	VII	Box and Crate Shop	Y	Y					
31	Dispatch Office and Equipment Pool	1942	Admin Area	VII	Dispatch Office and Equipment Pool	Y	Y					
32	Office and Theatre	1942	Admin Area	VII	Office and Theatre	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
33	Community Center	1962	Admin Area	VII	Community Center	Y	Y					
34	Housing NCO	1950	Admin Area	VII	Housing NCO	Y	Y					
35	Housing Quarters	1942	Admin Area	VII	Housing Quarters	Y	Y					
36	Crew Room, Kitchen	1943	Admin Area	VII	Chemical Treaty related	Y	Y					
37	Boiler House	1961	Admin Area	VII	Boiler House	Y	Y				Y	
38	Bathhouse	1969	Admin Area	VII	Bathhouse	Y	Y					Y
39	Oil Storage Dock	1965		VII	Oil Storage Dock							Y
40	Swimming Pool	1969	Admin Area	VII	unknown							
41	Standby Generator Plant	1972	Admin Area	VII	Standby Generator		Y					
42	Salvage and Surplus Property	1976	Admin Area	VII	Salvage and Surplus Property		Y					
43	Shed		Admin Area	VII	Shed not located							
44	Substation, 66,000-volt	1941	Admin Area	VII	Switching Station							
45	Post "4" Building	1982	Admin Area	VII	Sentry Station							
46	Valve House for Diesel Fuel Tanks	1944	Admin Area	VII	Valve House for Diesel Fuel Tanks							
47	Viewing Platform	1960			Viewing Platform							
48	Forklift Revetment (Load PE Equipment)	1948			Forklift Loading Dock							
49	Quonset Hut	1946			Demolished in 1987							
50	Quonset Hut	1946			Demolished in 1987							
51	Housing Quarters	1941	Admin Area	VII	Commander's Quarters							

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
52	Office Building	1941	Admin Area	VII	Admin General Purpose	Y	Y					
53	Office Building	1941	Admin Area	VII	Admin General Purpose	Y	Y					
54	Treaty Building	1941	Admin Area	VII	Treaty Building	Y	Y					
55	Office Space	1941	Admin Area	VII	Office Space	Y	Y					
56	Demolished	1942			Demolished							
57	Telephone Communication building	1995			Telephone Communication Building							
58	Standby Generator Plant	1942	Admin Area	VII	Standby Generator Plant		Y					
60	Steam Cleaning Slab	1949	Admin Area	VII	Steam Cleaning Slab							
61	Tennis Court	1953			Abandoned							
62	Recreation Center	1993			Abandoned							
63	Stables	1948			Demolished		Y					
64	Pump House for Store Oil	1944			Demolished							
65	School Bus Waiting Shed	1981			School Bus Waiting Shed							
66	Sludge Pit (Fire Truck Testing)	1963			Sludge Pit (Fire Truck Testing)							
67	Multiple Court Area	1969			Multiple Court Area							
68	Physical Training Course	1981			Physical Training Course							
70	NCO Quarters Garage	1942	Admin Area	VII	NCO Quarters Garage		Y					
71	BOQ Shed Garage	1944	Admin Area	VII	BOQ Shed Garage		Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
72	Garage for Building 35	1942	Admin Area	VII	Garage for Building 35		Y					
73	Garage for Building 51	1941	Admin Area	VII	Garage		Y					
74	Garage for Building 55	1941	Admin Area	VII	Garage		Y					
76	Traffic Control Center – Main Gate	1953			Traffic Control		Y					
77	Maintenance Open Building	1975			Maintenance Open Building	Y	Y			Y		
82	Drum Storage Shed	1960	Admin Area	VII	Storage Shed		Y					
83	Storage Shed	1982	Admin Area	VII	Abandoned							
84	Storage Shed	1982	Admin Area	VII	Acetylene Storage Building							
85	Storage Shed	1982	Admin Area	VII	Possibly Demolished							
86	Parts Storage	1982			Parts Storage Not Located							
87	Motor Oil Drum Storage	1994			Motor Oil Drum Storage							
88	Rocket & Bomb Display	1997			Rocket & Bomb Display							
89	Rocket Display – Admin	1966			Rocket Display – Admin							
101	Warehouse	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
102	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
103	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	P	Y					
105	Standard Warehouse	1942	Deactivation Furnace Area	II	Demolished	Y	Y					
106	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	Y	Y					
107	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	P	Y					
108	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	Y	Y					
109	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	P	Y					
110	Standard Warehouse	1942	Deactivation Furnace Area	II	Standard Warehouse Vacant	P	Y					
111	Standard Warehouse	1942	Deactivation Furnace Area	II	General Vacant Purpose Warehouse	Y	Y					
112	Standard Warehouse	1942	Deactivation Furnace Area	II	General Vacant Purpose Warehouse	Y	Y					
113	Standard Warehouse	1942	Deactivation Furnace Area	II	General Vacant Purpose Warehouse	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
114	Small Arms Storage	1942	Deactivation Furnace Area	II	General Vacant Purpose Warehouse		Y					
115	Shop Type Warehouse	1942	Deactivation Furnace Area	II	Storage for Construction	Y	Y				Y	
116	Admin Building	1942	Deactivation Furnace Area	II	Vacant	Y	Y					
117	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
118	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
119	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	P	Y					
120	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	P	Y					
121	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
122	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
123	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	P	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
124	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant		Y					
125	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	P	Y					
126	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant		Y					
127	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
128	Standard Warehouse – Type A	1942	Deactivation Furnace Area	II	Warehouse, Vacant	Y	Y					
129	Optical Storage	1942	Deactivation Furnace Area	II	Storage Vacant		Y					
130	Armco Ordinance Repair Shop	1942	Deactivation Furnace Area	II	Vacant	Y	Y					
131	Armco Ordinance Repair Shop	1942	Deactivation Furnace Area	II	Vacant	Y	Y					
133	Pump House for Reservoir	1942	Deactivation Furnace Area	II	Pump House for Reservoir, 1,000,000 Gallons	Y	Y					
135	Pump House Sprinkler System	1948	Deactivation Furnace Area	II	Pump House Sprinkler System	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
137	Powder Collection Cubicle	1956	Deactivation Furnace Area	II	Powder Collection Cubicle		Y					
139	Reservoir (1,000,000 Gallons)	1942			Reservoir (1,000,000 Gallons)	Y						
154	Latrine	1968	Deactivation Furnace Area	II	Latrine		Y					
155	Latrine	1968	Deactivation Furnace Area	II	Latrine		Y					
160	Pump House Well No. 4	1952	Deactivation Furnace Area	II	Pump House Well No. 4		Y					
161	Pump House Well No. 5	1952	Deactivation Furnace Area	II	Pump House Well No. 5		Y					
200	Storage Shed	1942	Deactivation Furnace Area	II	Storage Shed	Y	Y					
201	Storage Shed	1942	Warehouse Area	II	Storage Shed	P	Y					
202	Storage Shed	1942	Warehouse Area	II	Storage Shed	Y	Y					
203	Storage Shed	1942	Warehouse Area	II	Storage Shed	P	Y			P		
204	Storage Shed	1942	Warehouse Area	II	Storage Shed		Y					
205	Storage Shed	1942	Warehouse Area	II	Storage Shed	P	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
206	Deactivation Furnace	Unknown	Deactivation Furnace Area	II								
208	Break Room and Latrine	1959	Warehouse Area	II	Office for Washington Co.	Y	Y					
212	Firing Range	1987			Firing Range							
328	Storage Shed	1953	Near south border	V	Storage Shed		Y					
343	Concrete Vault	1941			Concrete Vault							
345	Railroad Inspection Pit	1943			Railroad Inspection Pit							
346	Railroad Scales	1941	Near south border	V	Railroad Scales	Y	Y					
401	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	Y	Y					
402	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
403	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
404	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	Y	Y					
405	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
406	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
407	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
408	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
409	Standard Magazine	1941	Magazine Area	V	Standard Magazine (Possibly Vacant)	P	Y					
410	Standard Magazine	1941	Magazine Area	V	Standard Magazine	P	Y					
411	Standard Magazine	1941	Magazine Area	V	Standard Magazine	P	Y					
412	Standard Magazine	1941	Magazine Area	V	Standard Magazine	Y	Y					
413	Standard Magazine	1941	Magazine Area	V	Standard Magazine	P	Y					
414	Standard Magazine	1941	Magazine Area	V	Standard Magazine	P	Y					
415	Inspector's Workshop	1942	South of Explosives Washout Area	V	Inspector's Workshop	Y	Y	Y				
416	Boiler Room for Building 415	1942	South of Explosives Washout Area	V	Boiler Room for Building 415	Y	Y					
417	Renovation Building	1953	Explosives Washout Area	V	Ammo Renovation Depot Vacant	Y	Y					P
418	Latrine	1952	Explosives Washout Area	V	Latrine	Y	Y					
419	Renovation field Office No. 2	1942	Explosives Washout Area	V	Renovation field Office No. 2	Y	Y					Y

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
420	Inspector's Workshop/Lunchroom	1953	South of Explosives Washout Area	V	Inspector's Workshop/Lunchroom	Y	Y					P
421	Dunnage Building	1942	Along railroad	II	Dunnage Building	P	Y					
422	Rabbit House	1942	Along railroad	II	Rabbit House (Vacant)	Y	Y					
423	Dunnage Building	1942	Along railroad	II	Dunnage Building	Y	Y					
424	Dunnage Building	1942	Along railroad	II	Dunnage Building		Y					
425	Dunnage Building	1942	Along railroad	II	Dunnage Building	Y	Y					
426	Dunnage Building	1942	Along railroad	II	Dunnage Building		Y					
427	Dunnage Building	1942	Along railroad	II	Dunnage Building	Y	Y					
431	Bundle Building	1953	Near Magazine Area	V	Bundle Building	Y						
433	Boiler House for Buildings 431, 434	1942	Near Magazine Area	V	Boiler House for Buildings 431, 434	Y						Y
434	Bundle Building	1953	Near Magazine Area	V	Bundle Building	Y						
442	Black Powder Magazine	1942	Near Borrow Pit	VI	Black Powder Magazine	Y	Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
447	Transmitter House	1941	Near Explosives Washout Area	V	Transmitter House	Y	Y					
450	Storage Building for Vehicles	1984			Storage Building for Vehicles							
454	Sentry Building	1998			Sentry Building							
455	Pump House Well No. 3	1962	Between Igloo Blocks G and F	V	Pump House Well No. 3		Y					
457	Guard House I Block	1962	Igloo Block I	VIII	Unknown	Y	Y					
478	Booster Pump House	1954	Explosives Washout Area	V	Booster Pump House	Y	Y					
482	Service Magazine	1953	Explosives Washout Area	V	Demolished		Y					
483	Service Magazine	1953	Explosives Washout Area	V	Demolished		Y					
484	Vacuum Pit	1953	Explosives Washout Area	V	Vacuum Pit		Y					
485	Service Magazine	1953	Explosives Washout Area	V	Service Magazine		Y					
486	Boiler House	1954	Explosives Washout Area	V	Vacant	Y	Y					P
488	Service Magazine	1953			Vacant		Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
489	Environmental Office (to be abated and demolished), Formerly Explosives Washout Plant	1963	Explosives Washout Area	V	Environmental Office, Demolished	P	Y					
490	Service Magazine (TNT Storage) Renovation	1953	Explosives Washout Area	V	Demolished		Y					
493	Clean and Paint Shop Renovation	1953	Explosives Washout Area	V	Clean and Paint Shop Renovation Vacant	Y	Y					
494	Paint Storage Building Renovation	1953	Explosives Washout Area	V	Vacant		Y					
495	Air Compressor Building Renovation	1953	Explosives Washout Area	V	Air Compressor Building Renovation	Y	Y					
501-517	Civilian Family Quarters, 5th Ave	1941	Admin Area	VII	Demolished 1999	Y	Y					
605	Storehouse Disassembly Plant	1950	Near Munitions Disassembly Area	VII	Vacant	Y	Y					
606	Latrine	1950	Near Munitions Disassembly Area	VII	Vacant	Y	Y					
608	Ammo Normal Maintenance Building	1955	Near Munitions Disassembly Area	VII	Vacant	Y	Y					P

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
609	Storehouse Ammo	1955	Near Munitions Disassembly Area	VII	Ammo	Y	Y					
610	Vacuum collector Barricade	1955	Near Munitions Disassembly Area	VII	Barricade	Y	Y					
611	Storehouse Flammable	1955	Near Munitions Disassembly Area	VII	Storehouse Flammable	Y	Y					
612	Heating Plant and Air compressor	1955	Near Munitions Disassembly Area	VII	Heating Plant and Air compressor	Y	Y					Y
613	Pump House Well No. 6	1955	Near northern border of UMCD	VII	Pump House Well No. 6		Y					
614	Ammo Disassembly and Renovation Building	1958	Near Munitions Disassembly Area	VII	Ammo Disassembly and Renovation Building	Y	Y					P
615	Vacuum Collector Barricade	1958	Near Munitions Disassembly Area	VII	Vacuum Collector Barricade	Y	Y					
616	Mounded Concrete Box Magazine	1958	Near Munitions Disassembly Area	VII	Mounded Concrete Box Magazine		Y					

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
617	Boiler Plant and Compressor Room	1955	Near Munitions Disassembly Area	VII	Boiler Plant and Compressor Room	Y	Y					Y
619	Quonset Hut, Lunchroom	1959	Near Munitions Disassembly Area	VII	Quonset Hut, Lunchroom	Y	Y					
621	Pump House Well No. 7	1961	Near northern border of UMCD	VII	Pump House Well No. 7	Y	Y					
622	Firing Range Bunker	1961	ADA east entrance	I	Firing Range Bunker	Y	Y					P
623	Motor Hold-down Foundation	1962	Near Munitions Disassembly Area	VII	Motor Hold-down Foundation							
624	Change House, ADA	1985	ADA east entrance	I	Unknown	Y	Y					
653	Storage	1953	Igloo Block K	IV	General Storehouse Standby Generator Plant, K Block		Y					
654	Storage	1985	Near Igloo Block K	IV	Ammo Renovation Shop, Heating Fuel Storage, and Septic Tank and Drainfield, K block	P						
656	Quality Assurance Facility	1980	Near Igloo Block K	IV	Quality Assurance Facility, K Block	P			Y			
658	Shed	1989	Igloo Block K	IV	Shed, K Block							

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
659	Storehouse	1978	Igloo Block K	IV	Storehouse, K Block	Y	Y					
660	Storage	1979	Igloo Block K	IV	Storage, K Block	P						
701	Bunker	1943			Bunker							
702-782	Foxhole Shelters	1943			Foxhole Shelters							
801-834	Transfer depot Explosives Building	1941-1944	Along Railroad	V, VI								
835-838	Tool House	1941-1944	Along Railroad	VI	Tool House							
Igloo Block A	Igloo	1941	Igloo Block A	VIII	Igloo							
Igloo Block B	Igloo	1941	Igloo Block B	VIII	Igloo							
Igloo Block C	Igloo	1941	Igloo Block C	VIII	Igloo							
Igloo Blocks D-E	Igloo	1941	Igloo Blocks D and E	VIII	Igloo			Y				
Igloo Blocks F-G	Igloo	1941	Igloo Blocks F and G	V, VI	Igloo							
Igloo Block H	Igloo	1941	Igloo Block H	III	Igloo			Y				
Igloo Block I	Igloo	1941	Igloo Block I	III	Igloo							

Building Number	Building Name	Year Built	Location	Study Section Number	Current Use	Asbestos	Lead	Radon	Radio-Nuclides	PCBs Storage	Petroleum Releases	Hazardous Substances Releases
Igloo Blocks J and K except bldg. 1901, 1902	Igloo	1941	Igloo Blocks J and K	IV,V	Igloo							
1901-1902	Igloo, J Block, 40 ft	1941	Igloo Block J	V	Igloo							

Notes: ‘Y’ means testing was positive, ‘N’ means testing was negative or no suspect materials were present, ‘P’ means there is potential for the hazardous material to be present (i.e. no assessment or testing has been performed), and ‘A’ means suspect material is present and assumed to be positive based on visual appearance of similarity to materials that have tested positively in the past.

Refer to Figures 2 & 3 Appendix G for building locations

Table 31. Summary of ECP Findings for Solid Waste Management Units (SWMUs) and Former Investigation Sites

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
1	Deactivation Furnace	DF	II	N	N	N	N	N	N	N	N	Y
2	Storage Igloos	---	multiple									
3	Hazardous Waste Storage Facility	DF	II									
4	Explosives Washout Lagoons	EWL	V	N	N	N	N	N	N	N	N	Y
5	Explosives Washout Plant (building 489)	EWL	V	N	N	N	N	N	N	N	N	Y
6	Sewage Treatment Plant	S. Central	VI	N	N	N	N	N	N	N	N	Y
7	Aniline Pit	ADA	I	N	N	N	N	N	N	N	N	Y
8	Acid Pit	ADA	I	N	N	N	N	N	N	N	N	Y
9	GB Bomb Disassembly Area	W. Central	III	N	N	N	N	N	N	N	Y	Y
10	Agent H Storage Area	N. Central	IV	N	N	N	N	N	N	N	N	Y
11	Active Landfill	East	VIII	N	N	N	N	N	N	N	N	Y
12	Inactive Landfill	S. Central	VI	N	N	N	N	N	N	N	N	Y
13	Smoke Canister Disposal Area	ADA	I	N	N	N	N	N	N	N	N	Y
14	Flare and Fuse Disposal Area	ADA	I	N	N	N	N	N	N	N	N	Y
15	TNT Burn Area	ADA	I	N	N	N	N	N	N	N	N	Y

Study Site Number	**Site Name**	**Location**	**Study Section Number**	**Asbestos**	**Lead**	**Radon**	**Radio-Nuclides**	**Unexploded Ordnance**	**PCBs Storage**	**Petroleum Storage**	**Petroleum Releases**	**Hazardous Substances Release or Storage**
16	Open Detonation (OD) Pits	ADA	I	N	N	N	N	N	N	N	N	Y
17	Above Ground OD Area	ADA	I	N	N	N	N	N	N	N	N	Y
18	Dunnage Pits	ADA	I	N	N	N	N	N	N	N	N	Y
19	Open Burning (OB) Trenches	ADA	I	N	N	N	N	N	N	N	N	Y
20	Open Burning (OB) Area	ADA	I	N	N	N	N	N	N	N	N	Y
21	Missile Fuel Storage Areas	ADA	I	N	N	N	N	N	N	N	Y	N
22	Defense Reutilization Marketing Office (former DRMO) area	ADMIN	VII				N	N	Y	Y	Y	Y
23	Building 5 Waste Oil Tank	ADMIN	VII				N	N	N	Y	Y	N
24	Building 10 Waste Oil Tank	ADMIN	VII				N	N	N	Y	Y	N
25	Metal Ore Piles	DF	II	N	N	N	N	N	N	N	N	Y
26	Metal Ingot Stockpile	DF	II	N	N	N	N	N	N	N	N	Y
27	Pesticide Storage Building (Building 8)	ADMIN	VII	N	N	N	N	N	N	N	N	Y
28	Fuel Burning Area	ADA	I	N	N	N	N	N	N	N	N	N
29	Septic Tanks*	---	multiple	N	N	N	N	N	N	N	N	Y
30	Storm Sewer Tile Field	S. Central	VI	N	N	N	N	N	N	N	Y	Y

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
31	Pesticide Pits	ADA	I	N	N	N	N	N	N	N	N	Y
32	Open Burning Trays	ADA	I	N	N	N	N	N	N	N	N	Y
33	Gravel Pit Disposal Area	S. Central	VI	N	N	N	N	N	N	N	N	Y
34	Paint Spray and Shot Blast Areas	DF	II	N	N	N	N	N	N	N	Y	Y
35	Malathion Storage Leak Areas	DF	II	N	N	N	N	N	N	N	N	Y
36	Building 493 Paint Sludge Discharge Area	EWL	V	N	N	N	N	N	N	N	N	Y
37	Building 131 Paint Sludge Discharge Area	DF	II	N	N	N	N	N	N	N	N	Y
38	Pit Field Area	ADA	I	N	N	N	N	N	N	N	N	Y
39	QA Function Range	East	VIII	N	N	N	N	Y	N	N	N	Y
40	Jeep Storage Area	DF	II	N	N	N	N	N	N	N	N	N
41	GB/VX Decontamination Solution Burial Areas	ADA	I	N	N	N	N	N	N	N	N	Y
42	Former Underground Storage Tank (UST) Locations (Administrative Area)	---	multiple	N	N	N	N	N	N	Y	Y	N
43	Former Gas Station/Possible UST Location (Central UMCD Grounds)	East	VIII	N	N	N	N	N	N	Y	Y	N

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
44	Road Oil Application/Disposal Sites	ADMIN	VII	N	N	N	N	N	N	N	Y	N
45	Building 612 and Building 617 Boiler Discharge Areas	W. Central	III	N	N	N	N	N	N	N	N	Y
46	Railcar Unloading Area	DF	II	N	N	N	N	N	N	N	N	Y
47	Boiler/Laundry Effluent Discharge Site	EWL	V	N	N	N	N	N	N	N	N	Y
48	Pipe Discharge Area	S. Central	VI	N	N	N	N	N	N	N	N	Y
49	Drill and Transfer Site	N. Central	IV	N	N	N	N	N	N	N	N	Y
50	Railroad Landfill Areas	S. Central	VI	N	N	N	N	N	N	N	Y	Y
51	Large Open Areas (Vicinity of EWL)	EWL	V	N	N	N	N	N	N	N	N	Y
52	Coyote Coulee Discharge Area	EWL	V	N	N	N	N	N	N	N	N	Y
53	Building 433 Collection Sump/Cistern and Disposal Area	East	VIII	N	N	N	N	N	N	N	Y	Y
54	Possible Disposal Pit Location	ADA	I	N	N	N	N	N	N	N	N	N
55	Trench/Burn Field	ADA	I	N	N	N	N	N	N	N	N	Y
56	Munitions Crate Burn Area	ADA	I	N	N	N	N	N	N	N	N	Y

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
57	Former Pit Area Locations	ADA	I	N	N	N	N	N	N	N	N	Y
58	Borrow/Burn/Disposal Area	ADA	I	N	N	N	N	N	N	N	N	Y
59	GB/VX Decontamination Solution Disposal Areas	ADA	I	N	N	N	N	N	N	N	N	Y
60	Active Firing Range	ADA	I	N	N	N	N	N	N	N	N	Y
61	Open Paint Spray Areas	East	VIII	N	N	N	N	N	N	N	N	Y
62	Paint and Solvent Disposal Area	EWL	V	N	N	N	N	N	N	N	N	Y
63	Pier 386 Chemical Solution Disposal Area	N. Central	IV	N	N	N	N	N	N	N	N	Y
64	Leaking Railcar Shipment Inspection Area	S. Central	VI	N	N	N	N	N	N	N	Y	Y
65	Waste Paint and Solvent Disposal Area (Building 608)	W. Central	III	N	N	N	N	N	N	N	N	Y
66	Brass, Copper, and Steel Storage Area	W. Central	III	N	N	N	N	N	N	N	N	Y
67	Building 439 Brass Cleaning Operations Area	EWL	V	N	N	N	N	N	N	N	N	Y

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
68	UDMH Operations Area (Building 129)	DF	II	N	N	N	N	N	N	N	N	Y
69	Skunk Works Area	DF	II	N	N	N	N	N	N	N	N	Y
70	Wood Preserving Solution Spill Area	ADMIN	VII	N	N	N	N	N	N	N	Y	Y
71	Possible Fire Training Pits Area	ADMIN	VII	N	N	N	N	N	N	N	Y	Y
72	Vehicle Storage Area	ADMIN	VII	N	N	N	N	N	N	N	N	N
73	Diesel Fuel Spill Location	ADMIN	VII	N	N	N	N	N	N	Y	Y	N
74	Oil/Fuel Transfer Station (Building 23)	ADMIN	VII	N	N	N	N	N	N	Y	Y	N
75	Battery Acid Collection Sump (Building 31)	ADMIN	VII	N	N	N	N	N	N	N	N	Y
76	Photographic Chemical Disposal Area (Building 54)	ADMIN	VII	N	N	N	N	N	N	N	N	Y
77	Paint Storage and Disposal Area (Area 304)	ADMIN	VII	N	N	N	N	N	N	N	N	Y
78	Buildings 608 and 614 Heat Exchange Systems	W. Central	III	N	N	N	N	N	N	Y	N	N
79	Malathion Spray Areas	East	VIII	N	N	N	N	N	N	N	N	Y
80	Disposal Pit and Graded Areas	DF	II	N	N	N	N	N	N	N	N	Y

Study Site Number	Site Name	Location	Study Section Number	Asbestos	Lead	Radon	Radio-Nuclides	Unexploded Ordnance	PCBs Storage	Petroleum Storage	Petroleum Releases	Hazardous Substances Release or Storage
81	Former Raw Material Storage Locations	DF	II	N	N	N	N	N	N	N	N	N
82	Former Gravel Pit/Disposal Location	ADA	I	N	N	N	N	N	N	N	N	Y
83	Leaking Drum Storage Area	ADMIN	VII	N	N	N	N	N	N	N	N	Y
NA	PCB Transformer Location Transformer 162, 163, & 225	---	multiple	N	N	N	N	N	Y	N	N	Y

6. CERTIFICATIONS

All information/documentation provided accurately reflects the condition of the Umatilla Chemical Depot property. This report meets the DoD requirements for completion of an Environmental Condition of Property report.

Michele Martin	Richard Wilson, Environmental Engineer
BRAC Environmental Coordinator	Program Manager
Umatilla Chemical Depot	U.S. Army Corps of Engineers – Seattle District

In accordance with the requirements of 40 CFR §312 concerning the results of inquiry by an environmental professional:

"[I, We] declare that, to the best of [my, our] professional knowledge and belief, [I, we] meet the definition of Environmental Professional as defined in § 312.10 of this part."

"[I, We] have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. [I, We] have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312."

Deborah Johnston
U.S. Army Corps of Engineers – Seattle District

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U.S. Army Base Realignment and Closure (BRAC) Environmental Condition of Property Report Update Umatilla Chemical Depot – Oregon

For Reassignment to the Army National Guard and Subsequent License to the Oregon Army National Guard

Prepared by

BRAC

May 26, 2017

TABLE OF CONTENTS

TABLES

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

A	Asbestos
ACSIM	Army Chief of Staff for Installation Management
ADA	Ammunition Disposal Area (or Activity)
AR	Army Regulation
Army	United States Army
ARNG	Army National Guard
AST	Above Ground Storage Tank
ASTM	American Society for Testing Materials
Bldg	Building
BRAC	Base Realignment and Closure
BRRM	Base Redevelopment and Realignment Manual
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERFA	Community Environmental Response Facilitation Act
CDA	Columbia Development Authority
CFR	Code of Federal Regulations
cm2	Centimeters Squared
CMA	U.S. Army Chemical Materials Agency
DGM	Digital Geospacial Imaging
DoD	U.S. Department of Defense
ECP	Environmental Condition of Property
EPA	U.S. Environmental Protection Agency
ESA	Engineering Sampling Analysis
EW	Extraction Well
EWL	Explosives Washout Lagoons
FFS	Focus Feasibility Study
GAC	Granular Activated Carbon
gpm	Gallons Per Minute
HR	Hazardous substance Release
HS	Hazardous Substance Storage
HWMU	Hazardous Waste Management Units
IF	Infiltration
L	Lead
LAPP	Lagoon amendment Pilot Project
LUC	Land Use Control
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams/kilogram
MMRP	Military Munitions Response Program
NPDES	National Pollutant Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
ODHS	Oregon Department of Human Services
OE	Ordnance and Explosive

OR	Oregon Regulation
ORARNG	Oregon Army National Guard
PCB	Polychlorinated biphenyl
PGG	Pacific Grain Growers
POL	Petroleum, Oil, and Lubricant
PP	Proposed Plan
PR	Petroleum Release
PS	Petroleum Storage
PWS	Performance Work Statement
PWS	Public Water System
R	Radon
RAD	Radiation
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SFT	Shipping and Firing Tubes
TNT	2,4,6-Trinitrotoluene
TSCA	Toxic Substance Control Act
TSDF	Treatment Storage and Disposal Facility
µg	Micrograms
UMCD	Umatilla Chemical Depot
UMCDF	Umatilla Chemical Agent Disposal Facility
US	United States
USACE	US Army Corps of Engineers
UST	Underground Storage Tank
UXO	Unexploded Ordnance

UMATILLA CHEMICAL DEPOT
ENVIRONMENTAL CONDITION OF PROPERTY
FOR NATIONAL GUARD PARCEL
MAY 2017 UPDATE

1 PURPOSE

As specified in Army Regulation (AR) 200-1, the content of the Environmental Condition of Property (ECP) Report depends on the nature of the transaction and the proposed transferee/lessee. The Army Chief of Staff for Installation Management (ACSIM), Base Realignment and Closure Division (BRACD) will reassign 7,500 acres of the Umatilla Chemical Depot (UMCD) to the Army National Guard (ARNG). The property will subsequently be licensed to the Oregon Army National Guard (ORARNG) for military training purposes. This ECP update will address only the 7,500 acres being licensed to the ORARNG. Map 1 in Attachment 1 is the Reuse Map and shows the parcels designated for the ORARNG, the Oregon Department of Transportation and the Columbia Development Authority (CDA). This ECP update will address only the ORARNG parcel and changes that have occurred since the update in 2013.

1.1 General

This ECP update meets the Department of Defense (DoD) preparation requirements for an ECP Report. The ECP was performed to collect reliable information regarding the environmental condition of the property to determine the property's suitability for out-grant or transfer, and to meet the requirements under §120(h)(1) and (3)(A)(i) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 40 Code of Federal Regulations (CFR) Part 373, Section 15-5 of AR 200-1, and DoD Base Redevelopment and Realignment Manual (BRRM), 4165.66M, Section C8.3. The information gathered during this assessment will be used to assist the ORARNG in making informed decisions about the transfer of the property by reducing uncertainty regarding its environmental condition. The Army prepares an ECP for the following purposes (AR 200-1 2007; DoD 2006):

- Summarize historical, cultural, and environmental conditions and include references to publicly available related reports, studies, and permits.
- Provide an accurate summary of the environmental condition of the property.
- Provide the Military Department with information used to make disposal decisions regarding the property.
- Provide the public with information relative to the environmental condition of the property.
- Assist in community planning for the reuse of BRAC property.
- Assist Federal agencies during the property screening process.
- Provide information for prospective buyers.

- Assist prospective new owners in meeting the requirements under US Environmental Protection Agency's (EPA) "All Appropriate Inquiry" regulations. The EPA issued the All Appropriate Inquiry Rule on November 1, 2005 (40 CFR Part 312).
- Provide information about completed remedial and corrective actions at the property.
- Assist in determining appropriate responsibilities, asset valuation, and liabilities with other parties to a transaction.

The updated ECP Report was performed in substantial compliance with American Society for Testing Materials (ASTM) Standard Practice D6008-96, *Standard Practice for Conducting Environmental Baseline Surveys (*ASTM 2005*)* and Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Activities, ASTM D5746-98 (2016) were followed in the preparation of this update.

2 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMITS

The Umatilla Chemical Agent Disposal Facility (UMCDF) was a RCRA permitted Treatment, Storage, and Disposal Facility (TSDF) constructed and operated for the sole purpose of destroying the chemical agents stored at UMCD. The facility was completed in 2001 and incineration of chemical agents began in 2004. The destruction of the agent was completed in October, 2011. In addition to the demilitarization facility, the UMCDF had permitted hazardous waste stored in igloos in J-block.

The UMCD has RCRA permit, OR6 213 820 917 issued by the Oregon Department of Environmental Quality (ODEQ) (ODEQ 1997a), for the storage of chemical agent and agent related waste in I, J, and K, block and for non-agent waste storage in other locations throughout the depot.

The UMCDF has completed RCRA closure for both the facility and the storage igloos of permit ORQ 000 009 431 (ODEC 1997b). The applicable land use controls (LUC) have been incorporated into the UMCD RCRA permit OR6 213 820 917 which is in the closure process. The applicable LUCs limit use to non-residential use including no child care facilities.

The LUCs apply to the buildings and some areas immediately adjacent to buildings and the igloos, which include 6' in front of the igloos. Below is a summary of the buildings that will have RCRA LUCs (Note: Attachment 2 is a list of references of CMA environmental documents).

Table 1

ORARNG RCRA Locations

Area	Bldg #	Bldg or Site	Comment
I-Block Igloos	1699-1722	Igloos	Includes 6' in front of igloo
J-Block Igloos	1723-1734 1737-1748 1753-1764 1768-1774 1777-1779 1797-1807		Includes 6' in front of igloo.
K-Block Igloos	1811-1900	Igloos	Includes 6' in front of igloo
K-Block	654	Toxic Chemical Munitions	
K-Block	655	Laundry, Satellite Accumulation Area (SAA) & 90 storage	
K-Block	656	Laboratory; SAA	
K-Block	659	Mustard Shed	
K-Block	837	Pier 37; 90 day storage	Includes fenced area outside
Cantonment Area	5	Auto shop, SAA	
Cantonment Area	7	SAA	
Cantonment Area	11	Offices and shops; SAA	
Cantonment Area	14	SAA	
Cantonment Area	27	Battery shop	
Cantonment Area	31	90 day storage outside bldg 31	
400 Area	419	Old laundry SAA	
400 Area	419	Septic outside old laundry.	
400 Area	419	Ton container wash out	

3 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

3.1 Explosive Washout Lagoon (EWL) Groundwater Contamination

From the mid-1950s to 1965, explosives, contaminated sludge, and liquid wastes generated at the UMCD Washout Plant were discharged and allowed to collect in unlined lagoons and infiltrate into the soil and groundwater at the South Lagoon Area, resulting in contamination of RDX and TNT. The Army initiated a Remedial Investigation (RI) in 1987 and the Record of Decision (ROD) was signed in 1994 (US Army 1994a).

The source of the groundwater contamination is located on the ORARNG parcel (see maps 1, 2, and 3 in Attachment 1). The selected remedy for the contaminated soil source included excavation of the soils and treatment via composting from June 1994 to May 1997. EPA approved the *Remedial Action Report Explosives Washout Lagoons, Soils Operable Unit* (USACE 1998a).

The ROD identified pump and treat as the selected remedy for treatment of groundwater contamination. The contaminated groundwater remediation facility, a pump and treat facility with extraction wells, was constructed in 1995 and brought online in 1996 to remove explosives from the ground-water. Map 1 in Attachment 1 shows the approximate location of the plume. Maps 2 and 3 shows details of the plume and associated equipment including the CDA parcel.

The original extraction and injection system, constructed in 1995, included three extraction wells (EW-1, EW-3, and EW-4) capable of a combined pumping rate at 1,300 gallons per minute (gpm), a centralized treatment plant rated at 1,500 gpm consisting of four 20,000-pound granular activated carbon (GAC) filters, and four infiltration fields (IF-L, IF-1, IF-2, and IF-3). This original system began operation in January 1997. The approved design is presented in the three volume *95% Remedial Design Submittal Contaminated Groundwater Remediation Explosives Washout Lagoons Umatilla Depot Activity, Hermiston Oregon* (Seattle District U.S. Army Corps of Engineers, May 1995). In 2012, the remedy was expanded to include new extraction well EW-6 in the Eastern Lobe.

The extraction and treatment system operated continuously (except for periodic maintenance and occasional unplanned down time) from 1997 until February 2009, during which time approximately 1,300 pounds of contaminant were removed in the treatment system. In 2009, the system began operating under a pulse-pumping scheme to evaluate whether cycling the extraction off and on could increase system efficiency. Because pulse-pumping was found to be ineffective at increasing the recovery rate, groundwater extraction was suspended in 2009 in order to perform field testing of an alternative *in-situ* bioremediation remedy.

In 2010, the US Army Corps of Engineers (USACE) initiated a series of bench-scale treatability studies, in both field and laboratory, to evaluate in-situ bioremediation for treatment of the residual explosives contamination. In-situ bioremediation testing conducted at the site, known as the Lagoon Amendment Pilot Project (LAPP), began in 2010, with successive tests conducted between 2011 and 2013. LAPP 0 was conducted in 2010, LAPP 1 in 2011, LAPP 2 in 2012, and LAPP 3 in 2013. As a consequence during LAPP testing, the treatment plant was operated for approximately seven days during each of the tests, including withdrawal of groundwater at wells

EW-1 and EW-3 and injection of groundwater along with carbon substrate amendment[3] at the former washout lagoons infiltration field. The results for the LAPP testing are presented in separate reports (USACE, 2011a, 2011b, 2012a, 2013a, 2014).

As of late 2013, most of the extraction and treatment capacity is being used to remedy the Eastern Lobe which is on property slated for transfer to the CDA (US Army 2016a). During 2014, the treatment plant processed approximately 336 million gallons of explosives contaminated groundwater, all through EW-6 which operated at approximately 700 gallons per minute. In 2015, groundwater was extracted through EW-4 and EW-6. Approximately 210 million gallons of explosives-contaminated groundwater was treated in 2015 due to planned periodic shut-downs to allow for bioremediation field testing. All groundwater was returned to the aquifer through the infiltration fields IF-2 and IF-3.

Currently BRAC and USACE are evaluating alternatives to address the remaining contamination of groundwater at the EWL. Basic components of the remedial alternatives subjected to a detailed evaluation for the contaminated groundwater at the EWL include:

1) Continued Pump and Treat: continued groundwater pumping through the current treatment system
2) Pump and Treat Expansion: groundwater pumping through an expanded treatment system, which may include portable GAC units
3) Bioremediation: injection of carbon substrate into the subsurface through the existing lagoon infiltration gallery and a new network of alternating injection and extraction wells.
4) Pump and Treat Expansion and Bioremediation: groundwater pumping through an expanded treatment system, plus the injection of carbon substrate into the subsurface through the existing lagoon infiltration gallery.

A Focus Feasibility Study (FFS), Proposed Plan (PP), and ROD amendment will be prepared for EPA approval. It is likely that bioremediation will target the high concentration of RDX in the central part of the plume. Pump and treat will continue to be used for the eastern plume. The southwest plume will likely be treated via pump and treat either at the existing plant or a portable unit. A design contract will be awarded in 2017 and a construction contract in 2018 with operations to begin in early 2019. The latest annual report was submitted February 2016 (USACE 2016).

Until remediation is achieved institutional controls will be implemented to restrict access to the contaminated aquifer, the contaminated ground water remediation equipment and the interconnecting piping.

3.2 Ammunition Disposal Area

Starting in 1945, the Ammunition Demolition Activity Area (ADA) was used to dispose of ordnance and other solid wastes by burning, detonation, dumping, or burial. The activities were conducted at twenty sites identified in the Remedial Investigation/ Feasibility Study (RI/FS) as actual or possible locations. The general location of the ADA is in Map 1 in Attachment 1.

The selected remedies identified in the September 1994 ADA Operable Unit ROD (US Army 1994b), included:

1) Cleanup of chemically contaminated soils of sites 15, 17, 19, 31, and 32.
2) Remove Munitions and Explosives of Concern (MEC) items from the ground surface.
3) Detect and quantify MEC below the ground surface.
4) Conduct retrieval and treatment of buried MEC to a depth that will allow for the selected land use.

Cleanup of the contaminated soil and removal of surface unexploded ordnance (UXO) was completed in 2003 (USACE 2005).

In July 1998, an Engineering Sampling Analysis (ESA) of the ADA was prepared to "detect and quantify UXO below the ground surface". The document assessed the MEC risk and presented and evaluated alternatives to reduce the potential risk of MEC exposure to the property owners following the closure of the UMCD (Earth Technology Corporation, 1998).

The field investigation was conducted in two phases. The first phase involved performing a geo-physical investigation of the 1750-acre site to locate subsurface anomalies. The entire ADA was geo-physically mapped. The second phase of the field investigation involved subsurface sampling. The MEC found included bombs and projectiles, artillery and mortar rounds, mines, and propellant. Also found was Ordnance and Explosive (OE) scrap including inert practice bombs, tail fins, and munitions fragments.

The Remedial Design and Remedial Action (RD/RA) phases of this project were contracted with TerranearPMC in September 2012 with the intention of completing all ROD requirements (USACE 2015b). The contractor began field clearance work in 2014 and completed a Digital Geophysical Mapping (DGM) survey in 2014. Based on the results of the survey, the contractor believed approximately 350 acres of the area were more saturated with metallic debris than was originally anticipated and stated they could not complete the remedial action objectives within the funding of the contract (see Map 1 and 4 in Attachment 1). The contract was partially terminated for convenience on 27 March 2015 without completion of all tasks.

BRAC reevaluated the ADA remedy goals in concert with, US EPA, ODEQ, the Army National Guard, and ORARNG during November 2015 to February 2016. As a result of these discussions, the USACE Omaha District was tasked to complete a revised Performance Work Statement (PWS) and pursue contracting actions.

The continued use of the land by the ORARNG as small arms ranges is considered by the US EPA to be "industrial use" in the target areas and range fan. The MEC clearance level at the ADA is therefore to be industrial land use standards. In agreement with the regulators, clearance of MEC shall be to 3' and all pits and trenches to depth.

A new RD/RA contract to complete clearance of the remaining 350 acres was awarded in July 2016, with execution from July 2016 through July 2021.

4 MUNITIONS DECONTAMINATION, UMAD-149 BUILDINGS 608 AND 614 COMPLEX

Decontamination activities for these buildings pertain to the Military Munitions Response Program (MMRP). The objective of the project was to decontaminate the explosive residue hazards remaining in the 608/614 complex to a level that is safe for human habitation and use, and certify that the structures are free of explosives. The project primarily encompassed decontamination of interior building structures, vacuum system piping, and various processing equipment (for location see map 1). The project included limited abatement of asbestos and bird guano hazards to the degree needed to perform the primary project objective.

The building 608 complex includes buildings 608, 609, 610, 611, and 612. Building 608 was constructed in 1955 for the renovation of missiles, bombs, and shells. Munitions were dismantled on the southern side of the building and refurbished (repainted, etc.) on the northern side. Any excess propellant was removed on the southern side via vacuum pipes to the vacuum equipment housed in building 610, then collected and stored in containers for disposal. Building 609 was used for storage, possibly of explosive material. Building 611 was used as a break room or office space for workers. Building 612 was the boiler room, which supplied steam and compressed air to building 608.

The building 614 Complex includes buildings 614, 615, 616, 617, 619, and 622. Building 614 was constructed in 1958 for the same purposes as building 608. The southern side of the building contains vacuum equipment that was used to transport explosive and/or propellant material to a vacuum and collection system in building 615. Building 616 was used for storage, possibly of explosive materials. Building 617 was the boiler room for building 614. Building 619 was a break room. Building 622 was used as a changing room. It contains five rooms separated by drywall containing an office area, a restroom, and showers.

The USACE awarded Contract W9128F-14-C-0001 to North Wind Solutions. The site Specific Final Report was complete in July 2015 (July 2015).

5 TOXIC SUBSTANCE CONTROL ACT (TSCA)

CMA is in the process of closing its permitted hazardous waste management units (HWMU), in accordance with Attachment 6 to the UMCD Permit, OR6 213 820 917, *Partial Closure Plan*. Facilities currently involved in that process include 104 J- and K-Block igloos. A subset of these HWMUs was used to manage polychlorinated biphenyl (PCB)-items and/or wastes potentially contaminated with PCBs, and are thus regulated under the *Toxic Substances Control Act* (TSCA). As stipulated in Section 1.6.5.4 of the *Partial Closure Plan*, the TSCA closeout report was prepared for submittal to the U.S. EPA, summarizing and evaluating PCB analytical results, to support facility closures under TSCA (US ARMY 2013).

Planning and implementation of TSCA-related closure activities are documented in the *Partial Closure Plan* and in RCRA closure certification packages (US Army 2016b). The closure plan and certification packages are available on the ODEQ Chemical Demilitarization Program webpage (http://www.deq.state.or.us/umatilla/cdp.htm). The PCB data from the individual RCRA closure certification packages (US Army 2016) were collected and summarized in the TSCA Summary Report to support a termination of TSCA storage requirements at UMCD (US Army 2013).

Potential sources of PCB contamination were as follows:

- Forty-nine of the 90 K-Block igloos were used to stockpile M55 rockets. Each rocket was encased in a fiberglass shipping and firing tube (SFT). PCBs were incorporated into the matrix of the fiberglass, in concentrations that ranged from below 50 µg/g to in excess of 2,000 µg/g. All SFTs and enclosed rockets have been removed and destroyed in the UMCDF RCRA and TSCA permitted facility. The assumption driving closure activities is that deterioration of, or physical damage to, the exterior surface of these SFTs while in storage could have released PCB-containing fiberglass particulates.
- Two J-Block igloos were used to manage wastes that could have contained PCBs. Igloo J-1798 was used to store hazardous wastes that could have contained SFTs or SFT fragments and particulates. Igloo J-1805 was used for waste segregation activities, which could have involved wastes that included SFTs or SFT fragments and particulates. Records do not identify any leaks or spills.

Closure activities performed under the *Partial Closure Plan* included removing (vacuuming) and sampling debris from the floors in each of the identified HWMUs, and then wipe sampling interior concrete surfaces to verify that closure standards were met.

Coarse debris (rocks, wood, concrete chips, etc.) was removed from the unit floors by hand. Fine debris was then removed from the floors using vacuums equipped with high-efficiency particulate air (HEPA) filters. Accumulated debris was containerized by HWMU. A representative debris sample was collected for each HWMU and analyzed for Aroclor 1016 and Aroclor 1254 using EPA SW-846 Method 8082, to support waste determination. Aroclor 1016 was not detected in any sample. Aroclor 1254 was detected in 10 debris samples, at an average of 19.6 mg/kg, and with a maximum concentration of 45.1 mg/kg. No debris samples exceeded the TSCA bulk waste threshold of < 50 ppm (< 50 mg/kg) PCBs. From a TSCA perspective, this supports a determination that all collected debris is non-PCB bulk waste.

After debris removal, facility interior surfaces were wipe sampled using gauze pads wetted with acetone. Wipes were analyzed for Aroclor 1016 and Aroclor 1254 using EPA SW-846 Method 8082. Aroclor 1016 was not detected in any sample. Aroclor 1254 was detected in 15 wipe samples at an average concentration of 0.177 µg/100 cm2.1 The maximum concentration detected was 0.432 µg/100 cm2, which is less than 5% of the TSCA unrestricted closure threshold of 10 µg/100 cm2. Fourteen of the 15 verification samples with detectable Aroclor 1254 came from six consecutively numbered K-Block igloos, each used to store VX M55 rockets received from the Newport Army Ammunition Plant in 1962. This result suggests that there was something about the particular batch or batches of SFT used. Perhaps there was a higher proportion of SFTs with the high concentration of PCBs, but since all of the rockets and SFTs have been incinerated, this conjecture cannot be investigated.

In 2015 EPA expressed a concern that PCB in debris or dust may migrate into floors and walls of the igloos. EPA determined that further information was needed and requested additional sampling of igloos K-1843, -1857, -1860. -1876, 1890, -1891, 1892, -1893, 1894, and -1895 (US EPA 2015). Twenty-one concrete powder samples were collected from the floors (14) and walls (6 plus one duplicate) of the ten identified igloos. The results were documented in US ARMY 2016. Aroclor 1254 was again the only PCB detected and was detected in all 21 samples. Twenty of the samples (95%) had reported concentrations below the TSCA clean closure standard of 1 ppm (≤1 mg PCB/kg) specified for high occupancy areas (40 CFR 761.61 (a)(4)(i)(A). A single concrete sample (1.1 µg PCB/g) collected from a wall surface within K-1843 slightly exceeded the high occupancy standard but was well below the low occupancy area standard of ≤ 25 ppm (≤ 25 mg PCB/kg)(40 CFR 761.61 (a)(4)(i)(B)(US Army 2016b).

Evaluation of the reported results supports a TSCA clean closure determination for the subject facilities, in the context of TSCA closure requirements. In a letter to CMA on May 4, 2017 (Attachment 3), the US US EPA stated,

> "On the basis of the information evaluated and since the PCB Bulk Product Waste stored pursuant to the approval has been disposed, the EPA hereby declares that the Umatilla site is no longer subject to the §761.62(c) risk-based storage approval issued April 12, 2006. The approval is hereby terminated for the Umatilla site, effective upon the signature of this letter" (US EPA 2017).

6 TITLE V OF CLEAN AIR ACT (CAA)

The Oregon Title V Operating Permit (25-0024-TV-01 (ODEQ 2009)) for the UMCDF was cancelled in August 2013 (ODEQ August 2013).

7 WATER POLLUTION CONTROL FACILITES (WPCF) PERMITS

The Installation has two WPCF Permits:

- Permit Number 102031 (ODEQ 2006): This is for the Imhoff tank and leach field which serve the administrative area. Permit 102031 expired on 2/28/2015, but a renewal application was filed in 11/2014. The application was deemed complete on 12/24/2014, and the expired permit was administratively extended until a new permit is issued by DEQ. This permit will transfer to the ORARNG when the property transfers.

- Permit Number 101456 (ODEQ 2003): This is for the individual septic systems throughout the installation, including the UMCDF. The ORARNG will keep the permit and the CDA will apply for a new permit for their sewage/septic systems. Those septic tanks that have been abandoned will be decommissioned in and removed from the permit.

The tank tanks that are in the process of being decommissioned are:

- ORARNG facilities (approximate locations):
  - 415
  - 417
  - 419
  - 420
  - 493
  - 497
  - 608
  - 614

    - 457
    - 486
    - 622
    - 663

- CDA facilities (approximate locations):
    - 128
    - 131
    - 204
    - 208
    - 433

The remaining septic systems will be:

- ORARNG facilities:
    - K-block (buildings: 654, 655, 656, and 660)
    - I-Block entrance
    - Building 402

- CDA facilities:
    - UMCDF
    - Buildings at E-38 gate

8 DRINKING WATER PERMITS

UMCD has two public drinking water systems. Both are non-transient, non-community systems. In both systems, water is obtained through groundwater wells and treated with gas chlorination. Both permits will remain with the ORARNG after transfer.

The Oregon Department of Human Services (ODHS) Drinking Water Program assigned Public Water System (PWS) Identification Number OR4101136 to the system that serves the UMCD administration area and includes wells 1, 2, 4, and 5. Water is piped from wells 4 and 5 in the southwest corner of UMCD to the administration area. Wells 1 and 2 are located in the administration area, but are currently not functioning (ODHS 2015).

PWS Identification Number OR4194664 refers to the water system that serves the northern portion of UMCD and consists of wells 6 and 7. They support the buildings in K-block, the northern part of the base, and the UMCDF (ODHS 2009).

9 ABOVEGROUND STORAGE TANKS (AST)

The below table lists the AST on the Installation. It includes the two tanks on the future CDA parcel: a 280 gallon tank near building 133 for the back-up generator for well 4 and a 2,000 gallon fuel oil tank for building 403.

Table 2

UMCD Aboveground Storage Tanks

Identifier	Bldg	Size	Material	Notes	Comment
PT-1000-1	1	1,000	Propane	Pacific Grain Growers (PGG)/Caretaker Lease	
PT-1000-2	2	1,000	Propane	PGG/Caretaker Lease	
PT-1000-4A	4	1,000	Propane	PGG/Caretaker Lease	
PT-1000-4B	4	1,000	Propane	PGG/Caretaker Lease	
PT-1000-4C	4	1,000	Propane	PGG/Caretaker Lease	
PT-1000-4D	4	1,000	Propane	PGG/Caretaker Lease	
PT-500-Mobile	4 West	500	Propane	Army owned	
ASTg-250-Storage	4 west	250	Diesel	Attached to generator	Storage
AST-275-5	5	275	Diesel		Empty
AST-250-6A	6	250	Diesel		Yellow tank
AST-250-6B	6	250	Diesel		Empty
AST-250-6C	6	250	Diesel		Yellow tank
AST-250-6D	6	250	Diesel		Yellow tank
AST-10000-6	6	10,000	Diesel	POL	ORARNG
AST-15000-6	6	15,000	Gasoline	MOGAS	ORARNG
PT-1000-6	6	1,000	Propane	PGG/Caretaker Lease	
PT-1000-11	11	1,000	Propane	PGG/Caretaker Lease	
ASTg-1500-14	14	1,500	Diesel	Admin Gen	In use
PT-1000-18A	18	1,000	Propane	Oregon Military Department (OMD)/PGG lease	
PT-1000-18B	18	1,000	Propane	OMD/PGG lease	
PT-1000-28A	28	1,000	Propane	OMD/PGG lease	
PT-1000-28B	28	1,000	Propane	OMD/PGG lease	
PT-500-30A	30	500	Propane	OMD/PGG lease	
PT-1000-30B	30	1,000	Propane	OMD/PGG lease	
PT-250-31	31	250	Propane	Army owned	
PT-1000-31A	31	1,000	Propane	OMD/PGG lease	
PT-1000-31B	31	1,000	Propane	OMD/PGG lease	
PT-1000-31C	31	1,000	Propane	OMD/PGG lease	
ASTg-650-32	32	650	Diesel	Bldg 32 generator	In use
PT-50-32	32	50	Propane	Army owned	
PT-1000-32A	32	1,000	Propane	PGG/Caretaker Lease	
PT-1000-32B	32	1,000	Propane	PGG/Caretaker Lease	
PT-1000-33	33	1,000	Propane	PGG/Caretaker Lease	

PT-1000-36A	36	1,000	Propane	OMD/PGG lease	
PT-1000-36B	36	1,000	Propane	OMD/PGG lease	
AST-1000-37	37	1,000	Used Oil	Supervault 1000 gal	
PT-250-51	51	250	Propane	Army owned	
PT-1000-53A	53	1,000	Propane	OMD/PGG lease	
PT-1000-53B	53	1,000	Propane	OMD/PGG lease	
PT-1000-54	54	1,000	Propane	PGG/Caretaker Lease	
PT-500-55	55	500	Propane	Army owned	
ASTg-500-57	57	500	Diesel	Telecom generator	In use
PT-1000-62	62	1,000	Propane	OMD/PGG lease	
PT-250-75	75	250	Propane	PGG/Caretaker Lease	
ASTv-1000-77	77	1,000	Oil	Supervault 1000 gal	ORARNG, for used oil
PT-1000-77A	77	1,000	Propane	OMD/PGG Lease	
AST-280-660	133	280	Diesel	Well 4 generator	In future CDA area
PT-500-201	201	500	Propane	Army owned	
AST-2000-401	401	2,000	Fuel Oil	URS owned	Empty
AST-2000-403	403	2,000	Fuel Oil	URS owned	In future CDA area
PT-500-419	419	500	Propane	Army owned	
AST-1000-457	457	1,000	Diesel	Supervault 1000 gal	Empty
ASTg-540-618	618	540	Diesel	Well 6 generator	In use
AST-275-653	653	275	Diesel	north end of parking lot	Yellow tank
AST-10000-660	660	10,000	Diesel	Supervault 10000 gal	Empty

10 RADITAION PROTECTION SURVEY

The Radiation Protection Survey was conducted by the US Army Public Health Center in July, 2016 (US Army (APHC) 2016). The buildings that were investigated were, buildings 654 and 655 in K-block in the ORARNG parcel and igloo 928 in the CDA parcel. There were no radiological health hazards and no residual radioactivity above U.S. Army regulatory limits.

11 UPDATED ECP CATEGORIES

The ASTM D6008 establishes the criteria for evaluating the environmental condition of property. ASTM D5746 establishes the criteria for assigning the ECP Type (1 through 7) following evaluations. Both are intended to comply with Community Environmental Response Facilitation Act (CERFA) (Pub. L. 102-426) and guidance established thereunder. CERFA directs federal agencies to evaluate all property on which federal government operations will be terminated to identify uncontaminated parcels. The ECP and supporting documentation summarizing CERFA designations for land at UMCD were prepared and submitted to the ODEQ and EPA on 14 December 2010, and the ECP acreages were updated in September 2013, and in this document (USACE 2010, 2013b). Table 3 lists the category types and associated acreage. Map 5 illustrates the ECP sites.

Table 3

CERFA Designations on ORARNG Parcel

Properties Type	Definition	Total Acreage at UMCD CDA Properties
Area Type 1	Areas where no release or disposal of hazardous substances or petroleum products above *de minimis* quantities has occurred, and to which there has been no migration of such substances from adjacent areas.	1,598.92
Area Type 2	Areas in which release or disposal of petroleum products above *de minimis* quantities has occurred.	150.20
Area Type 3	Areas in which release, disposal, or migration of hazardous substances has occurred, but in concentrations that do not require removal or other remedial response.	127.28
Area Type 4	Areas in which release, disposal, or migration of hazardous substances has occurred, but all removal or other remedial actions necessary to protect human health and the environment have been taken.	3.10
Area Type 5	Areas in which release, disposal, or migration of hazardous substances has occurred, and removal or remedial actions are underway, but not all required actions have been taken.	2020.50
Area Type 6	Areas in which release, disposal, or migration of hazardous substances has occurred but required remedial actions have not been implemented.	0.00
Area Type 7	Areas that are unevaluated or require additional evaluation.	0.00
	TOTAL:	7,500

Table 4 lists the sites on the ORARNG parcel and their current environmental condition type. Many of the sites had previously had asbestos and radon as an ECP category code. There was no release of asbestos to the environment and radon is naturally occurring, so neither should be listed as an environmental condition.

Table 4

Environmental Condition Type Properties

Study Section No.	Previous ECP Parcel Designa-tion	New ECP Parcel Designa-tion	Study Site Name	Prev Cond Type	New Cond Type	Comments
I	1(5)X	1(5)HR	All ADA* grounds (1,670 acres)	5	N/C	Note: This applies to all sites in the ADA, which will remain a 5 until remediation is complete.
II	25(4)HR, PR	25(4)HR, PR	Site 34 Paint Spray and Shot Blast Area (1.2 acres)	4	N/C	
VII	26(3)PS, RAD	26(2)PR, PS	Building 24 (well #1 pump house) and adjacent UST #46 (0.03 acres)	3	2	
III	27(7)R	27(1)	Building 619 (0.02 acres)	7	1	Remediated internal explosive contaminates per MMRP, UMAD-149. No release to the environment. Corrected to a 1.
III	28(6)A, HR, PS	28(1)	Buildings 614 through 617 (0.4 acres)	6	1	
III	29(2)PS	29(1)	Building 670 and adjacent AST (0.04)	2	1	Corrected. No release to the environment.
III	30(6)A, HR, PS	30(1)	Buildings 601 through 605 (0.6 acres) Site 9 GB Bomb Disassembly Area (23.0 acres)	6	1	Remediated internal explosive contaminates per MMRP, UMAD-149. No release to the environment. Corrected to a 1.
III	31(6)A, HR, PS	31(1)	Buildings 609, and 610 (0.2 acres) Site 45B Building 612 and 617 Boiler Discharge Areas (2.7 acres) Site 65 Waste Paint and Solvent Disposal Area (Building 608) (0.5 acres)	6	1	

III	32(7)A, PS	32(2)PS, PR	Northern fenced portion of Block-I Igloos & USTs and ASTs near NE corner (139.1 acres)	7	2	Was a 7 due to agent storage. Site was RCRA closed in 2009 (ODEQ 2009). UST was removed.
III	33(2)PS	33(1)PS	Buildings 426, 455 and associated USTs; I-block Total parcel acreage (4.56 acres)	2	1	Corrected. No hazardous substance or petroleum release to the environment.
III	34(3)HR	34(3)HR	Site 82 Former Gravel Pit/Disposal Location; south of I-block (15.0 acres)	3	N/C	
V	45(5)A, L, R, HR,PS, PR, RAD	45(4/5) HR	Site 4 East Washout Lagoons, soil (1.6 acres)	5	4	Corrected. Soil ROD completed in 1992 (US Army 1992)
			Explosive Washout Lagoons Groundwater Plume (350.5 acres)	5	N/C	Still in remediation
			Site 5 East Washout Plant (Building 489) (0.3 acres)	5	4	Corrected, per 2013 ECP, ROD completed in 1994.
VII	48(2)PS	48(1)PS	Former AST location East of Rim Road South (0.72 acres)	2	1	Corrected. No release to the environment.
VI	49(3)HR	49(3)HR	Site 33 Gravel Pit Disposal Area (2.6 acres)	3	N/C	
VI	50(3)HR	50(3)HR	Site 64 Leaking Railcar Shipment Inspection Area (6.4 acres)	3	N/C	
VI	51(3)HR, PR	51(3)HR, PR	Site 6 Sewage Treatment Plant (0.4 acres)	3	N/C	
			Site 30 Storm Sewer Tile Field (0.6 acres)			
			Site 48 Pipe Discharge Area (16.6 acres)			
VI	52(3)HR, PR	52(3)HR, PR	Site 50 Railroad; Landfill (site 12) Areas (53.4 acres)	3	N/C	
VII	61(3)HR	61(3)HR	Site 70 Wood Preserving Solution Spill Area (0.9 acres)	3	N/C	

VII	62(3)HR, PS	62(3)HR, PS	Site 77 Paint Storage and Disposal Area (Area 304) (0.1 acres)	3	N/C	
VII	63(3)HS, PS	63(3)HS, PS	Buildings 27 and 30A (0.1 acres)	3	N/C	
VII	64(6)A, PS	64(1)PS	Building 30 (0.45 acres)	6	1	Corrected. No release to the environment.
VII	65(2)PS, PR	65(2)PS, PR	Building 42 (0.52 acres)	2	N/C	
VII	66(3)HS, PS	66(1)HS, PS	Site 75 Battery Acid Collection Sump (Building 31) (0.57 acres)	3	1	Corrected. No release to the environment.
VII	67(6)A, HS, PS, PR	67(2)HS, PS, PR	Buildings 5, 37 and associated former USTs (1.09 acres total)	6	2	Bldg 5 still has UST & contaminated soil that is not accessible. DEQ said NFA at this time.
VII	68(4)A, PS	68(2) PR, PS	Site 42 Former UST Locations (Administrative Area) (3.0 acres) Buildings 6,7,8, and 10 (0.4 acres)	4	2	Corrected. Petroleum release and remediated.
VII	69(3)HR, HS, PS, PR	69(2) PS, PR	Site 42A Former UST Locations (Administrative Area) (3 acres) Buildings 21 (0.04 acres), 24 (0.03 acres), 46 (0.02 acres)	3	2	Corrected. Petroleum release and remediated.
VII	70(2)PS	70(2) PS, PR	Former UST 70 near intersection of Fir and D St. (0.03 acres)	2	N/C	
VII	71(2)PS	71(2)PS, PR	Building 29; UST 100 (0.07 acres)	2	N/C	
VII	72(4)A	72(1)	Building 4 (0.34 acres)	4	1	Corrected. No hazardous release to the environment.
VII	73(4)A, PS	73(2) PS, PR	Building 18; UST 5 (0.36 acres)	4	2	Corrected. Minimal petroleum release. NFA
VII	74(2)PS	74(2)PS, PR	UST NE of Building 17 (0.03 acres)	2	N/C	

VII	75(3)HS, HR, PS, PR	75(3)HS, HR, PS, PR	Site 22, the former DRMO area; Buildings 42 and 77 (6.6 acres)	3	N/C	
VII	76(6)A, HS	76(1)HS	Building 11 (0.79 acres)	6	1	Corrected. No hazardous release to the environment.
VII	77(6)A, PS	77 (1) PS	Building 36 and 53N (0.32 acres)	3	1	Corrected. No release to the environment
VII	78(6)A, PS	78(1)PS	Building 53S (0.16 acres)	6	1	Corrected; no release to environment.
VII	79(6)A, HS, HR, PS, PR	79(3)HS, HR, PS, PR	Site 44 Road Oil Application/Disposal Sites	3	N/C	
			Site 76 Photographic Chemical Disposal Area (Area 304) (0.1 acres)			
			Buildings 3 (0.11 acres), 28 (0.05 acres), 54 (0.17 acres)			
			Total parcel acreage (39.12 acres)			
VII	80(4)A, HS, HR, PS	80(2)HS, PS, PR	Building 2 (UST 2) (0.16 acres)	4	2	Corrected; minimal release from UST.
VII	81(2)PS	81(1)PS, PR	UST of Building 41 (0.07 acres)	2	1	Corrected. UST removed. Has AST. No release to environment.
VII	82(7)A, R, PS	82(1)PS	Building 57 (0.09 acres)	7	1	Corrected. No hazardous substance or petroleum release to the environment. UST removed.
VII	83(4)A, PS	83(1)PS	Building 51 (0.08 acres)	4	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	84(7)R	84(1)	Building 73 (0.03 acres)	7	1	Corrected. No hazardous substance or

						petroleum release to the environment.
VII	85(7)R	85(1)	Building 55G (0.02 acres)	7	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	86(2)PS	86(2)PS, PR	Building 55 (0.07 acres)	2	N/C	Corrected. Minimal release.
VII	87(3)HS, HR	87(3)HS, HR	Former PCB Transformer Vault (0.02 acres)	3	N/C	
VII	88(6)R, PS	88(1)PS	Building 1 (0.26 acres)	6	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	89(7)R, PS	89(1)PS	Building 35 (0.06 acres)	7	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	90(3)HR, PS	90(3)HS, HR	Buildings 15 and 16 (0.1 acre); Former PCB Transformer Vault (0.37 acres)	3	N/C	
VII	91(7)A, R	91(1)	Building 70 (0.05 acres)	7	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	92(6)A, PS	92(1)PS	Building 32 (0.19 acre)	6	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	93(3)HR	93(3)HR	Former PCB Transformer Vault (0.07 acres)	3	N/C	
VII	94(2)PS	94(2)PS, PR	Building 33; UST 8 (0.14 acres)	2	N/C	
VII	95(4)A, PS	95(2) PS, PR	Building 34; UST 34 (0.10 acres)	4	2	Corrected. Release and remediation.
VII	96(7)R	96(1)	Building 71 (0.06 acres)	7	1	Corrected. No hazardous substance or petroleum release to the environment.

VII	97(2)PS	97(1)PS	Buildings 38 and 40 (0.26 acres total)	2	1	Corrected. No hazardous substance or petroleum release to the environment.
VII	98(2)PS	98(2)PS, PR	Former USTs around 5th Avenue (2.01 acres)	2	N/C	
V	99(7)HS	99(1)HS	All Block J Igloos (11.2 acres)	7	1	Was 7 for agent storage. Agent is destroyed and igloos are under RCRA closure. No hazardous substance or petroleum release to the environment.
III	100(2)PS	100(1)PS	Buildings 613, 618, and 621 (14.09 acres total)	2	1	Corrected. No hazardous substance or petroleum release to the environment.

Notes:

A = Asbestos
HS = Hazardous Substance Storage
HR = Hazardous Substance Release
N/C = No Change
PS = Petroleum Storage
PR = Petroleum Release
R = Radon
RAD = Radiation

Each parcel was assigned a unique parcel identification number, an ECP Condition type in parentheses, and the type of release or environmental issue that is known or suspected for that parcel. Additional information regarding the unique parcel identification numbers within this ECP can be found in Section 4.18, Section 5.1 of the 2013 ECP update. Map 5 shows the current ECP categories on the ORARNG Parcel).

* ADA: this area was originally identified in 1993 FFS by Arthur Little as having 20 sites (Little 1993a). Five sites (15, 17, 19, 31, and 32) were remediated for soils contamination, which was complete in January 2003 (USACE 2005). The remainder of remediation is to address munitions clearance on approximately 350 acres. The entire 1,670 acres of the ADA will remain condition code 5 until the site is closed per the ROD (US Army 1994).

CERTIFICATIONS

All information/documentation provided accurately reflects the condition of the Umatilla Chemical Depot Property transfer for to the Army National Guard. The report meets the DoD requirements of an update for an Environmental Condition of Property Report.

for Thomas A   30 MAY 2017

James E. Briggs   Date
Branch Chief
ACSIM DAIM-ODB

In accordance with the requirements of 40 CFR §312 concerning the results of inquiry by an environmental professional:

"I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312 of this part."

"I have the specific qualification based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR part 312."

LANIGAN.MICHELE.M.1149287929

Digitally signed by LANIGAN.MICHELE.M.1149287929
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=LANIGAN.MICHELE.M.1149287929
Date: 2017.05.26 11:31:55 -07'00'

Michele M. Lanigan   Date
BRAC Environmental Coordinator
Umatilla Chemical Depot

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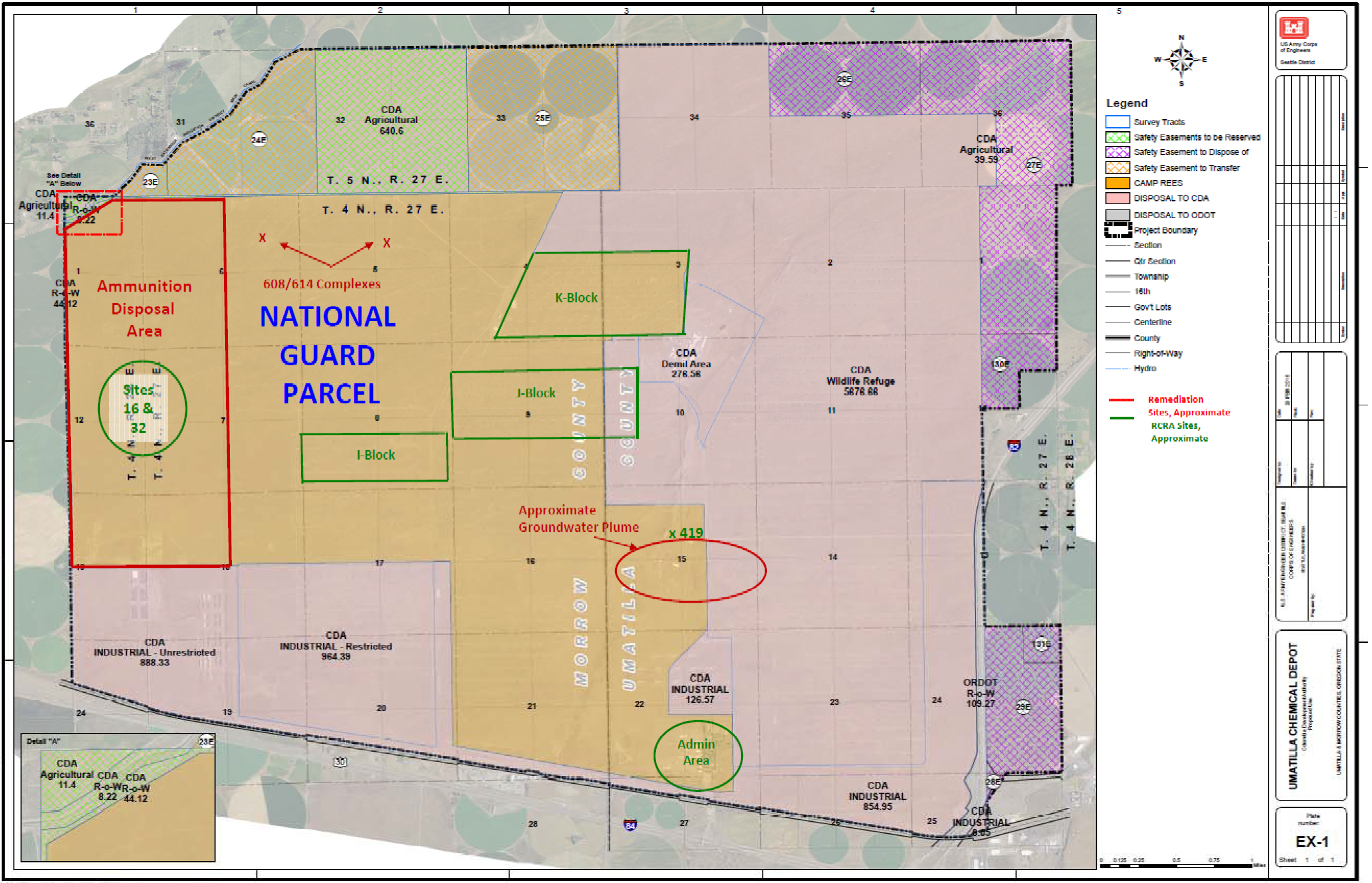
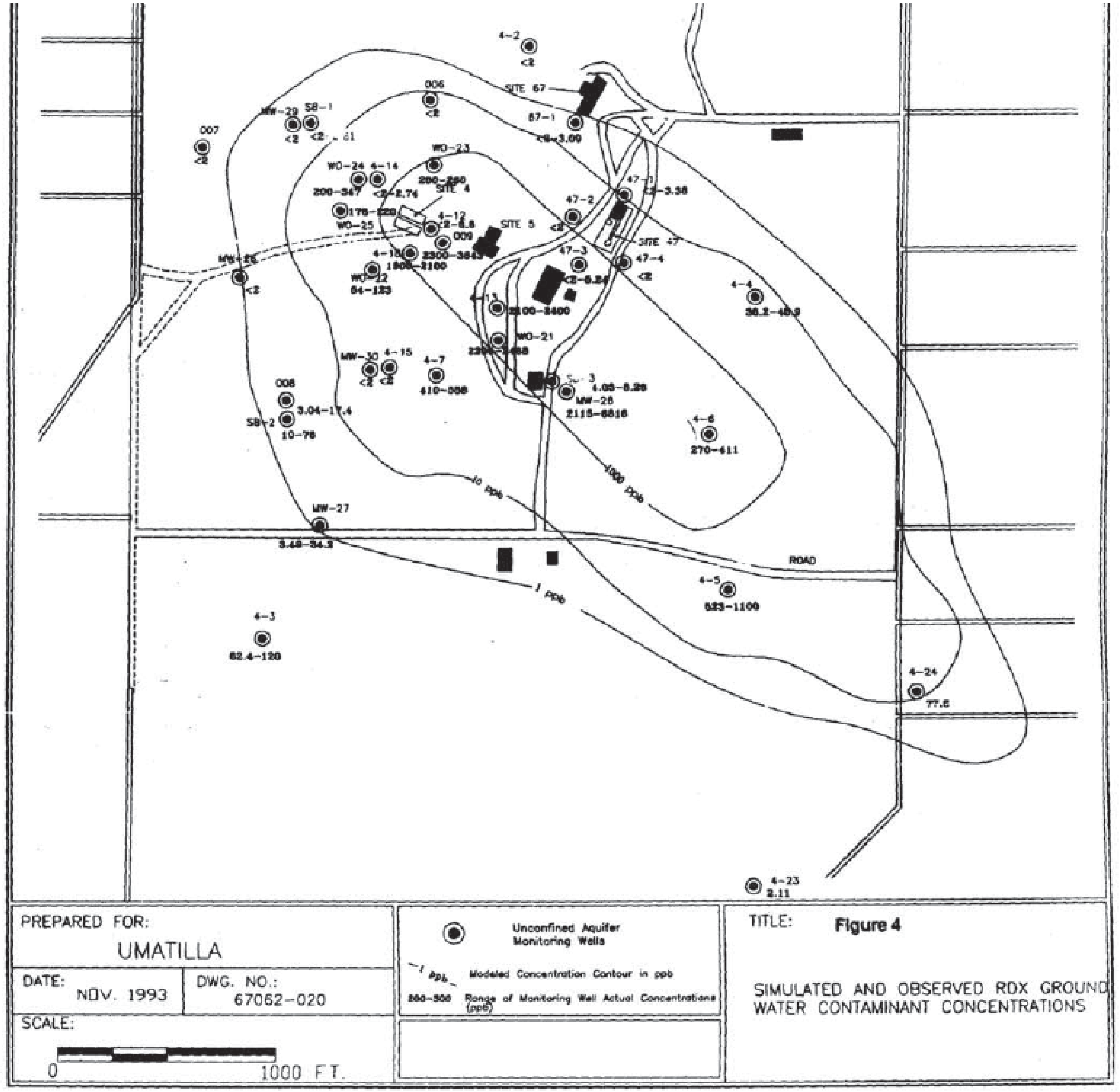
ATTACHMENT 1

MAPS

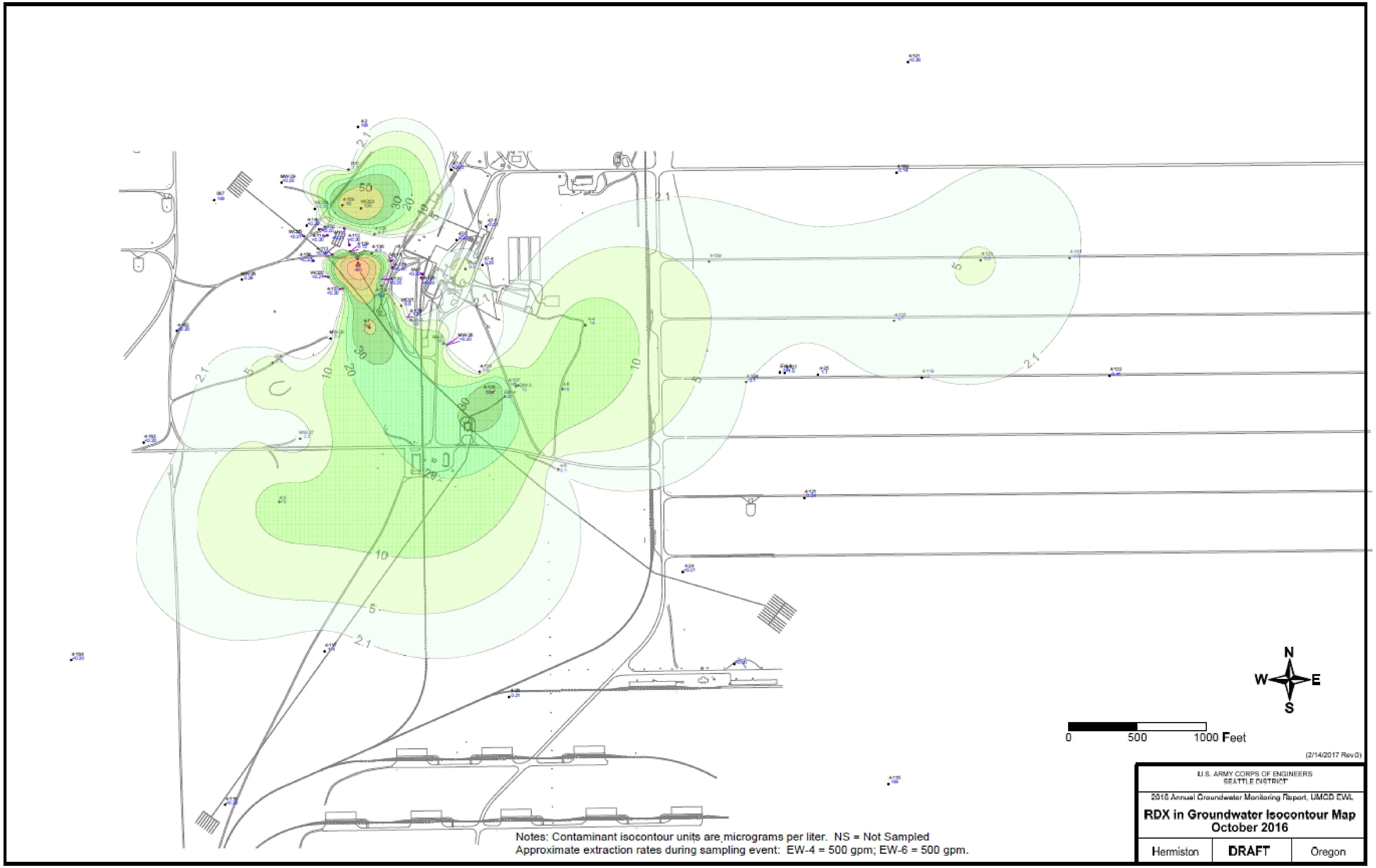
MAP 1
INSTALLATION REUSE MAP – CERCLA and RCRA



MAP 2
GROUNDWATER PLUME 1993; from the June 1994 ROD

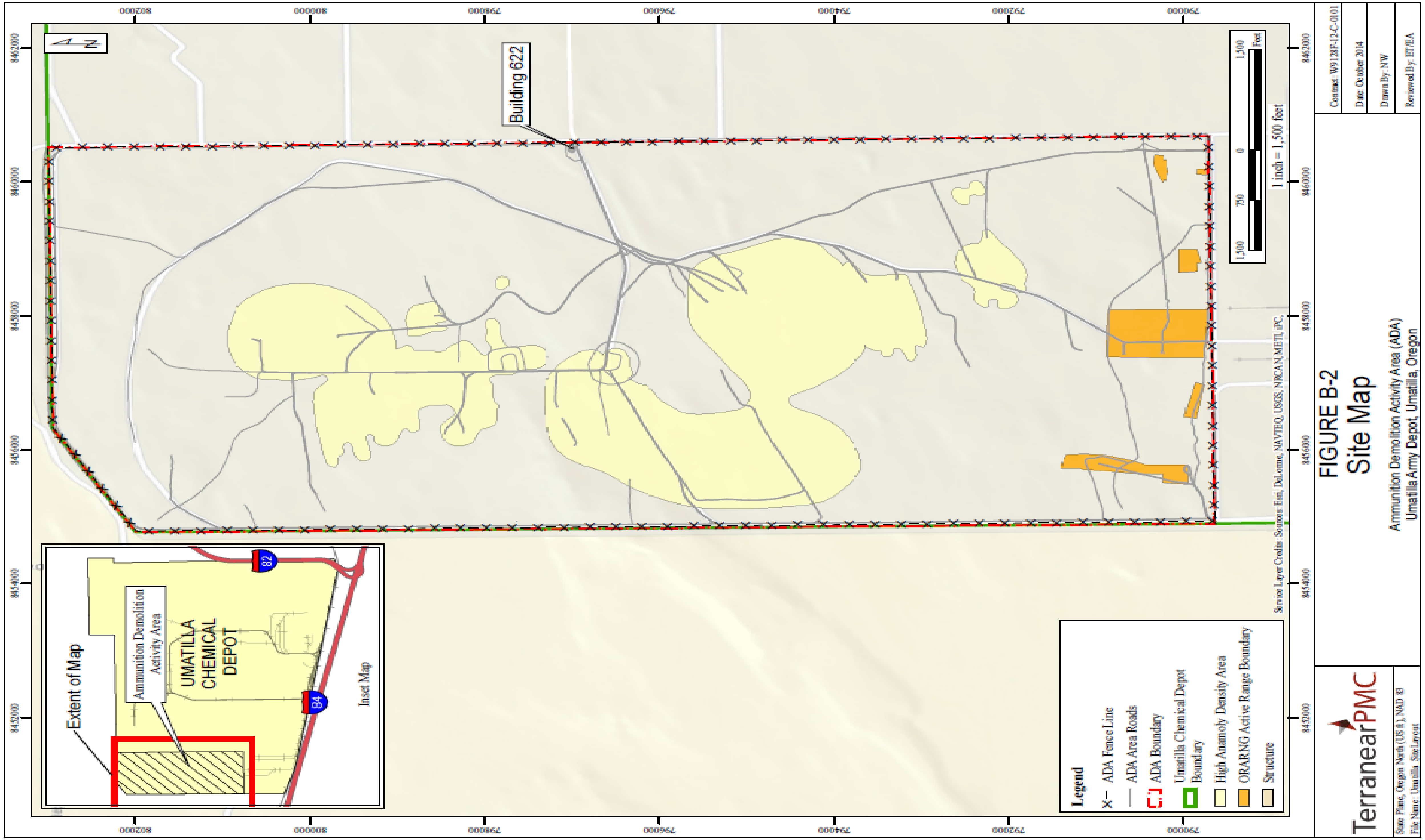


MAP 3
GROUNDWATER PLUME 2016



Notes: Contaminant isocontour units are micrograms per liter. NS = Not Sampled
Approximate extraction rates during sampling event: EW-4 = 500 gpm; EW-6 = 500 gpm.

MAP 4
ADA HIGH DENSITY AREA 2014 (USACE 2015b)



Map 5
Installation Map with ECP Categories

N
W E
S

Legend

▭ Oregon National Guard Property

ORARNG_Property_Intersect

Environmental Condition of Property

- ⬜ 1 No Documented Release
- 🟦 2 Release or Disposal of Petroluem Only
- 🟩 3 Release below action levels
- 🟪 4 Remediation of historic release has occurred
- 🟨 5 Remedial actions are underway
- 🟧 6 Release above action levels no remediation underway
- 🟥 7 Unevaluated

ECP Condition Type	Map Color	Definition	Total Acreage at UMCD
1	Clear	Areas in which no release or disposal of hazardous substances or petroleum products above de minimis quantities has occurred and to which there has been no migration of such substances from adjacent areas	5,198.92
2	Blue	Areas in which release or disposal of petroleum products above de minimis quantities has occurred.	150.2
3	Green	Area in which release, disposal, or migration of hazardous substances has occurred, but in concentrations that do not require removal or other remedial response.	127.28
4	Purple	Area in which release, disposal, or migration of hazardous substances has occurred, but all removal or other remedial actions necessary to protect human health and the environment have been taken	3.1
5	Yellow	Areas in which release, disposal, or migration of hazardous substances has occurred, and removal or other remedial actions are underway, but all required actions have not been taken	2020.5
6	Orange	Areas in which release, disposal, or migration of hazardous substances has occurred, but required remedial actions have not been implemented.	0.00
7	Red	Areas that have not been evaluated or that require additional evaluation.	0.00
		Total:	7,500

Feet
0 2,500 5,000 10,000

UMATILLA CHEMICAL DEPOT Umatilla, Oregon	**Installation Building Map with ECP Property Categorization**	
LAST REVISION: 8/28/2015	**MAP AUTHOR:** SCJ, EBW, BCJ	**DEPT:** Geospatial

Map 6 Contonment Area Map with ECP Categories

Legend

🟥	Oregon National Guard Property

ORARNG_Property_Intersect

Environmental Condition of Property

⬜	1 No Documented Release
🟦	2 Release or Disposal of Petroluem Only
🟩	3 Release below action levels
🟪	4 Remediation of historic release has occurred
🟨	5 Remedial actions are underway
🟧	6 Release above action levels no remediation underway
🟥	7 Unevaluated

Feet
0 250 500 1,000

UMATILLA CHEMICAL DEPOT
Umatilla, Oregon

Installation Building Map with ECP Property Categorization

LAST REVISION: 8/28/2015
MAP AUTHOR: SCJ, EBW, BCJ
DEPT: Geospatial

Attachment 2
Chemical Material Agency References

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Attachment 3
EPA TSCA Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND
EMERGENCY RESPONSE

NOW THE
OFFICE OF LAND AND
EMERGENCY MANAGEMENT

MAY 04 2017

Colonel Nathaniel W. Farmer
Director
Department of the Army
U.S. Army Chemical Materials Activity (AMSCM-D)
E4585 Hoadley Road
Aberdeen Proving Ground, Maryland 21020-5424

Dear Colonel Farmer:

This letter is in response to your November 18, 2013, letter requesting the U.S. Environmental Protection Agency (EPA) terminate the alternative polychlorinated biphenyl (PCB) storage approval ("approval") for the U.S. Army's Umatilla Chemical Depot site ("the Umatilla site") in Hermiston, Oregon.

At Umatilla, the Army stockpiled shipping and firing tubes for M55 rockets, which contained high concentrations of PCBs. The EPA issued the Umatilla site an alternative PCB storage approval on April 12, 2006, in a letter from Maria J. Doa, Director of the National Program Chemical Division. The approval was issued pursuant to 40 CFR 761.62(c)(1), which allows the EPA to issue approvals to store PCB Bulk Product Waste in a manner that differs from what is prescribed in § 761.65, provided it does not pose an unreasonable risk of injury to health or the environment. The approval waived the § 761.65(c)(5) regulatory requirement to inspect the rocket storage igloos for leaks every thirty days and the § 761.65(b)(1)(ii) regulatory requirement to have a continuous six-inch floor curbing. The approval covers chemical activities at four Army sites: Pine Bluff, Anniston, Blue Grass, and Umatilla. At the Army's request, EPA modified the approval to remove Pine Bluff and Anniston on April 8, 2014, and January 12, 2015, respectively.

In evaluating the request to terminate Umatilla's storage approval, EPA became aware that confirmatory wipe samples were not performed in accordance with requirements under the Toxic Substances Control Act (TSCA) or the "Umatilla Chemical Depot Closure Plan," dated December 12, 2013. EPA also became concerned that PCBs in the debris or in contaminated dust may have migrated into the concrete walls or floor of the igloos and may present future risk. On September 14, 2015, EPA notified you that additional core sampling was required for several K-block igloos and the additional sampling must be collected in accordance with the U.S. EPA Standard Operating Procedure for Sampling Porous Surfaces for PCBs. The results of the additional samples were received by the EPA on May 4, 2016.

In evaluating your request to terminate Umatilla's storage approval, EPA considered the following:

1) The shipping and firing tubes for the M-55 rockets contained PCBs in non-liquid form bound in their matted fiberglass matrix. The tubes were designated for disposal as PCB Bulk Product Waste.

2) No shipping and firing tubes remain at the Umatilla site, as they have all been treated and disposed in the Umatilla Chemical Agent Disposal Facility.

3) The post-cleanup wipe sampling performed by the Army found no PCB concentrations above 10 µg/100 cm^2 on surfaces of the igloos, which is the action level for PCBs in a wipe sample according to § 761.125. The highest concentration of PCBs found in a sample was 0.4320 µg/100 cm^2.

4) Although the Army cleaned the storage igloos and conducted post-cleanup wipe sampling, EPA determined that the wipe sampling was not performed as directed in "Umatilla Chemical Depot Closure Plan," dated December 12, 2013, or in accordance with TSCA requirements. Additional post-cleanup sampling was then conducted as described in "Umatilla Chemical Depot M55 Rocket Igloo TSCA PCB Closure Verification Sampling," dated May 2016. This subsequent sampling involved obtaining core samples of the concrete and had a cleanup goal of 1 part per million (ppm).

5) The post-cleanup core sampling performed by the Army found that 20 of 21 concrete powdered samples were below the cleanup goal of 1 ppm PCBs. One sample was found within a wall in igloo K-1843 and had a concentration of 1.1 ppm. Although this one sample slightly exceeded the cleanup goal, EPA finds that human exposure will be limited because there is limited ingress and egress such that people cannot regularly work or live in the igloo. Furthermore, while PCBs are unlikely to migrate out of the concrete, EPA would not consider any release to the local environment at the low level of PCBs contained in the concrete to pose an unreasonable risk. Thus, EPA finds that this igloo does not present an unreasonable risk of injury to health or the environment.

6) We understand that the Army is including information about the PCB-contamination and clean-up in its Property Condition report and providing that report to the Oregon National Guard upon transfer of the property. This information will provide the new owners with:

   - a brief history of the storage of the PCB material in the igloos at Umatilla;
   - all PCB-related cleanup activities conducted in the igloos at Umatilla;
   - all PCB sampling results which verifies that cleanup was completed for the igloos; and
   - this letter, which terminates the storage approval at the Umatilla site.

On the basis of the information evaluated and since the PCB Bulk Product Waste stored pursuant to the approval has been disposed, the EPA hereby declares that the Umatilla site is no longer subject to the § 761.62(c) risk-based storage approval issued April 12, 2006. The approval is hereby terminated for the Umatilla site, effective upon the signature date of this letter.

Should you have any questions, please contact Josh Smeraldi of my staff at 703-308-0441.

Sincerely,

Barnes Johnson

Barnes Johnson, Director
Office of Resource Conservation and Recovery

cc: Ms. Lisa McArthur, EPA Region 10
Ms. Michelle Mullin, EPA Region 10
Ms. Lissa Druback, Oregon Department of Environmental Quality
Mr. Robert Kasper, The U.S. Army Chemical Materials Activity
Mr. Drew Lyle, The U.S. Army Chemical Materials Activity

FINAL

ENVIRONMENTAL ASSESSMENT

FOR

EXPANDED OPERATIONS AT THE OREGON ARMY NATIONAL GUARD'S CAMP UMATILLA OREGON (CUO)

OREGON NATIONAL GUARD

OREGON MILITARY DEPARTMENT
1776 MILITIA WAY SE
SALEM, OR 97309

CONTRACT # W912JV15C3001

AUGUST 30, 2018

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ENVIRONMENTAL ASSESSMENT SIGNATURE PAGE

LEAD AGENCY:	National Guard Bureau (NGB)
COOPERATING AGENCIES:	None
TITLE OF PROPOSED ACTION:	Expanded Operations at the Oregon National Guard's Camp Umatilla Oregon (CUO)
AFFECTED JURISDICTION:	Umatilla, Umatilla and Morrow Counties, Oregon
POINT OF CONTACT:	Mr. Jim Arnold, Environmental Program Manager, Oregon Military Department, P.O. Box 14350, Salem, OR 97309 Telephone: (503) 584-3551
PROPONENTS:	Oregon Army National Guard (ORARNG)

REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
MICHAEL E. STENCEL Major General, ORARNG The Adjutant General	ROY D. SWAFFORD Director Installations, Oregon Military Department	SCOTT B. HILDEBRANDT Colonel, ORARNG Deputy Chief of Staff for Operations and Plans

REVIEWED BY:	REVIEWED BY:
KENNETH SAFE Construction & Facilities Management Officer, Oregon Military Department	JAMES G. ARNOLD Environmental Program Manager, Oregon Military Department

DOCUMENT DESIGNATION: Final Environmental Assessment

ABSTRACT: This Environmental Assessment (EA) analyzes the potential environmental effects that would be likely to occur as a result of the expansion of military training operations and related infrastructure development, by the Oregon National Guard, on a portion of the former United States Army

Umatilla Chemical Depot (UCD). The EA follows a land reassignment, completed in December 2017, allowing the Oregon Army National Guard (ORARNG) and the Oregon Military Department control and use of 7,500 acres of the former UCD.

EXECUTIVE SUMMARY

This Environmental Assessment (EA) analyzes the potential environmental effects that would be likely to occur as a result of the expansion of military training operations and related infrastructure development, by the Oregon National Guard, on a portion of the former United States Army Umatilla Chemical Depot (UCD) using both federal and state funding. The EA follows a land reassignment, completed in November 2017, allowing the Oregon Army National Guard (ORARNG) and the Oregon Military Department (OMD) control and use of 7,500 acres of the former UCD.

This EA was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 United States Code [USC] 4321 et seq.) and the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and is consistent with Title 32 CFR Part 651, Army Regulation (AR) 200-1, U.S. Army National Guard (ARNG) NEPA Handbook Volumes I-III, and Oregon Army National Guard (ORARNG) Pamphlet (PAM) 200-1.

Proposed Action

The Proposed Action consists of expanded military training operations and associated infrastructure development that would occur over approximately the next 5 years on Camp Umatilla Oregon (CUO). CUO refers to the 7,500 acres of the former Umatilla Chemical Depot that have been reassigned to the ORARNG and OMD. The purpose of the Proposed Action is to support the core training and readiness objectives for all ORARNG elements as part of the Combined Arms Training Strategy, along with the U.S. Army Training and Doctrine Command (TRADOC) Programs of Instruction (POI) required for the RTI, by maximizing the training opportunities available on the 7,500-acre CUO in an economically feasible way. Three geographic “Use Areas” have been identified where general types of military training or other activities and associated facilities would occur: the Cantonment Use Area, the Live-Fire Use Area, and the Maneuver Use Area. Each of these Use Areas would require some construction to support the military training or other activities proposed for that Use Area. Construction efforts using a combination of federal and state funds would include new construction of purpose-built modern facilities, and modification and re-use of existing structures to house or support military training. In general, the strategy for development of CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, igloo complexes, etc.) where possible to accomplish the required training or other use, and to reduce the environmental impacts associated with native habitat conversion. The Proposed Action also includes required infrastructure improvements that cut across Use Areas. These infrastructure improvements are mostly utilities–related, and would include the potable water system, wastewater treatment system, transportation system, and enhanced firebreak system.

Under the Proposed Action, military training activities at CUO would be expanded to fully support the training requirements of multiple battalions. The CUO would have a capacity to support 620 transient personnel, with surges up to 1,240 transient personnel. The operational capabilities would accommodate company-sized maneuvers, along with weapons live-fire range capability for individual qualifications. The support facilities, training areas, weapons ranges, and full-time staff would support the core training and readiness objectives for all ORARNG elements as part of the Combined Arms Training Strategy, along with the U.S. Army Training and Doctrine Command (TRADOC) Programs of Instruction required for the Regional Training Institute (RTI).

According to the Range Facility Management Support System (RFMSS), annual throughput of all combined personnel at CUO has averaged approximately 22,000 man-days over the last 5 years.

Implementation of the Proposed Action anticipates average annual throughput of Soldier man-days at 40,000 to 50,000, based on increased training exercises by ORARNG units and increased training schedules by the RTI.

Whether analyzing for the maximum occupancy at one time or the annual throughput in man-days, the users would likely cycle through all three of the major Use Areas described in this EA during their stay at CUO. Soldiers and students would be billeted in the Cantonment Use Area; conduct weapons live-fire training and qualification in the Live-Fire Use Area; and conduct mounted and dismounted maneuver training in the Maneuver Use Area.

Infrastructure development, military training activities, and potential disturbed acreage included under the Proposed Action are summarized below in Table ES.1. Best Management Practices (BMPs) that OMD employs as part of its standard operating procedures that would minimize impacts associated with the Proposed Action are included in the Section 2 narrative.

Table ES.1: List of Individual Projects Included in the Proposed Action

Project Description	Total Acres	Acres New Disturbance	Funding Source	Planned Date
Live Fire Use Area				
Construct and operate up to four additional firing lanes at the Modified Record Fire (MRF) range (NG PAM 415-12)	20	8	SRM	2020
Cantonment Use Area				
Construct and operate a large, gravel tent pad site for a battalion element/multiple companies with adjacent latrine/shower buildings, covered training/mess shelters, and pads for Mobile Containerized Kitchens (NG PAM 415-12)	10	10	SRM/ Troop Labor	2019
Maneuver Use Area				
Construct and operate a large Military Operations on Urbanized Terrain (MOUT) site (urban and/or rural village) (NG PAM 415-12 and RTI POI)	556	100	SRM/ Troop Labor	2018-2022
Construct and operate helicopter landing zones (HLZ) and two parachute drop zones (DZ) for personnel and cargo (NG PAM 415-12)	210	10	G3	2019
Construct and operate an Ammunition Supply Point (ASP) by repurposing 4 to 12 existing Igloos (NG PAM 415-12)	50	10	SRM	2021
Construct and operate new maneuver lanes and a tracked/fighting vehicle maneuver course (non-live fire), including new connector trails, staging areas, and enhanced firebreaks as needed (NG PAM 415-12)	166	116	G3/ Troop Labor/ SRM	2019-2021
Utility and Transportation Projects that cut across Use Areas				
Repair and operate the potable Water System (NG PAM 415-12)	8	8	SRM/ UMMC	2018
Repair and operate the Wastewater System (NG PAM 415-12 MILCON PN411503)	5	5	Milcon/ UMMC	2018
Construct perimeter roads, fencing, and firebreaks (NG PAM 415-12)	110	110	SRM/ Troop Labor	2019-2022

Note: A total potential new disturbance of approximately 360 acres may result from the Proposed Action, due to 17 acres of overlap of individual actions in the above table.

Alternatives

NEPA, CEQ regulations, and 32 CFR 651 require all reasonable alternatives to be explored and objectively evaluated. Alternatives that are eliminated from detailed study must be identified, along with a brief discussion of the reasons for eliminating them. For purposes of analysis, an alternative was considered “reasonable” only if it would enable the ORARNG to accomplish mission requirements and meet the purpose of and need for the Proposed Action. “Unreasonable” alternatives would not enable the ORARNG to meet the purpose of and need for the Proposed Action. The ORARNG considered the following alternatives: 1) implement the Proposed Action at locations other than CUO (existing military installations--Camp Rilea, Camp Adair, Biak Training Center, Naval Weapons System Training Facility Boardman; Private Lands; federal lands; and state lands), 2) simulated training, and 3) rearrange the three major Use Areas. These alternatives were eliminated from further consideration because they did not meet one or more of the screening criteria.

The ORARNG applied the following criteria to screen and evaluate possible alternatives for the Proposed Action. The ORARNG identified that a suitable alternative would need to meet all of the following criteria:

1. Meets the purpose and need
2. Economically feasible (within the realm of historic recorded funding levels)
3. Controllable variables (e.g., alternatives that require Congressional action would be outside ORARNG’s control)
4. Safety (e.g., live-fire ranges must be sited with adequate Surface Danger Zones [SDZ])
5. Minimize adverse impacts to the environment

Through application of these screening criteria, the ORARNG determined that the Proposed Action is the only alternative capable of meeting the screening criteria. This EA examines two alternatives in-depth: the Proposed Action Alternative, and the No Action Alternative.

- The Proposed Action would expand ORARNG military training activities at CUO and infrastructure development required over the next 5 years.
- The No Action Alternative would continue ORARNG military training activities at CUO at present and historic levels, including typical incremental improvements and fluctuations in training cadence and intensity that normally occur.

The Proposed Action was designed by ORARNG staff to meet the purpose and need by accomplishing the required military training, while attempting to minimize environmental impacts associated with native habitat conversion by reusing and repurposing existing disturbed areas (buildings, roads, igloo complexes, etc.) where possible. The No Action Alternative would not meet the purpose and need. However, the No Action Alternative is comparatively analyzed in this EA, as required under Federal Law.

Affected Environment

The CUO study area is in the Pleistocene Lake Basin Level IV ecoregion, which covers approximately 1,407 square miles in eastern Oregon. The Pleistocene Lake Basin is a sub-region of the Columbia Plateau Level III ecoregion, which includes portions of Oregon and Washington, with small areas extending over the Idaho state border and into British Columbia. The Pleistocene Lake Basin ecoregion is defined by a nearly level to undulating plain shaped by Pleistocene lakes and floodwaters from glacial lakes Missoula and Columbia. The topography of this ecoregion slopes to the Columbia River. The low, rolling topography and Shrub-Steppe habitat of CUO includes elevations ranging from 400 to 677 feet above mean sea level. Vegetation communities in the CUO study area are predominantly cheatgrass-dominated grasslands interspersed with native perennial grasslands and areas of sagebrush and antelope bitterbrush shrublands.

Existing training activities are organized in three different categories: live-fire weapons training and qualification, mounted and dismounted maneuver training, and classroom and simulations training. There are approximately 20 full-time ORARNG Range operation and training staff who regularly work at CUO. Over the last 5 years, the ORARNG training enclave averaged approximately 22,000 man-days of training per year. The general training categories are summarized as follows:

- Live-fire weapons training occurs in the existing Live-Fire Use Area, in the southwestern corner of the property along Range Road, with the direction of fire oriented to the north. The former Ammunition Disposal Area (ADA) that encompasses approximately 1,750 acres to the north of the live-fire ranges serves as the SDZ for all existing live-fire ranges, per AR 385-63.
- Classroom and simulation training is performed in buildings and structures in the Cantonment Use Area. Basic functional activities include administrative, classroom, storage, billeting, dining, physical fitness, and supporting vehicle parking areas.
- Maneuver training occurs in the maneuver area, and includes both mounted (on road only) and dismounted maneuver.

Environmental Consequences

The Proposed Action was evaluated to determine its potential direct or indirect impact(s) on the physical, environmental, cultural, and socioeconomic aspects of CUO and the surrounding area. Technical areas evaluated include: land use; air quality; noise; geology, topography, and soils; water resources; biological resources; cultural resources; socioeconomics; environmental justice; regional infrastructure; hazardous and toxic materials and waste; and wildland fire. The Proposed Action Alternative and No Action Alternative would result in the impacts summarized in Table ES.2.

Mitigation Measures

Mitigation measures are defined as project-specific requirements, not routinely implemented by the ORARNG, that are necessary to reduce identified potentially significant adverse environmental impacts to *less-than-significant* levels. BMPs are regulatory compliance measures that the ORARNG regularly implements as part of their activities, as appropriate, across the State of Oregon. Per established protocols, procedures, and requirements, the ORARNG will satisfy all applicable regulatory requirements associated with the proposed construction, renovation, conversion, and demolition projects. These BMPs are summarized in Section 2.2.7 of this EA, and are included as components of the Proposed Action Alternative. To reduce impacts associated with the Proposed Action Alternative to *less-than-significant* levels, the project-specific mitigation measures are required.

Table ES.2: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	Proposed Action
Land Use	**No Impact.** No new installation infrastructure and no change to use type or levels.	**Less than significant.** No conflict with overall authorized land use. Site activities would not change, but would be expanded in scope. Long-term positive impact would occur through development of the CUO consistent with existing land use and zoning.
Air Quality	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to pollutant emissions.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to the potential for dust generation and air emissions from construction activities. Long-term, less-than-significant, adverse impacts from emissions associated with increased equipment and vehicle use and increased fugitive dust during training operations.
Noise	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to local noise environment.	**Less than significant.** Short-term, less-than-significant adverse impacts due to construction noise. Long-term, less-than-significant adverse impacts due to increased noise generation from increased training activities that would be performed consistent with the Statewide Operational Noise Management Plan (SONMP) and existing noise-related Right-of-Way, and would not impact sensitive land uses.
Geology, Topography, and Soils	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to soil compaction from continued training activities.	**Less than significant.** Short-term, less-than-significant adverse impact through vegetation removal, ground disturbance, and potential compaction during construction. Long-term, less-than-significant, adverse impacts through loss of soil function resulting from creation of impervious surfaces. Proposed ground disturbance in identified areas of severe soil hazards would be conducted using erosion control best management practices (BMPs).
Water Resources	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to soil erosion during training operations and continued water usage at current levels.	**Less than significant.** Short-term, less-than-significant adverse impacts due to the potential for release of toxic or hazardous materials during construction, which would be completed in accordance with permit requirements. Long-term, less-than-significant adverse impacts due to increased water usage that would remain within allocated water rights. Contamination to groundwater from operations, including the proposed wastewater treatment plant, would be unlikely to occur due to implementation of BMPs.

Table ES.2: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Biological (Vegetation, Fish and Wildlife, and Wildland Fire)	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to trampling and degradation of non-native vegetation during training activities and impacts to species due to continued human presence in areas previously disturbed by current training and operational activities. Long-term, less-than-significant adverse impacts would occur due to lack of firebreaks at CUO; however, an Integrated Wildland Fire Management Plan would be created for the site.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to vegetation removal and disturbance, habitat loss and degradation during construction, and potential for more frequent fire starts. Long-term, less-than-significant adverse impacts due to vegetation removal and disturbance during operations and training that would occur primarily in areas dominated by non-native and invasive species, and due to habitat conversion, noise, and/or human presence from training and operational activities to be conducted in accordance with the Integrated Natural Resource Management Plan (INRMP). Impacts would be reduced by implementation of exotic/invasive species reduction goals established in the INRMP. Long-term, less-than-significant adverse impact due to increased fire risk from increased training; however, offset by incorporation of BMPs, including firebreaks and creation of the Integrated Wildland Fire Management Plan.
Cultural Resources	**Less than significant.** Short-term impacts would not occur. Long-term, less-than-significant adverse impacts due to continued training and operations activities that could potentially result in occasional cultural resource discoveries and required building maintenance/upkeep that would be performed in existing management plan.	**Mitigated to less than significant**. Short-term, less-than-significant adverse impacts due to the potential for cultural resource discovery during construction. Long-term, significant adverse impacts due to impacts to 563 National Register of Historic Places (NRHP)-eligible buildings and structures associated with the Umatilla Chemical Depot (UCD) Historic District; an NRHP-eligible wagon road; and a potentially eligible property of traditional religious and cultural significance identified by the Confederated Tribes of the Umatilla Indian Reservation. Impacts would be reduced to less-than-significant levels with implementation of mitigation measures discussed in Section 4 and the 2018 Programmatic Agreement.
Socioeconomics	**No impact.** Economic activity associated with current uses of Camp Umatilla Oregon (CUO) would continue, and use levels of CUO would not change.	**Less than significant.** Short-term positive impact due to increased economic activity during construction. Long-term positive impact due to increased long-term employment, income, and population levels and corresponding purchases of goods and services.
Environmental Justice	**No impact.** Activity and use levels would remain the same; no impacts to environmental justice populations.	**No impact.** No disproportionate adverse environmental, economic, or health-specific impact to minority or low-income populations. No disproportionate environmental or health risks to children.
Infrastructure	**Less than significant.** Minor improvements to water and wastewater systems to accommodate CUO use levels would result in short- and long-term positive impacts due to improvements to the potable water system and wastewater system to accommodate existing uses.	**Less than significant.** Short- and long-term positive impacts due to improvements of existing infrastructure and construction of additional on-site utility infrastructure with sufficient capacity to accommodate increased activity levels.
Hazardous and Toxic Materials/ Wastes	**Less than significant.** Long-term positive impacts due to management of Regulated Building Material (RBM) and hazardous wastes remaining at the site.	**Less than significant.** Short- and long-term beneficial impacts would occur due to abatement of existing RBM and management of hazardous materials during operations.

Mitigation measures consist of the cultural resources actions identified in the 2018 Programmatic Agreement:

- Designate a representative historic district within a 15.5-acre area in the central cantonment and an 8-acre area of Igloos and maintain the integrity of those historic buildings and structures for the foreseeable future.
- Develop a historic district management manual for the newly designated representative district.
- Protect the property of traditional religious and cultural significance (PTRCS) site identified by the CTUIR as though it is NRHP-eligible by limiting off-road vehicular traffic or new construction within the PTRCS site and by consulting with the CTUIR to develop a protocol allowing tribal member access to carry out cultural practices or prior to unavoidable ground-disturbing actions.
- Complete additional archaeological surveys in previously undisturbed areas prior to any CUO Expansion and Development ground-disturbing actions in that area.
- Photo-document the wagon road (35UM497), update the site form, and complete a Light Intensity Distance and Ranging (LIDAR) study to better document its track across the CUO.

Agency and Public Involvement

Letters were sent out on August 12, 2016, to multiple local, state, and federal agencies notifying them of the project and the scope of this EA, and providing an opportunity for involvement in the environmental review process. If an FNSI is determined to be appropriate, the Final EA and FNSI will be made available for public review. Public and stakeholder comments will be considered prior to a decision and issuance of an FNSI.

Conclusions

The scope of this EA includes analysis of the current military training activities (No Action) and those proposed increased military training activities and related infrastructure development projects over the next 5 years (Proposed Action). The evaluation performed in this EA concludes there would be *no significant adverse impact*, either individually or cumulatively, to the local environment or quality of life as a result of implementing the Proposed Action Alternative, provided BMPs and mitigation measures specified in this EA are implemented. This EA's analysis determines, therefore, an Environmental Impact Statement is unnecessary for implementing the Proposed Action, and that a mitigated Finding of No Significant Impact is appropriate. The Proposed Action Alternative was determined by the ORARNG to provide the best combination of land and resources to sustain quality military training, and to maintain and improve the units' readiness postures. The No Action Alternative was not found to satisfy the purpose of and need for the project. This alternative would limit the capability of the ORARNG to carry out its assigned mission. Therefore, this EA recommends implementation of the Proposed Action Alternative.

Because the CUO expanded training project would be implemented over an extended period of time (approximately 5 years), the ORARNG will review this NEPA analysis periodically, in consultation with ARNG's Installations and Environment Directorate (ARNG-I&E), to ensure no substantial changes have occurred to environmental resources or regulatory requirements since the completion of this EA. If changes have occurred, the ORARNG would prepare an updated NEPA analysis in the form of a Supplemental EA or tiered Categorical Exclusion. This original EA would be used as the foundation for the updated analysis, and supplemental NEPA analyses would focus on those issues that have changed.

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

ºF	degrees Fahrenheit
ACHP	Advisory Council of Historic Preservation
ACM	Asbestos-containing material
ADA	Ammunition Disposal Area
ADNL	A-weighted day-night level
AEDB-R	Army Environmental Database-Restoration
AGL	above ground level
ARNG	Army National Guard
ASP	Ammunition Supply Point
AST	Aboveground storage tank
AR	Army Regulation
B2H	Boardman to Hemingway
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BLM	Bureau of Land Management
BMP	best management practice
BRAC	Base Realignment and Closure
BTC	Biak Training Center
ca.	circa
CAA	Clean Air Act
CAFO	Concentrated Animal Feeding Operation
CDA	Columbia Development Authority
CDNL	C-weighted day-night level
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CMA	Chemical Materials Activity
CPQC	Combat Pistol/Military Police Firearms Qualification Course
CRO	
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CUO	Camp Umatilla Oregon
dB	decibel
dBA	A-scale decibel
DEQ	Oregon Department of Environmental Quality
DNL	day-night level
DoD	Department of Defense
DZ	drop zone
EA	Environmental Assessment
EBS	Environmental Baseline Survey
ECOP	Environmental Condition of Property
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FFA	Federal Facilities Agreement
FNSI	Finding of No Significant Impact
FP	Firing Point
gpcpd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GWMA	Groundwater Management Area
HLZ	helicopter landing zone
HMWSMP	Hazardous Material, Waste, and Spill Management Plan
HTMW	Hazardous and Toxic Materials and Wastes
I	Interstate
ICIS-Air	Integrated Compliance Information System for Air
IPMP	Integrated Pest Management Plan
IWFMP	Integrated Wildland Fire Management Plan
ICRMP	Integrated Cultural Resource Management Plan
IMILES	Instrumentable Multiple Integrated Laser Engagement System

INRMP	Integrated Natural Resource Management Plan
ISC	Installation Spill Contingency
ITAM	Integrated Training Area Management
JBLM	Joint Base Lewis McChord
LRA	Local Reuse Authority
LUB	Lower Umatilla Basin
LUC	land use control
mg/L	milligram per liter
M-S	Mission Sensitive
MBTA	Migratory Bird Treaty Act
mm	millimeter
MOU	Memorandum of Understanding
MOUT	Military Operations in Urbanized Terrain
MRF	Modified Record Fire
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFA	No Further Action
NGB	National Guard Bureau
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWSTF	Naval Weapons System Training Facility
OAR	Oregon Administrative Rule
OCTC	Orchard Combat Training Center
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
OMD	Oregon Military Department
ORARNG	Oregon Army National Guard
ORBIC	Oregon Biodiversity Information Center
OWRD	Oregon Water Resources Department
OU	Operable Unit

PA	Programmatic Agreement
PAM	Pamphlet
PCB	polychlorinated biphenyl
POI	Programs of Instruction
PTRCS	property of traditional religious and cultural significance
RBM	Regulated Building Material
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RTI	Regional Training Institute
SAW	Squad Automatic Weapon
§	Section
SDZ	Surface Danger Zone
sf	square feet
SHPO	State Historic Preservation Office
SONMP	Statewide Operational Noise Management Plan
SPCC	Spill Prevention, Control, and Countermeasure
SWMU	Solid Waste Management Unit
TCPC	Tank Commanders Proficiency Course
TRADOC	U.S. Army Training and Doctrine Command
TSCA	Toxic Substance Control Act
U.S.C.	United States Code
UAS	Unmanned Aerial System
UCD	Umatilla Chemical Depot
UEC	Umatilla Electric Cooperative
UIC	underground injection control
UMAD	Umatilla Army Depot
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
WPCF	Water Pollution Control Facility
WWII	World War II
YTC	Yakima Training Center

SECTION 1: PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 Introduction

This Environmental Assessment (EA) analyzes the potential environmental effects that would be likely to occur as a result of the expansion of military training operations and related infrastructure development on a portion of the former United States Army Umatilla Chemical Depot (UCD). The EA follows a recently completed land reassignment (November 27, 2017), allowing the Oregon Army National Guard (ORARNG) and the Oregon Military Department (OMD) control and use of 7,500 acres of the former UCD. This EA was prepared in accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (CEQ Regulations, 40 Code of Federal Regulations [CFR] Parts 1500-1508), and is consistent with Title 32 CFR Part 651, Army Regulation (AR) 200-1 (U.S. Army 2007), U.S. Army National Guard (ARNG) NEPA Handbook Volumes I-III (ARNG 2011), and Oregon Army National Guard Pamphlet (PAM) 200-1 (ORARNG 2012).

The UCD was an Army ordnance depot from 1941 until 2011, used for management and storage of munitions and chemical agents. Most recently, it was used for decommissioning and disposal of chemical agents. In 1998 and 2005, Base Realignment and Closure (BRAC) legislation recommended the UCD for closure on completion of the chemical demilitarization mission. That mission was completed in late 2011, when the last of the munitions stored on UCD were destroyed through incineration (Kennedy/Jenks Consultants 2014). The Army closed the UCD as an active military installation on August 1, 2012, and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 BRAC process. The ORARNG maintained an enclave on the property since the early 1980s to support various military training activities of ORARNG Soldiers. That enclave included 2,100 acres of property and several buildings licensed from the Army to the ORARNG.

Ongoing ORARNG activities at Camp Umatilla Oregon (CUO) include training and administrative uses. Training activities are generally organized into three different categories: live-fire weapons training and qualification, mounted and dismounted maneuver training, and classroom and simulations training. There are approximately 20 full-time ORARNG range operation and training staff working on CUO. Over the last 5 years, CUO has averaged approximately 22,000 man-days[1] of training, based on Range Facility Management Support System data. This includes ORARNG Inactive Duty Training, or “weekend drill,” and Annual Training, or 2-week “Summer Training”; Regional Training Institute (RTI) students; Army Active Duty; and other training. CUO is open for training activities year round. Training activities are intermittent, and range from small units (50 to 60 people) over a weekend to company or battalion-sized activities (several hundred people) over a 2-week period. RTI has regular use of two existing buildings for classrooms and RTI Headquarters and cadre administration, as well as shared use of the existing barracks and dining facility. RTI offers four or five cycles of three different courses running concurrently several times per year, and each cycle runs 3 weeks. The courses offered by RTI are the Infantry Transition Course, Infantry Qualification Course, and the Advanced Leader’s Course for Infantry.

The approved BRAC disposal plan calls for approximately 9,555 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses; this includes approximately

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[1] Soldiers on-site per day. For example, 50 Soldiers training on-site for a 2-day weekend is 100 man-days.

5,700 acres on the eastern side of the former UCD that will be conserved as wildlife habitat. The Army retained the balance of the installation, approximately 7,500 acres, as an expanded training area for and under the control of the ORARNG, currently identified as CUO. CUO training activities are managed by the ORARNG and support individual and collective training through weapons proficiency and company-sized maneuvers. The CUO property is federally owned, and training activities and related development are conducted using both federal and state funding. The scope of this EA includes analysis of the current military training activities (No Action), and those proposed increased military training activities and related infrastructure development projects over the next 5 years (Proposed Action). As individual projects are funded and designed over the next 5 years, the ORARNG would review this EA to determine if updated NEPA analysis is required by tiering or supplement, as needed. The NEPA analysis for the BRAC real estate transfer of the balance of the property to local governments is currently being addressed by the Army in a separate EA *(Environmental Assessment for Disposal and Reuse of Umatilla Chemical Depot,* August 2016) and is outside the scope of this document. The NEPA analysis for reassignment of 7,500 acres for ORARNG use was completed by BRAC under a categorical exclusion in February 2017.

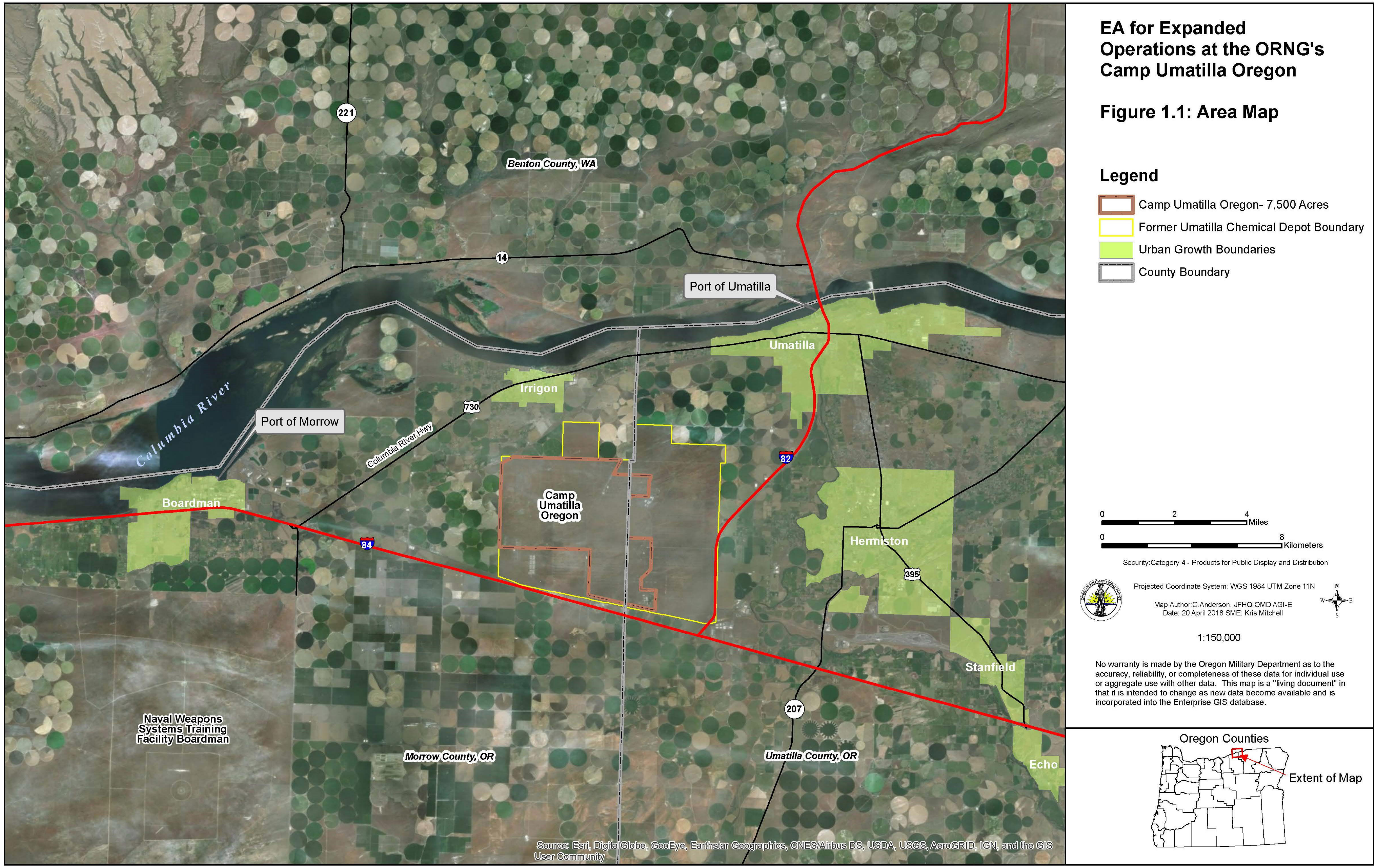
1.2 Background–Former Umatilla Chemical Depot

1.2.1 Location

The former UCD consists of 19,728 acres at the northwestern corner of Interstate (I)-82 and I-84, situated in both Morrow County, Oregon (53 percent), and Umatilla County, Oregon (47 percent). The installation is about 5 miles southwest of the City of Umatilla, 4 miles west of the City of Hermiston, and 0.75 mile southeast of the City of Irrigon (see Figures 1.1 and 1.2).

1.2.2 History

The UCD property was obtained by the United States government in 1940 for an ammunition and supply depot (Dodd n.d.:231; Umatilla Army Depot n.d.:3). Construction was completed in 1941, and included 1,000 ammunition storage igloos, along with shops, offices, warehouses, family housing, barracks, and miles of railroad siding and roads (Hightower 1984:15; Macnab 1975:248-249; Umatilla Army Depot n.d.:3). The original purpose of the UCD was the storage and processing of military vehicles, and storage and issue of lend-lease quartermaster supplies, ammunition, small arms, and components to support America’s involvement in World War II (WWII; U.S. Department of the Army 1982:2). In 1962, the purpose of the UCD changed to include receiving, storing, issuing, and maintaining chemical munitions (U.S. Department of the Army 1982:2). In 2004, the UCD mission changed to destruction of its chemical munitions stockpile to fulfill United States treaty obligations. When the BRAC Commission recommended the UCD for realignment in 1998, a Local Reuse Authority (LRA) was formed with representatives from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Port of Morrow, Port of Umatilla, Morrow County, and Umatilla County. In 2005, when the UCD was once again placed on the BRAC list, the LRA reconvened to map out a strategy to convert existing military structures and land to public and commercial uses. In 2014, the LRA was recognized by the Department of Defense (DoD), and was renamed the Columbia Development Authority (CDA).



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 1.1: Area Map

Security:Category 4 - Products for Public Display and Distribution

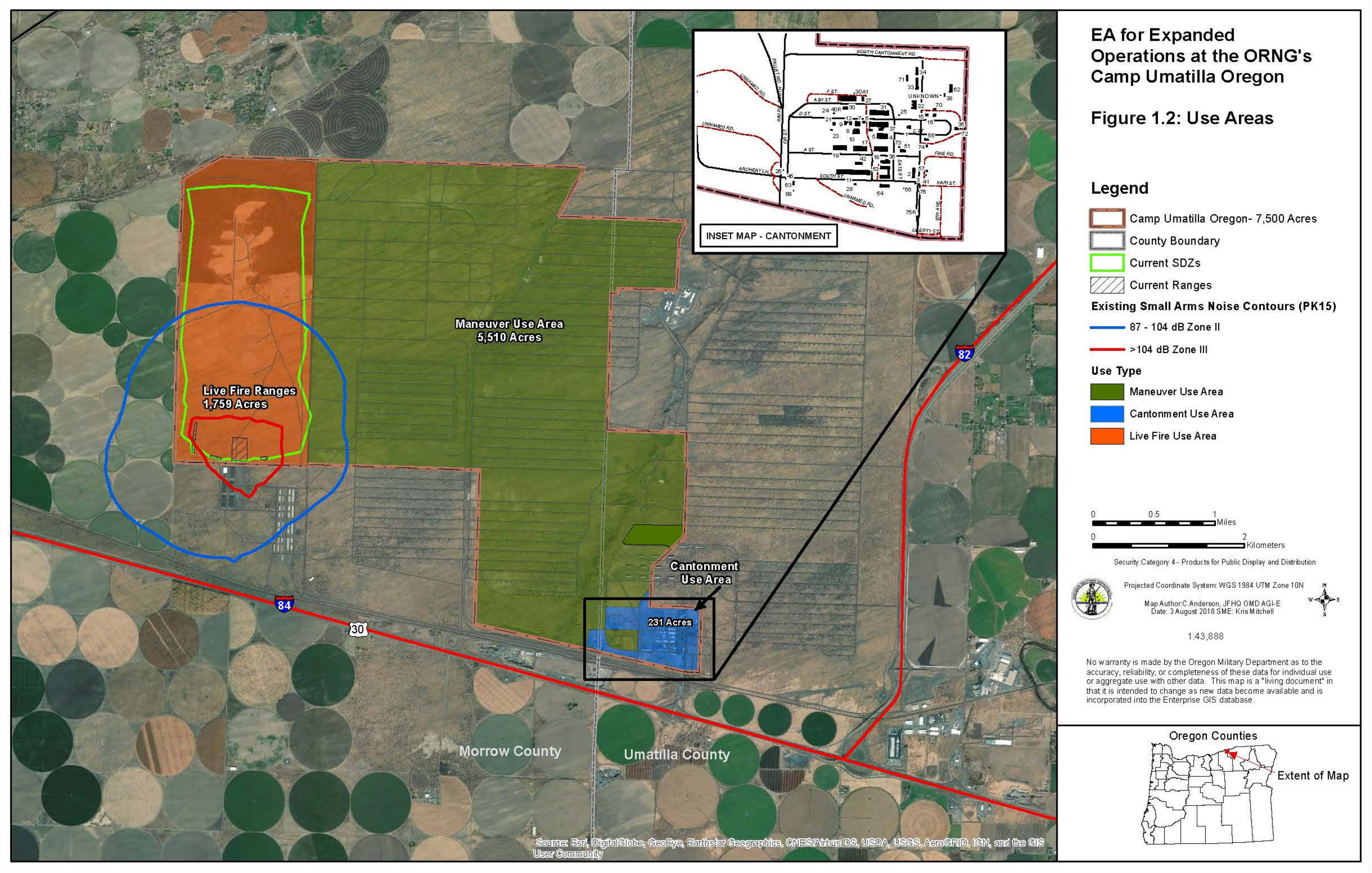
Projected Coordinate System: WGS 1984 UTM Zone 11N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

1:150,000

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document" in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 1.2: Use Areas

Security:Category 4 - Products for Public Display and Distribution

Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 3 August 2018 SME: Kris Mitchell

1:43,888

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document" in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

To help foster the redevelopment, the CDA was charged with obtaining public input from parties potentially interested in the property, including state, local, and public organizations and agencies interested in applying for public and economic benefit through conveyance of the property. In addition, the CDA was tasked to develop the base reuse plan (to establish zoning), conduct property due diligence studies, prepare a market and facilities assessment of the property, and identify existing assets. The CDA was also assigned the task of negotiating the disposition of the base with the Army, and of gaining the Army's approval of its plan for the area to be released for public and commercial development. The ORARNG subsequently participated in negotiations with the CDA to preserve a portion of the UCD, and a plan was developed to accommodate the ORARNG's military training. The BRAC transfer of 7,500 acres to the ORARNG was completed in December 2017.

The approximately 20,000-acre property has been managed by a Caretaker, contracted by BRAC, since it was officially closed by the Army in 2012. BRAC will continue to use a Caretaker-like arrangement to manage the balance of the property until each parcel is transferred to the new owners or license. The built environment in the former UCD includes more than 1,500 structures built during WWII and the Cold War-era to support the storage and maintenance of munitions and chemical agents. Although some of the buildings are still in use and remain in good condition, many of the structures are not currently used and are in various states of disrepair.

1.3 Purpose and Need for the Proposed Action

The Proposed Action for this EA is the expansion of existing military training operations and related infrastructure improvements at CUO. The purpose of the Proposed Action is to support the core training and readiness objectives for all ORARNG elements as part of the Combined Arms Training Strategy, along with the U.S. Army Training and Doctrine Command (TRADOC) Programs of Instruction (POI) required for the RTI by maximizing the training opportunities available on the 7,500-acre CUO in an economically feasible way. The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORARNG Soldiers with adequate infantry and maneuver training opportunities. The ORARNG shortage of training and maneuver land (need for the Proposed Action) was validated by the National Guard Bureau (NGB) Training Support Systems Division in a Memorandum dated 5 February 2013.[2] This memorandum supported the acquisition of CUO to meet ORARNG training requirements. The individual projects listed in Table 2.1 have been validated by the NGB separately, and are authorized by NGB PAM 415-12.

The ORARNG has a dual state and federal mission to "provide the State of Oregon and the United States with a ready force of Citizen-Soldiers, Airmen, and Civilians trained and equipped to respond to any contingency" (ORNG 2016). The National Guard has a federal mission to "to provide trained units and qualified persons available for active duty in the armed forces, in time of war or national emergency, and at such other times as the national security may require, to fill the needs of the armed forces whenever more units and persons are needed than are available in the regular components" (Army, Navy, Marine Corps, or Air Force) (Title 10 United States Code [U.S.C.] Section [§]10102). At the state level, the ORARNG's mission is to provide assistance during emergencies caused by natural disasters, civil disturbances, acts of terrorism, and other threats to life, property, or civil order as directed by the State Governor (OMD 2016b).

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[2] Macia, Thomas E., Chief Training Support System Division, NGB. 5 Feb 2013.

The complexity of modern warfare, weaponry, and security requires regular training by military personnel to obtain and maintain proficiency in the use, operation, capabilities, and limitations of weapons, equipment, and military actions. Modern military actions require teamwork between numerous people, equipment, and vehicles, which requires regular training exercises for military personnel to work seamlessly as a team in a variety of environments and circumstances. Military training doctrine and procedures are based on requirements for deployment of forces and are modeled as a continuum, from basic and specialized individual military skills, to intermediate skills or small unit training, to advanced, integrated training events; this continuum is sometimes referred to as “crawl, walk, run.”

The ORARNG must provide its Soldiers with adequate training, as described above, to achieve the Army’s mission to fight and win our nation’s wars by providing prompt, sustained land dominance across the full range of military operations and the spectrum of conflict in support of combatant commanders. The purpose of the Proposed Action is to support the training requirements of multiple battalions, ranging in size from 350 to 750 personnel, by maximizing the infantry and maneuver training opportunities available at the 7,500-acre CUO, in an economically feasible way. The operational capabilities would accommodate company-sized maneuvers, along with live-fire range capability for individual qualifications. The ORARNG and OMD would meet infantry and maneuver training requirements by expanding the existing Modified Record Fire (MRF) Range; constructing and operating a large Military Operations in Urbanized Terrain (MOUT) site, maneuver course with staging areas, a large tent pad site, ammunition supply point, Drop Zones, and helicopter landing zones; and by replacing supporting potable water, wastewater, and transportation infrastructure, over the next 5 years, as funding is available.

The need for the Proposed Action is to remedy the existing shortfall of infantry and maneuver training capabilities in the State of Oregon to more efficiently meet company- and battalion-level training requirements and Mission-Essential Task Lists. Efficiency would be gained by increasing training time and resources through reducing time and costs associated with extended movements to other out-of-state training complexes. As an in-state training complex, CUO would be closer to ORARNG units than either Joint Base Lewis McChord (JBLM)/Yakima Training Center (YTC) in Washington or Orchard Combat Training Center (OCTC) in Idaho, and would have the advantage of priority range scheduling for Oregon units, unlike JBLM/YTC or OCTC.

1.4 Scope of the EA

This EA evaluates expanded military training operations for the ORARNG, including related infrastructure development required over the next 5 years. This EA evaluates potential impacts that could occur as a result of the alternatives in the following resource categories:

- Land Use
- Air Quality
- Noise
- Geology, Topography, and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous and Toxic Materials and Wastes

1.5 Decision Making

Pursuant to DoD Directive 5105.77, dated October 30, 2015, the NGB serves as the principal advisor on matters involving the ORARNG, and is responsible for implementing DoD guidance on the structure and strength authorizations of the ARNG. The NGB is responsible for ensuring that ARNG activities are performed in accordance with applicable policies and regulations. Therefore, the NGB is the lead federal agency responsible for preparation of NEPA-compliant documentation on projects for which the ORARNG is the proponent. In that capacity, the NGB is ultimately responsible for environmental analyses and documentation; however, the local responsibility for NEPA document preparation falls on the ORARNG (DoD Directive 5105.77).

This EA analyzes the potential for significant environmental effects associated with the Proposed Action and alternatives, including the No Action Alternative. If the analyses presented in this EA indicate that the Proposed Action would not result in significant environmental or socioeconomic effects, then a Finding of No Significant Impact (FNSI) will be prepared. An FNSI briefly presents the reasons why a proposed action would not have a significant effect on the human environment, and why an Environmental Impact Statement (EIS) would not be necessary. If the analyses presented in this EA indicate that significant environmental effects would result from the Proposed Action that cannot be mitigated to insignificance, a Notice of Intent to prepare an EIS would be required, or no action would be taken.

1.6 Public and Agency Involvement

Letters were sent out on August 12, 2016, to multiple local, state, and federal agencies notifying them of the project and the scope of this EA, and providing an opportunity for involvement in the environmental review process. The letter and mailing list are provided in Section 9 of this EA. If an FNSI is determined to be appropriate, the Final EA and FNSI will be made available for public review. Public and stakeholder comments will be considered prior to a decision and issuance of an FNSI.

1.7 Related NEPA, Environmental, and Other Documents and Processes

No EAs or EISs have been prepared by the ORARNG for CUO. The *Environmental Assessment for Disposal and Reuse of Umatilla Chemical Depot* (August 2016), with a draft FNSI, was prepared for the land transfer to local governments associated with the BRAC process. The *Military Readiness Activities at Naval Weapons Systems Training Facility Boardman, Final Environmental Impact Statement* (December 2015) was prepared for military readiness activities proposed at the Naval Weapons Systems Training Facility (NWSTF) Boardman, which is approximately 6 miles west-southwest of the former UCD. The NWSTF Final EIS was used in this EA to evaluate cumulative impacts, as discussed in Chapter 4 (U.S. Navy 2016).

1.8 Regulatory Framework

Various federal and state laws, ordinances, rules, regulations, and policies are pertinent to implementation of the Proposed Action. These include, but are not limited to, the following:

- NEPA of 1969
- CEQ Regulations 40 CFR Parts 1500-1508
- Clean Air Act (CAA)
- Clean Water Act, Sections 401 and 404 (33 U.S.C. 1251 et seq.)
- Endangered Species Act (ESA) (16 U.S.C. 1531 et seq., as amended)
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712)
- Executive Order (EO) 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)
- National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. 300101 et seq.)
- EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)
- EO 13045 (Protection of Children from Environmental Health Risks and Safety Risks)
- AR 200-1, *Environmental Quality: Environmental Protection and Enhancement*
- ORARNG PAM 200-1, *Environmental Quality: Guide to Environmental Compliance*
- Army NEPA Regulation, 32 CFR 651, *Environmental Analysis of Army Actions*
- ARNG NEPA Handbook, *Guidance on Preparing Environmental Documentation for Army National Guard Action in Compliance with the National Environmental Policy Act of 1969* (ARNG 2011)
- Section 438 of the Energy Independence and Security Act of 2007 Description of Proposed Action and Alternatives

SECTION 2: DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This section describes the alternatives that were considered and their development process. Two alternatives were carried forward for consideration and evaluation in this EA: the Proposed Action Alternative, and the No Action Alternative.

2.2 Proposed Action

This EA evaluates expanded military training operations and associated infrastructure development required over approximately the next 5 years at CUO. Three “Use Areas” have been identified that describe the geographic areas where general types of military training activities and associated facilities would occur (see Figure 1.2). Each of these Use Areas would require some construction to support the military training or associated support activities proposed for that Use Area. Construction efforts would include new purpose-built modern facilities and modification and re-use of existing structures for military training and support activities. In general, the strategy for development of CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, igloo complexes, etc.), where possible to accomplish the required training and support activities, and to reduce the environmental impacts associated with native habitat conversion. The Proposed Action also requires infrastructure improvements that cut across Use Areas. These infrastructure improvements are mostly utilities–related, and would include the potable water system, wastewater treatment system, transportation system, and enhanced firebreak system.

Under the Proposed Action, military training activities at CUO would be expanded to fully support the training requirements of multiple battalions. The CUO would have a capacity to support 620 transient personnel, with surges up to 1,240 transient personnel. The operational capabilities would accommodate company[3]-sized maneuvers, along with live-fire range capability, for individual and collective team qualifications. The support facilities, training areas, ranges, and full-time staff would support the core training and readiness objectives for all ORARNG elements as part of the Combined Arms Training Strategy, along with the TRADOC Programs of Instruction required for the RTI.

Annual throughput of all combined personnel has averaged approximately 22,000 man-days over the last 5 years. Implementation of the Proposed Action anticipates an average annual throughput of Soldier man-days at 40,000 to 50,000, based on increased training exercises by ORARNG units and increased training schedules by the RTI.

Whether analyzing for the maximum occupancy at one time or the annual throughput in man-days, the users would likely cycle through all three of the major Use Areas described in this EA during their stay at CUO. Soldiers and students would be billeted in the Cantonment Use Area, conduct live-fire training and qualification in the Live-Fire Use Area, and conduct mounted and dismounted maneuver training in the Maneuver Use Area. These Use Areas are identified on Figure 1.2.

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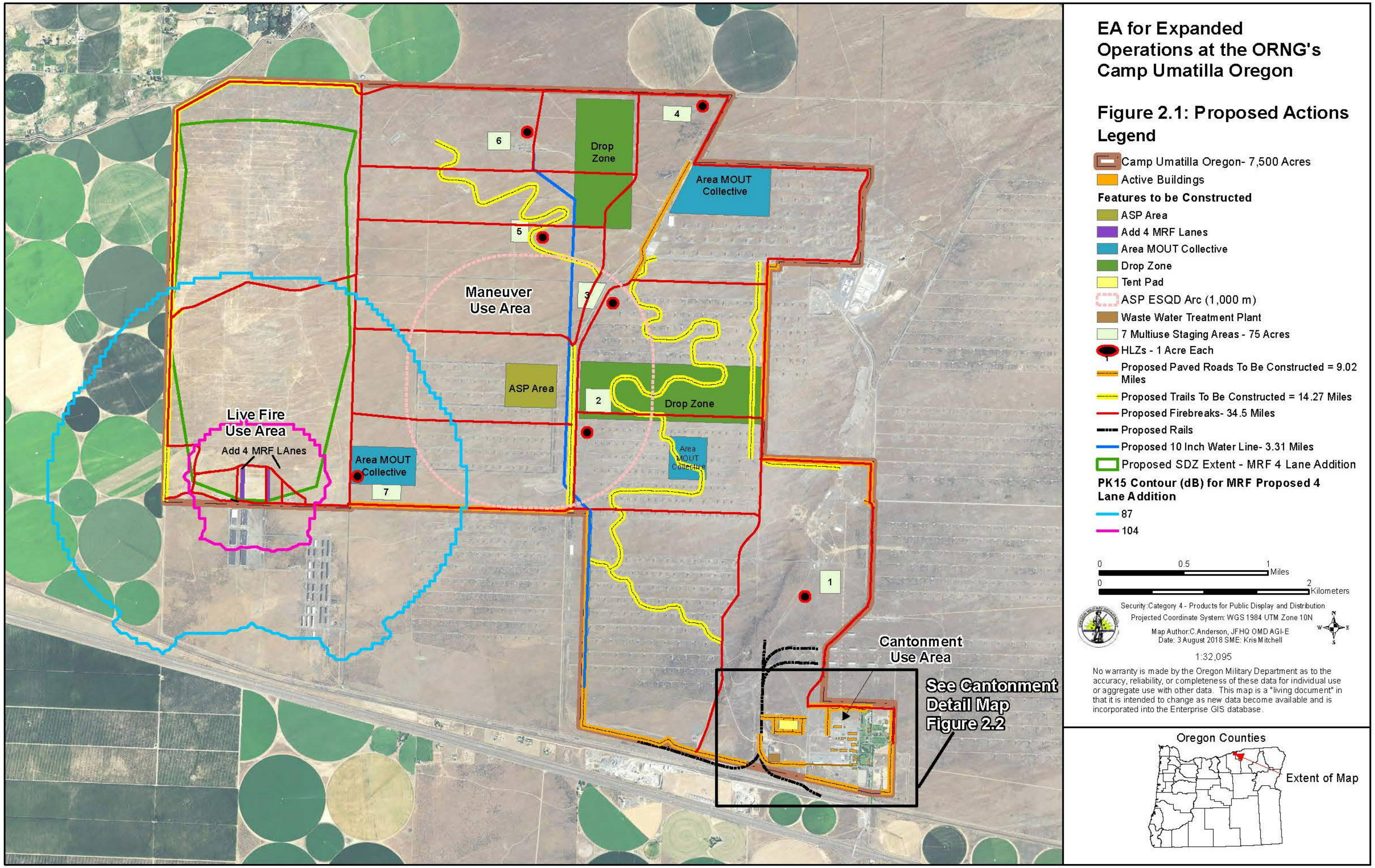
[3] A company typically consists of 3 to 5 platoons; a platoon typically consists of 16 to 40 Soldiers, and is made up of 3 to 4 Squads of 4 to 10 Soldiers each. See “Operational Unit Diagrams” at the following link for more information on the size, types, and leadership structure of U.S. Army Units. https://www.army.mil/info/organization/unitsand commands/oud/.

Infrastructure development, military training activities, and use levels included under the Proposed Action are organized by Use Area, summarized below in Table 2.1, and shown on Figures 2.1 and 2.2. Approximations of total size and acreages of new disturbance for each individual project are estimated. The following subsections provide more detail on activities included in the Proposed Action, by Use Area, and the Best Management Practices (BMPs) that OMD employs as part of its standard operating procedures that would minimize impacts associated with the Proposed Action.

Table 2.1: List of Individual Projects Included in the Proposed Action

Project Description	Total Acres	Acres New Disturbance	Funding Source	Implementation Date
Live Fire Use Area				
Construct and operate up to four additional firing lanes at the Modified Record Fire (MRF) range (NG PAM 415-12)	20	8	SRM	2020
Cantonment Use Area				
Construct and operate a large, gravel tent pad site for a battalion element/multiple companies with adjacent latrine/shower buildings, covered training/mess shelters, and pads for Mobile Containerized Kitchens (NG PAM 415-12)	10	10	SRM/ Troop Labor	2019
Maneuver Use Area				
Construct and operate a large Military Operations on Urbanized Terrain (MOUT) site (urban and/or rural village) (NG PAM 415-12 and RTI POI)	556	100	SRM/ Troop Labor	2018-2022
Construct and operate helicopter landing zones (HLZ) and two parachute drop zones (DZ) for personnel and cargo (NG PAM 415-12)	210	10	G3	2019
Construct and operate an Ammunition Supply Point (ASP) by repurposing 4 to 12 existing Igloos (NG PAM 415-12)	50	10	SRM	2021
Construct and operate new maneuver lanes and a tracked/fighting vehicle maneuver course (non-live fire), including new connector trails, staging areas, and enhanced firebreaks as needed (NG PAM 415-12)	166	116	G3/ Troop Labor/ SRM	2019-2021
Utility and Transportation Projects that cut across Use Areas				
Repair and operate potable Water System (NG PAM 415-12)	8	8	SRM/ UMMC	2018
Repair and operate a Wastewater Collection, Treatment, and Disposal System (NG PAM 415-12 MILCON PN411503)	5	5	Milcon/ UMMC	2018
Construct perimeter roads, fencing, and firebreaks (NG PAM 415-12)	110	110	SRM/ Troop Labor	2019-2022

Note: A total potential new disturbance of approximately 360 acres may result from the Proposed Action, due to 17 acres of overlap of individual actions in the above table.



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 2.1: Proposed Actions

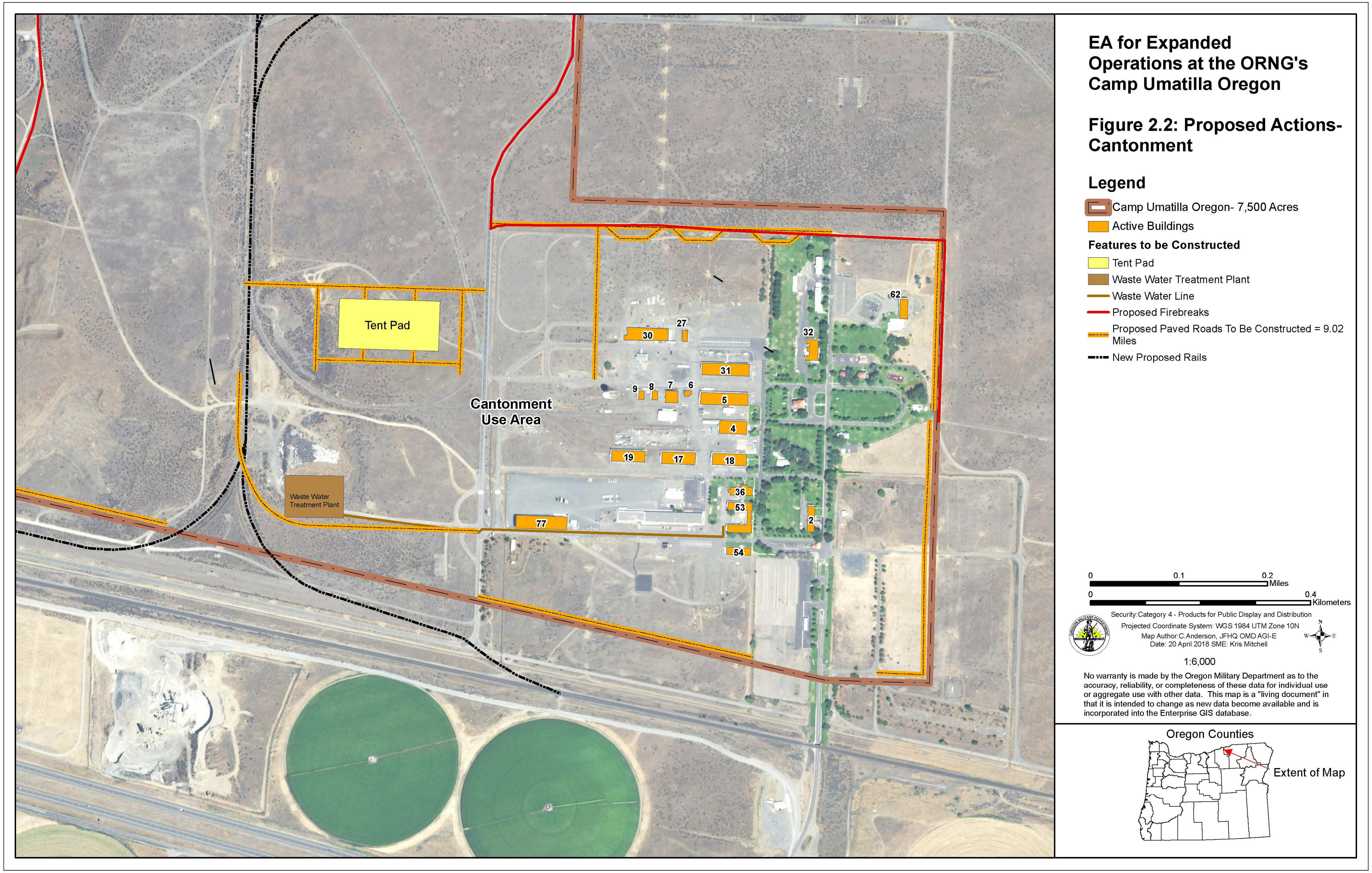


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Figure 2.2: Proposed Actions- Cantonment

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Projected Coordinate System: WGS 1984 UTM Zone 10N
Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

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2.2.1 Live-Fire Military Training Use Area

The Live-Fire Use Area (Figure 2.1) is along the western side of CUO, with the installation boundary as its northern, western, and southern perimeter, and West Patrol Road to the east.

New activities proposed for the Live-Fire Use Area would be similar to existing ongoing activities as described in Section 1.1. The existing small-arms firing ranges along the southern boundary of the Live-Fire Use Area (oriented north) that would remain include a standard-design 36 firing point (FP) Basic 10- to 25-meter Zero Range, an MRF Range with 10 FP, an Automated Combat Pistol/Military Police Firearms Qualification Course (CPQC) with 10 FP, and a live-fire Grenade Launcher Range (Training Practice chalk rounds only) with 4 FP. The existing small-arms Surface Danger Zone (SDZ)[4] would remain within the property boundary.

The Proposed Action includes adding up to four additional FPs to the MRF range. The four additional FPs would be added to the existing MRF Range in such a way as to keep the SDZ within the property boundary.

2.2.2 Cantonment Use Area

The Cantonment Use Area would consist of the existing UCD cantonment of approximately 170 acres, and an expanded area of approximately 60 acres on the northern and western sides of the existing cantonment. The Cantonment Use Area is the area where classroom training and non-training activities would take place, including administration and operations, housing, dining, and storage. The area is contained by the installation boundary to the north, east, and south, and Rim Road South to the west, as identified on Figure 2.2. The Cantonment Use Area has numerous existing structures that would be retained or modified for use as part of CUO, or demolished and replaced with new construction. The area would provide the typical cantonment-type support services and infrastructure for the training activities occurring throughout CUO.

A Transient Training unit “tent city” is proposed for the cantonment to accommodate additional personnel during large training events, and would include gravel pads for portable showers/latrines, covered training/mess shelters, and pads with hookups for Mobile Containerized Kitchens. Total ground disturbance would include approximately 10 acres.

2.2.3 Military Maneuver Training Use Area

The approximately 5,000-acre Maneuver Use Area (Figure 2.1) would include both mounted and dismounted military maneuver training. Mounted maneuver training includes Soldiers in military vehicles, including both wheeled and tracked vehicles. Military vehicles would include the M1 Abrams, M2/3 Bradley Fighting Vehicles, M113 Armored Personnel Carrier, Family of Medium Tactical Vehicles, Armored Security Vehicle, and High Mobility Multipurpose Wheeled Vehicles currently stationed at CUO, as well as proposed future vehicles such as the Stryker, Mine Resistant Ambush Protected Vehicle, Husky Vehicle-Mounted Mine Detector, and Buffalo Mine-Protected Vehicle. Mounted maneuver would occur on roads and trails only, and no off-road maneuver would be allowed. Dismounted maneuver

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[4] The Surface Danger Zone (SDZ) is defined as the ground and airspace designated in the training complex (to include associated safety areas) for vertical and lateral containment of projectiles, fragments, debris, and components resulting from the firing, launching, or detonation of weapon systems, to include explosives and demolitions (DA PAM 385-63 Range Safety).

typically includes squad- to company-sized units moving through the training area on foot. These scenario-based exercises could be force-on-force, and could include use of blank ammunition and Instrumentable Multiple Integrated Laser Engagement System (IMILES) gear. Both mounted and dismounted maneuver training could include use of small Unmanned Aerial System (UASs) such as the hand-launched RQ-11 Raven. There would be overlap of mounted and dismounted maneuver area and scenarios, as well as a number of fixed training facilities that would support both mounted and dismounted training.

Training activities proposed for the Maneuver Use Area could occur during day or night, and would produce noise from vehicle movements and firing individual and crew-served weapons with blank ammunition; however, live-rounds would not be fired in the Maneuver Use Area. Proposed training activities and related infrastructure for the Maneuver Use Area would include the following:

- **MOUT** – MOUT training prepares Soldiers for combat in urban and village environments. Infrastructure activities to support this training could include reuse of existing buildings, new building construction, and building demolition as needed. The type of facilities for urban and village environments are similar, including buildings, building facades, and walled compounds and structures, except urban environment would have a higher building density and road network. The MOUT training areas would be geographically dispersed in the Maneuver Use Area, and would be incorporated into the maneuver trails. The MOUT training area would encompass up to approximately 100 acres of new ground disturbance.
- **Wheeled and Tracked Vehicle Maneuver Trails** – Wheeled and tracked vehicle training would occur on existing secondary roads in the Maneuver Training Use Area. Both wheeled and tracked vehicle training would occur on road or trail only, and no off-road training would be allowed. Where needed, staging areas and segments of new trail construction would be required to connect existing secondary paved roads, which would be allowed to deteriorate over time into gravel maneuver trails. In addition, new trails would be constructed to add some variety to the mostly grid-pattern layout of the existing network. Such training might include simulated Improvised Explosive Device response, force-on-force scenarios, or route clearance training, and would be coupled with MOUT training scenarios and driver’s training. Future systems may include some versions of the Stryker. The Stryker is an eight-wheeled rubber-tired combat vehicle that is lighter, smaller, and more readily deployable than current Army combat vehicles of the same capabilities. Maneuver trails and staging areas would include approximately 116 acres of new ground disturbance.
- **Drop Zone (DZ)** – Designation of the two DZs would not include construction activities. The areas would be surveyed and documented to ensure no safety hazards (such as fences or telephone poles) are present before publication of availability for training and use. The unobstructed terrain between the “G” and “J” Block igloo complexes and another area just west of “K” Block each total approximately 200 acres, and would be best suited for use as a DZ. The DZs would support insertion and extraction activities, which train military forces to deliver and extract equipment and personnel using a variety of techniques. These activities encompass parachute, fast rope, rappel, and Soldier extractions. The C-130 and MV-22 aircraft, CH-46, CH-47, and UH-60 helicopters are typically used for equipment and personnel inserts. Insertion and extraction activities at CUO would be fairly infrequent, and centered on parachute dropping of personnel, military equipment, and supplies. Helicopter training operations would remain above 500 feet (152 meters) above ground level (AGL) while outside the boundary of CUO (unless precluded by

weather). All fixed-wing training operations would comply with Federal Aviation Administration (FAA) regulations and altitude requirements. When not in use as a DZ, the areas would be used for dismounted maneuver training.

- **Helicopter Landing Zones (HLZs)** – HLZs could be located in the DZs, on existing paved open areas that occur throughout the Maneuver Use Area, or by constructing new cleared areas of approximately 1 acre each. Additional aviation training associated with HLZs could include training helicopter pilots both day and night with a variety of aviation tasks, including hoisting operations that involve lowering a crew member by winch for Search and Rescue training, sling-load operations that involve the aircraft lifting a heavy load attached to a long-line and suspended beneath the helicopter, and austere landing and take-offs that involve extremely dusty environments. Some Night Vision Goggle/Night Vision Device Training could also be accomplished, although most of this type of training would take place at the nearby NWSTF Boardman. Helicopter training operations would remain above 500 feet (152 meters) AGL while outside the boundary of CUO. HLZ and DZ training combined would include up to approximately 50 flights per year.
- **Ammunition Supply Point (ASP)** – The Maneuver Use Area would include an ASP for receiving, storing, and issuing all ammunition for use at CUO. The ASP would be approximately 50 acres, and would reuse 4 to 12 existing igloos with modifications necessary to bring them up to date. The ASP would include a 1,000-meter explosive safety quantity distance arc that would preclude any new construction or habitable buildings in this area.

2.2.4 Utilities and Infrastructure that Cut Across Use Areas

Construction of new utility infrastructure support systems is a priority over construction of new training center facilities because such systems are the foundation for the Proposed Action. The following systems were originally constructed in the early 1940s, and need some level of repair or replacement.

2.2.4.1 Water System

In the immediate-term, potable water would continue to be supplied to CUO through existing wells and distribution systems. However, the existing system is located, in part, on parcels that did not remain under ORARNG control, and require easements and use agreements between the OMD and various land owners. The Proposed Action includes replacement or construction of a new water supply and distribution system, including additional storage reservoirs for the Cantonment Use Area and training center that would keep the entire potable water system within the boundaries of CUO. The proposed potable water system is shown on Figure 2.3.

2.2.4.2 Wastewater System

The *OMD Camp Umatilla Condition Assessment Report* (Kennedy/Jenks Consultants 2013) identified interim measures to restore full functionality to the wastewater treatment system to support a population of up to 40 full-time personnel, which was estimated to be the need on property reassignment. Measures included repairing or adding additional functional drainfield area, and bringing the small Imhoff tank on-line in place of the large Imhoff tank.

In addition to the interim measures previously discussed, the OMD has prepared the *OMD Camp Umatilla Wastewater System Assessment* (Kennedy/Jenks Consultants 2017) according to Oregon Department of Environmental Quality (DEQ) requirements, which describes the wastewater treatment and discharge method for new construction to support CUO. The proposed wastewater treatment plant consists of a gravity collection system serving the Cantonment Area and multiple decentralized on-site septic systems across the CUO. Wastewater will be treated in a facultative lagoon with sufficient retention time to accommodate approximately 122 full-time staff, and up to 1,240 transient users. Final facility design would receive DEQ plan approval, and treated wastewater would be discharged in accordance with a DEQ permit.

2.2.4.3 Perimeter Roads, Perimeter Fencing and Firebreaks

Finalization of the CUO boundary, in agreements with adjacent future land users, will leave areas along the western, southern, and eastern sides of the CUO property with no perimeter/patrol road or fencing. New road or trail segments and fencing would be constructed to restore continuity of the perimeter road and security fence lost with the transfer of property parcels. Existing primary paved roads would be maintained as they are. In total, approximately 10 miles of new perimeter roads and fencing would be constructed. Firebreak measures, such as the clearing or control of vegetation in approximately 16-foot-wide strips, would be implemented along approximately 40 miles of roads and trails to help reduce the spread of wildland fires. Total ground disturbance related to construction of new perimeter roads, perimeter fencing, and firebreaks across all Use Areas would include approximately 110 acres. Proposed road and trail improvements are shown on Figure 2.4.

Transportation from home station (armories) or other locations to CUO and back are not analyzed in this EA, because all Army convoys comply with the Defense Transportation Agency DTR 4500.9-R *Defense Transportation Regulations Part III, Mobility* (specifically, Appendix F-Military Movement on Public Roads; DoD 2016).

2.2.5 Best Management Practices

As standard operating procedure, OMD implements several management plans and BMPs that minimize environmental impacts. These BMPs would be implemented as part of the Proposed Action, and are summarized in Section 4.13.

2.2.5.1 Hazardous Material, Waste, and Spill Management Plan (HMWSMP)

The HMWSMP prescribes responsibilities, policies, and procedures for storing and managing hazardous materials, accumulating and managing wastes, and responding to spills of hazardous materials and wastes in the ORARNG. The HMWSMP was completed in accordance with AR 200-1 to ensure ORARNG compliance with applicable federal, state, and local environmental laws and regulations.

2.2.5.2 Integrated Natural Resource Management Plan (INRMP)

In accordance with the requirements of the Sikes Act, as amended, the ORARNG and OMD would prepare an INRMP for CUO. The INRMP would include management actions that would focus on sustaining natural resource conditions to provide natural environmental conditions for military training activities. Under the Sikes Act and DoD direction, an INRMP is required to provide for:

- No net loss in the capability of military installation lands to support the military mission of the installation;
- Fish and wildlife management, land management, weed and exotic species management, forest management, and fish- and wildlife-oriented recreation;
- Fish and wildlife habitat enhancement or modifications;

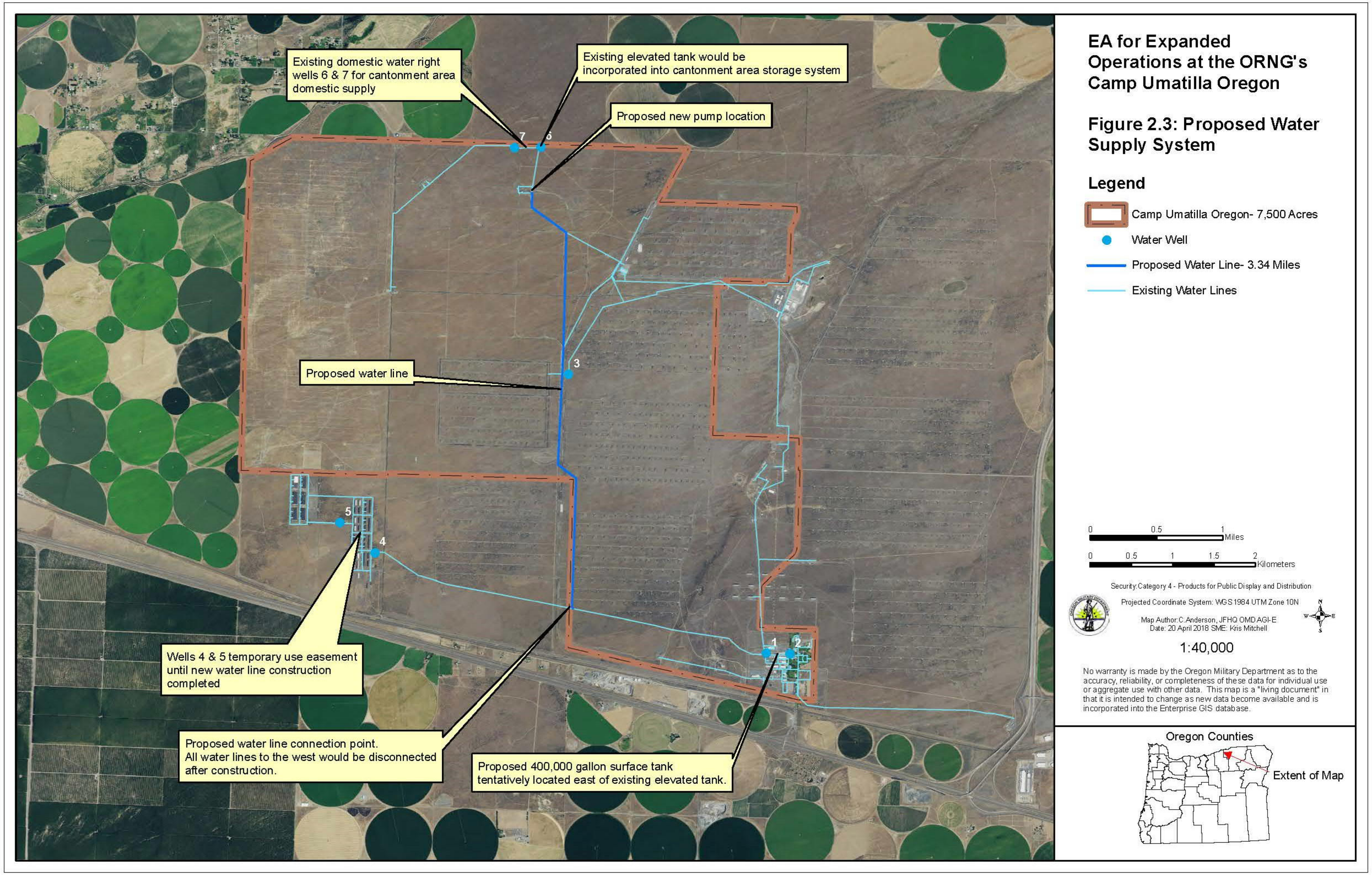

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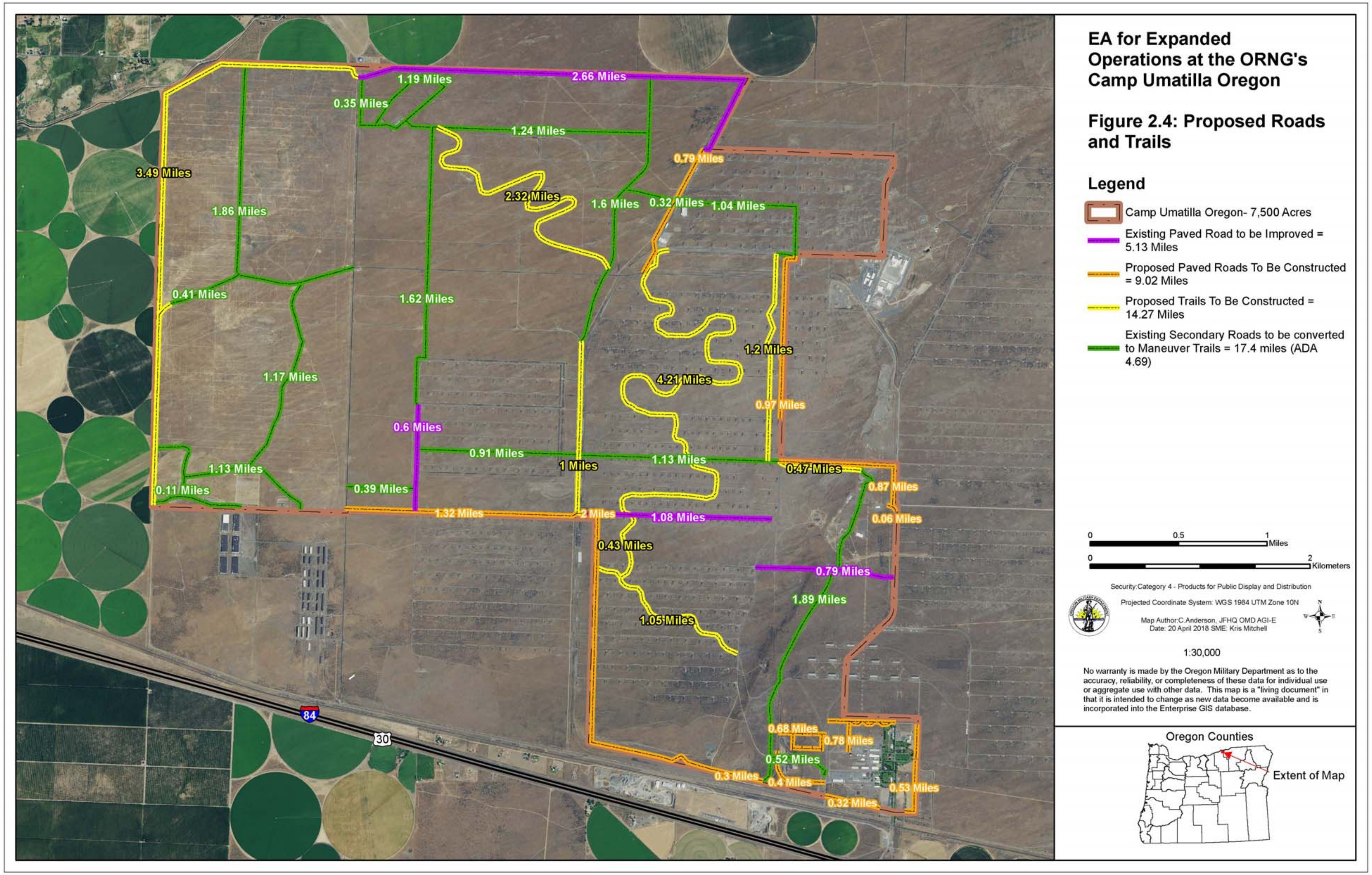
Figure 2.3: Proposed Water Supply System



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 2.4: Proposed Roads and Trails

Legend

🟫 Camp Umatilla Oregon- 7,500 Acres

Existing Paved Road to be Improved = 5.13 Miles

Proposed Paved Roads To Be Constructed = 9.02 Miles

Proposed Trails To Be Constructed = 14.27 Miles

Existing Secondary Roads to be converted to Maneuver Trails = 17.4 miles (ADA 4.69)

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Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

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- Wetland protection, enhancement, and restoration where necessary for support of fish and wildlife;
- Integration of and consistency among the various activities conducted under the plan with other appropriate installation plans;
- Establishment of specific natural resource management objectives and time frames for proposed action;
- Sustained use by the public of natural resources to the extent such use is not inconsistent with the needs of fish and wildlife resources management;
- Public access to the military installation, appropriate for the public's sustained use of natural resources, subject to requirements necessary to ensure safety and military security;
- Enforcement of applicable natural resource laws and regulations; and
- Such other activities as the Chief of the NGB determines appropriate.

2.2.5.3 Integrated Training Area Management (ITAM) Program

The ITAM Program is a management program that integrates Army training and other mission requirements for land use and sound natural resource management on maneuver lands. Program activities could include management actions such as marking cultural or environmentally sensitive areas for avoidance, and actions to prevent or repair damage resulting from vehicle maneuver training.

2.2.5.4 Integrated Cultural Resource Management Plan (ICRMP)

In accordance with Army requirements, the ORARNG and OMD would revise the existing statewide ICRMP to include CUO. The ICRMP includes the following goals:

- Ensure compliance with federal preservation laws.
- Consult with appropriate stakeholders and federally recognized Tribes.
- Locate, evaluate, and protect archaeological, historical, and sacred sites.
- Contribute to the regional archaeological and historical body of knowledge.
- Employ efficient techniques for the management of cultural resources.

2.2.5.5 Integrated Wildland Fire Management Plan (IWFMP)

The IWFMP would include the objectives listed below. The IWFMP is currently in the process of being developed.

- Maintain or improve the quality of lands represented in the installations of ORARNG.
- Allow military operations and training to occur at the tempo required to maintain a high level of combat readiness.
- Prioritize installations, and locations within installations, for funding and implementation of fire management improvements.
- Establish a series of firebreaks and/or fuel breaks at high fire risk installations/areas to reduce the probability of a fire moving into high-value areas or off installation. Establish monitoring protocols and minimum specifications for these breaks.
- When possible, control the timing of ignitions so that fires which occur do so when there is a high probability of controlling the fire and protecting all valued resources.
- Communicate within the fire management hierarchy to improve practices and policies.

- Communicate and educate other departments to facilitate a reduction in fire starts.
- Update interagency agreements as necessary to ensure prompt and complete cooperation during wildfire incidents both on ORARNG lands and on those of other agreeing agencies.
- Establish fire management qualifications for all firefighters and fire managers, and ensure all personnel assigned to those positions are trained to a level appropriate for their expected duties.

2.2.5.6 Spill Prevention, Control, and Countermeasures (SPCC) Plan

An SPCC Plan would be completed for CUO. The SPCC Plan identifies potential spill sites and provides a framework for ensuring that the CUO has the resources, structures, and equipment in place to prevent, control, and respond to oil or hazardous substance spills. The SPCC Plan would be completed in accordance with the Oil Pollution Prevention regulations at 40 CFR 112 and AR 200-1. The SPCC Plan is reviewed annually to determine if possible changes in the physical structures or operational procedures have occurred, or if more effective prevention and control technologies are available.

2.2.5.7 State Operational Noise Management Plan (SONMP)

The SONMP provides a strategy for noise management at ORANRG facilities. Elements of the SONMP include education about noise and Army noise metrics; complaint management; and when necessary, noise abatement procedures (ORARNG 2010). OMD would revise the Statewide Noise Plan as funding becomes available.

2.2.5.8 Construction BMPs

Construction BMPs would be implemented to control dust, avoid and minimize erosion and sediment migration, avoid the take of migratory birds during nesting season, and prevent release of toxic or hazardous chemicals to the environment. BMPs could include dust abatement, Regulated Building Materials surveys and abatement, mulching, storm sewer inlet protection, and water run-on and run-off controls.

2.3 Alternatives Considered

This section describes the alternatives that were evaluated and the selection criteria that were used to select the Preferred Alternative in the ORARNG's effort to consider a range of reasonable alternatives.

2.3.1 Alternative Development–Screening Criteria

CEQ implementing regulations provide guidance on the consideration of alternatives in an EIS or EA. These regulations require the decision-maker to consider the environmental effects of a proposed action, and a range of alternatives to a proposed action (40 CFR §1502.14). The range of alternatives includes reasonable alternatives (including a No Action Alternative), which must be rigorously and objectively explored, as well as other alternatives that are eliminated from detailed study. Reasonable alternatives include those that are practical or feasible from a technical, temporal, and economic standpoint, and support the underlying purpose of and need for the proposed action.

Alternatives considered in this EA were developed by the ORARNG after careful assessment by subject-matter experts, including units and commands that use the ranges, range management professionals, Planning staff, and Environmental staff. The team developed criteria to assess whether a possible alternative meets the underlying purpose of and need for the Proposed Action, and is practical or feasible from a technical and economic standpoint. Any alternative considered for further analysis must meet the following criteria.

- **Meets purpose and need** – must correct the deficiencies identified in Section 1.3.
- **Economically feasible** – must be an alternative that meets the purpose and need in an economically feasible way. The ORARNG would not likely receive sufficient funding at one time to complete construction of all the facilities required for an expanded Training Center. Development would need to proceed in a phased approach as funding is gradually received from a number of different sources, including both federal and state.
- **Controllable variables** – must reduce the number of variables that are outside ORARNG control to be successful. For example, alternatives that require Congressional action would not be in ORARNG's control.
- **Safety** – must implement training, including live-fire weapons training, in a safe manner that is in compliance with Army and regulatory requirements. In addition, must implement site construction and training activities in consideration of existing clean-up areas, Land Use Controls (LUCs), and Recognized Environmental Conditions as identified in the Environmental Condition of Property (ECOP).
- **Minimize adverse impacts to the environment** – construction and training activities should be sited and conducted to minimize adverse environmental impacts where possible, including the amount of habitat converted from native to developed.

Table 2.2 below lists each of the alternatives—those carried forward for detailed analysis and those not carried forward—and describes how they each met or did not meet the purpose and need of each individual selection criterion described above.

Table 2.2: Summary of Alternatives Considered

Alternatives	Meets Purpose and Need	Economically Feasible	Control of Variables	Safety	Minimize Environmental Impacts
Proposed Action	Yes	Yes	Yes	Yes	Yes
No Action	No	Yes	No	Yes	Yes
Camp Rilea	No	No	No	No	Unknown
Camp Adair	No	No	No	No	Unknown
Biak Leased Lands	No	Yes	No	No	Unknown
NWSTF Boardman	Yes	Yes	No	Yes	No
Private Lands	Yes	No	No	Yes	Unknown
Federal Ld Withdrawal	Yes	Yes	No	Yes	Unknown
Oregon DSL	Yes	No	No	Yes	Unknown
Simulations Training	No	Yes	Yes	Yes	Yes
Rearrange Use Areas	Yes	No	Yes	No	No

2.3.2 Evaluated Alternatives

2.3.2.1 Proposed Action (Preferred Alternative)

The Proposed Action is the expanded military training activities at CUO and infrastructure development required over the next 5 years. The Proposed Action is described in detail in Section 2.2 above.

The Proposed Action was designed by ORARNG staff to meet the purpose and need by accomplishing the required military training, while attempting to minimize environmental impacts associated with native habitat conversion by reusing and repurposing existing disturbed areas (buildings, roads, igloo complexes, etc.), where possible. This alternative is the only one that meets all criteria.

2.3.2.2 No Action

In accordance with CEQ regulations (40 CFR §1502.14[d]), analysis of the No Action Alternative is required. The No Action Alternative provides a baseline against which the effects of the Proposed Action and all other alternatives can be compared. The No Action Alternative analyzed in this EA involves continuing military training activities at CUO at regular and historic levels, including typical incremental improvements and fluctuations in training cadence and intensity that would normally occur. The potential impacts of the No Action Alternative are compared to the potential impacts of the Proposed Action. Although the No Action Alternative would not satisfy the purpose of or need for the Proposed Action, this alternative was retained to provide a comparative baseline against which to analyze the effects of the Proposed Action, as required under the CEQ Regulations (40 CFR §1502.14). The No Action Alternative reflects the status quo and serves as a benchmark against which the effects of the Proposed Action can be evaluated. The No Action Alternative is best described in the existing conditions sections (Section 1.1.2 and Section 3.1.2), and fundamentally includes the following continued ORARNG activities in the three main Use Areas.

- Live-Fire Military Training Use Area – Continue use of the existing live-fire ranges as described in Section 3.1.2.
- Cantonment Use Area – Continue use of the existing licensed buildings and structures, including continued routine maintenance for the same basic functions and activities described in Section 3.1.2.2.
- Military Maneuver Training Use Area –Continue existing training activities described in Section 3.1.2.3.

2.3.3 Alternatives Eliminated from Further Consideration

The ORARNG evaluated a full range of alternatives using the screening criteria outlined in Section 2.3.1 to identify reasonable alternatives that would be carried forward for analysis in this EA. Pursuant to 40 CFR §1502.14(a), the ORARNG eliminated from further analysis the alternatives described in the following section because they did not meet the purpose of and need for the Proposed Action, or were not practical or feasible from a technical or economic standpoint. The following alternatives were considered, but not carried forward for detailed analysis, because they were not found to be reasonable through the screening process.

2.3.3.1 Implementing the Proposed Action at Locations Other Than Camp Umatilla Oregon

Developing an expanded Training Center at one or more locations other than CUO is outside the scope of this EA, and therefore eliminated from detailed study. However, it is worth noting that the ORARNG has conducted a number of internal studies and prepared planning documents in the past, related to both the BRAC action to close the former UCD, and the NWSTF Boardman EIS, to identify other lands that would provide the functionality of an expanded training site. Because of the dual nature of the state National Guard system, federal funds can be used to construct new facilities, but the state is required to provide the land suitable for construction, at the state's expense (National Guard Regulation 415-5, Section 7-6(c)(3)). Acquisition of 7,000 acres of maneuver land is beyond the State of Oregon's capacity. All of these study efforts have concluded that acquisition of federal, state, or private lands other than the CUO is not feasible.

2.3.3.1.1 Camp Rilea

Camp Rilea Oregon (CRO) is a 1,800-acre ORARNG training site on the west coast between the cities of Warrenton to the north and Seaside to the south. CRO is surrounded on three sides by residential housing, and on the west by the Pacific Ocean. CRO is too small to provide additional maneuver training, and the State of Oregon is not able to fund the purchase of 7,000 acres of coastal residential real estate adjacent to CRO for conversion to maneuver training.

2.3.3.1.2 Camp Adair

Similar to CRO, Camp Adair is a small, 527-acre training site in the Willamette Valley near Independence, Oregon that is also surrounded by rural residential and farm lands. Camp Adair is too small to provide additional maneuver training, and any effort to acquire 7,000 acres of maneuver lands adjacent to Camp Adair would be prohibitively expensive.

2.3.3.1.3 Biak Training Center (BTC)

BTC is on Bureau of Land Management (BLM) lands under long-term lease to the ORARNG, and is situated in the central portion of the state near Redmond, Oregon. The ORARNG does not have exclusive use of these lands, but rather shares use with the general public and grazing lessors. Military maneuver training at BTC is constrained for safety reasons, predominantly due to the public presence on the maneuver trails and public recreational shooting near units training. Acquisition of an additional 7,000 acres of public lands adjacent to BTC would be outside the control of the ORARNG (would be BLM's decision based on their Resource Area Management Plans), and would be less than optimal space for military maneuver training, because it is constrained by safety issues.

2.3.3.1.4 Navy Weapons Systems Training Facility Boardman

NWSTF Boardman is a U.S. Navy–owned property south of Boardman, Oregon; approximately 15 miles west of CUO. The ORARNG has a license and Host-Tenant Agreement that will allow construction of several live-fire ranges on the Navy's property at Boardman. However, the option of 7,000 acres of maneuver training area is not available due to the presence of an Oregon-listed endangered species Washington Ground Squirrel, and U.S. Navy commitments to maintain this ecologically valuable piece of Shrub-Steppe habitat. Acquisition of 7,000 acres of Navy property at NWSTF Boardman for maneuver training would be outside the control of the ORARNG, and could have potential environmental impacts.

2.3.3.1.5 Private Lands

In a 2010 internal study of potential private land acquisition to support the NWSTF Boardman EIS, the ORARNG evaluated 19 parcels of property suggested by The Nature Conservancy that appeared the most feasible for military training ranges. In all cases, after more detailed analysis, the ORARNG found that the parcels would not be feasible due to several reasons. All 19 parcels were made up of multiple owners that would all have to agree to sell; each contained state or county roads or other utility rights-of-way that would have to be vacated; each would have to be rezoned; and all were located more than 30 miles from existing ORARNG support facilities. The ORARNG determined that acquisition of private property is not feasible, because it would be too costly; would require decisions outside the control of the ORARNG; and would require costly and time-consuming processes to vacate public roads and rezone.

2.3.3.1.6 Withdrawal of Federal Lands

The Engle Act of 1958 prevents the U.S. military from withdrawing more than 5,000 acres of existing federal lands from public use without the express act of Congress. Therefore, withdrawing 7,000 acres of existing federal lands would require an act of Congress, and is outside the control of the ORARNG to complete.

2.3.3.1.7 Oregon Department of State Lands

ODSL land holdings in the State of Oregon are used to generate funds for the public school system. An attempt to convert 7,000 acres from revenue-generating status to military maneuver training would be outside the control of the ORARNG, and would have a negative impact on school funding.

2.3.3.2 Simulated Training

Military training includes extensive use of computer-simulated virtual training environments, and involves command and control exercises without operational forces (constructive training). These training methods have substantial value in achieving limited training objectives. Computer technologies provide excellent tools for implementing a successful, integrated training program, while reducing the risk and expense typically associated with live military training. However, virtual and constructive training are an adjunct to, not a substitute for, live training, including live-fire training. Unlike live training, simulated training does not provide the requisite level of realism necessary to attain combat readiness, and cannot replicate the high-stress environment encountered during combat operations. Current simulation technology does not permit training with the degree of fidelity required to maintain proficiency. Basic training can take place using simulators; however, beyond basic levels, simulation is of limited utility because the simulator cannot match the dynamic nature of the environment. Specifically, coordinated unit-level activities require multiple crews to interact in a variety of environments that cannot be simulated. Moreover, it is a training imperative that crews actually use the weapons and equipment they will be called on to operate.

This alternative—substitution of simulation for live training—fails to meet the purpose of and need for the Proposed Action, and was therefore eliminated from detailed study.

2.3.3.3 Rearrange Three Major Use Areas

ORARNG staff analyzed the possibility of rearranging the three major Use Areas. Any rearrangement of these Use Areas outside of the Proposed Action arrangement described above would require extensive replication of existing and serviceable facilities in the Live-Fire Use Area and the Cantonment Use Area that would be prohibitively expensive, would not lend itself to gradual buildout, and would have a greater potential for adverse impact to the environment, for little or no benefit. For this reason, the alternative of rearranging the three major Use Areas was eliminated from detailed study.

2.3.4 Alternative Impact Comparison Matrix

This EA evaluates the potential direct, indirect, and cumulative environmental, cultural, socioeconomic, and physical effects of the No Action and Proposed Action alternatives. A comparison of the environmental consequences of these alternatives is provided in Table 2.3 below.

Table 2.3: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Land Use	**No Impact.** No new installation infrastructure and no change to use type or levels.	**Less than significant.** No conflict with overall authorized land use. Site activities would not change, but would be expanded in scope. Long-term positive impact would occur through development of the CUO consistent with existing land use and zoning.
Air Quality	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to pollutant emissions.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to the potential for dust generation and air emissions from construction activities. Long-term, less-than-significant, adverse impacts from emissions associated with increased equipment and vehicle use and increased fugitive dust during training operations.
Noise	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to local noise environment.	**Less than significant.** Short-term, less-than-significant adverse impacts due to construction noise. Long-term, less-than-significant adverse impacts due to increased noise generation from increased training activities that would be performed consistent with the Statewide Operational Noise Management Plan (SONMP) and existing noise-related Right-of-Way, and would not impact sensitive land uses.
Geology, Topography, and Soils	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to soil compaction from continued training activities.	**Less than significant.** Short-term, less-than-significant adverse impact through vegetation removal, ground disturbance, and potential compaction during construction. Long-term, less-than-significant, adverse impacts through loss of soil function resulting from creation of impervious surfaces. Proposed ground disturbance in identified areas of severe soil hazards would be conducted using erosion control best management practices (BMPs).
Water Resources	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to soil erosion during training operations and continued water usage at current levels.	**Less than significant.** Short-term, less-than-significant adverse impacts due to the potential for release of toxic or hazardous materials during construction, which would be completed in accordance with permit requirements. Long-term, less–than-significant adverse impacts due to increased water usage that would remain within allocated water rights. Contamination to groundwater from operations, including the proposed wastewater treatment plant, would be unlikely to occur due to implementation of BMPs.

Table 2.3: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Biological (Vegetation, Fish and Wildlife, and Wildland Fire)	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to trampling and degradation of non-native vegetation during training activities and impacts to species due to continued human presence in areas previously disturbed by current training and operational activities. Long-term, less-than-significant adverse impacts would occur due to lack of firebreaks at CUO; however, an Integrated Wildland Fire Management Plan would be created for the site.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to vegetation removal and disturbance, habitat loss and degradation during construction, and potential for more frequent fire starts. Long-term, less-than-significant adverse impacts due to vegetation removal and disturbance during operations and training that would occur primarily in areas dominated by non-native and invasive species, and due to habitat conversion, noise, and/or human presence from training and operational activities to be conducted in accordance with the Integrated Natural Resource Management Plan (INRMP). Impacts would be reduced by implementation of exotic/invasive species reduction goals established in the INRMP. Long-term, less-than-significant adverse impact due increased fire risk from increased training; however, offset by incorporation of BMPs, including firebreaks and creation of the Integrated Wildland Fire Management Plan.
Cultural Resources	**Less than significant.** Short-term impacts would not occur. Long-term, less-than-significant adverse impacts due to continued training and operations activities that could potentially result in occasional cultural resource discoveries and required building maintenance/upkeep that would be performed in existing management plan.	**Mitigated to less than significant**. Short-term, less-than-significant adverse impacts due to the potential for cultural resource discovery during construction. Long-term, significant adverse impacts due to impacts to 563 National Register of Historic Places (NRHP)-eligible buildings and structures associated with the UCD Historic District; an NRHP-eligible wagon road; and a potentially eligible property of traditional religious and cultural significance identified by the Confederated Tribes of the Umatilla Indian Reservation. Impacts would be reduced to less-than-significant levels with implementation of mitigation measures discussed in Section 4 and the 2018 Programmatic Agreement.
Socioeconomics	**No impact.** Economic activity associated with current uses of Camp Umatilla Oregon (CUO) would continue, and use levels of CUO would not change.	**Less than significant.** Short-term positive impact due to increased economic activity during construction. Long-term positive impact due to increased long-term employment, income, and population levels and corresponding purchases of goods and services.
Environmental Justice	**No impact.** Activity and use levels would remain the same; no impacts to environmental justice populations.	**No impact.** No disproportionate adverse environmental, economic, or health-specific impact to minority or low-income populations. No disproportionate environmental or health risks to children.

Table 2.3: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	Proposed Action
Infrastructure	**Less than significant.** Minor improvements to water and wastewater systems to accommodate CUO use levels would result in short- and long-term positive impacts due to improvements to the potable water system and wastewater system to accommodate existing uses.	**Less than significant.** Short- and long term positive impacts due to improvements of existing infrastructure and construction of additional on-site utility infrastructure with sufficient capacity to accommodate increased activity levels.
Hazardous and Toxic Materials/ Wastes	**Less than significant.** Long-term positive impacts due to management of Regulated Building Material (RBM) and hazardous wastes remaining at the site.	**Less than significant.** Short- and long-term beneficial impacts would occur due to abatement of existing RBM and management of hazardous materials during operations.

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SECTION 3: AFFECTED ENVIRONMENT

This section describes the existing environmental and developed conditions of the CUO study area. The CUO study area is defined as the 7,500-acre area that was retained by the Army and leased to the OMD for ORARNG training purposes in December 2017, shown on Figure 1.2.

3.1 Location Description

3.1.1 Environmental Setting

The CUO study area is in the Pleistocene Lake Basin Level IV ecoregion (Thorson et al. 2003), which covers approximately 1,407 square miles in eastern Oregon. The Pleistocene Lake Basin is a sub-region of the Columbia Plateau Level III ecoregion, which includes portions of Oregon and Washington, with small areas extending over the Idaho state border and into British Columbia. The Pleistocene Lake Basin ecoregion is defined by a nearly level to undulating plain shaped by Pleistocene lakes and floodwaters from glacial lakes Missoula and Columbia (Thorson et al. 2003). The topography of this ecoregion slopes to the Columbia River. Elevations on CUO property range from 400 to 677 feet above mean sea level (Pumphrey 2002).

The climate is arid, with significant variation between cold winters (26 degrees Fahrenheit (ºF) low, 41ºF high) and hot summers (52ºF low, 86ºF high). The ecoregion receives between 7 and 10 inches of precipitation per year (Thorson et al. 2003), much of that in the form of snow. The dry climate is largely due to the rain shadow caused by the Cascade and Coast mountain ranges west of the CUO study area.

3.1.2 Existing Site Activities and Facilities

This section describes the existing site activities and facilities that occur in CUO. Existing training activities are organized in three different categories: live-fire weapons training and qualification, mounted and dismounted maneuver training, and classroom and simulations training. There are approximately 20 full-time ORARNG Range operation and training staff who regularly work at CUO. Over the last 5 years, ORARNG training has averaged approximately 22,000 man-days of training per year.

3.1.2.1 Live-Fire Weapons Training and Qualification

Live-fire weapons training occurs in the existing Life-Fire Use Area in the southwestern corner of the property along Range Road, with the direction of fire oriented to the north. The former Ammunition Disposal Area (ADA) that encompasses approximately 1,750 acres to the north of the live-fire ranges serves as the SDZ for all existing live-fire ranges per AR 385-63. The following ranges with support buildings and structures (identified in Table 3.1 below) are included in this complex and are currently used by the ORARNG.

- **MRF Range** – The MRF Range is an Army standard range that allows Soldiers to complete annual Army individual qualification requirements for his/her primary individual weapon (M16/M4). The range consists of 10 lanes of fire with a number of electronically controlled pneumatically actuated pop-up targets out to a maximum distance of 300 meters. The range provides digital scoring on Soldier performance, and encompasses approximately 20 acres.
- **CPQC** – The CPQC is an Army standard range that allows Soldiers to complete annual Army individual qualification requirements for side arms (typically M9). This range consists of 10 lanes of fire with a number of electronically controlled pneumatically actuated pop-up and swing-away

targets out to a maximum distance of 25 meters. The range provides digital scoring on Soldier performance, and encompasses approximately 4 acres.

- **M203 Practice Range** – The M203 Practice Range supports the M203 40 millimeter (mm) grenade launcher. The M203 is typically an accessory mounted on a Soldier's primary individual weapon. This range consists of four lanes of fire out to a maximum distance of 300 meters and includes stationary targets. Only Training Practice chalk rounds are used on this range; no explosive or dud-producing live ammunition is used. The practice rounds fire from the M203 like normal ammunition, but do not explode on impact with the target; instead, the plastic casing breaks open, releasing orange chalk powder on the target. This range does not provide digital feedback, and encompasses approximately 6 acres.
- **Basic 10-Meter/25 Meter Firing Range (Zero Range)** – The Zero Range consists of 36 lanes of fire out to a maximum distance of 25 meters. The range allows Soldiers' familiarization training on the operation of the M249 Squad Automatic Weapon (SAW) and M4/M16 individual weapons. The targets are stationary, and there is no digital feedback. The M249 SAW and M4/M16 fire 5.56-mm ammunition. No 7.62-mm or larger weapons are allowed on this range because the SDZ would extend off CUO, which is not permitted. This range encompasses approximately 3 acres.

Buildings and structures that support these ranges are listed in the Table 3.1.

Table 3.1: Existing Buildings and Structures Supporting Live-Fire Activities

Building Number	Building Name	Area	Date Constructed
RGSP2	Range Support Facility – Modified Record Fire (MRF)	105 square feet (sf)	2009
RGSP3	Range Support Facility	105 sf	2009
NGS01	Range Briefing Structure	4,080 sf	2011
NGH05	Ammunition Breakdown Building – Zero Range	168 sf	2011
NGH02	Ammunition Breakdown Building – MRF Range	168 sf	2011
TBD	Impact Area Non-Dudded	1,743 acres	Unknown
RANG5	Basic 10M – 25M Firing Range (Zero)	3 acres	2011
RANG2	MRF Range	20 acres	2009
RANG3	Automated Combat Pistol/Military Police Firearms Qualification Course (CPQC)	4 acres	2009
RANG4	M203 Practice Range (Grenade Launcher Range)	6 acres	2011
OBST5	Observation Tower – Zero Range	200 sf	2011
OBST2	Observation Tower – MRF	100 sf	2009
OBST3	Observation Tower – CPQC	100 sf	2009

3.1.2.2 Administrative, Classroom, and Support (Cantonment)

The ORARNG military training includes the following buildings and structures in the Cantonment Use Area. The basic functional activities that they support include administrative, classroom, storage, billeting, dining, physical fitness, and supporting parking compound areas. Figure 2.2 shows the locations of the buildings currently included, which are also listed in Table 3.2 below.

Table 3.2: Active Cantonment Buildings

Building Number	Building Name	Area (square feet)	Date Constructed
Building 2	Fire Station	10,842	1941
Building 4	Machine Shop	21,994	1942
Building 5	Vehicle Maintenance Shop	13,469	1942
Building 6	Fuel POL Building	410	1942
Building 7	Carpenter Shop	4,300	1942
Building 8	Pest Control Building	1,581	1942
Building 9	Housing Warehouse	1,567	1942
Building 17	General Purpose Warehouse	13,591	1942
Building 18	Regional Training Institute (RTI) Administrative Storage	5,530	1942
Building 19	Inert Storage Warehouse	12,120	1942
Building 27	Weapons Cleaning Station	1,800	1988
Building 30	Simulator Building	3,056	1942
Building 31	RTI Administrative Storage Building	18,960	1942
Building 32	Office	9,094	1942
Building 36	Transient Dining Facility Building	5,767	1943
Building 53	Enlisted Barracks Transient Building	23,332	1941
Building 54	Treaty Building	5,521	1941
Building 62	RTI Physical Fitness Center Building	10,097	1993
Building 77	Storage Shed Installation	16,950	1975

3.1.2.3 Maneuver Training

Military training currently occurs in the maneuver area and includes both mounted (wheeled or tracked vehicle maneuver) and dismounted maneuver (individual and groups of Soldiers on foot). Maneuver training activities currently include the following:

- Tank Commanders Proficiency Course (TCPC) – an approximately 3.5-mile training course in a 340-acre parcel for M1 Abrams Tanks and M2/M3 Bradley Fighting Vehicles that allows the commander and crews to practice working together as a team while traversing the driving course.
- Helicopter Operations – landings and take-offs of CH-47 Chinook, HH-60 Blackhawks, and UH-72 Lakota to practice loading and unloading Soldiers and supplies, and conducting medical evacuations. Helicopters remain above 500 feet AGL when outside of the CUO boundary. Helicopter operation at CUO is infrequent, and occurs fewer than ten times per year on average.
- Dismounted Maneuver Training – involves various training scenarios, including dry-fire (blanks–no projectiles fired) exercises and use of role players; and can involve multiple Military Services. Typically, small units of military personnel move across the landscape on foot undetected conducting reconnaissance missions or coordinating air strikes (simulated). Dismounted maneuver training can include use of a small hand-launched remote control aircraft with video capability, such as the RQ-11 Raven UAS.

- Land Navigation Course – involves Soldiers walking from station to station using compass, map, and pace counts to progress through the course. The total area includes approximately 860 acres.
- Ad Hoc MOUT Site Training – occurs in various vacant and abandoned buildings that are periodically used for small-unit urban assault training exercises. These exercises do not include live-fire training, but may include opposing force scenarios and blanks used with IMILES-like laser systems. MOUT training can include use of the RQ-11 Raven UAS.
- Bivouac Training – includes Tactical Operations Center and Field Training Exercises using tactical tents such as Army-issued Deployable Rapid Assembly Shelters and Base-X shelter systems. Field conditions simulate tactical scenarios and involve overnight stays.

3.2 Land Use

The CUO study area is currently authorized as a military facility under the jurisdiction of the United States Army, and was being managed according to the 2005 BRAC land use realignment process until December 2017, when the BRAC transfer was completed. Under the 2012 National Defense Authorization Act, the 7,500 acres of the former UCD were required to be retained by the Army for use by Reserve Components. Current land uses include administrative and training, consistent with zoning overlays by both Morrow and Umatilla Counties. A detailed description of current site use and authorized activities is included in Section 3.1.2 and shown on Figures 1.2 and 1.3. Access is restricted, and no public use of the land occurs at the site.

Areas in the former UCD that are outside the CUO study area are zoned by Umatilla County as light industrial and wildlife habitat land use. Morrow County has also designated the Morrow County portion of the former UCD as the Umatilla Depot Military Zone, which allows for outright military uses of this area (Morrow County 2014). The land surrounding the former UCD is predominantly privately owned agricultural land, with some areas zoned as light industrial and rural residential, and a small area zoned as agribusiness (ORNG 2015a). A noise emission right-of-way has been designated by the U.S. Army Corps of Engineers (USACE), and will remain in effect while the property to the south of the small arms ranges remains under BRAC control. The noise emission right-of-way will convert to a deed restriction in perpetuity when the balance of the property is transferred from BRAC to subsequent owners. Existing land uses adjacent to the CUO study area are shown on Figure 3.2.

3.3 Air Quality

The CAA (42 U.S.C. §7410) provides the principal framework for national, state, and local efforts to protect air quality. Under the CAA, the United States Environmental Protection Agency (EPA) is required to establish and maintain National Ambient Air Quality Standards (NAAQS) for criteria pollutants, including ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter equal to or less than 10 microns in diameter and 2.5 microns in diameter, and lead. NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare. Geographic areas that do not meet or have not consistently met NAAQS are designated as 1) nonattainment areas that consistently fail to meet NAAQS; or 2) maintenance areas, which had a history of previously failing to meet NAAQS but now meet NAAQS. The UCD is not in a designated nonattainment area, maintenance area, or designated air quality district (DEQ 2015a).

On a state level, the DEQ maintains a State of Oregon CAA Implementation Plan under Oregon Administrative Rule (OAR) 340-200-0040, and establishes ambient air quality standards for the state under OAR 340-202-0050. Fugitive emission requirements are defined under OAR 340-208-0210.

Air quality at a given location is affected by both anthropogenic sources, including stationary sources (e.g., industrial facilities) and mobile sources (e.g., mobile vehicles), and naturally occurring sources (e.g., windblown dust). Factors contributing to the air quality at a given location include the quantity and type of pollutants emitted locally and regionally, and the dispersion rates of pollutants in the region. Primary environmental setting factors affecting pollutant dispersion are wind speed and prevailing direction, atmospheric stability, temperature, the presence or absence of inversions, and land topography.

3.3.1 Existing Air Pollutant Emissions in the CUO Study Area

Current ORARNG activities in the CUO study area that generate air emissions include the following:

- Maneuver training (Section 3.1.2.3), including vehicle training and helicopter operations. These activities contribute to mobile sources of emissions and generate dust.
- Heating using propane boilers. Pollutant emissions from the propane boilers were calculated as 3.8 tons per year of carbon monoxide, 5.0 tons per year of nitrogen oxides, 1.0 ton per year of volatile organic compounds, and 0.5 ton per year of particulate matter.
- Vehicle emissions from personnel traveling to and from the ORARNG training enclave.
- Emissions from vehicles and equipment used for short-term construction projects.

A query of the EPA's Integrated Compliance Information System for Air (ICIS-Air) database was conducted to determine if any permitted facilities are located at or immediately adjacent to the CUO study area. The ICIS-Air database includes facilities permitted through federal, state, local, and tribal regulatory agencies. The results of the query indicate that there are no operating facilities at or immediately adjacent to the CUO study area. The former UCD operated a permitted Hazardous Waste Treatment and Disposal system in the past; however, the system is listed as "Permanently Closed," and associated air emissions are no longer being generated.

Per the ICIS-Air database, existing pollutant emissions sources in the vicinity of CUO are listed below. All are reported to be in compliance with permit requirements (EPA 2016):

- Hermiston Generating Company, at 78145 Westland Road in Hermiston, Oregon, approximately 2.4 miles east of the former UCD. The Hermiston Generating Company facility is a fossil fuel electric power generating plant.
- Northwest Pipeline Corporation Plymouth Plant on Christie Road in Plymouth, Washington, approximately 4.6 miles north of the UCD. The Northwest Pipe facility is a natural gas transmission line.
- Price-Less Gas, at 711 6th Street in Umatilla, Oregon, approximately 6.5 miles northeast of the UCD. The Price-Less Gas facility is a measuring and dispensing pump manufacturing facility.
- Conagra Foods Lamb Weston, Inc., at 750 NE Columbia Avenue in Boardman, Oregon, approximately 7.1 miles west of the UCD. The Conagra facility is a frozen specialty food manufacturing facility.

3.3.1.1 Regional and Local Air Quality

The Oregon DEQ operates the ambient air quality monitoring network for the entire state, with the exception of Lane County. The closest air quality monitoring station to the CUO study area is at the Hermiston Municipal Airport. The most recent available air quality monitoring data summary from the Hermiston station indicates the local air quality index was considered “Good” for 132 days out of a total 153 days monitored. Air quality on 11 days was considered “Moderate,” with no days considered unhealthy (DEQ 2014). Air quality monitoring data from the Hermiston station indicates the CUO study area is in attainment for all criteria pollutants. The UCD is not in a designated nonattainment area, maintenance area, or designated air quality district (DEQ 2015a).

3.3.2 Sensitive Receptors

No sensitive receptors associated with air quality are in or immediately adjacent to the CUO study area. The nearest sensitive receptor to the CUO study area is the Irrigon Elementary School, approximately 1.5 miles from the northern boundary of the UCD. The locations of sensitive receptors relative to the CUO study area are shown on Figure 3.1.

3.4 Noise

Noise is generally defined as unwanted sound. It may be any sound that is undesirable because it interferes with communications or other human activities, is intense enough to cause hearing damage, or is otherwise annoying. In general, the military noise environment consists of three types of noise: 1) transportation noise from aircraft and vehicle activities; 2) high-amplitude noise from armor and artillery firing and demolition operations; and 3) noise from firing at small-arms ranges.

3.4.1 Noise Level Assessment

Noise may be intermittent or continuous, steady or impulsive. Human response to noise is extremely diverse and varies according to the type of noise source, the sensitivity and expectations of the receptor, the time of day, and the distance between the source and the receptor. The decibel (dB) is the accepted unit of measurement for noise level. The A-scale (dBA) is an adjusted dB that corresponds to the range of normal hearing.

Noise levels are primarily described as the day-night level (DNL). The DNL is the time-weighted energy average sound level over a 24-hour period, with a 10-dB penalty added to the nighttime levels. This nighttime adjustment accounts for the increased sensitivity to nighttime noise levels. The DNL is an accepted unit for quantifying human annoyance to general environmental noise, and is used to evaluate noise levels at noise-sensitive receptor locations. The annual average DNL is used to assess noise levels for most general activities.

Noise from transportation sources such as vehicles and aircraft, and from continuous sources such as generators, is assessed using the A-weighted DNL (ADNL). The ADNL significantly reduces the measured pressure level for low-frequency sounds, while slightly increasing the measured pressure level for some high-frequency sounds.

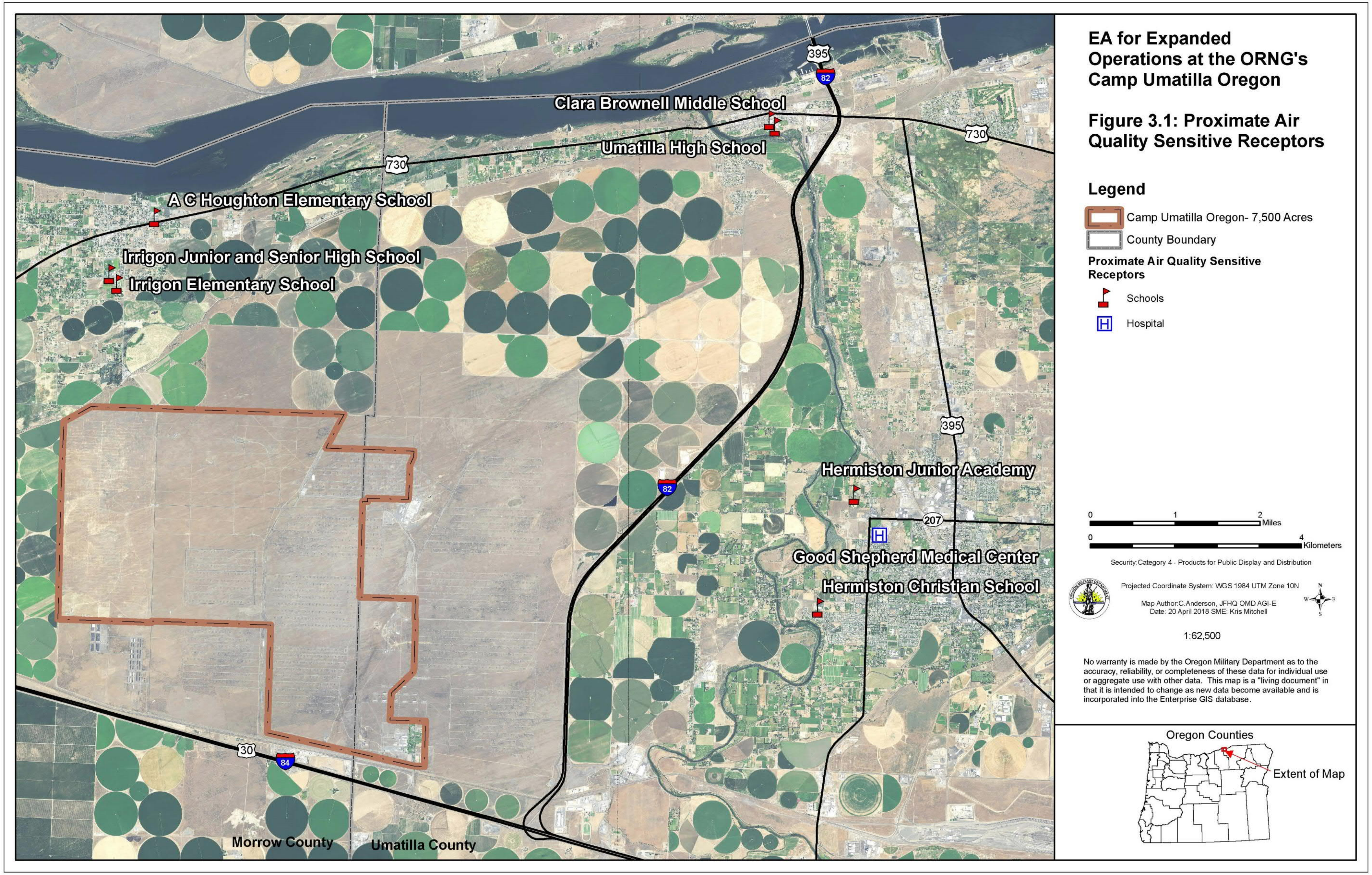

Figure 3.1: Proximate Air Quality Sensitive Receptors

Security:Category 4 - Products for Public Display and Distribution

Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document" in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

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Impulse noise resulting from artillery fire and explosives demolition activities is primarily assessed in terms of the C-weighted DNL (CDNL). The CDNL is often used to characterize high-energy blast noise and other low-frequency sounds capable of inducing vibrations in buildings or other structures. The C-weighted scale does not significantly reduce the measured pressure level for low-frequency components of a sound. Single-event noise data, including PK 15(met), may be used to assess effects of noise from test and training ranges (U.S. Army 2007). The metric PK 15(met) is the calculated peak noise level, without frequency weighting, expected to be exceeded by 15 percent of all events that might occur. Noise from small-arms ranges is currently assessed using the PK 15(met) or A-weighted sound exposure level.

3.4.2 ORARNG Statewide Operational Noise Management Plan

The SONMP provides a strategy for noise management at CUO and other ORARNG facilities. Elements of the SONMP include education about noise and Army noise metrics; complaint management; and when necessary, noise abatement procedures (ORARNG 2010).

The noise impact on the community surrounding the CUO study area is translated into noise zones. Two noise zones (Zone III and Zone II) are considered incompatible with potentially sensitive land uses such as schools, hospitals, residences, and churches. Areas outside these two zones are considered compatible with sensitive land uses. The Zone III and Zone II definitions, locations, and land use recommendations are described in Table 3.3. No noise-sensitive receptors are located in Zone III and Zone II at CUO. A map of existing noise zones and sensitive receptors is included as Figure 3.2. As shown on Figure 3.2, there are several rural residential areas in the vicinity; however, none are in noise Zone III or II.

Table 3.3: Noise Zones

Noise Zone and Decibel Levels	Definition	Location within ORARNG Training Enclave	Land Use
Zone III • **Transportation (ADNL) >75** • **Small Arms (PK15) >104** • **Impulsive (CDNL) >70**	Not recommended with noise-sensitive land uses	Entirely contained in the ORARNG training enclave	No non-recommended land uses in Zone III
Zone II • **Transportation (ADNL) 65 to 75** • **Small Arms (PK15) 87 to 104** • **Impulsive (CDNL) 62 to 70**	Normally not recommended with noise-sensitive land uses	Extends 900 meters beyond the ORARNG training enclave due west into an agricultural area	No non-recommended land uses in Zone II

3.5 Geology, Topography, and Soils

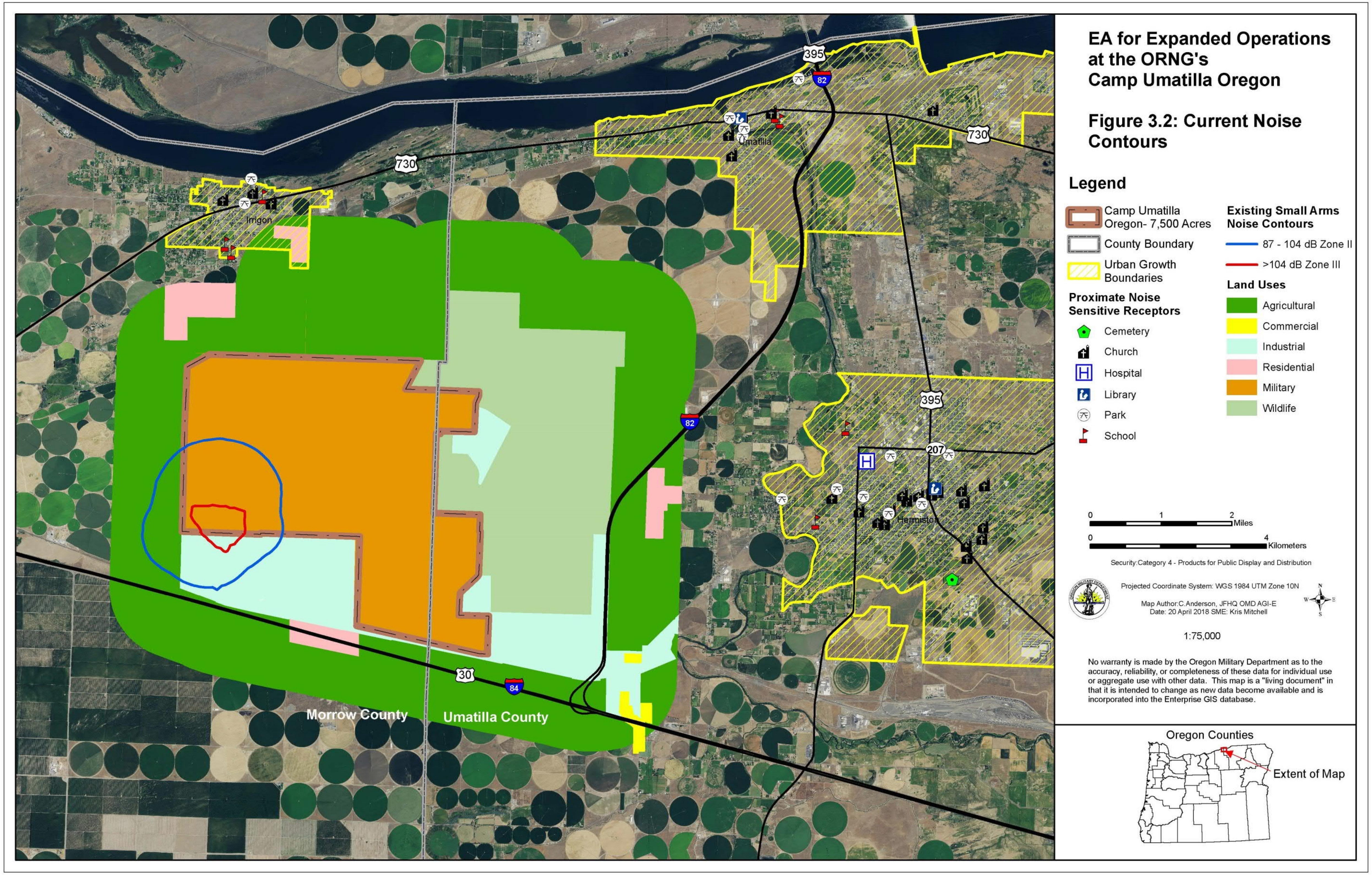
The CUO study area is in the Pleistocene Lake Basin Level IV ecoregion (Thorson et al. 2003), which covers approximately 1,407 square miles in eastern Oregon. The Pleistocene Lake Basin ecoregion is defined by a nearly level to undulating plain shaped by Pleistocene lakes and floodwaters from glacial lakes Missoula and Columbia (Thorson et al. 2003). The topography of this ecoregion slopes to the Columbia River. Elevations on the CUO property range from 400 to 677 feet above mean sea level (Pumphrey 2002).

The site is primarily flat to low rolling topography, with two distinct topographical features that characterize the surface of the UCD: the parallel, lacustrine-deposited dune lines; and Coyote Coulee. The dune lines are oriented along a northeast-southwest axis and have been shaped by strong southwest winds. One to several feet of silt-like material has been deposited over the original gravel surface of the area. Coyote Coulee is a valley oriented along a northeast axis in the east half of the CUO study area. The Coulee directs local winds northward and upward, resulting in localized areas of wind erosion along the toe of the escarpment at the eastern edge of the valley (Pumphrey 2002). Exposed areas in the CUO study area are highly susceptible to wind erosion, including the areas around ammunition igloos, unimproved roads, and Coyote Coulee (Pumphrey 2002). The surficial soil is underlain by as much as 200 feet of Pleistocene alluvial deposits known as Ordnance Gravels, which are composed of permeable silts, sands, and gravels, with some cobbles to the west of Coyote Coulee (AECOM 2014).

Soils in the CUO study area consist of sandy loam and coarse sand developed primarily from the alluvial deposits. The soils have been modified by wind action. Two soil map units, Quincy fine sand and Quincy loamy fine sand, cover more than 80 percent of the project area. These soils are both deep, excessively drained soils (NRCS 2016). The remainder of the site is covered by similar soil types that are well to excessively drained, with the exception of the Coyote Coulee area. The predominant soil type in that area has a low infiltration rate due to a hard duripan below the surface. These soils together cover approximately 2 percent of the CUO study area (NRCS 2016). Soil mapping units in the CUO study area are listed in Table 3.4, below, and shown on Figure 3.3. As shown in the table, the majority of the soils in the CUO study area have either a slight or moderate erosion hazard. Severe erosion hazards exist at Coyote Coulee (for both on- and off–road, and near the very northwestern corner of the site for roads). These severe erosion hazard areas constitute approximately 1.2 percent of the CUO study area. Generally, soils are suitable for construction. However, the eastern third of the CUO study area is limited for shallow excavations, primarily due to potential unstable excavation walls (NRCS 2016).

The Quincy fine sand (74B) and Quincy loamy fine sand (76B) soil units are designated as hydric soils by the Natural Resources Conservation Service (NRCS), indicating these soils are sufficiently wet in the upper part to develop anaerobic conditions during the growing season (NRCS 2016). These two units compose approximately 4.9 percent of the CUO Study Area.

Much of the project area was disturbed during construction and operation of the Depot. Nearly all of those disturbed areas have stabilized, and native vegetation communities have become re-established, although non-native species are present as well. Under existing conditions, there are numerous buildings, ranges, parking areas, and roads that have previously disturbed soils and microtopography through vegetation removal, surface leveling and grading, soil compaction, and covering soils limiting their productivity. Existing buildings, training areas, open storage, and parking facilities cover approximately



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 3.2: Current Noise Contours

Security:Category 4 - Products for Public Display and Distribution

Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

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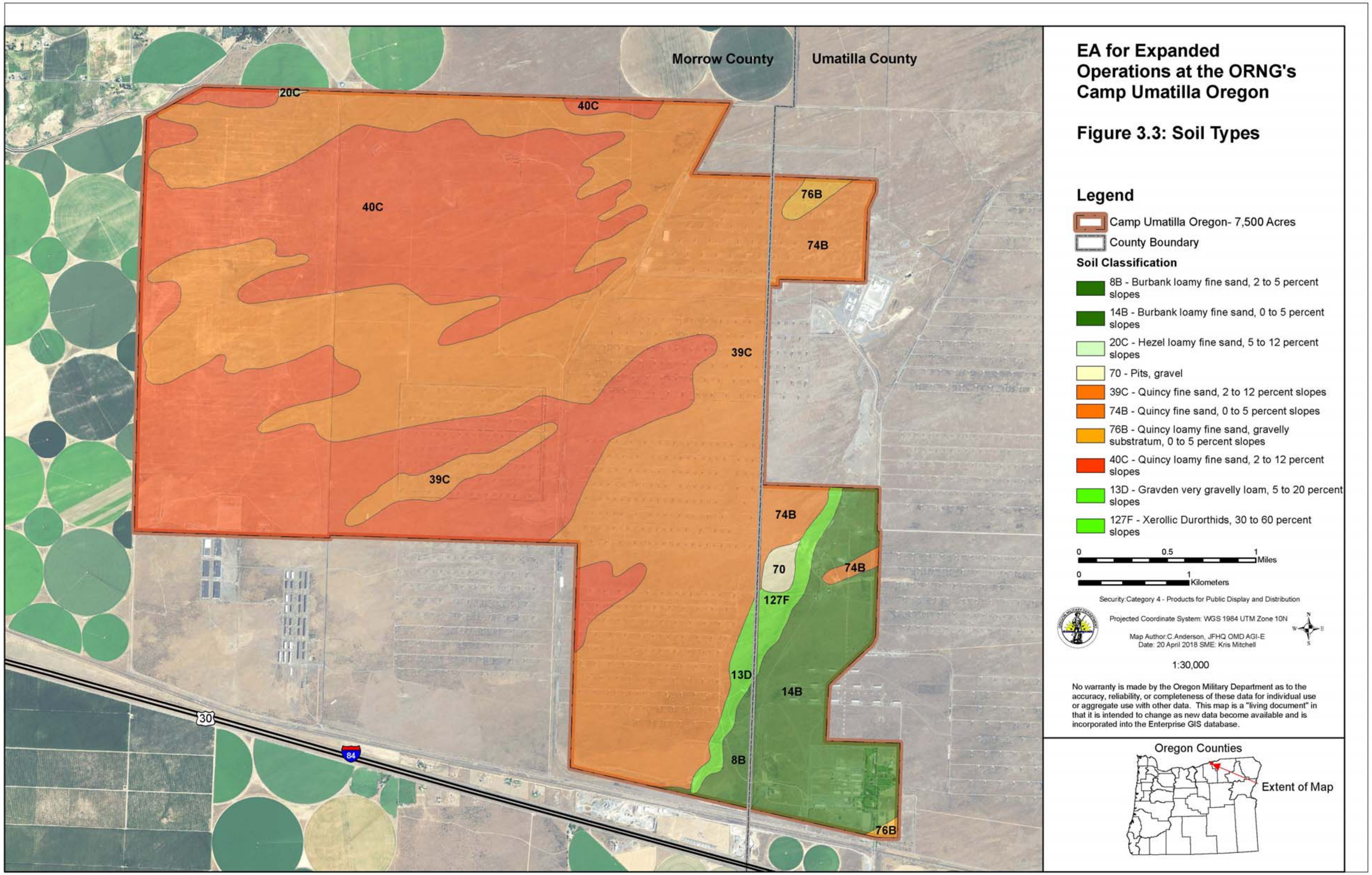
EA for Expanded Operations at the ORNG's Camp Umatilla Oregon
Figure 3.3: Soil Types
Morrow County
Umatilla County
20C
40C
40C
39C
39C
76B
74B
74B
74B
70
127F
13D
14B
8B
76B
30
84
Legend
Camp Umatilla Oregon- 7,500 Acres
County Boundary
Soil Classification
8B - Burbank loamy fine sand, 2 to 5 percent slopes
14B - Burbank loamy fine sand, 0 to 5 percent slopes
20C - Hezel loamy fine sand, 5 to 12 percent slopes
70 - Pits, gravel
39C - Quincy fine sand, 2 to 12 percent slopes
74B - Quincy fine sand, 0 to 5 percent slopes
76B - Quincy loamy fine sand, gravelly substratum, 0 to 5 percent slopes
40C - Quincy loamy fine sand, 2 to 12 percent slopes
13D - Gravden very gravelly loam, 5 to 20 percent slopes
127F - Xerollic Durorthids, 30 to 60 percent slopes
0
0.5
1
Miles
0
1
Kilometers
Security:Category 4 - Products for Public Display and Distribution
Projected Coordinate System: WGS 1984 UTM Zone 10N
Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell
N
W
E
S
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Oregon Counties
Extent of Map

Table 3.4. Soil Mapping Units in the CUO Study Area

Soil Mapping Unit Symbol	Soil Mapping Unit Name	Erosion Hazard (Road / Trail)[1]	NRCS Designated Hydric Soil[2]	USDA Prime Farmland[3]	Erosion Hazard (Off-Road/Off-Trail)[4]	Percent of CUO Study Area
8B	Burbank loamy fine sand, 2 to 5 percent slopes	Slight	No	No	Slight	1.8
13D	Gravden very gravelly loam, 5 to 20 percent slopes	Moderate	No	No	Slight	0.9
20C	Hezel loamy fine sand, 5 to 12 percent slopes	Severe	No	No	Slight	0.1
39C	Quincy fine sand, 2 to 12 percent slopes	Moderate	No	No	Slight	46.2
40C	Quincy loamy fine sand, 2 to 12 percent slopes	Moderate	No	No	Slight	37.3
14B	Burbank loamy fine sand, 0 to 5 percent slopes	Slight	No	No	Slight	7.3
70	Pits, gravel	Not Rated	No	No	Not Rated	0.4
74B	Quincy fine sand, 0 to 5 percent slopes	Slight	Yes	No	Slight	4.4
76B	Quincy loamy fine sand, gravelly substratum, 0 to 5 percent slopes	Moderate	Yes	No	Slight	0.5
127F	Xerollic Durorthids, 30 to 60 percent slopes	Severe	No	No	Severe	1.1

Source: NRCS 2016
Notes:
1) Erosion hazards on roads and trails are defined as:
    Slight = Little or no erosion is likely on unsurfaced roads and trails.
    Moderate = Some erosion is likely on unsurfaced roads and trail, the roads or trails may require occasional maintenance, and simple erosion-control measures are needed.
    Severe = Substantial erosion is expected on unsurfaced roads and trails, the roads or trails require frequent maintenance, and costly erosion-control measures are needed.
2) The NRCS designates the soil mapping unit as a hydric soil (NRCS 2016)
3) Soil map unit is designated in the *Prime Farmland List for Oregon* (USDA 2015)
4) Erosion hazards on off-road and off-trail areas are defined as:
    Slight = Erosion is unlikely under ordinary climatic conditions.
    Moderate = Some erosion is likely and erosion-control measures may be needed.
    Severe = Erosion is very likely and erosion-control measures, including revegetation of bare areas, are advised
CUO = Camp Umatilla Oregon
NRCS = Natural Resources Conservation Service
USDA = U.S. Department of Agriculture

35 acres of soils under existing conditions. There are also approximately 91.5 miles of existing paved roads, equating to approximately 180 acres of impervious surface, throughout the CUO study area.

The nearest active fault line is approximately 35 miles away (DOGAMI 2016). The bottom of the Coyote Coulee valley is identified as having a high likelihood for landslides, probably due to the steeper topography on either side (DOGAMI 2016).

3.6 Water Resources

Water resources include surface water bodies, groundwater, and wetland and floodplain areas at or in the vicinity of the CUO study area. Each of these resources is discussed in the following sections.

3.6.1 Surface Water

There are no surface water bodies in CUO: the Columbia River is approximately 3.3 miles north of CUO; and the Umatilla River, including several diverted irrigation canals, is approximately 6 miles to the east. Average annual precipitation is 8.85 inches, 60 percent of which occurs between November and March (AMEC 2012). Stormwater runoff is minimal at CUO because of the small amount of precipitation the area receives and the abundance of permeable soils; most precipitation infiltrates on-site and does not discharge off-site, although precipitation in the Administrative Area drains into the stormwater management system. Stormwater runoff from the balance of the cantonment area is allowed to percolate into the ground. The remainder of CUO lacks well-defined drainage patterns. The minimal runoff generated throughout CUO generally flows into the numerous shallow depressions found in the flat and gently rolling topography throughout CUO. Coyote Coulee is the only existing well-defined drainage system at CUO outside of the cantonment area, because much of the precipitation percolates downward to the extensive subsurface groundwater system, where it eventually flows in a northwesterly direction toward the Columbia River. There are several small depressions in CUO, primarily along the floor of Coyote Coulee, that collect water from winter rains, and dry out during the summer (Cleland et al. 1987).

3.6.2 Groundwater

Groundwater occurs beneath the CUO study area in a series of relatively deep, confined basalt aquifers and in a highly productive permeable unconfined aquifer to the south of the CUO study area (extending off-site). The unconfined aquifer consists of the alluvial deposits and the weathered surface of the Elephant Mountain Member basalt, and is overlain by approximately 20 to 125 feet of unsaturated alluvial sand and gravel. Depth to groundwater ranges from 60 to 100 feet below ground surface. Three municipal water systems—Hermiston, Umatilla, and Irrigon—draw from groundwater within a 4-mile radius of the CUO study area.

In 1990, DEQ declared the Lower Umatilla Basin (LUB) Groundwater Management Area (GWMA) be established due to elevated levels of nitrate-nitrogen concentrations (DEQ 2016). The federal safe drinking water standard is 10 milligrams per liter (mg/L), and the trigger level that resulted in establishment of the GWMA under Oregon law is 7 mg/L. Five primary sources of nitrate-nitrogen were identified, one of which was the explosives washout lagoons at the former UCD. The LUB GWMA Action Plan was finalized in December 1997, but the most recent summary report indicates levels of up to 64 mg/L, and demonstrates that the area-wide trend is still increasing levels of nitrate-nitrogen (DEQ 2012). The U.S. Army is involved in implementation of the Action Plan, and has a goal of a downward nitrate trend from the UCD washout lagoons, which is being met as of the most recent Evaluation of the Action Plan (DEQ 2013). Five wells installed around the capped UCD landfill are monitored as part of the

GWMA. Ongoing pump-and-treat activities are occurring that are expected to be protective of human health and the environment on completion, but require prohibition of groundwater use in the interim.

Beginning in the 1970s, the Oregon Water Resources Department (OWRD) established four Ground Water Critical Areas and one Classified Ground Water Area in the L due to the decline in water levels of the aquifer from irrigation diversions. The CUO study area is in the Ordnance Gravel Critical Groundwater Area. Currently, water levels in the critical area are fairly stable. However, water use under permit remains high, and there is a slow, steady increase in exempt uses that do not require permits (such as domestic use, stock-watering, and limited commercial or industrial applications). More recharge or less water use is needed to correct current water-level trends (OWRD 2003), which establishes significant restrictions on accessing groundwater resources in the area. More information on water supply for CUO is provided in Section 3.11.

3.6.3 Wetlands and Floodplains

There is one small freshwater emergent wetland mapped by the National Wetland Inventory along the western boundary of the CUO study area in the Live-Fire Use Area (USFWS 2016a). This wetland is likely due to irrigation runoff occurring immediately west of the CUO study area, and is approximately 0.4 acre, according to 2014 aerial imagery. There are no identified riparian areas in the CUO study area (USFWS 2016a). Vegetation surveys conducted in 2014 identified a small area with wetland vegetation in the CUO study area, which appeared to be associated with artificial water sources. At the far northwestern corner of CUO, a single large sprinkler resulted in a strand of wetland vegetation approximately 0.1 acre in size (Brown and Meinke 2016). There are no mapped 100-year floodplains in the CUO study area (FEMA 2007).

3.7 Biological Resources

Biological resources include vegetation, fish, and wildlife. Each of these resources is discussed in the following sections.

3.7.1 Vegetation

Vegetation in the CUO study area has been subject to extensive historical disturbance. Assessment of historical photos from 1941 indicates that much of the installation was bladed during construction to clear brush to minimize wildfire potential (AECOM 2014). Significant portions of the former UCD were disturbed during major construction of the early 1940s; however, vegetation at the site (both invasive species and native vegetation) has reestablished naturally. Road clearing and construction activities have occurred throughout the CUO study area, and much of the vegetation has been fragmented and subject to disturbance. Vegetation in the Live-Fire Use Area and the northwestern portion of the CUO study area has experienced less disturbance and fragmentation than other areas of the CUO study area, and therefore has the highest degree of intact native vegetation.

Fire history in the former UCD and CUO study area is not well documented. Most range fires on the former UCD or its boundaries have been contained to less than 500 acres, although recent fires along the western and northern boundary have been substantially larger, in the range of 1,000 acres, with the 2016 fire being approximately 2,500 acres (OMD Wildland Fire Services 2016). Because of the recently established fire records at the former UCD, there is very little data to establish frequency, character, or intensity of fires in the CUO study area. Between June 2001 and August 2009, there have been approximately 39 documented wildland fires either on the former UCD or threatening its boundaries

(OMD Wildland Fire Services 2016). A dramatic increase was noted between 2007 and 2009, with 18 of those fires occurring in that timeframe. From July 2011 to May 2016, there have been an additional 13 documented wildland fires in the CUO boundary (Jeff Mach, Oregon Military Department, personal communication August 15, 2016). The majority of fires were human–caused, and isolated to the railroad tracks or roadsides with the intervention of the then Umatilla Chemical Depot Fire Department (OMD Wildland Fire Services 2016). During the fire season, thunderstorms (with dry lightning) occur, which increases the chance of igniting large fires. Fires typically move from west to east.

Fuels in the CUO study area are classified as Grass Group Fuel Model 1 (OMD Wildland Fire Services 2016). Cheatgrass (*Bromus tectorum*) is the prominent fuel on CUO. This fuel is continuous, grows quickly, and dries out in late spring. Antelope bitterbrush (*Purshia tridentata*) and sagebrush (*Artemisia tridentata*) grow throughout CUO. Several areas of the bitterbrush are dead and dry. The cheatgrass is the main carrier of fire into the shrub class of fuels on the camp (OMD Wildland Fire Services 2016). Flame length without wind and terrain features can be from 6 inches to 2 feet. Once shrubs are involved, the flame length can significantly increase with flame lengths in excess of 4 feet (OMD Wildland Fire Services 2016).

Vegetation communities in the CUO study area are predominantly cheatgrass-dominated grasslands interspersed with native perennial grasslands and areas of sagebrush and antelope bitterbrush shrublands. A total of 106 plant taxa was encountered in the CUO study area during floristic surveys of the site in 2014 (Appendix B; Brown and Meinke 2016). Approximately 69 percent of the plant species encountered during these surveys were native, and 31 percent were exotic. Sandberg's bluegrass (*Poa secunda*) is the most abundant native species; hairy false goldenaster (*Heterotheca villosa* ssp. *villosa*) and lanceleaf scurfpea (*Amsinckia lycopsoides*) are also abundant. Antelope bitterbrush is still abundant at the site despite a massive die-off of this species that occurred in recent years, likely due to fungal pathogens, although very few mature adults of this species are still alive (Brown and Meinke 2016). Dominant invasive or non-native species in the CUO study area are cheatgrass, tall tumblemustard (*Sissymbrium altissimum*), Russian thistle (*Salsola iberica*), rush skeletonweed (*Chondrilla juncea*), and yellow salsify (*Tragopogon dubius*) (Brown and Meinke 2016).

The following four dominant plant associations, listed in order of abundance, occur in the CUO study area (Brown and Meinke 2016):

- **Scurf pea and cheatgrass grassland** – Occurs in large and small patches throughout the area. Scurf pea and cheatgrass are the dominant species; a very low diversity of other grass and forb species occurs in this community type.
- **False goldenaster and cheatgrass grassland** – Found predominantly in the southern half of the CUO study area. Dominated by cheatgrass with false goldenaster and other invasive annual forbs.
- **Mixed antelope bitterbrush and rabbitbrush (*Ericameria nauseosa* ssp. *speciosa* and *Chrysothamnus viscidiflorus* var. *viscidiflorus*) shrubland** – Occurs in relatively large, discontinuous swaths across the area. Most of the adult antelope bitterbrush shrubs are dead, but there is some establishment of younger plants. This community also supports patches of native and non-native perennial grasses.

- **Mixed rabbitbrush shrubland** – Occurs in the northwestern corner of the camp and has a relatively high level of native plant diversity and abundance. Dominant shrubs are rubber rabbitbrush and yellow rabbitbrush, with other native shrubs, forbs, and grasses being common.

Five additional minor vegetation communities were identified during surveys of the site in 2014 and 2015. Figure 3.4 shows the distribution of all vegetation communities in the CUO study area. Ornamental landscape trees are found in the cantonment area. Landscape trees in this area provide vegetative structural diversity and wildlife habitat. Twenty-four different landscape tree species were identified during surveys in 2015, one of which (black cottonwood [*Populus nigra*]) is a native species (Brown and Meinke 2016).

3.7.1.1 Special-Status Plants

The U.S. Fish and Wildlife Service (USFWS) administers the ESA of 1973, as amended. This law provides federal protection for species designated as endangered or threatened. No ESA-listed plants or state-listed threatened or endangered plants have been identified during surveys of the CUO study area (Brown and Meinke 2016) or are reported to potentially occur in the CUO study area (USFWS 2016b).

Occurrences of three plant species listed as rare by the State of Oregon (although not threatened or endangered) were found in the CUO study area (Brown and Meinke 2016): Columbia milkvetch (*Astragalus columbianus*), The Dalles milkvetch (*Astragalus sclerocarpus*), and rush skeleton plant (*Lygodesmia juncea*). Columbia milkvetch has a State Rank of 4, indicating that it is apparently secure across its full range, but that there is cause for concern for its populations in Oregon. This species is also on the Oregon Biodiversity Information Center (ORBIC) List 4, which indicates that it is not currently threatened or endangered, but that it may be either very rare and secure, or declining but still too common to be considered for higher conservation status (ORBIC 2013). The Dalles milkvetch and rush skeleton plant do not have a State Rank, but are on ORBIC List 3, indicating that more information is needed to accurately determine if these species are threatened or endangered in Oregon (ORBIC 2013). The milkvetch species have been mapped mostly in the eastern half of the CUO study area in areas among the igloos. Several hundred individuals of each species have been found in the CUO study area (Brown and Meinke 2016).

3.7.1.2 Noxious Weeds

Past disturbance and human use of the Depot has contributed to the presence of non-native, invasive weed species, including noxious weeds, throughout the CUO study area. Six Oregon-listed noxious weed species have been documented in the CUO study area during surveys in 2015: diffuse knapweed (*Centaurea diffusa*), rush skeletonweed (*Chondrilla juncea*), Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*), milk thistle (*Silybum marianum*), and tree of heaven (*Ailanthus altissima*). All of these species are Oregon Department of Agriculture B-rated noxious weed species, which indicates they are of economic importance, regionally abundant, and with limited distribution in some counties (ODA 2016). Treatment of B-rated noxious weeds is recommended by Oregon Department of Agriculture, but is not mandatory. Additionally, Morrow County lists rush skeletonweed and Scotch thistle as A-list noxious weeds, and Canada thistle and diffuse knapweed as B-list noxious weeds. Umatilla County designates rush skeletonweed as an A-list noxious weed and Canada thistle, diffuse knapweed, and Scotch thistle as B-list noxious weeds. Cereal rye (*Secale cereale*), another species at the site, is listed as a B-list noxious weed by both counties. County ordinances mandate that landowners treat county-listed A-list noxious weeds.

Populations of noxious weeds in the CUO study area are currently treated with herbicides when they are detected, following prescriptions in the ORARNG Integrated Pest Management Plan (ORARNG 2018).

Locations of infestations of these species have not been tracked over time, although infestations have generally been found along roadways and other disturbed areas (USFWS 2007). Tree of heaven is found in the cantonment area, and was likely intentionally planted at the site. It was not clear at the time of the 2015 surveys if this species actually poses a threat of colonizing adjacent ecological systems (Brown and Meinke 2016).

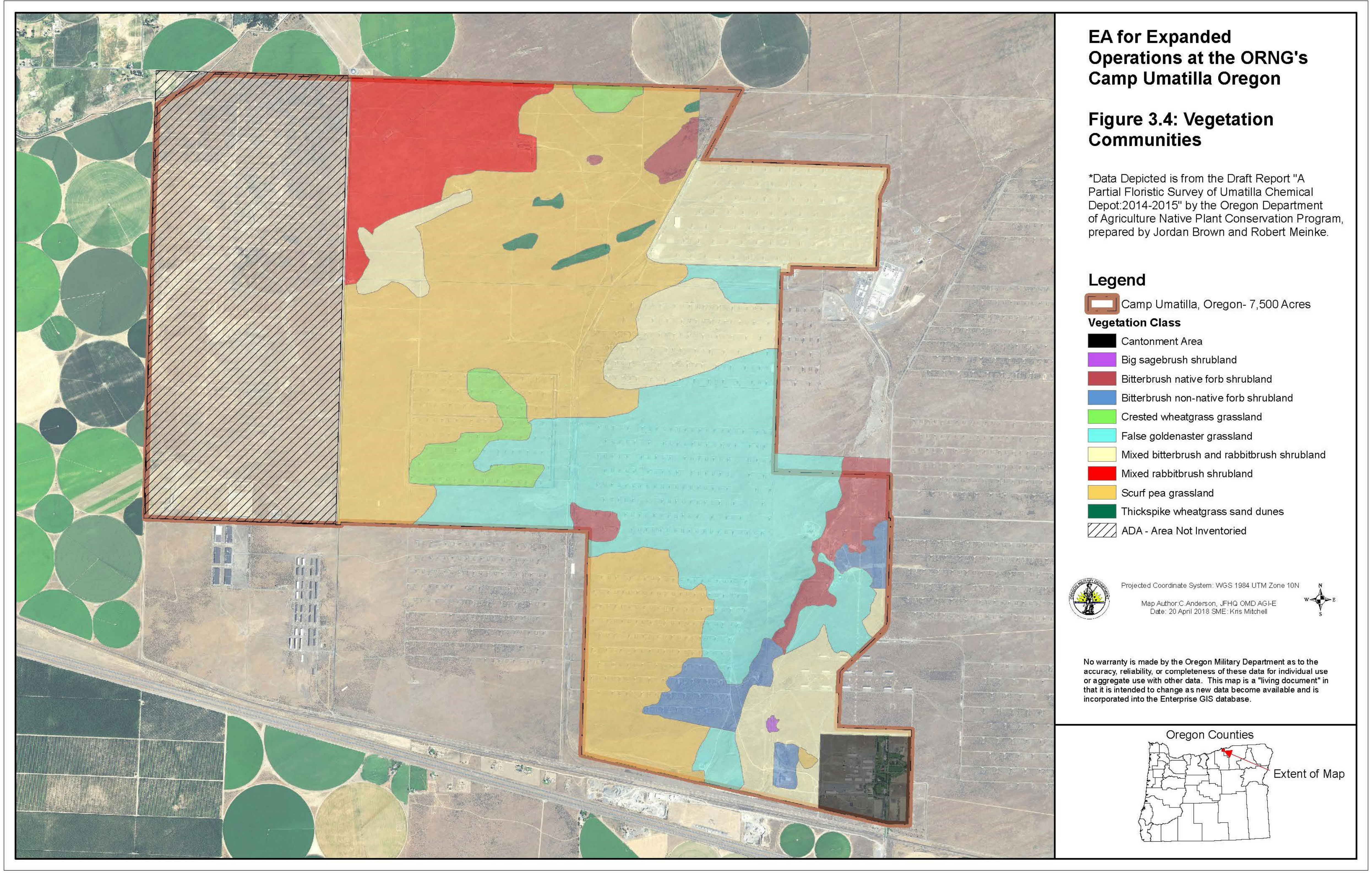
3.7.2 Fish and Wildlife

3.7.2.1 Special-Status Wildlife

No ESA-listed animals have been identified during surveys of the CUO study area (Tetra Tech 2002; USFWS 2007; Mach 2016a). The Washington ground squirrel (*Urocitellus washingtoni*), an Oregon Department of Fish and Wildlife (ODFW)-listed endangered species, has the potential to occur in the CUO study area (USFWS 2016b). The Washington ground squirrel has not been documented as occurring at the site during surveys (Tetra Tech 2002; USFWS 2007; Mach 2016a); therefore, this species will not be analyzed further. The Gray wolf (*Canis lupus*) is also reported as having the potential to occur in the CUO study area (USFWS 2016b); however, gray wolves have never been observed at the site (Mach 2016a). Additionally, the isolated nature of the habitat in this area, the high human use of the ORARNG training enclave and surrounding lands, and lack of adequate prey base make it extremely unlikely that gray wolves would occur in the CUO study area; therefore, this species will not be analyzed further. Bull trout (*Salvelinus confluentus*) is also reported by the USFWS IPaC database as having the potential to be impacted by actions on CUO (USFWS 2016a); however, no surface water conveyance occurs at the site, so impact to this species would not occur, and this species will not be analyzed further.

Several non-ESA-listed special-status wildlife species (one reptile, one mammal, and 66 bird species) have been documented in the CUO study area and immediate area, and several other special-status wildlife species have the potential to occur in the CUO study area. A complete list of these species is presented in Table 3.5. Many of these species are ODFW-listed sensitive species, with either a “vulnerable” or “critical” designation. Several are also ORBIC-listed species, Birds of Conservation Concern (BCC) for USFWS Bird Conservation Region (BCR) 9 (Great Basin), and/or DoD Mission Sensitive (M-S) species. Sensitive wildlife species have been identified throughout the CUO study area during surveys of the UCD, and are listed on Table 3.5 (Tetra Tech 2002; USFWS 2007; Mach 2016a). Raptors and other birds have been observed roosting in ornamental landscape trees in the cantonment area.

Since 2008, the Army and OMD, with the assistance of the USFWS and the Global Owl Project, have been implementing conservation measures at the former UCD for western burrowing owl (*Athene cunicularia hypugaea*), an Oregon Sensitive-Critical and DoD M-S species. The Depot’s natural resources manager noticed in 2007 that this species was experiencing a scarcity of available burrows, likely as a result of predator control actions targeting coyotes (*Canis latrans*) and American badgers (*Taxidea taxus*). Nesting surveys, initiated by the Army and continued by OMD, have been performed at the site since 2008, and 189 artificial burrows have been installed at the former UCD as of 2016. A total of 662 fledglings has been produced by owls nesting on the UCD between 2009 and 2014. In 2016, 66 pairs of burrowing owls nested on the former UCD. The Army, in cooperation with United States and Canada federal, state, and provincial wildlife agencies, has given some fledgling owls to the Burrowing Owl Conservation Society of British Columbia for use in their captive breeding and reintroduction program. The former UCD is the most important and concentrated western burrowing owl propagation center in the Columbia Plateau region (Mach 2016b).



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 3.4: Vegetation Communities

*Data Depicted is from the Draft Report "A Partial Floristic Survey of Umatilla Chemical Depot:2014-2015" by the Oregon Department of Agriculture Native Plant Conservation Program, prepared by Jordan Brown and Robert Meinke.

Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

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Table 3.5: Special-Status Wildlife Species that Occur or have Potential to Occur in the CUO Study Area

Common Name	Federal Status[1]	State Status[1]	Global (G) and State (S) Rank[2]	Other Status[1,3,4]	Occurrence[5,6,7]
Northern sagebrush lizard (*Sceloporus graciosus graciosus)*	Species of Concern	Sensitive-Vulnerable	G5T5; S5	ORBIC List 4	Present
Black-tailed jackrabbit (*Lepus californicus)*	None	Sensitive-Vulnerable	G5; S4	ORBIC List 4	Present
Long-legged myotis (*Myotis volans)*	Species of Concern	Sensitive-Vulnerable	G4G5; S3	ORBIC List 4	Potential
Pallid bat (*Antrozous pallidus)*	Species of Concern	Sensitive-Vulnerable	G4; S2	ORBIC List 2	Potential
Townsend's big-eared bat (*Corynorhinus townsendii)*	Species of Concern	Sensitive-Critical	G4; S2	ORBIC List 2	Potential
White-tailed Jackrabbit (*Lepus townsendii)*	None	Sensitive-Vulnerable	G5; S4	ORBIC List 3	Potential
Bald eagle (*Haliaeetus leucocephalus)*	None	Sensitive-Vulnerable	G5; S4B,S4N	Bald and Golden Eagle Protection Act; BCC Region 9; ORBIC List 4; MBTA	Potential; not confirmed, but may be transient visitors to the area [7]
Bobolink (*Dolichonyx oryzivorus)*	None	Sensitive-Vulnerable	G5; S2B	ORBIC List 2; MBTA	Present
Brewer's sparrow (*Spizella breweri)*	None	None	G5; S4B	BCC Region 9; MBTA; DoD M-S Species	Present
Common nighthawk (*Chordeiles minor)*	None	None	G5; S5B	ORBIC List 4; MBTA; DoD M-S Species	Present
Ferruginous hawk (*Buteo regalis)*	None	Sensitive-Vulnerable	G4; S3B	BCC Region 9; MBTA	Present
Golden eagle (*Aquila chrysaetos)*	None	None	G5; S3S4	Bald and Golden Eagle Protection Act; ONHIC List 4; BCC Region 9; MBTA	Present
Grasshopper sparrow (*Ammodramus savannarum)*	None	Sensitive-Vulnerable	G5; S2B	MBTA; DoD M-S Species	Present
Lewis' woodpecker (*Melanerpes lewis)*	None	Sensitive-Critical	G4; S2S3B	BCC Region 9; MBTA; DoD M-S Species	Present
Loggerhead shrike (*Lanius ludovicianus)*	None	Sensitive-Vulnerable	G4; S3B,S2N	BCC Region 9; MBTA; DoD M-S Species	Present
Long-billed curlew (*Numenius americanus)*	None	Sensitive-Vulnerable	G5; S3B	BCC Region 9; MBTA; DoD M-S Species	Present

Table 3.5: Special-Status Wildlife Species that Occur or have Potential to Occur in the CUO Study Area

Common Name	Federal Status[1]	State Status[1]	Global (G) and State (S) Rank[2]	Other Status[1,3,4]	Occurrence[5,6,7]
Merlin (*Falco columbarius)*	None	None	G5; SHB	ORBIC List 2; MBTA	Present
Peregrine falcon (*Falco peregrinus)*	None	Sensitive-Vulnerable	G4; S1	BCC Region 9; MBTA	Potential; not confirmed, but may be transient visitors to the area [7]
Prairie falcon (*Falco mexicanus)*	None	None	G5; S4	MBTA; DoD M-S Species	Present
Sage sparrow (*Amphispiza belli)*	None	Sensitive-Critical	G4; S?	BCC Region 9; MBTA	Present
Sage thrasher (*Oreoscoptes montanus*)	None	None	G4; S4B	BCC Region 9; MBTA	Present
Swainson's hawk (*Buteo swainsoni)*	None	Sensitive-Vulnerable	G5; S3B	MBTA	Present
Tricolored blackbird (*Agelaius tricolor)*	None	None	G3G4; S2B	BCC Region 9; MBTA	Potential; not confirmed[7]
Western burrowing owl (*Athene cunicularia hypugaea)*	None	Sensitive-Critical	G4T4; S3B	MBTA; DoD M-S Species	Present
Western meadowlark (*Sturnella neglecta)*	None	Sensitive-Critical	G5; S4	ORBIC List 4; MBTA	Present

Sources: [1] ORBIC 2013; [2] NatureServe 2015; [3] USFWS 2013; [4] USFWS 2008; [5] USFWS 2007; [6] Mach 2016a; [7] Blake 2013; [8] TetraTech 2002

Notes:

Global and State Rank codes (NatureServe 2015): G4: Apparently Secure; G5: Secure; S?: Unranked; S1: Critically Imperiled; S2: Imperiled; S3: Vulnerable; S4: Apparently Secure; S5: Secure; SH: Possibly Extirpated; N: Non-breeding population in state; B: Breeding population in state

MBTA: Indicates birds protected under the Migratory Bird Treaty Act (80 FR 80594; USFWS 2015).

DoD M-S Species: Indicates birds on the DoD Partners in Flight Program list. These are species that occur on DoD lands and are at risk of becoming listed as threatened or endangered under the federal Endangered Species Act if current population trends continue. The purpose of this list is to help DoD resource managers better prioritize monitoring and management efforts on those species (and their habitats) having the highest potential to impact the military mission should they become federally listed. A secondary focus is on those species with significant conservation concern on DoD lands.

BCC Region 9: Indicates birds of conservation concern identified by the USFWS for Region 9 (USFWS 2008).

ORBIC List 1: Contains taxa that are threatened with extinction or presumed to be extinct throughout their entire range. These are the taxa most at risk and should be the highest priority for conservation action.

ORBIC List 2: Contains species threatened with extirpation or presumed to be extirpated from the State of Oregon. These are often peripheral or disjunct species that are of concern when considering species diversity within Oregon's borders. They can be very significant when protecting the genetic diversity of a taxon. ORBIC regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.

ORBIC List 3: Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range. Many taxa on this list may eventually be determined to belong on List 1 or List 2, so it is important that they be looked for, and that the few known occurrences be protected.

ORBIC List 4: Contains species that are of conservation concern but are not currently threatened or endangered. This includes taxa that are very rare but are currently secure, as well as taxa that are declining in numbers or habitat but are still too common to be proposed as threatened or endangered. Although these taxa may not currently need the same active management attention as threatened or endangered taxa, they do require continued monitoring.

3.7.2.2 Migratory Birds

The majority of the bird species found at the site are protected under the MBTA (16 U.S.C. 703-712). Currently, land in the CUO study area is managed in accordance with a Memorandum of Understanding (MOU) between the DoD and the USFWS addressing the conservation of migratory birds on DoD properties (DoD and USFWS 2006). The current INRMP provides conservation measures to protect migratory birds, including raptors, from impacts due to transmission lines and demolition activities. The list of migratory birds known to occur at the site (including some species that are also special-status species) is provided in Table 3.6.

Table 3.6: Migratory Bird Species that Occur at the CUO

Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American pipit	*Anthus rubescens*
American robin	*Turdus migratorius*
Bank swallow	*Riparia riparia*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Black phoebe	*Sayonaris nigricans*
Black-billed magpie	*Pica pica*
Bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer’s sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Bullock’s oriole	*Icterus bullockii*
California gull	*Larus californicus*
Chipping sparrow	*Spizella passerina*
Cliff swallow	*Petrochelidon pyrrhonota*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Cooper's hawk	*Accipiter cooperii*
Dark-eyed junco	*Junco hyemalis*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Grasshopper sparrow	*Ammodramus savannarum*
Great blue heron	*Ardea herodias*
Great horned owl	*Bubo virginianus*
Horned lark	*Eremophila alpestris*

Table 3.6: Migratory Bird Species that Occur at the CUO

Common Name	Scientific Name
House finch	*Carpodacus mexicanus*
Kildeer	*Charadrius vociferus*
Lark sparrow	*Chondestes grammacus*
Lewis' woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovincianus*
Long-billed curlew	*Numenius americanus*
Mallard	*Anas platyrhynchos*
Merlin	*Falco columbarius*
Mourning dove	*Zenaida macroura marginella*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Prairie falcon	*Falco mexicanus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Rough-legged hawk	*Buteo lagopus*
Ruby-crowned kinglet	*Regulus calendula*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Short-eared owl	*Asio flammeus*
Spotted towhee	*Pipilo maculatus*
Swainson's hawk	*Buteo swainsoni*
Tree swallow	*Tachycineta bicolor*
Vesper sparrow	*Pooecetes gramineus*
Violet-green swallow	*Tachycineta thalassina*
Western burrowing owl	*Athene cunicularia hypugea*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
Western screech-owl	*Megascops kennicottii*
Western wood-pewee	*Contopus sordidulus*
White-crowned sparrow	*Zonotrichia leucophrys*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*

Notes: List includes some species that are also special-status species for other reasons.
Sources: USFWS 2013; Mach 2016a; Blake 2013; Tetra Tech 2002

The MBTA prohibits the taking, killing, or possessing of migratory birds or the parts, nests, or eggs of such birds, unless permitted by regulation. Per 50 CFR §21.15, *Authorization of Take Incidental to Military Readiness Activities*, the Armed Forces must give appropriate consideration to protecting migratory birds when planning and executing military readiness activities. However, implementing those protections must not diminish the effectiveness of the military readiness activities. The OMD must confer and cooperate with the USFWS to develop and implement appropriate conservation measures for actions that, as determined through the NEPA process, may result in a significant adverse effect on a population of migratory bird species. Potential effects on migratory bird species identified due to conservation concerns are evaluated in Section 4.7.1.2.2.

EO 13186 requires each federal agency to develop an MOU with the USFWS that promotes the conservation of migratory birds. Effective in September 2014, the MOU between DoD and USFWS outlines a collaborative approach to promote the conservation of migratory bird populations. The NEPA process is used to assess the direct and indirect impacts of a proposed action on migratory birds, and their habitat, in a project area. Responsibilities of the DoD under this MOU include the following:

- Follow all migratory bird permitting requirements for non-military readiness activities.
- Incorporate comprehensive migratory bird management objectives in the preparation of DoD planning documents (including INRMPs).
- Incorporate conservation measures in regional or state bird conservation plans.
- Allow the USFWS to access DoD lands if needed and as consistent with imperatives of safety and security.
- Analyze impacts of proposed actions on migratory birds through the planning process, and include the USFWS in impact assessment and the development of avoidance or minimization measures.
- Manage DoD lands and non-military readiness activities in a manner that supports migratory bird conservation.
- Develop and implement new and/or existing inventory and monitoring programs to evaluate the effectiveness of conservation measures to minimize or mitigate take of migratory birds.
- Reduce the potential for bird/window collisions by considering new building locations and orientations with respect to migratory bird habitat areas, and through the use of other techniques, such as reducing the amount of reflective glass on buildings.

3.7.2.3 General Wildlife

No comprehensive planning-level surveys for non-sensitive vertebrate species have been conducted at the former UCD or the CUO study area, although several wildlife species are known to occur in the area. Observations of non-sensitive vertebrate species have been made during surveys for breeding birds in 2013 (Blake 2013), surveys for threatened and endangered species in 2002 (Tetra Tech 2002), and general surveys in 1993 (USACE 1993). A list of wildlife species observed in the CUO study area is presented in Table 3.7.

Table 3.7: General Wildlife Species Present in the CUO Study Area

Common Name	Scientific Name
Amphibians	
Great Basin spadefoot toad	*Scaphiopus intermontanus*
Reptiles	
Bull snake	*Pituophis catenifer sayi*
Great Basin gopher snake	*Pituophis catenifer deserticola*
Northern pacific rattlesnake	*Crotalus viridis oreganus*
Western yellow-bellied racer	*Coluber constrictor mormon*
Birds	
California quail	*Callipepla californica*
Eurasian collared dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
Gray partridge	*Perdix perdix*
House sparrow	*Passer domesticus*
Ring-necked pheasant	*Phasianus colchicus*
Rock pigeon	*Columba livia*
Mammals	
American badger	*Taxidea taxus*
Bushy-tailed woodrat, packrat	*Neotoma cinerea*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Field mouse	*Peromyscus spp.*
Great Basin pocket mouse	*Perognathus parvus*
House mouse	*Mus musculus*
Long-tailed weasel, bridled weasel, big stoat	*Mustela frenata*
North American porcupine	*Erethizon dorsatum*
Northern pocket gopher	*Thomomys talpoides*
Nuttall's cottontail rabbit, mountain cottontail rabbit	*Sylvilagus nuttallii*
Ord's kangaroo rat	*Dipodomys ordii*
Pronghorn antelope	*Antilocapra americana*
Western harvest mouse	*Reithrodontomys megalotis*

Sources: Mach 2016a; Blake 2013; TetraTech 2002

The former UCD hosted a captive herd of pronghorn antelope (*Antilocapra americana*) between 1969 and 2014 as part of an ODFW breeding and translocation program (Mach 2016b). Predator control efforts on the former UCD between 1970 and 1980 in support of the pronghorn antelope program resulted in a reduction of coyotes and American badgers (Mach 2016b). The antelope herd was removed from the former UCD by ODFW in 2013 (Mach 2016b).

3.8 Cultural Resources

Cultural resources consist of locations of human activity, occupation, or use identified through field inventory, historic documentation, or oral evidence. The term encompasses historic properties as defined by the National Register of Historic Places (NRHP), including archaeological and architectural properties, as well as sites or places of traditional cultural or religious importance to Native American Tribes or other social or cultural groups. This section begins with an overview of the general cultural setting of the UCD, and then describes the existing cultural resources in the COU study area.

3.8.1 Cultural Setting

Although archaeological sites in the Columbia Plateau indicate that humans have inhabited the area for at least 10,000 years, most regional studies have focused on the resource-rich river systems, resulting in an incomplete understanding of the prehistory of the UCD. Prehistoric human populations in the areas surrounding the UCD were closely associated with areas near the more bountiful riverine resources, using the upland plateau areas for hunting and gathering efforts as a seasonal supplement to riverine resources. Because the UCD site is situated away from the naturally occurring water sources of the Columbia and Umatilla Rivers, little evidence of prehistoric human activity has been documented at the UCD (Pumphrey 2002:3-30).

The occupants of the UCD and surrounding area were the Sahaptin-speaking Umatilla Indians. Traditionally, the Umatilla practiced a riverine fishing economy, supplemented by hunting and gathering following a semi-nomadic seasonal round. Use of UCD lands during the ethnohistoric period was likely restricted to subsistence activities such as hunting and gathering. Winter villages were situated in a core territory along the lower courses of the Umatilla River to about present-day Alderdale. The Umatilla exploited a much wider subsistence range, however, which included the Blue and Wallowa Mountains, the Grande Ronde and Wallowa Valleys, the John Day River, and other areas to the south and west of their homeland. Typically, this wider subsistence range was shared with neighboring tribes such as the Cayuse, Walla Walla, Nez Perce, and Palouse (Cleland et al. 1987:1-7).

The Umatilla used other habitation and resource exploitation sites near the UCD, including areas near the present locales of Mottinger, Hermiston, Echo, Alderdale, Arlington, Roosevelt, Blalock, Boulder, Castle Rock, Rock Creek, Thanksgiving Island, and Blalock Island. To the southeast, the Umatilla shared a number of subsistence sites with the Nez Perce, Walla Walla, and Palouse along the Grand Ronde and Wallowa Rivers. To the west, they shared similar areas with the Tenino (Warm Springs), Cayuse, and other Columbia River groups along the John Day and Deschutes Rivers (Cleland et al. 1987:2-25).

The migration of Euro-Americans into Oregon caused conflicts with the region’s indigenous groups (Pumphrey 2002). In 1855, Washington territorial governor Isaac Stevens and Oregon Territory Superintendent of Indian Affairs Joel Palmer entered into a treaty with representatives of the Cayuse, Walla Walla, and Umatilla Tribes, who agreed to move to the Umatilla Reservation east of Pendleton, approximately 40 miles from the UCD. The CTUIR was officially allotted in 1885.

Settlement of the UCD area prior to military activity was limited by the dry climate, soil conditions, and lack of nearby natural water features. Visible wagon trail remnants on UCD property, including the circa (ca.) 1860 Old Emigrant Wagon Road and the 1875 GLO Wagon Road Umatilla Cutoff, represent pioneer transient activity in the area. However, homesteading and settler migration patterns have left little impact on the natural environment compared to military activity (Pumphrey 2002).

From the 1860s to the 1880s, cattle ranching dominated the region between The Dalles and the Umatilla River. During the latter two decades of the nineteenth century, sheep, ranch cattle, and wheat replaced open-range cattle in the area. These changes led to the construction of the Oregon-Washington Railroad and Navigation Company Railroad and the massive influx of settlers accompanying the availability of cheap transportation (Cleland et al. 1987:2-51). The main line of the Union Pacific Railroad, the Coyote or Messner-Hinkle cutoff, was constructed ca. 1915 along what would become the southern boundary of the UCD (Pumphrey 2002:3-12).

In 1940, the U.S. prepared for war, and the government obtained the UCD parcel for a new ammunition and supply depot (Dodd n.d.:231; Umatilla Army Depot n.d.:3). The UCD met several criteria for the siting of new military installations, because the parcel was a safe distance from the coast, yet close enough to northwestern military posts, ports, and rail lines to facilitate shipment of supplies (Hightower 1984:15; Kuranda et al. 2009:3-4). An important aspect of the UCD was its railroad infrastructure, which facilitated the loading and unloading of munitions. The internal rail network of approximately 50 miles of railroad track connected to the Union Pacific Railroad (Chance 2010:8; Hightower 1984:15).

The military operation employed approximately 7,000 workers during peak construction. The Umatilla Ordnance Depot was dedicated on October 14, 1941, and charged with the mission of storage and processing of vehicles, storage, and issue of lend-lease, quartermaster supplies, ammunition, small arms, and components (U.S. Department of the Army 1982:2). Following America's entrance into WWII, the Depot was vital in the support of the Armed Forces, providing storage of quartermaster materials and ammunition for Seattle General Depot (DARCOM 1981:1).

At the conclusion of WWII, large stocks of ammunition were sent to Umatilla Ordnance Depot for renovation, maintenance and storage, or demilitarization and scrap metal salvaging (Umatilla Army Depot n.d.:3; U.S. Department of the Army 1982:2). Activity increased again during the Korean War in the early 1950s. Ammunition was shipped by barge, arriving at Irrigon, and transported to the Depot (Macnab 1975:288; Umatilla Army Depot n.d.:3). As a safety precaution, the Depot obtained approximately 4,000 acres of adjoining land between 1957 and 1960 to serve as a safety buffer. In 1962, the facility was renamed Umatilla Army Chemical Depot, and was given the mission of receiving, storing, issuing, and maintaining toxic munitions (U.S. Department of the Army 1982:2). The Depot sent munitions shipments to Vietnam from 1965 until 1973. The facility was then renamed Umatilla Depot Activity (UMDA), with the mission to operate a reserve storage activity. With each increase in activity at the Depot during significant military buildup, the surrounding area benefitted. Many members of the CTUIR were employed at the facility. Additionally, agricultural communities, such as Hermiston, Irrigon, and Umatilla, prospered with the influx of workers (Macnab 1975:249).

The UCD had over 1,500 buildings and structures, most of which were built between 1941 and the end of WWII. These included administration, maintenance, and housing facilities, ammunition storage igloos, and warehouses (Chance 2010:13). Past activities at the depot included materials storage, ammunition demolition, maintenance, ammunition renovation, waste disposal, and firing range operations. Ammunition demolition began in 1945; and in 1947, an ammunition renovation complex was added, with two ammunition maintenance buildings added in 1955 and 1958. Chemical agents, missiles, and missile fuel were stored at the Depot until the early 1960s (Chance 2010:13). In 1988, the Commission on Base Closures recommended the Depot for realignment, and under BRAC, the storage of conventional ordnance was moved or destroyed. The realigned mission was the destruction of stored chemical munitions, completed in 2012 (Chance 2010:14).

3.8.2 Identification of Historic Properties

For this EA, efforts to identify historic properties included a desktop review of archival materials, including confidentially maintained data on file at the State Historic Preservation Office (SHPO), aerial photographs, documents provided by OMD, and historical maps. Historic properties were also identified as a result of the PA consultation. A total of 670 acres of the CUO have been surveyed for archaeological resources (some according to older standards) and 3,075 acres are previously disturbed and would not warrant archaeological survey. A total of 4,211 acres remain to be surveyed or re-surveyed prior to ground-disturbing actions (PA 2018).

Numerous cultural resource surveys have been conducted within the CUO study area (Cooper and Scott 2016; Stegner et. al. 2015; Boreson 1996; Celmer 1996; Cleland et al. 1987; Hightower 1984; Rice, Brunner, and Cooke 1984). These investigations have resulted in the identification of one archaeological site, one linear resource, one historic district, and one property of traditional religious and cultural significance (PTRCS) within the CUO study area (Table 3.8).

Table 3.8: Previously Identified Cultural Resources within the CUO Study Area

Resource No.	Site Class	Site Type	National Register of Historic Places Status	Attributes	Report No.
N/A	Historic	District	Eligible	UCD Historic District (includes HAER No. 5 – Headquarters Building and Fire House)	(Hightower 1984; SHPO 1998; Pumphrey 2002)
35UM489	Historic	Site	Not Eligible	UCD Cantonment Military Site	27314 (Stegner et al. 2015)
35UM497	Historic	Linear	Eligible	1875 GLO Wagon Road Umatilla Cutoff	15401A-C (Boreson 1996) 28313 (Cooper and Scott 2016)
N/A	Multi	PTRCS	Potentially Eligible	Coyote Coulee (Geographic Feature that Crosses the CUO)	Engum 2016

Archaeological site 35UM489, the UCD Cantonment Site, consists of a diffuse scatter of military-related historic archaeological features and artifacts affiliated with the WWII and Cold-War-era development of the UCD. This approximate 200-acre site was recommended as not eligible for the NRHP (Stegner et al. 2015), and OMD and SHPO concurred with these findings.

The ca. 1875 Umatilla Cutoff wagon road (site 35UM49) crosses the southern portion of the CUO study area. This site was determined eligible for the NRHP by the USACE with concurrence received from the SHPO by correspondence dated August 18, 2016 (PA 2017).

Above-ground or architectural resources within the CUO study area include hundreds of military-affiliated structures and features which are summarized as part of the UCD Historic District. The BRAC and USACE previously evaluated 1,516 buildings and structures that were once part of the Umatilla Chemical Depot and determined that 1,217 of them are eligible for inclusion in the NRHP as contributing properties to an historic district under criterion A for their association with the WWII-era ammunition storage and Cold War-era Chemical Weapons work. This determination received concurrence from the Oregon SHPO by correspondence dated May 25, 2016. A total of 563 buildings and structures of the 1,217 that are National Register eligible are inside the boundaries of CUO and may be adversely effected as part of the CUO Expansion and Development Project (PA 2017).

Although the entire CUO study area has not been previously surveyed for archaeological resources, based on the results of the literature review and previous archaeological investigations in the region, the uplands lacking a water source like those that comprise the study area generally have low potential for precontact archaeological sites (Pumphrey 2002:3-42). Historic sites associated with the ca. 1875 wagon road could be encountered, as could evidence for transient use, such as trash dumps or railroad-related sites. WWII and Cold War-era military land use is expected to obscure potentially older archaeological features or sites, and the probability of encountering intact, significant resources appears to be low for much of the UCD due to past soil disturbances up to depths of 3 to 6 feet or greater (Pumphrey 2002:3-42). For BRAC lands leaving federal ownership at UCD, an intensive cultural resources investigation was recently conducted on 3,350 acres adjacent to the CUO (AMEC 2016). The investigation identified two NRHP-eligible historic wagon roads (35UM497 and 35UM498), 33 historic isolates, 2 historic sites, and 2 precontact isolated finds (lithic flakes) as a result of pedestrian surveys and excavation of over 2,500 shovel test probes, illustrating types of resources, low density of resources, and military-related disturbances that can be expected within the CUO study area.

The CTUIR Cultural Resources Protection Program conducted a traditional use investigation of the former UCD (Engum 2016). Fourteen native place names were identified as historic properties of religious and cultural significance to the CTUIR and are adjacent to the CUO study area, including permanent village locations, fishing camps, and legendary sites. One historic property of religious and cultural significance to the CTUIR was in the CUO study area, which is now known by the English language name of Coyote Coulee. Coyote Coulee traverses the CUO study area and is a traditionally used travel route, hunting location, and plant-gathering area that was used seasonally by the CTUIR.

Since the 1980s, the CUO study area has been governed by cultural resource management plans (Cleland et al 1987; Pumphrey 2002). In 2013, the Department of the Army prepared the *Programmatic Agreement among the Department of the Army, State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Closure and Transfer of Select Parcels of Umatilla Chemical Depot, Oregon* (U.S. Army et al. 2013). The implementation of the required stipulations in the programmatic agreement focused mainly on the property not remaining under federal control as CUO, and is ongoing.

In 2018, the ARNG-I&E, on behalf of NGB, and ORARNG signed a *Programmatic Agreement among the National Guard Bureau, the Oregon Army National Guard, the Oregon State Historic Preservation Office, and The Advisory Council on Historic Preservation for the Camp Umatilla Oregon Expansion, Development, and Operations Project*. The stipulations of the Programmatic Agreement (PA) address the cultural resources discussed in this EA, and are described in Section 4.8.3.

3.9 Socioeconomics

The area of analysis for socioeconomic conditions associated with actions in the CUO study area is Umatilla and Morrow Counties in Oregon. This section describes the existing socioeconomic characteristics, including demographics, employment, and income in the analysis area.

3.9.1 Population Demographics

Population in the two-county region in 2014 was 87,862 people. Population in the two-county region increased by 7.7 percent from 2000 to 2014, which represents a lower rate of increase than the national average of 11.6 percent during that time period. The majority of people in the two-county area identify as white (non-Hispanic or non-Latino; 67.5 percent) or Hispanic or Latino (25.9 percent). The remaining

6.6 percent of people are Black/African American (0.6 percent), Asian (0.7 percent), American Indian (1.7 percent), Native Hawaiian or other Pacific Islander (0.1 percent), other race (0.1 percent), or two or more races (3.4 percent; U.S. Department of Commerce 2015a).

3.9.2 Regional Employment

There were 46,240 full- and part-time jobs in the analysis area in 2014. The number of jobs for each industry in the analysis area is shown in Table 3.9. Of this total, 234 jobs (0.5 percent) were associated with the military (U.S. Department of Commerce 2015b). Labor earnings from military employment account for 0.3 percent of total labor earnings in the two-county analysis area.

Table 3.9: Employment and Labor Earnings by Industry in Morrow and Umatilla Counties in 2014 (2015 dollars)

	Number of Jobs	Percent of Total Jobs	Labor Earnings (in Thousands of Dollars)	Percent of Total Labor Earnings
Total	**46,240**	--	**$2,125,800**	--
Non-services related	**13,302**	**29.2%**	**639,656**	**30.1%**
Farm	4,553	10.0%	221,450	10.4%
Forestry, fishing, and agricultural services	1,655	3.6%	58,759	2.8%
Mining (including fossil fuels)	130	0.3%	1,669	0.1%
Construction	1,829	4.0%	103,676	4.9%
Manufacturing	5,135	11.3%	254,103	12.0%
Services related	**24,481**	**53.8%**	**965,193**	**45.4%**
Utilities	351	0.8%	48,088	2.3%
Wholesale trade	1,069	2.3%	59,974	2.8%
Retail trade	4,279	9.4%	120,211	5.7%
Transportation and warehousing	3,113	6.8%	193,667	9.1%
Information	320	0.7%	19,133	0.9%
Finance and insurance	1,106	2.4%	36,384	1.7%
Real estate and rental and leasing	1,192	2.6%	14,312	0.7%
Professional and technical services	1,168	2.6%	59,727	2.8%
Management of companies and enterprises	160	0.4%	17,182	0.8%
Administrative and waste services	1,685	3.7%	82,240	3.9%
Educational services	306	0.7%	6,935	0.3%
Health care and social assistance	4,391	9.6%	176,927	8.3%
Arts, entertainment, and recreation	523	1.1%	4,628	0.2%
Accommodation and food services	2,666	5.9%	53,619	2.5%
Other services, except public administration	2,152	4.7%	73,131	3.4%
Government	**7,753**	**17.0%**	**495,776**	**23.3%**
Federal	571	1.3%	55,345	2.6%
State and Local	6,948	15.3%	433,051	20.4%
Military	234	0.5%	7,380	0.3%

Source: U.S. Department of Commerce 2015b

3.9.3 Regional Housing

There were 4,442 housing units in Morrow County and 29,667 housing units in Umatilla County in 2014. The availability of housing units in Morrow and Umatilla counties has remained relatively constant in the timeframe between 2005 and 2014, with 10 units built in Morrow County and 125 units built in Umatilla County during this time. There was an 89.8 percent occupancy rate for housing units in the two-county area in 2014 (U.S. Department of Commerce 2015a).

The city of Hermiston is reported to have sufficient land within its urban growth boundary to meet commercial and housing needs for the next 20 years. The city of Umatilla is also reported to have enough land within its urban growth boundary to meet commercial and housing needs for the next 20 years; however, Umatilla has planned for an increase in housing and commercial demand due to the deconstruction of the UCD incinerator (ORNG 2015b). The city of Irrigon intends to petition the state for an expansion of the urban growth boundary to accommodate anticipated need for residential, commercial, and industrial infrastructure.

3.10 Environmental Justice

EO 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires federal agencies to identify and address as appropriate disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations, and to provide opportunity for participation in the public involvement process. Federal actions should be conducted in a manner that does not exclude communities from participation in, deny communities the benefits of, or subject communities to discrimination under such actions, because of their race, color, or national origin.

Overall, populations in the two-county area are poorer than the national average. In Morrow County, 19.3 percent of people and 15.5 percent of families are living below the poverty line. In Umatilla County, 17.1 percent of people and 13.2 percent of families are living below the poverty line. Both of these counties have poverty levels higher than the national average (15.6 percent of individuals, and 11.5 percent of families living below the poverty line).

Approximately 33 percent of residents in the two-county area are of Hispanic or Latino, Black/African American, Asian, American Indian, Native Hawaiian or other Pacific Islander, other race, or two or more races (U.S. Department of Commerce 2015a). The two-county area has a higher percentage of residents that are Hispanic or Latino (25.9 percent) and American Indian (1.7 percent) than the national averages for these races (16.9 and 0.7 percent, respectively). The two-county area has a lower percentage of residents that are Black/African American (0.6 percent) and Asian (0.7 percent) than the national average (12.2 percent and 4.9 percent, respectively).

The average percentage of households that receive at least a portion of their income from food stamps or the Supplemental Nutrition Assistance Program in the two-county area is 22.4 percent, which is higher than the national average of 13.0 percent. The average percentage of residents older than 25 in the two-county area with a high school education is 82.5 percent, which is slightly less than the national average of 86.3 percent. Monthly cost of rent exceeds 30 percent of household income for 28.4 percent of households in the two-county area (U.S. Department of Commerce 2015a).

3.11 Infrastructure

The following section describes the existing infrastructure in the CUO study area. These systems currently support the existing ORARNG enclave, although they are not included under the existing license, and are managed by the Caretaker contract.

3.11.1 Potable Water System

Water is supplied throughout the CUO study area via an on-site water system consisting of wells, pipelines, and storage reservoirs. Chlorination at the well head is the only treatment required and provided in the system. The water system is divided into two parts—one serving the northwestern and northern-central portion of CUO study area (North System), and the second serving the southwestern (warehouse) area and the cantonment area (South System). The igloo areas are not served by the water system (Kennedy/Jenks Consultants 2014).

The North System provides water for fire protection, domestic use, and industrial use, and includes Wells 3, 6 and 7, one elevated storage reservoir, and booster pump stations. Well 3 is permitted for only 10 gallons per minute (gpm) for fire protection and is not currently in use. Well 6 is active and provides water; Well 7 is out of service due to an electrical issue, but is believed to be productive. Wells 3, 6, and 7 are within the CUO boundary. The South System provides water for fire protection, irrigation, and domestic use, and includes four Wells 1, 2, 4, and 5, and two elevated reservoirs. Wells 1 and 2 in the South System no longer produce water, but could be repairable. Wells 4 and 5 do produce water, but are outside of the CUO boundary.

ORARNG received reassignment for all the water rights on Wells 2 and 3, half of the fire protection water right on Well 1, and all of the domestic use water right for Well 6. Currently, there are water rights for 224 gpm for domestic uses that are in production at CUO. The reassignment documents are included in Appendix E. The remaining 3,231-gpm water rights will be conveyed by deed from the Army to the CDA. Table 3.10 summarizes the water status for the wells.

Table 3.10: Water Well Status

Well	Reported Pumping Capacity (gpm[1])	Water Right Capacity (gpm[1])	Allowed Use	Status of Well
1	--	153	Irrigation for 27 acres	Not currently in use, casing is bent.
		898	Fire Protection[2]	
2	--	350	Domestic	Not currently in use, pump needs to be replaced.
3	10	10	Fire Protection[2]	Low production, well not currently in use.
4	400	498	Fire Protection[2]	Capacity of well is insufficient to supply the full rate authorized by the water right. The well is outside of the CUO boundary.
5	800	498	Fire Protection[2]	The well is outside of the CUO boundary.
6	550	224	Domestic	Capacity of well is sufficient, but not currently in use.
7	500	1,014	Manufacturing and Fire Protection[2]	Well is not operating due to an electrical issue. A water right transfer has been complete.
		772	Fire Protection[2]	

[1] gpm = gallons per minute

[2] A water right is not required for fire protection.

Source: Kennedy/Jenks Consultants 2014; Table ES.3

3.11.2 Wastewater System

The wastewater system was installed in the 1940s, and consists of a concrete control box, two concrete Imhoff tanks (a small tank and a large tank), a drying pond, and two concrete conveyance pipes. Sewage from the administrative area is collected and carried to a treatment facility approximately 5,000 feet west; the cantonment area is the only area served with a piped sanitary sewer system. Currently, the control box diverts flow from the collection system to the small Imhoff tank because the large Imhoff tank leaks and is not operational. The small Imhoff tank has an average overflow rate of 800 gallons per square foot per day, and provides a total liquid capacity of approximately 52,800 gallons per day (gpd). Flows for existing usage are approximately 740 gpd (Kennedy/Jenks Consultants 2013). The Imhoff tanks treat wastewater through settling, sedimentation, and anaerobic digestion. A drying pond between the two Imhoff tanks receives discharge from the Imhoff tanks; the discharge dries and is then taken to a landfill for disposal.

Individual septic tanks and drain fields provide for treatment of domestic sewage at locations other than the cantonment area. Most of these decentralized septic tanks and drain fields were not constructed to modern standards, and will require replacement or abandonment (Kennedy/Jenks Consultants 2016). Six of the decentralized systems are operational and will remain in service (Kennedy/Jenks Consultants 2016). The stormwater management pipes in the Administrative Area, which are co-located with the wastewater system, may need to be repaired simultaneously.

A conditions assessment performed by Kennedy/Jenks Consultants in 2013, and a subsequent evaluation by the USACE, identified the existing wastewater facilities to be in poor condition and unsuitable for continued extended service (Kennedy/Jenks Consultants 2017).

3.11.3 Electrical System

Electrical power is supplied to the CUO study area on overhead lines by the Umatilla Electric Cooperative (UEC). The service is provided at 12,470 volts, three-phase, four-wire, 60 hertz. The CUO substation is east of the main entrance, where the CUO electrical system is fed on overhead lines mounted on wooden poles along roads similar to a rural electrical system. The lines have existed since the original UCD construction, and the poles are in substandard condition (Dana Engineering 2014).

3.11.4 Communication System

Telephone service enters the CUO study area at the southeastern corner of the property. Services are a combination of overhead and underground lines going to locations throughout the CUO study area. Most of the system is underground, serving the administration and main outlying buildings. Remote areas have special mine-type units mounted on posts, or provisions for portable telephones (Dana Engineering 2016).

3.11.5 Heating, Ventilation, and Cooling System

There is no centralized heating plant in the CUO study area. Buildings are heated by individual propane heating systems with propane storage tanks adjacent to each structure. Some of the larger buildings have multiple propane storage tanks. Wall- and window-mounted air-conditioners are electrically powered.

3.11.6 Transportation Network

An existing internal paved roadway network traverses the former UCD, with connections to local access roads at the northwestern and southeastern corners of the facility (see Figure 2.4). A perimeter road currently encircles the former UCD property. However, on completion of the land conveyances, the perimeter road and fence would become disjointed, and the 7,500-acre CUO study area would not have a complete and contiguous perimeter patrol road. Within the CUO boundary, there are roads providing circulation routes in the cantonment, warehouse, and igloo complexes. The condition of the existing paved asphalt roadways varies from very good to deteriorating. Some existing roads were tested to handle varying load weights of heavy trucks and military equipment from 9,000 to 12,000 pounds. The CUO study area is accessed via two main interstates: I-84 and I-82. Annual average daily traffic on I-84 and I-82 in this area is 14,400 and 18,800, respectively (ODOT 2014).

Existing rail lines at the former UCD were installed in the early 1940s, with track of a standard design for that time period. From the boundary spur line, the former UCD was served by a looped rail system, essentially adjacent to the former munitions storage blocks. A dead-end rail line serves the warehouse area in the southwestern corner of CUO study area; however, the line serving the warehouse is now severed from the main line. In total, the CUO study area has about 50 miles of track.

3.12 Hazardous and Toxic Materials/Wastes

A hazardous material is any item or agent that has the potential to cause harm to humans, animals, or the environment either individually or through interaction with other factors. Hazardous materials are defined as substances with strong physical properties, such as ignitability, corrosivity, reactivity, or toxicity that may cause an increase in mortality or illness, or pose a substantial threat to human health or the environment. Hazardous wastes are defined as any solid, liquid, contained gaseous, or semisolid waste, or any combination of wastes, that pose a substantial present or potential hazard to human health or the environment.

Numerous federal, state, and local laws regulate the storage, handling, disposal, and transportation of hazardous and toxic materials and wastes (HTMW). At the federal level, these include the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. §6901–6992k), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §9601 et seq.), Toxic Substances Control Act (TSCA), and Department of Transportation and Occupational Safety and Health Administration laws. The primary purpose of these laws is to protect public health and the environment. At a state level, hazardous wastes and materials are regulated by the DEQ (Oregon Revised Statute Chapters 465 and 466), Oregon Department of Transportation, the Oregon State Fire Marshal, and the Oregon Occupational Safety and Health Administration.

CUO is regulated as a Conditionally Exempt Small Quantity Generator (CESQG) of hazardous waste under RCRA. Hazardous materials management at CUO is conducted in accordance with ORARNG PAM 200-1, *Environmental Quality: Guide to Environmental Compliance* (ORARNG 2012), and ORARNG Regulation 420-47, *Installations: Hazardous Material, Waste, and Spill Management Plan* (ORARNG 2009). These guidelines and regulation describe management practices to control the procurement, use, and storage of hazardous materials to prevent pollution from being generated, minimize hazards of chemical use to the health of employees and the environment, and provide waste minimization.

An SPCC Plan and an Installation Spill Contingency (ISC) Plan were developed by the Army Chemical Materials Activity (CMA), and are maintained by BRAC for the UCD. The SPCC and ISC Plans identify potential oil and hazardous spill sites at the facility, and establish procedures and resources to respond to and clean up spills. Following property reassignment, the OMD is developing a SPCC Plan to cover their operations.

3.12.1 Environmental Condition of Property / Environmental Baseline Survey

There are several contaminated areas in the cantonment area, as well as other sites across the CUO study area. The contamination results from various chemicals commonly found on installations such as the UCD when adequate environmental controls were not in place. Remediation efforts are currently under way, as described in Section 3.12.2 below.

An ECOP/Environmental Baseline Survey (EBS) Report was completed for a proposed CUO parcel of the former UCD in 2012 (AMEC 2012). The ECOP/EBS identified several existing recognized environmental conditions and environmental liabilities associated with past Army operations and use of the property. Areas in the CUO study area were classified in accordance with the ARNG's ECOP Standard Operating Procedure dated March 14, 2007, as follows:

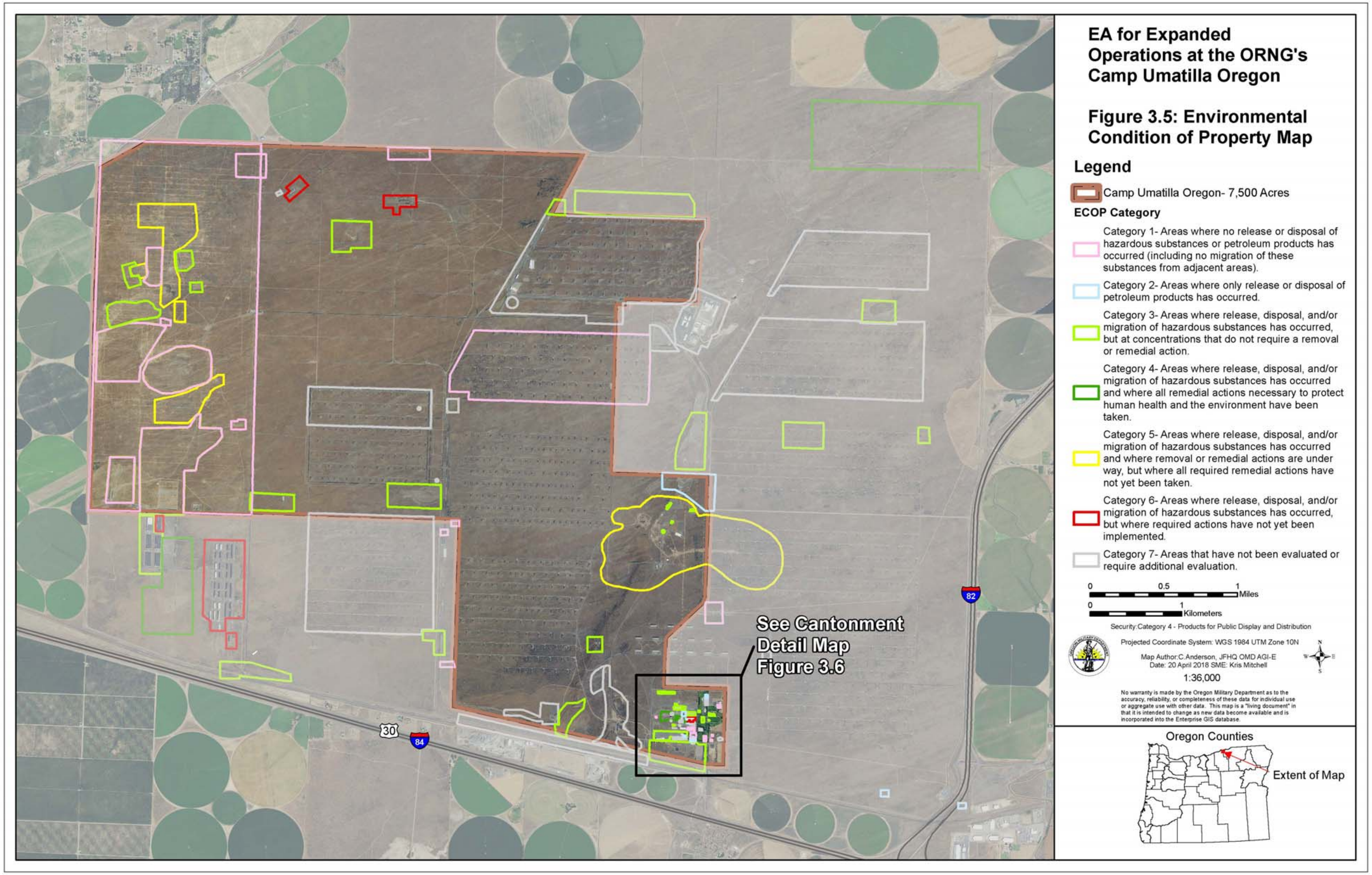
- **Category 1** – Areas where no release or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).
- **Category 2** – Areas where only release or disposal of petroleum products has occurred.
- **Category 3** – Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial action.
- **Category 4** – Areas where release, disposal, and/or migration of hazardous substances has occurred and where all remedial actions necessary to protect human health and the environment have been taken.
- **Category 5** – Areas where release, disposal, and/or migration of hazardous substances has occurred and where removal or remedial actions are under way, but where all required remedial actions have not yet been taken.
- **Category 6** – Areas where release, disposal, and/or migration of hazardous substances has occurred, but where required actions have not yet been implemented.
- **Category 7** – Areas that have not been evaluated, or require additional evaluation.

Areas identified in the ECOP are shown on Figures 3.5 and 3.6. Areas requiring completion of environmental restoration are described in Section 3.12.2.

Additional findings of the ECOP/EBS related to hazardous wastes are described below.

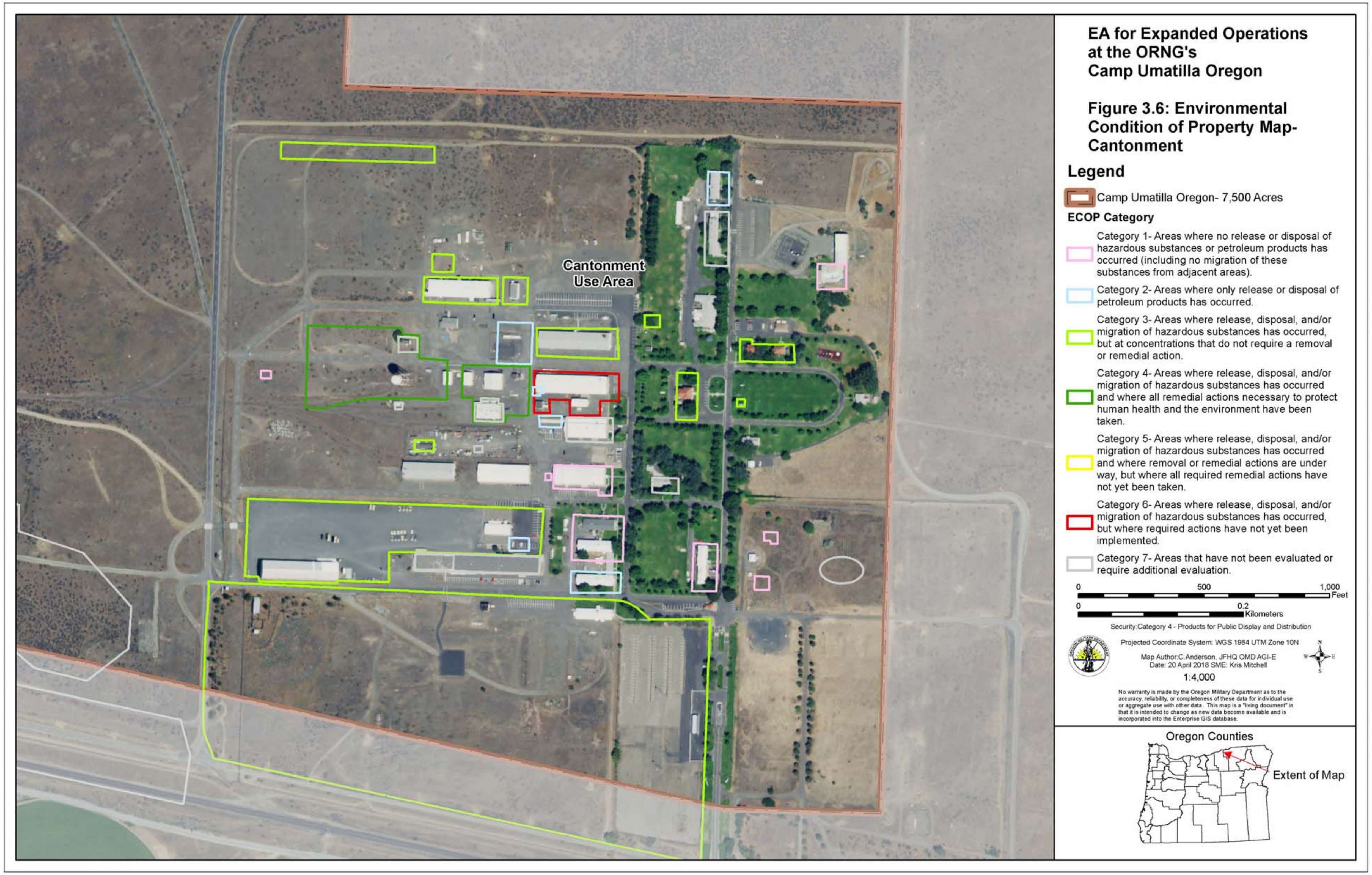
3.12.1.1 Asbestos-Containing Materials (ACM)

During the site reconnaissance conducted as part of the ECOP/EBS, suspect ACM was observed in many of the existing buildings and structures. Immediate mitigation was determined to be required for building materials that were no longer intact due to weatherization and lack of maintenance. Future mitigation, including building-specific surveys, was recommended for construction and demolition activities that would later be performed at the buildings.



EA for Expanded Operations at the ORNG's Camp Umatilla Oregon

Figure 3.5: Environmental Condition of Property Map



EA for Expanded Operations
at the ORNG's
Camp Umatilla Oregon

Figure 3.6: Environmental Condition of Property Map-Cantonment

3.12.1.2 Federal Facilities Agreement

The proposed CUO parcel of the former UCD is subject to a Federal Facilities Agreement (FFA), titled *Umatilla Army Depot (Lagoons)*, signed in 1989 by the Army, EPA, and DEQ. The FFA indicates the Army and all subsequent property owners are bound to cleanup requirements for nine designated cleanup locations, identified as operable units (OUs). The number of OUs was reduced to eight in a series of Records of Decision (RODs) in the mid-1990s, which established cleanup goals and remediation strategies for each of the OUs. Six of the eight OUs are within the boundaries of the CUO study area. The Army, EPA, and DEQ have agreed that remedial actions at four of the OUs are protective of human health and environment, and No Further Action (NFA) is required at these four OUs. The agreement is documented in the *Memorandum of Agreement between the National Guard Bureau and The U.S. Army BRAC Division* (U.S. Army 2016). Two of the OUs remain in the process of cleanup: the ADA in the northwestern portion of the CUO study area; and Explosives Washout Lagoon–Groundwater in the southeastern portion of the CUO study area. The former UCD is included on the EPA National Priorities List under Superfund Site ID 1000546.

3.12.1.3 Miscellaneous Sites OU

The Miscellaneous Sites OU includes 32 separate locations throughout the former UCD, where past environmental investigations have identified potential contamination from historical operations. Remediation in the form of soil removal occurred at three of the 32 locations. According to a joint ROD between the EPA and the Army, subsurface soil and groundwater investigations indicated no need for further cleanup at the remaining 29 locations (AMEC 2012).

3.12.1.4 Petroleum Underground Storage Tanks (USTs)

Several investigations to identify historical locations of petroleum USTs, UST sampling investigations, and UST removals have taken place since the 1980s. However, there is a potential that petroleum USTs may exist in areas that were not previously identified or were not documented.

3.12.1.5 Gravel Borrow Pits

Approximately 10 to 12 gravel borrow pits were observed throughout the CUO study area. Disposal of construction demolition debris, metal, tires, and wood was observed in all former borrow pits. Former borrow pits also could have been used for disposal of other materials. Most gravel borrow pits were identified as Study Sites in previous investigations. The Army, EPA, and DEQ have determined that no environmental work is required at the gravel borrow pits (U.S. Army 2016). However, gravel pits used for the disposal of construction and other debris with NFAs from the DEQ should be revisited to determine if proper closure protocols have been followed. A gravel borrow pit in J-Block was not identified as a previous Study Site, and was observed to contain construction debris.

3.12.1.6 Igloo Blocks

Approximately 427 igloos are in the CUO study area. Igloos may have lead-containing paint and asbestos tar surfacing at the interface between the rooftops and vegetation. Igloos were not included in lead paint surveys formerly conducted at the UCD.

3.12.1.7 Septic Systems

Although most current and former septic systems have been identified, not all former septic systems may have been documented or properly investigated. As an example, foundations and a possible septic leach field were observed in Area III during the ECOP/EBS site reconnaissance (AMEC 2012).

3.12.1.8 Transformers

Comprehensive sampling, removal, and replacement surveys for transformers were completed in 1989 and 1993. During the field reconnaissance, out-of-service transformers were observed at several locations in the CUO study area. Materials associated with former transformers, such as electrical lines, insulators, metal transformer platforms, and utility poles were observed at several locations. In November 2017, the 74 transformers were removed and transported off-site for disposal by BRAC (U.S. Army 2017).

3.12.1.9 Hazardous Building Materials

The following hazardous building materials have been observed or documented:

- Suspect ACM was observed in many of the existing buildings and structures.
- Paint containing detectable concentrations of lead is present in many buildings and structures.
- Radon concentrations above 4.0 picocuries per liter are present in Buildings 1, 5, and 415.
- Regulated materials potentially classified as universal hazardous wastes, including mercury-containing fluorescent light tubes, high-intensity discharge lighting and thermostats, chlorofluorocarbons-containing air conditioners, and polychlorinated biphenyl (PCB)-containing light ballasts were observed in buildings.
- PCB bulk-waste products may be present in caulking, door frames, and masonry materials in many buildings constructed or renovated prior to 1978.

3.12.1.10 Drywells and Underground Injection Controls (UICs)

UCD installation maps depicted several existing drywells and catch basins that are not connected to a storm sewer system. Because the Cantonment Area is the only area in the CUO study area connected to a storm sewer system, catch basins outside of the existing Cantonment Area are likely connected to drywells. Roof drains on buildings in the existing Cantonment Area discharge precipitation directly to the ground surface. Roof drains and dry wells qualify as UICs per DEQ regulation 340-044-0005(24).

3.12.2 Current Remedial Actions

A Memorandum of Agreement was signed on August 2, 2016, between the NGB and BRAC for the Real Property Assignment and Transfer of Responsibility for Real Property Located on the Former Umatilla Chemical Depot, Umatilla and Morrow Counties, Oregon. Per the 1989 FFA, the FFA OUs and UCD Solid Waste Management Units (SWMUs) will achieve compliance in accordance with CERCLA. The SWMUs also will meet applicable corrective action requirements under RCRA. The UCD Hazardous Waste Management Units will achieve compliance in accordance with the state hazardous waste management permit (RCRA permit).

Sixty-nine Army Environmental Database-Restoration (AEDB-R) sites are on the portion of the property conveyed to the NGB as CUO. Sixty-seven of the AEDB-R sites have achieved Response Complete status. Two of the remaining sites require completion of environmental restoration pursuant to the FFA and RCRA permit, and are described below.

3.12.2.1 Umatilla Army Depot (UMAD)-024 South Lagoon (Site 4)

UMAD-024 consists of a groundwater plume near and extending across the eastern edge of CUO. Site UMAD-024 is subject to the ROD for Umatilla Depot Activity Explosives Washout Lagoons Groundwater Operable Unit, dated June 7, 1994. A Focused Feasibility Study was completed in 2011 to evaluate the addition of bioremediation when the plume size is sufficiently reduced. The Focused Feasibility Study received concurrence from EPA Region 10, and the DEQ and is currently being updated; a ROD Amendment may be issued to modify or amend the selected remedy.

3.12.2.2 Umatilla Army Depot (UMAD)-148 ADA Unexploded Ordnance (UXO) Clearance

UMAD-148 is comprised of an approximately 1,750-acre area in the northeastern section of the UCD. UMAD-148 is subject to the ROD for Umatilla Depot Activity Ammunition Demolition Activity Area Operable Unit, dated June 10, 1994, and amended by the Explanation of Significant Differences for Umatilla Chemical Depot Ammunition Demolition Activity Area Operable Unit, Site 19E/F, dated June 27, 2002. A portion of UMAD-148 is currently under contract for cleanup, with an expected completion in 3 years.

3.12.3 Land Use Controls

In accordance with AR 200-1, *Environmental Quality: Environmental Protection and Enhancement*, the ORARNG has completed an inventory and map of locations at CUO requiring LUCs. LUCs may consist of institutional or engineering controls used to prevent unacceptable exposures to contamination left in place at the completion of removal or remedial actions. Examples of common institutional controls are restrictions on groundwater use or prohibition of use as a daycare. Examples of common engineering controls are fences to prevent unauthorized entry or caps over contaminated soils.

Thirty locations at CUO are designated as requiring LUCs; these locations are shown on Figure 3-7. Development restrictions associated with the LUC locations will be integrated in the future master plan for CUO. The OMD is currently working with the DEQ to establish an MOU (or other administrative instrument) for maintaining the LUCs established by regulators following RCRA and CERCLA closure of remediation sites.

3.12.4 U.S. Army Chemical Materials Activity Permits

UCD was a RCRA-permitted waste treatment and storage facility. The following permits are the responsibility of the Army, and may continue to remain in effect after real property assignment to, and conveyance of, CUO to NGB:

- **TSCA Permit for K Block Igloos** – The U.S. Army and EPA are currently in the final stages of closing this permit.
- **RCRA Permits** – Umatilla Chemical Depot Permit No. OR6 213 820 917 authorizes the storage of hazardous waste. Umatilla Chemical Disposal Facility Permit No. ORQ 000 009 431-01, issued to the CMA, authorizes the construction and operation of a Treatment, Storage, and Disposal Facility to incinerate chemical agents. CMA is solely responsible for managing termination of the RCRA permits. The DEQ, with oversight by EPA Region 10, and the CMA are negotiating appropriate mechanisms for implementing LUCs required by the RCRA permits.

3.12.5 Hazardous Materials Generation and Storage

Lead is used at CUO in the form of ammunition for live-fire range training. Approximately 548.9 pounds of lead were released in 2015. Expended lead is managed in accordance with applicable federal, state, and local requirements and DoD, Army, and ORARNG requirements for management of hazardous waste.

Limited quantities of hazardous materials and hazardous waste are stored at CUO. The ORARNG is subject to Section 302 of the Emergency Planning and Community Right-to-Know Act regarding Extremely Hazardous Substances. Reportable quantities of hazardous substances are stored at CUO, including de-icing fluid, jet fuel, oxygen, acetylene, chlorine, propane, and sodium chloride (Oregon State Fire Marshal 2015). Hazardous substances are managed in accordance with ORARNG PAM 200-1 and ORARNG Regulation 420-47 to maintain a current inventory of all hazardous materials on hand and/or used in operations, to protect human health and environmental quality, and perform regular inspections of stored hazardous materials.

According to the 2012 ECOP/EBS Report, the following USTs and Aboveground Storage Tanks (ASTs) are in the CUO study area:

- Five USTs, including two regulated and DEQ-permitted USTs and three unregulated USTs.
- Sixteen ASTs used to store propane, fuel, and used oil. The ASTs are managed in accordance with the SPCC Plan and applicable regulations. The ASTs range in size from 275 gallons to 15,000 gallons.

As described in the SPCC and ISC Plans, no ASTs or other aboveground storage units with the potential to spill are located near any waterbodies, drainage pathways, or sensitive environmental areas (ORNG 2011).

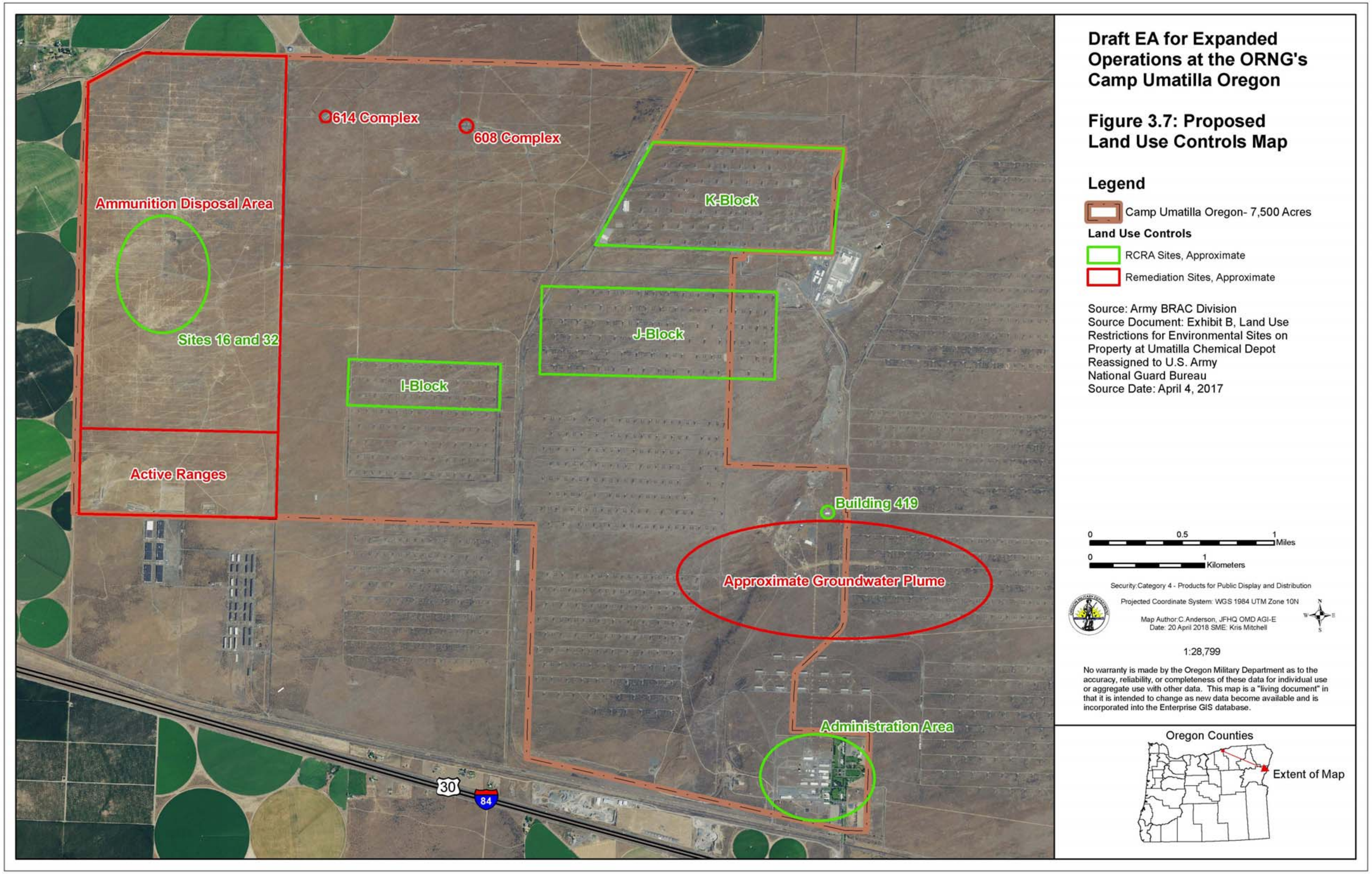


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Figure 3.7: Proposed Land Use Controls Map

Legend

🟫 Camp Umatilla Oregon- 7,500 Acres

Land Use Controls

🟩 RCRA Sites, Approximate

🟥 Remediation Sites, Approximate

Source: Army BRAC Division
Source Document: Exhibit B, Land Use Restrictions for Environmental Sites on Property at Umatilla Chemical Depot Reassigned to U.S. Army National Guard Bureau
Source Date: April 4, 2017

Security:Category 4 - Products for Public Display and Distribution

Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 20 April 2018 SME: Kris Mitchell

1:28,799

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document" in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

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SECTION 4: ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

Chapter 4 describes the potential impacts that could occur to the natural and human environment as a result of the Proposed Action and No Action alternatives. For each resource, significance thresholds are defined.

The impact analysis assumes that under the Proposed Action, projects would be constructed as funding becomes available over the next 5 years. In general, the strategy for development of CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, igloo complexes, etc.), where possible, to accomplish the required training, and to reduce the environmental impacts associated with native habitat conversion. During the first few years of the Proposed Action, most improvements that would occur would be associated with the renovation of existing buildings and infrastructure improvements, with the majority of construction activity occurring within the next 5 years, as summarized in the bullets below. Construction projects are planned to occur as shown in Table 2.1. Three construction projects would occur over a range of 3 to 5 years, as follows:

- Construction of the MOUT in the Maneuver Use Area would occur over a 5-year period, with approximately 110 acres constructed per year.
- Construction of the new maneuver lanes and vehicle maneuver course in the Maneuver Use Area would occur over a 3-year period, with approximately 60 acres disturbed per year.
- Construction of perimeter roads, fencing, and firebreaks throughout the CUO would occur over a 3-year period, with approximately 40 acres constructed per year.

4.2 Land Use

For this analysis, changes in land use that would result in **inconsistencies with zoning, external planning documents, or planning goals** are considered significant impacts to land use.

4.2.1 Effects of the Proposed Action

No short-term impacts to land use would occur due to construction activities. **Long-term, positive impacts** would result from development and operation of the CUO.

4.2.1.1 Construction Activities

There would be **no short-term impacts** to land use.

4.2.1.2 Site Operations

CUO would continue to be authorized as a military facility under the Proposed Action. Although activities would be expanded in scope, there would be no conflict with the overall authorized land use for the area, because land uses would continue to be administrative and training, and therefore be consistent with existing land use and zoning in and adjacent to the CUO. Land use in CUO would be guided by the *ORNG Umatilla Training Center Site Development Plan* (2016). Long-term positive impacts on land use would occur due to development of the CUO consistent with existing land use and zoning rules.

4.2.1.3 Impact Summary

As described above, significant impacts related to land use include changes in land use that would result in inconsistencies in zoning, external planning documents, and planning goals. The Proposed Action would result in long-term positive impacts because:

- There would be no short-term, construction-related impacts to land use; and
- Proposed development would be consistent with existing land use and zoning rules in and adjacent to CUO.

4.2.2 Effects of the No Action Alternative

Under the No Action Alternative, the 7,500 acres of CUO would still be used by OMD for training purposes. However, no additional infrastructure would be built, and use levels would remain the same as existing conditions. There would be **no impacts** to land use associated with this alternative.

4.2.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.3 Air Quality

For this analysis, impacts that would result in **exceedance of one or more NAAQS** are considered to be significant.

4.3.1 Effects of the Proposed Action

The Proposed Action would result in short-term effects to air quality from construction activities and long-term, operational effects associated with CUO site operations. **Short-term, less than significant, adverse impacts** would occur due to the potential for dust generation and air emissions from construction activities. **Long-term, less than significant adverse impacts to air quality would occur** due to emissions associated with increased equipment and vehicle use and increased fugitive dust during training operations.

4.3.1.1 Construction Activities

Under the Proposed Action, short-term, less-than-significant adverse impacts to air quality are expected to consist of temporary emissions and generation of dust through construction of new buildings, facilities, and outdoor training areas. During construction activities, dust would be managed in accordance with state and local regulations and BMPs. Fugitive dust emissions would be mitigated in accordance with the State of Oregon CAA Implementation Plan under OAR 340-200-0040, and Requirements for Fugitive Emissions under OAR 340-204-0210. Typical BMPs include providing temporary designated driving surfaces consisting of graveled and/or paved surfaces, and wetting unimproved driving areas with water or tackifiers to suppress dust. Measures to minimize dust generated during construction would be coordinated with sediment transport control measures as part of the DEQ National Pollutant Discharge Elimination System (NPDES) construction stormwater permit requirements. Air monitoring is not expected to be required. No sensitive receptors are in the immediate vicinity of proposed construction or training areas.

4.3.1.2 Site Operations

Under the Proposed Action, long-term, less-than-significant adverse impacts to air quality are expected to occur due to increased vehicle emissions and generation of dust from expansion of vehicle, helicopter, and heavy equipment training and transportation-related activities, including driving and parking of privately owned and military-owned vehicles. The Proposed Action is expected to result in an additional 30 vehicles at CUO on each training day. Greenhouse gas and vehicle emissions are expected to increase slightly from these increased training operations, but not exceed air quality standards.

4.3.1.3 Impact Summary

As described above, significant impacts to air quality are considered to be impacts that would result in exceedances of one or more NAAQS. The Proposed Action would result in less-than-significant adverse impacts to air quality because:

- Short-term construction emissions would be managed in accordance with state and local regulations;
- Short-term generation of dust during construction activities would be managed in accordance with erosion and sediment transport BMPs;
- CUO is not in a nonattainment area; therefore, proposed facilities would not generate emissions above applicable DEQ limits; and
- Identified regional air pollutant emission facilities are all in compliance with permits.

4.3.2 Effects of the No Action Alternative

Under the No Action Alternative, pollutant emissions would be limited to current levels associated with training activities, vehicle use, and operation of propane boilers for heating. There would be **no impacts** to air quality associated with this alternative.

4.3.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.4 Noise

For this analysis, impacts that result in **incompatibility with local land uses per the SONMP and AR 200-1, Chapter 7**, are considered to be significant.

4.4.1 Effects of the Proposed Action

Under the Proposed Action, **short-term, less-than-significant adverse** impacts to the local noise environment would occur. Direct impacts would include short-term increases in noise levels as a result of construction activities. **Long-term, less-than-significant adverse impacts** would occur due to increases in noise levels from new training areas and increased levels of training activity.

4.4.1.1 Construction Activities

Noise-generating sources during construction activities would be associated primarily with standard construction equipment. Given the distance between proposed construction sites and sensitive receptors, coupled with the temporary duration of these activities conducted during normal business hours, construction noise impacts are considered less than significant.

Construction activities generate noise by their very nature, and the associated noise levels are highly variable, depending on the type, number, and operating schedules of equipment. Construction projects under this alternative would be performed in stages, each having its own combination of equipment and noise characteristics and magnitudes. Construction activities would include mobilization, site preparation, excavation, foundation placement, utility development, and heavy equipment movement. The most prevalent noise source at construction sites is the internal combustion engine. General construction equipment using engines includes, but is not limited to, heavy, medium, and light equipment such as excavators; roller compactors; front-end loaders; bulldozers; graders; backhoes; dump trucks; water trucks; concrete trucks; pump trucks; utility trucks; cranes; sheet pile drivers; man lifts; forklifts; and lube, oil, and fuel trucks.

Peak noise levels vary at a given location based on line of sight, topography, vegetation, and atmospheric conditions. In addition, peak noise levels would be variable and intermittent because each piece of equipment is only operated when needed. However, peak construction noise levels would be considerably higher than existing noise levels. Relatively high peak noise levels in the range of 93 to 108 dBA would occur on the active construction site, decreasing with distance from the construction areas. Table 4.1 presents peak noise levels that could be expected from a range of construction equipment during proposed construction activities.

Combined peak noise levels, or worst-case noise levels when several loud pieces of equipment are used in a small area at the same time, are expected to occur rarely, if ever, during the project. Under these circumstances, peak noise levels could exceed 90 dBA within 200 feet of the construction area, depending on equipment being used. The worst-case noise levels as described above are detailed in Table 4.1.

Although noise levels would be high in the immediate area, the intermittent nature of peak construction noise levels would not create the steady noise level conditions for an extended duration that could lead to hearing damage. Construction workers would follow standard federal Occupational Safety and Health Administration requirements to prevent hearing damage.

Areas that would be most affected by noise from construction include those closest to the construction footprint. Land uses surrounding CUO are primarily agricultural, although there are a few areas of rural residential land use nearby at distances as close as approximately 0.5 mile to the south and northwest of CUO. The OMD would incorporate several BMPs to limit noise impacts during construction, as listed in below:

- Limit, to the extent possible, construction and associated heavy truck traffic between 9 p.m. to 7 a.m. This measure would reduce noise impacts during sensitive nighttime hours.
- Locate stationary equipment as far away from sensitive receivers as possible.
- Select material transportation routes as far away from sensitive receivers as possible.
- Shut down noise-generating heavy equipment when it is not needed.
- Maintain noisy equipment per manufacturer’s recommendations.
- Encourage construction personnel to operate equipment in the quietest manner practicable (e.g., speed restrictions, retarder brake restrictions, engine speed restrictions).

Table 4.1: Peak Noise Levels Expected from Typical Construction Equipment

Source	Peak Noise Level (dBA, attenuated)							
	Distance from Source (feet)							
	0	50	100	200	400	1,000	1,700	2,500
Heavy Truck	95	84 to 89	78 to 93	72 to 77	66 to 71	58 to 63	54 to 59	50 to 55
Dump Truck	108	88	82	76	70	62	58	54
Concrete Mixer	108	85	79	73	67	59	55	51
Jack-hammer	108	88	82	76	70	62	58	54
Scraper	93	80 to 89	74 to 82	68 to 77	60 to 71	54 to 63	50 to 59	46 to 55
Bulldozer	107	87 to 102	81 to 96	75 to 90	69 to 84	61 to 76	57 to 72	53 to 68
Generator	96	76	70	64	58	50	46	42
Crane	104	75 to 88	69 to 82	63 to 76	55 to 70	49 to 62	45 to 48	41 to 54
Loader	104	73 to 86	67 to 80	61 to 74	55 to 68	47 to 60	43 to 56	39 to 52
Grader	108	88 to 91	82 to 85	76 to 79	70 to 73	62 to 65	58 to 61	54 to 57
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Worst-Case Combined Peak Noise Level (Bulldozer, Jackhammer, Scraper)

Combined Peak Noise Level	Distance from Source (feet)				
	50	100	200	0.25 Mile	0.5 Mile
	103	97	91	74	68

Source: Tipler 1976

Additional short-term noise impacts could occur from workers commuting and material transport. Area traffic volumes and noise levels would increase slightly as construction employees commute to and from work at the project areas, and delivery and service vehicles (including trucks of various sizes) transit to and from the site. Because trucks are present during most phases of construction, and leave and enter the site via local thoroughfares, truck noises tend to impact more people over a wider area. People living in the residential areas near CUO would experience short-term increases in traffic noise during daytime hours. However, additional construction traffic to and from CUO would primarily occur on I-84, where large truck traffic at high speeds is common; therefore, increases in noise from project construction traffic would not constitute a substantial increase over existing conditions. These short-term, intermittent effects are not considered significant because they would not result in noise levels that are incompatible with local land uses.

4.4.1.2 Site Operations

Long-term, less-than-significant adverse impacts would result from continued and expanded training activities described in Section 2.2. Noise-generating activity would include training vehicles, helicopters, and live fire activities. Typically, training activities would be conducted during daytime hours.

Short-term noise impacts could occur from military vehicles training on CUO. Similar to the description of construction-related vehicles above, military vehicles used in military training would increase noise levels slightly. Although trucks are present during many phases of military training, CUO is surrounded primarily by agricultural activities, and exposure to nearby residences would be minimal. People living in the residential areas near CUO could experience short-term increases in traffic noise during daytime hours from the arrival and departure of military vehicles at CUO. However, additional military traffic to and from CUO would primarily occur on I-84, where large truck traffic at high speeds is common; therefore, increases in noise from military vehicle traffic would not constitute a substantial increase over existing conditions. These short-term, intermittent effects are not considered significant because they would not result in noise levels that are incompatible with local land uses.

Helicopter operations would remain above FAA-approved 500 feet AGL when outside the boundary of CUO, and would follow flight paths that avoid residential areas and other sensitive noise receptors, according to the Army's "Fly Neighborly" program. The average number of annual flights would range from 12 to 24, with a possible maximum of 50. Based on the 2010 SONMP, the low number of flights would not warrant additional noise modeling; however, the proposed helicopter activities at CUO would be included in the SONMP update, currently scheduled for 2019.

The proposed expanded live fire activities and additional firing lanes at CUO would not result in appreciable changes to the existing Noise Zone II and III contours shown on Figure 2.1, versus Figure 3.2. There are no sensitive receptors or sensitive land uses that intersect Noise Zones II or III—either existing or proposed. The noise emission right-of-way to the south of the small arms ranges is in effect while the adjacent property remains under BRAC control. After BRAC transfer of the adjacent property, the noise emission right-of-way will convert to a deed restriction in perpetuity.

4.4.1.3 Impact Summary

As described above, significant impacts related to noise are considered to be impacts that would result in incompatibility with local land uses per the SONMP and AR 200-1, Chapter 14. The Proposed Action would result in short- and long-term, less-than-significant adverse impacts related to noise because:

- Noise would be managed consistent with the updated SONMP, planned for revision in 2019. In the interim, the OMD would continue to manage noise consistent with the current SONMP for CUO to ensure noise associated with military training operations is compatible with surrounding land uses.
- Noise would be managed in accordance with AR 200-1 Chapter 14 to minimize disturbance to humans to the extent practicable.

4.4.2 Effects of the No Action Alternative

Implementation of the No Action Alternative would have **no impact** on the current local noise environment. Training and operations at CUO would continue under current conditions at current locations and levels.

4.4.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.5 Geology, Topography, and Soils

For this analysis, significant impacts to geology, topography, and soils are considered to be impacts that would result in a substantial increase in **soil erosion off-site, change in site topography that results in substantial change to runoff patterns, or disturbance in areas of severe soil hazards**.

4.5.1 Effects of the Proposed Action

The Proposed Action would have **short-term, less-than-significant adverse impacts** to soils from construction activities, and **long-term, less–than-significant adverse impacts** associated with operational site activities and infrastructure.

4.5.1.1 Construction Activities

Short-term, less-than-significant adverse impacts would occur due to clearing, grading, and excavation activities associated with construction. Disturbed and exposed soils from these construction activities could promote wind- and water-induced erosion. The OMD would obtain and comply with NPDES construction stormwater permits that would include BMPs to reduce erosion and sediment-laden stormwater runoff from discharging off-site. BMPs would likely include dust abatement, mulching, inlet protection, and run-on and run-off controls. Implementing these BMPs would avoid substantial soil erosion off-site.

4.5.1.2 Site Operations

In the Cantonment Use Area, long-term impacts to soils would be primarily associated with the creation of impervious surfaces associated with buildings and roads. The Cantonment Use Area would increase in size from 170 acres to approximately 231 acres, and impervious surfaces would increase to a total of approximately 46 acres. This would limit the infiltration of stormwater into soils, and increase stormwater runoff from the site. Due to the relatively low rainfall in the area and stormwater management measures that would be implemented, these impacts would not result in substantial changes in runoff patterns. Section 4.6 provides more information on impacts associated with stormwater runoff.

In the Maneuver Use Area, long-term impacts to soils would primarily result from construction of new impervious surfaces. New impervious surface would be created as part of new HLZs. However, existing secondary paved roads in the Maneuver Use Area would be allowed to deteriorate into gravel roads, resulting in a net reduction of total impervious surfaces under the Proposed Action (total of 63.9 acres of impervious surface in the Maneuver Use Area; as compared to 154.5 acres of impervious surface under the No Action alternative).

New infrastructure that would be constructed across Use Areas that could impact soils would include improvements to the potable water and wastewater systems, and road and trail construction and improvements. Impacts from the potable water system and wastewater system would include mixing of soil layers, and some additional impervious surface from storage tanks. The Proposed Action would improve 5.13 miles of existing paved roads, construct 9.02 miles of new paved roads, construct 14.27 miles of new trails, and convert 17.4 miles of existing secondary roads to maneuver trails (Figure 2.4). New roads would result in new impervious surface, which could result in loss of soil function. Deterioration of secondary paved roads in the Maneuver Use Area would increase acres of pervious surfaces, but would not return the soils of these areas to pre-disturbance conditions. Construction of new trails would result in vegetation loss, soil compaction, and increased potential for erosion. In addition, there would be 34.5 miles of firebreaks or fuel breaks that would result in an additional 66.9 acres of vegetation removal or reduction, which could lead to an increased potential for soil erosion in those areas.

As discussed above, the Proposed Action would result in short- and long-term impacts to soils. As discussed in Section 3.5, erosion hazards in CUO are primarily slight for non-road uses, and slight to moderate for trail and road use, indicating that roads may require occasional maintenance. No improvements are planned at the Coyote Coulee feature, where erosion hazards are severe. However, there is one location near the northwestern boundary with severe erosion hazards (soil mapping unit 20C) that could be crossed by a new trail. OMD would include additional erosion controls during and after construction, as necessary, to minimize erosion in that area. Therefore, there would be no substantial increase in soil erosion off-site with the incorporation of erosion and sediment control BMPs. Additionally, under the Proposed Action, several buildings would be demolished and the area re-vegetated. However, the majority of buildings demolished would be re-constructed, and there would still be an increase in the amount of non-vegetated surface within the CUO boundary.

4.5.1.3 Impact Summary

As described above, significant impacts to geology, topography, and soils are considered to be impacts that would result in a substantial increase in soil erosion off-site, change in site topography that results in substantial change to runoff patterns, or disturbance in areas of severe soil hazards. Short- and long-term, less-than-significant adverse impacts are not considered significant because:

- Soil erosion would be minimized through construction and operational BMPs as described in Section 2.2.7;
- Runoff patterns would not change; and
- Construction and operational erosion control BMPs would be implemented near the northwestern boundary of CUO, where a road would be constructed in an area of severe erosion hazards.

4.5.2 Effects of the No Action Alternative

Under the No Action Alternative, impacts to soils would be similar to existing conditions. The 7,500-acre CUO would still be used by ORARNG as a training facility; however, no new facilities would be constructed. Therefore, there would be no construction-related erosion impacts under the No Action Alternative. **Long-term, less-than-significant adverse impacts** would result from ongoing mounted and dismounted training activities that contribute to soil erosion. However, there would be no increase in impervious surface, and no grading that would alter drainage patterns in CUO. Therefore, there would be no substantial increase in soil erosion off-site, change in site topography that results in substantial change to runoff patterns, or disturbance in areas of severe soil hazards under the No Action Alternative. Significant impact thresholds identified for geology, topography, and soils would not be met.

4.5.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.6 Water Resources

For this analysis, significant impacts to water resources are considered to be impacts that would **violate water quality standards, result in hydro-modification to receiving waterbodies, result in a substantial increase in water consumption rates from wells over and above existing allocated water rights, contaminate groundwater affecting drinking water wells, or result in a permanent net loss of wetlands and riparian areas or their ecosystem functions**.

4.6.1 Effects of the Proposed Action

The Proposed Action would result in **short-term, less-than-significant adverse impacts** from construction activities, and **long-term, less-than-significant adverse impacts** from operational impacts associated with site activities and infrastructure. As detailed below, the Proposed Action would not result in impacts that would meet or exceed the defined significance thresholds; therefore, short- and long-term adverse impacts to water resources would be less than significant.

4.6.1.1 Surface Water

Impacts to surface water resources include both short-term impacts associated with construction activities and long-term impacts associated with site operations.

4.6.1.1.1 Construction Activities

Short-term, less-than-significant adverse impacts would occur due to clearing, grading, and excavation activities associated with construction that could result in erosion and an increase the sediment-load of stormwater runoff discharging off-site. These impacts are expected to be minimal because the majority of stormwater runoff would be infiltrated on-site due to the high permeability of on-site soils. Additionally, the OMD would comply with NPDES construction stormwater requirements that include measures and BMPs to reduce erosion and sediment-laden stormwater runoff from discharging off-site. BMPs would likely include dust abatement, mulching, inlet protection, and run-on and run-off controls. Implementing these BMPs would avoid substantial soil erosion off-site and minimize the discharge of sediment-laden stormwater.

4.6.1.1.2 Site Operations

Long-term, less-than-significant adverse impacts would result due to new impervious surfaces, change or increase in pollution-generating activities, and permanent vegetation removal. Construction of new impervious surface would affect the amount of stormwater runoff that would be generated on-site, although the planned deterioration of existing secondary paved roads in the Maneuver Use Area would result in a decrease in the total area of impervious surfaces under the Proposed Action. Throughout the CUO, with the exception of the Cantonment Use Area, stormwater runoff would continue to infiltrate into the ground due to the low annual precipitation, high infiltration rates of soils, and the large amount of land that would continue to be pervious and maintain capacity to infiltrate precipitation falling on CUO. The 14.27 miles of new trails and 66.9 acres of firebreaks would increase potential for erosion. Where these impacts would occur in areas of moderate or high erosion hazard, OMD would monitor roads for erosion, and implement BMPs as necessary.

In the Cantonment Use Area, the amount of stormwater generated from the site would increase under the Proposed Action. The Cantonment Use Area would expand from 170 acres under existing conditions to 231 acres, increasing the total impervious surface under the Proposed Action to 46 acres in this use area. This would increase the amount of stormwater generated on the site; however, stormwater would infiltrate into the ground prior to reaching surface waters. The increase in full-time staff and frequency and size of training activities would also result in more pollutants, such as oil, grease, sediment, and metals from the increased use of vehicles in the Cantonment Use Area. However, the OMD would comply with Section 438 of the Energy Independence and Security Act (EISA) of 2007, which requires any federal facility with a proposed disturbance area greater than 5,000 square feet to maintain or restore the pre-development hydrology of the property to the maximum extent technically feasible with respect to temperature, flow rate, runoff volume, and duration of flow. Due to favorable infiltration capacity in and adjacent to the site, additional stormwater management facilities above and beyond a standard curb-and-gutter collection system may not be required to meet the intent of the EISA of 2007.

4.6.1.2 Groundwater

Impacts to groundwater include both short-term, less-than-significant adverse impacts associated with construction activities, and long-term, less-than-significant adverse impacts associated with site operations.

4.6.1.2.1 Construction Activities

Short-term, less-than-significant, adverse impacts could result during construction due to the potential for a release of toxic or hazardous materials to the environment that could impact water quality. As discussed previously, the OMD would comply with NPDES construction stormwater requirements during construction that include pollution prevention and control measures, with proper storage and containment of hazardous materials and proper fueling techniques. With the implementation of these measures, and because depth to groundwater is approximately 60 feet or more (OWRD 2003), contamination of groundwater as a result of toxic or hazardous chemicals used during construction is not anticipated.

4.6.1.2.2 Site Operations

Long-term, less-than-significant adverse impacts would occur as a result of the construction of new impervious surfaces (primarily associated with the Cantonment Use Area), but would not affect groundwater recharge, because the overwhelming majority of the site would remain pervious, with high infiltration capacity.

The wastewater treatment system has potential to discharge contaminants into the ground, which could impact groundwater. As discussed in Section 4.11.1.2, the wastewater system would be constructed in accordance with a Water Pollution Control Facility (WPCF) permit from DEQ, and treated wastewater would be discharge in accordance with the WPCF permit to avoid contamination of groundwater and surface water quality. Improvements to the wastewater treatment system would be designed in accordance with the LUB GWMA Action Plan to avoid releases of nitrate-nitrogen. Remedial activities associated with the capped landfill and the five GWMA monitoring wells in the northeastern portion of CUO would not be disrupted by the Proposed Action. No impacts would occur to the levels of nitrate-nitrogen as a result of the Proposed Action.

Increased use of water from groundwater wells could result in further decline of the aquifer in the OWRD Ordnance Critical Ground Water Area, and cause long-term impacts to groundwater levels. However, water consumption at CUO would not exceed allocated water rights.

4.6.1.3 Wetlands

As discussed in Section 3.6.3, three potential wetlands have been identified in the CUO boundary. These potential wetlands are all likely a result of unnatural water sources. Regardless, if new development associated with the Proposed Action is planned near one of these potential wetlands, a wetland delineation would be conducted, and appropriate avoidance or mitigation would be performed if necessary so that there would be no net loss of wetlands or their functions as a result of the Proposed Action.

4.6.1.4 Impact Summary

As described above, significant impacts to water resources are considered to be impacts that would violate water quality standards, result in hydro-modification to receiving waterbodies, result in a substantial increase in water consumption rates from wells over and above existing allocated water rights, contaminate groundwater affecting drinking water wells, or result in a permanent net loss of wetlands and riparian areas or their ecosystem functions. The Proposed Action would result in short- and long-term, less-than-significant, adverse impacts that are not considered significant because:

- Site runoff would not reach surface waters, and therefore not violate water quality standards or result in hydro-modification of receiving waters;
- Water consumption at CUO would be within allocated water rights;
- Groundwater would not be contaminated due to depth to groundwater and BMPs implemented by OMD; and
- No development would occur in wetlands; therefore, there would be no loss of wetland area or function.

4.6.2 Effects of the No Action Alternative

Under the No Action Alternative, impacts to water resources would be similar to existing conditions. The 7,500-acre area would still be used by the ORARNG as a training facility; however, no new facilities would be constructed. Therefore, there would be no construction-related impacts to water resources under the No Action Alternative. Activities that contribute to vegetation trampling and removal would occur from mounted and dismounted training activities at the same level and frequency as existing conditions. There would be no new impervious surfaces and no grading that would alter drainage patterns in CUO. Therefore, there would be no substantial increase in soil erosion off-site, change in site topography that results in substantial change to runoff patterns, or resulting increase in pollution or flow rates or volumes to receiving waterbodies. There would be no new impervious surfaces; therefore, there would not be an increase in stormwater runoff or decrease in groundwater recharge as a result of the No Action Alternative. Ongoing activities would continue to be performed in accordance with the DEQ LUC GWMA Action Plan to reduce nitrate-nitrogen in groundwater, and the OWRD Ordnance Gravel Critical Groundwater Area to address water level declines, and no additional water rights would be granted. There would be no impacts to wetlands as a result of the No Action Alternative. The significant impact thresholds identified for water resources as described above would not be reached as a result of the No Action Alternative. Therefore, the No Action Alternative would have **short- and long-term, less-than-significant adverse** impacts to surface water, groundwater, and wetlands.

4.6.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.7 Biological Resources

Biological resources included in this analysis are vegetation, and fish and wildlife, including special-status or protected species. Significance criteria are described for each biological resource in the following sections.

4.7.1 Effects of the Proposed Action

Effects of the Proposed Action to biological resources include **short-term, less-than-significant adverse impacts** associated with construction, and **long-term, less-than-significant adverse impacts** associated with site operations.

No short-term impacts would occur. An Integrated Wildland Fire Management Plan would be developed based on the specific details of the Proposed Action that would incorporate BMPs, including the implementation of firebreaks, to minimize the risk of wildland fire and to control the spread of fires anticipated with new project activities. Although the risk of fire may increase due to additional training activities, implementation of the Integrated Wildland Fire Management Plan is expected to result in **long-term positive impacts**.

4.7.1.1 Vegetation

For this analysis, significant impacts to vegetation are considered to be impacts that would result in **“take” of ESA-listed threatened or endangered species, removal of special-status (Oregon state-listed) plant populations, or a substantial increased potential for infestation or spread of noxious weeds**. The Proposed Action would have short-term impacts to vegetation from construction activities and long-term, operational impacts associated with training activities and infrastructure. Because the disturbance would occur primarily in vegetation communities that are already dominated by non-native and invasive species, and because there would be no impacts to ESA-listed or Oregon state-listed plant species, impacts to vegetation would be less than significant.

4.7.1.1.1 Vegetation Communities

Impacts of construction and training activities on vegetation communities would be of a higher intensity in areas where vegetation is relatively intact and where native species predominate, such as in the Live-Fire Use Area and the northwestern corner of the Maneuver Use Area. Construction impacts on vegetation in areas where vegetation is already highly fragmented and disturbed, such as in the Cantonment Use Area, would be of a lower intensity.

4.7.1.1.2 Construction Activities

Short-term impacts to vegetation would occur as a result of site excavation, grading, and equipment operations during project construction, which would result in vegetation removal, increased dust deposition, and potential for the introduction and spread of noxious weeds. These impacts could also lead to potential changes to the composition and type of vegetation communities in CUO. The OMD would comply with NPDES construction stormwater requirements, which would include measures to minimize effects associated with construction-related vegetation removal. Localized, long-term effects to vegetation also would occur at locations where new facilities are constructed, and the existing vegetation is removed and replaced by buildings, roads, trails, and various types of proposed training and support facilities.

Construction equipment and activities would introduce additional ignition sources to CUO. Contractors would be briefed about fire danger prior to initiating work, and necessary precautions would be taken according to current fire danger levels.

Table 4.2 shows a comparison of vegetation acreages to potential disturbance resulting from the Proposed Action. As indicated in Section 3.7.1, vegetation in the CUO study area has been subject to extensive historical disturbance. Existing disturbance was approximated using the footprint of roads, buildings, and parking lots, and likely underestimates the actual value.

Table 4.2: Approximate Vegetation Disturbance Acreage by Class

Vegetation Class	Total Vegetation Class Area	Class Area remaining after Existing Disturbance	Proposed Action Disturbance	New Disturbance (Proposed minus Existing)
Cantonment Area[1]	153.9	92.5	5.9	5.5
Big sagebrush shrubland	3.1	3.0	0	0
Bitterbrush native forb shrubland	206.3	194.1	5.3	4.5
Bitterbrush non-native forb shrubland	171.6	165.2	9.1	8.9
Crested wheatgrass grassland	169.4	160.0	1.6	0.7
False goldenaster grassland	1,387.0	1,339.3	148.7	137.3
Mixed bitterbrush and rabbitbrush shrubland	1,044.6	980.1	21.9	14.9
Mixed rabbitbrush shrubland	454.6	434.4	17.4	11.9
Scurf pea grassland	2,137.0	2,065.0	102.2	87.8
Thickspike wheatgrass sand dunes	33.9	32.8	5.6	5.4
Not inventoried (Ammunition Disposal Area)[2]	1,744.0	1,687.0	42.5	32.3
Total Acreage	**7,505.4**	**7,153.4**	**360.2**	**309.1**

Notes:
1) The vegetation survey, dated 2014, used a smaller Cantonment Use Area boundary than the current boundary.
2) The Ammunition Disposal Area, including the Live-Fire Use Area, has not been inventoried for vegetation communities.

4.7.1.1.3 Site Operations

Impacts to vegetation communities would occur from the operation of CUO under the Proposed Action. The acreage of vegetation removal is discussed in Section 4.5. Vehicle and foot traffic in vegetated areas causes trampling and crushing of individual plants; and over time, these actions can result in degradation of plant communities. Vehicle and foot traffic in vegetated areas would be predominantly associated with training activities. Increased potential for wildland fire (Section 4.13) is likely to impact vegetation communities, potentially resulting in further loss of shrub and forb components, and increases in invasive annual grass species.

In the Live-Fire Use Area, disturbance associated with the Proposed Action would be limited to the 8 acres associated with adding four firing lanes to the MRF range. This area is vegetated, but it falls within the “Not Inventoried” area indicated in Table 4.2. These ranges will be adjacent to the existing range, where some erosion has occurred. In the Cantonment Use Area, approximately 46 acres of the 231-acre area would be impervious surfaces devoid of vegetation. However, this area is heavily developed and altered under existing conditions so that impacts to vegetation would be limited to 5.9 acres (Table 4.2). In the 5,000-acre Maneuver Use Area, 240 acres of new disturbance would be included under the Proposed Action. On approximately 110 of the 240 acres, impacts would primarily be associated with foot traffic from Soldiers as they travel across the area performing dismounted training activities, which would result in vegetation trampling and crushing, but not complete removal. The impacts to vegetation would be similar to dismounted maneuver activities conducted elsewhere throughout the 5,000-acre Maneuver Use Area. On the remaining 130 acres of new disturbance, vegetation removal would be permanent, resulting from construction of the ASP, new maneuver lanes, and the tracked/fighting vehicle maneuver course.

Throughout the CUO, there would be approximately 71 acres of permanent vegetation removal associated with construction and improvement of roads, trails, and firebreaks. In addition to new facilities, the Proposed Action would include demolition of many existing facilities, some of which would be revegetated. However, there would still be an overall net increase in the amount of non-vegetated surface in CUO.

An INRMP for the 7,500-acre CUO would be developed, and would include management directives and avoidance and/or minimization measures to protect vegetation (including rare plants) from impacts due to operation and maintenance activities, as well as to control the introduction and spread of noxious weeds in CUO.

There would be an increased potential for human-caused fires to be ignited by the increase in live-fire and other military training activities under the Proposed Action. Additionally, under the Proposed Action, there would be additional infrastructure that could be damaged or destroyed, and personnel that could be put at risk in the event of a fire. Potential for naturally caused wildland fires would remain the same as current conditions under the Proposed Action.

A draft Integrated Wildland Fire Management Plan has been prepared for CUO (OMD 2016a). This plan would be revised and would be used to manage wildland fire through prevention and suppression activities. The plan would include implementation of firebreaks to disrupt the travel of wildland fire through CUO. A detachment of three full-time OMD fire personnel would be stationed at CUO, and would be expanded to 9 to 12 personnel during fire season. Fire prevention and control BMPs that would likely be incorporated into the Integrated Wildland Fire Management Plan include the following:

- Develop a risk management review process and fire response coordination for proposed training events (would include standard operating procedures for when live-fire or pyrotechnics are planned).
- Employ prescribed burning, where appropriate and if conducted in a manner that does not promote colonization by exotic, invasive plants afterwards.
- Construct a fuel break network (potentially 16-foot strips plowed, mowed, or burned along some existing roads).
- Construct small, hardened or pre-burned areas designed for pyrotechnics use (e.g., open-topped 55-gallon drum emplaced in the ground surrounded by 10 feet or more of gravel).
- Provide 5-gallon water fire extinguishers to training units to be immediately available in case of fire.
- Provide awareness briefing to all incoming units.
- Review/revise hot work permitting process.
- Develop and maintain mutual aid agreements with other fire departments in the region.
- Provide additional fire equipment (brush trucks, water tender) as needed.
- Provide additional fire personnel as needed (including full-time and/or seasonal).

Implementation of these BMPs is expected to result in **long-term positive impacts** under the Proposed Action.

4.7.1.1.4 Special-Status Plants

No ESA-listed threatened, endangered, or candidate plant species or Oregon state-listed threatened or endangered plant species exist in CUO. Several thousand individuals of three Oregon rare plants (Columbia milkvetch, The Dalles milkvetch, and rush skeleton plant) are found throughout the CUO study area, and could be subject to disturbance due to construction and training activities. Impacts to individuals of these species are likely to occur with implementation of project activities; notably, the vehicle and foot traffic associated with site operations.

4.7.1.1.5 Noxious Weeds

Seeds of noxious and invasive weed species can be transported on vehicle tires and undercarriages, as well as on clothing and footwear of personnel traveling through an area. Additionally, noxious weeds and invasive species can more easily invade areas where the soil has been disturbed (i.e., through construction or heavy equipment use) due to associated changes in soil composition and chemistry. Therefore, it is likely that introduction and spread of noxious weeds would occur at the site as a result of construction activities and increased vehicular and foot traffic on roads and for training activities, particularly in the Maneuver Use Area. OMD would implement weed prevention and control measures in accordance with the updated INRMP and Integrated Pest Management Plan (IPMP), which may include biological, mechanical, and chemical control methods. Through the implementation of BMPs defined in the INRMP and IPMP, there would not be a substantial increased potential for infestation or spread of noxious weeds.

4.7.1.1.6 Impact Summary

As described above, significant impacts to vegetation are considered to be impacts that would result in "take" of ESA-listed threatened or endangered species, removal of special-status (Oregon state-listed) plant populations, or a substantial increased potential for infestation or spread of noxious weeds. Short- and long-term, less-than-significant adverse impacts would occur to vegetation. The Proposed Action would not result in significant impacts to vegetation because:

- There would be no impacts to ESA-listed or Oregon state-listed plant species;
- Disturbance would occur primarily in vegetation communities that are already dominated by non-native and invasive species; and
- OMD would implement weed prevention and control BMPs in accordance with the updated INRMP and IPMP; therefore, there would not be a substantial increased potential for infestation or spread of noxious weeds.

As described above, significant impacts to wildland fire are defined as impacts that would result in a substantial increased risk to public safety due to increased fire risk. The Proposed Action would result in **long-term positive impacts** to wildland fire because:

- Construction contractors would be briefed on the risk of wildland fire prior to initiating work; and
- CUO would be managed in accordance with an Integrated Wildland Fire Management Plan, which would include measures to prevent and minimize the risk of wildland fire and control the spread of fires (e.g., implementation of firebreaks, detachment of full-time fire personnel).

4.7.1.2 Fish and Wildlife

For this analysis, significant impacts to fish and wildlife species are considered to be impacts that would result in **incidental take of special-status wildlife species, substantial habitat loss and degradation due to construction activities and noise and/or human presence due to construction and training activities, or significant adverse impacts to migratory birds during construction and maintenance activities or site operations**. The Proposed Action would have **short-term, less-than-significant, adverse impacts** from construction activities, and **long-term, less-than-significant, adverse** operational impacts associated with vegetation removal and increased development at CUO.

4.7.1.2.1 Wildlife and Special-Status Species

Construction Activities

Short-term impacts to wildlife species would occur from the use of heavy machinery, vegetation clearing, and increased noise and human activities. Wildlife would be expected to vacate the immediate areas during construction, although some individuals of the less-mobile species (i.e., small mammals and reptiles) could be crushed or injured. Use of heavy machinery during clearing and construction activities can result in mortality to individual animals or crushing of nests or burrow sites. Human presence during construction at the site has the potential to disturb and displace wildlife species.

Site Operations

Construction of facilities under the Proposed Action would result in long-term removal of vegetation communities as described in Section 4.7.1.1.1. Removal of vegetation could eliminate habitat for wildlife species and result in displacement of individuals from an area. The introduction and spread of non-native plant species, including noxious weeds, due to ground disturbance from construction can degrade habitat for wildlife species. Degradation of habitat may eventually lead to displacement of wildlife species from an area. Human presence during training activities at the site has the potential to disturb and displace wildlife species. However, because the majority of wildlife habitats in CUO are currently highly fragmented and disturbed (i.e., dominated by non-native and invasive plant species; lack of shrub overstory components), and because wildlife in the area is likely habituated to human presence and noise associated with training activities, impacts to wildlife are likely to be minimal.

In the Live-Fire Use Area, impacts to vegetation could occur in the fire lanes, but would be limited to the area where weapons would be fired. Vegetation in the Live-Fire Use Area is a mix of native and non-native vegetation communities, and is relatively intact. Human use of this area under existing conditions has been relatively frequent, with loud noises occurring frequently due to firearms use. Therefore, wildlife in these areas may be desensitized to these types of effects.

The Cantonment Use Area would be expanded from 170 acres to 231 acres, and approximately 46 acres would be developed to be impervious, resulting in some loss of wildlife habitat in this area. In the Cantonment Use Area, development is already high, vegetation is predominantly non-native, and human presence is common. Therefore, wildlife use of this area is considered to be less frequent than the rest of CUO, and impacts to wildlife species in this area due to construction are likely to be minimal. The potential removal of landscape trees in this area could impact bird species that roost or nest in these trees; however, trees are common in the Cantonment Use Area, and loss of habitat due to the removal of select trees is anticipated to be minimal and is likely to be offset by planting new trees. Direct impacts to bird species can be avoided by restricting the timing of tree removal activities to outside the nesting season (April through August).

As mentioned above, in the Maneuver Use Area, vegetation trampling could occur from MOUT training and activity associated with the designated DZ, impacting up to 110 acres of new disturbance in addition to current operations (Table 2.1). These impacts would primarily be associated with foot traffic resulting in disturbance, but not complete removal, of vegetation. Other improvements in the Maneuver Use Area, such as the ASP, the new maneuver lanes, and the tracked/fighting vehicle maneuver course, would result in approximately 126 acres of new disturbance (Table 2.1). New impervious surfaces would be constructed in some locations, which would require vegetation removal. Existing secondary paved roads would be allowed to deteriorate into gravel roads, but would not be revegetated. Vegetation in this area is a mix of native and non-native vegetation communities, and human presence in this area has been relatively infrequent. Several wildlife species, including special-status wildlife (Appendix B), have been recorded in this area. Training activities in this area also have the potential to impact wildlife species due to human presence, noise, and vehicle movement.

An INRMP would be developed for the 7,500-acre CUO, and would include management directives and avoidance and/or minimization measures to protect special-status species from impacts due to operation and maintenance activities. Wildlife in CUO would be managed according to the revised INRMP and other DoD natural resource management guidance, objectives, and regulations, including those published in 50 CFR §21 and the 2002 DoD *Partners in Flight Strategic Plan* (DoD 2002), which presents overall objectives for the management of migratory bird species and their habitats on DoD lands.

Because the majority of the vegetation communities in the Maneuver Use Area are highly fragmented and disturbed (i.e., dominated by non-native and invasive plant species; lack of shrub overstory components), and because wildlife in the area is likely habituated to human presence and noise associated with training activities, impacts to wildlife, including special-status wildlife, are likely to be minimal and less than significant.

4.7.1.2.2 Migratory Birds

4.7.1.2.2.1 Construction and Maintenance Activities

Construction and operations activities described for wildlife and special-status species in Section 4.7.1 would be anticipated to have direct impacts on migratory birds. To minimize impacts, management measures for migratory birds would be conducted in accordance with 50 CFR §21 (Migratory Bird Permits). Ground-disturbing activities would be planned to avoid ground-nesting bird habitat as much as practicable. Ground-disturbing activities would be initiated prior to or after the nesting season (April through August) to prevent incidental take of ground-nesting birds. Artificial burrowing owl burrows would be moved to new locations, away from the planned disturbance, before or after nesting season. If necessary, vegetation removal from the construction site would occur before the nesting season to render the habitat unsuitable for nesting migratory birds and other special-status bird species, thereby avoiding the potential for the unintentional take of birds as much as possible.

4.7.1.2.2.2 Site Operations (Military Readiness Activities)

Incidental take of migratory birds during military readiness activities is authorized under 50 CFR 21.15 as long as significant adverse effects on a population are avoided. Readiness activities, such as range use and maneuver training, at CUO have the potential to injure or kill migratory birds. However, it is anticipated that any birds capable of flying would not be injured or killed during military readiness activities, including training. However, nests with eggs or chicks could be unintentionally disturbed, destroyed, or abandoned during these activities, although it is anticipated that these impacts would be rare. Nesting activity may decrease in CUO due to increased disturbance and noise. However, it is anticipated that birds would habituate to the military readiness activities over time, and that nesting would continue to occur in the area.

Project impacts on BCC species in the context of their populations in USFWS BCR 9 are used in this analysis as an indicator of project impacts on all migratory birds. Seven migratory bird species known to occur in CUO are also USFWS BCC for Region 9. These species are Brewer's sparrow (*Spizella breweri*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos)*, Lewis' woodpecker (*Melanerpes lewis*), loggerhead shrike (*Lanius ludovicianus*), sage sparrow (*Amphispiza belli*), and sage thrasher (*Oreoscoptes montanus*). Additionally, this analysis considers impacts to burrowing owl and long-billed curlew (*Numenius americanus*), two regionally important species that are known to nest at the CUO, to be indicative of impacts to all ground-nesting migratory bird species. All of these species are confirmed as occurring in the project area, and breeding of loggerhead shrike, long-billed curlew, and burrowing owl has been confirmed in grasslands at CUO (Blake 2013). Table 4.3 summarizes species occurrence at the site and population estimates for the Oregon and Washington areas of BCR 9.

Table 4.3: Migratory Bird Species Occurrence and Breeding Status at CUO

Common Name	Occurrence and Breeding Status at the Site[1]	Population estimate in BCR 9 (Oregon and Washington)[2]
Brewer's sparrow	Possible breeder in shrublands and grasslands.	1,470,000
Ferruginous hawk	Breeding not confirmed.	3,170
Golden eagle	Breeding not confirmed.	5,300
Lewis' woodpecker	Breeding not confirmed.	19,600
Loggerhead shrike	Breeding confirmed on grassland areas; possible in shrubland areas.	94,000
Long-billed curlew	Breeding confirmed in grassland areas.	15,823[3]
Sage sparrow	Breeding not confirmed.	320,000
Sage thrasher	Breeding possible in grassland areas.	880,000
Western burrowing owl	Breeding confirmed in grassland areas.	8,600

Sources:
[1] Blake 2013
[2] Based on North American Breeding Bird Survey Data obtained from the Partners in Flight Landbird Population Estimates Database (Partners in Flight 2013).
[3] This area is outside or on the periphery of species' typical breeding range. Population numbers are extrapolated based on the area of each region, and long-billed curlew data presented in Jones et al. (2008) for BCR 9.

Significant adverse effects to populations of migratory birds in the BCR in Oregon and Washington due to military readiness activities at the CUO are not likely to occur, because of the anticipated rarity of direct impacts on migratory birds and the large size of populations for most of these species in the BCR.

The Proposed Action would have less-than-significant impacts on migratory birds, given the size of the areas to be impacted, the fact that the habitat to be impacted is generally composed of non-native plant species, the abundance of migratory birds of conservation concern in the greater region, implementation of mitigation measures, and the low likelihood of incidental take during readiness exercises.

4.7.1.2.3 Impact Summary

As described above, significant impacts to vegetation resources are considered to be impacts that would result in "take" of ESA-listed threatened or endangered species, removal of special-status (Oregon state-listed) plant populations, or a substantial increased potential for infestation or spread of noxious weeds. Short- and long-term, less-than-significant adverse impacts would occur to vegetation resources. The Proposed Action would not result in significant impacts to vegetation resources because:

- Disturbance would occur primarily in vegetation communities that are already dominated by non-native and invasive species;
- Vegetation would be managed under a CUO INRMP and IPMP that would include management directives and avoidance and/or minimization measures to protect special-status species from impacts due to operation and maintenance activities.
- There would be no impacts to ESA-listed plant species; and
- There would be no impacts to Oregon state-listed plant species.

As described above, significant impacts to wildlife resources are considered to be impacts that would result in “take” of ESA-listed threatened or endangered species, or “take” of migratory birds outside of military readiness activities. Short- and long-term, less-than-significant adverse impacts would occur to wildlife resources. The Proposed Action would not result in significant impacts to wildlife resources because:

- Disturbance would occur primarily in habitats that are already degraded (i.e., dominated by non-native and invasive plant species, loss of shrub component);
- Wildlife would be managed under a CUO INRMP that would include management directives and avoidance and/or minimization measures to protect special-status species from impacts due to operation and maintenance activities.
- There would be no impacts to ESA-listed wildlife species;
- “Take” of migratory bird species would not occur outside of incidental, rare impacts due to military readiness activities; and
- “Take” of migratory bird species during construction would be prevented with scheduling restrictions and hazing prior to construction as needed.

4.7.2 Effects of the No Action Alternative

No short-term impacts would occur under the No Action Alternative. Effects of the No Action Alternative to biological resources include **long-term, less-than-significant, adverse impacts** to vegetation, fish, and wildlife resources.

4.7.2.1 Vegetation

Under the No Action Alternative, impacts to vegetation would be similar to existing conditions as described in Section 3.7.1. The 7,500-acre area would still be used by the ORARNG as a training facility; however, no new facilities would be constructed, and use levels would remain the same. Therefore, there would be no construction-related impacts to vegetation under the No Action Alternative. Activities that contribute to vegetation trampling, crushing, and removal would continue to occur from mounted and dismounted training activities. Under the No Action Alternative, the activity type and use level would be the same as existing conditions. Therefore, it is unlikely that special-status plant population would be removed or that there would be a substantial increase in noxious weed infestations under the No Action Alternative. Under the No Action Alternative, noxious weeds would continue to be managed consistent with state and county requirements, and according to the INRMP to be developed by the ORARNG. CUO would continue to follow all management prescriptions in the 2011 DoD Instruction *Natural Resources Conservation Program* (DoD 2011).

Management of wildland fire would be conducted in accordance with an Integrated Wildland Fire Management Plan. Under the No Action Alternative, ignition sources would be similar to existing conditions; however, fuel breaks would not be constructed under the No Action Alternative. Because ignition sources would be similar to existing conditions, and an Integrated Wildland Fire Management Plan would be developed, the No Action Alternative would not result in a substantial increased risk to public safety due to increased fire risk. Long-term adverse impacts would be less than significant.

4.7.2.2 Fish and Wildlife

There would be no construction-related impacts to fish and wildlife under the No Action Alternative, and operational impacts would be similar to existing conditions. Activities would continue that contribute to vegetation trampling, crushing, and removal from mounted and dismounted training activities. Incidental, although rare, direct impacts to migratory birds would continue due to military readiness activities, although these impacts would not significantly affect migratory bird populations in BCR 9. Because the activity type and use level would not change under the No Action Alternative, compared with existing conditions, the extent and intensity of damage to wildlife habitat from site activities would not change. The introduction and spread of noxious weeds, degradation of wildlife habitat, noise associated with training activities, and human presence would continue to impact wildlife species as a result of current training activities and travel through the site. CUO would continue to follow prescriptions in the INRMP and other DoD natural resource management guidance, objectives, and regulations, including those published in the 2002 DoD Partners in Flight Strategic Plan (DoD 2002) and 50 CFR §21. The No Action Alternative would not likely result in "take" of ESA-listed threatened or endangered species or migratory birds (outside of incidental, rare impacts during military readiness activities) or substantial decrease in wildlife habitat; therefore, long-term adverse impacts would be less than significant.

4.7.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.8 Cultural Resources

For this analysis, significant impacts to cultural resources are considered to be impacts that would result in **a loss of integrity as required for NRHP eligibility, unless mitigated to less than significant through completion of the Section 106 process under the NHPA**. Less–than-significant impacts would result in no detectable changes in integrity, and medium impacts would result in measureable impacts to integrity, but impacts that are not sufficient to affect NRHP eligibility.

4.8.1 Effects of the Proposed Action

Long-term, significant adverse impacts could occur due to the Proposed Action; however, these effects would be mitigated to **less than significant**. Cultural resources that have been determined eligible or are potentially eligible/unevaluated for the NRHP exist in the CUO, and are subject to project effects. These include a segment of wagon road (35UM497), 563 buildings and structures of the UCD Historic District that fall within the CUO, and the Coyote Coulee PTRCS identified by the CTUIR (Table 4.4).

A portion of the linear ca. 1875 Umatilla Cutoff wagon road (35UM497) alignment falls along the southern boundary, and was determined NRHP-eligible by BRAC, in consultation with the Oregon SHPO, as a pioneer transportation route. Effects to the NRHP-eligible site may include modification, or partial or complete obliteration, as a result of the CUO project and military training in the area.

A total of 563 buildings and structures that were once part of the Umatilla Chemical Depot is inside the boundaries of CUO, and may either be modified or demolished as part of the CUO Expansion and Development Project (PA 2017). These were determined by BRAC, in consultation with the Oregon

SHPO, to be NRHP-eligible as contributing properties to the UCD Historic District under criterion A for their association with the WWII-era ammunition storage and Cold War-era Chemical Weapons work.

The CTUIR identified one PTRCS in the CUO study area. Project effects to the Coyote Coulee PTRCS could include potential adverse effects due to minimization of access to the area by tribal members. These impacts would be resolved through implementation of the PA. Pursuant to the PA, ORARNG has agreed to limit off-road vehicular traffic or new construction in the PTRCS site. ORARNG will consult with the CTUIR to develop a protocol allowing tribal member access during certain times of the year to carry out cultural practices.

Effects of the Proposed Action would be significant (or adverse) to the NRHP-eligible historic properties listed in Table 4.4. The project would demolish or alter aspects of these resources that make them eligible for the NRHP. Consistent with 36 CFR 800, ORARNG consulted with SHPO, the Advisory Council of Historic Preservation (ACHP), and federally recognized Tribes on the Proposed Action to develop a PA. The PA was drafted to resolve adverse effects from the Proposed Action. For the purposes of NEPA, the mitigation measures outlined in the PA (Appendix C) and in Section 4.8.3 would reduce impacts to a less-than-significant level.

Table 4.4: Historic Properties in the CUO Study Area and Mitigation Measures

Resource No.	Site Class	Site Type	National Register of Historic Places Status	Attributes	PA Stipulation
N/A	Historic	District	Eligible	UCD Historic District (563 buildings and structures)	-Designate a representative historic district -Develop a historic district manual
35UM497	Historic	Linear	Eligible	1875 GLO Wagon Road Umatilla Cutoff	-Photographic inventory and site form update - Light Intensity Distance and Ranging study
N/A	Multi	PTRCS	Potentially Eligible	Coyote Coulee (Geographic Feature that Crosses the CUO)	-Limit traffic and construction -Allow tribal member access

Tribal consultation was initiated with the CTUIR, Confederated Tribes of the Warm Springs Reservation of Oregon, and the Legislative Commission on Indian Services by letter dated August 12, 2016. The CTUIR chose to consult; however, they did not choose to be a signatory to the PA. ORARNG staff met with CTUIR staff at the Tribal headquarters on four separate occasions; October 2016, April 2017, May 2017, and July 2017.

In addition to these documented resources, as yet unidentified archaeological sites and isolated finds would also be expected to be impacted by the Proposed Action. A total of 4,211 acres remain to be surveyed or re-surveyed prior to ground-disturbing activities. However, based on prior cultural surveys of 640 acres in the CUO and on survey and subsurface testing across 3,500 acres of adjacent UCD land, site density of non-surveyed lands in the CUO would be expected to be low, and include isolated historic and prehistoric artifacts or small sites, with the majority historic in affiliation and disturbed by prior military use (e.g., Cooper and Scott 2016; Stegner et al. 2015). Inadvertent discoveries of cultural resources or human skeletal remains, although not known to be present, could also occur as a result of ground-disturbing activities. Such discoveries would be addressed according to Standard Operating Procedures included in the ORARNG state-wide ICRMP, which would be revised to include CUO.

4.8.2 Effects of the No Action Alternative

Under the No Action Alternative, impacts to cultural resources would be similar to existing conditions, as described in Section 3.8.2. The 7,500-acre area would still be used by the ORARNG/OMD as a training facility; however, no new facilities would be constructed, and use levels would remain the same. Therefore, there would be no construction-related impacts to cultural resources under the No Action Alternative. Continued military training activities could minimally impact as-yet unidentified archaeological sites and isolated finds, and continued use may contribute to inadvertent discoveries. Most NRHP-eligible buildings and structures in the CUO would be maintained as they are currently for the foreseeable future in accordance with the existing ICRMP (Pumphrey 2002); therefore, buildings and structures in the historic district would not be adversely affected by the No Action Alternative. Under the No Action Alternative, cultural resources would continue to be managed consistent with federal and state requirements and according to the 2013 PA and ICRMP developed for Department of the Army (Pumphrey 2002). In addition, tribal consultation would continue to occur as outlined in the ICRMP procedures. Impacts to cultural resources under the No Action Alternative would be **long-term, less-than-significant, and adverse**.

4.8.3 Mitigation Measures

Mitigation of adverse effects is provided in the PA (2018) (Table 4.4). Because of the impacts to significant cultural resources, the CUO Expansion and Development Project would be required to:

- Designate a representative historic district in a 15.5-acre area in the central cantonment and an 8-acre area of igloos, and maintain this historic district for the foreseeable future, maintaining the integrity of those historic buildings and structures. Those buildings and structures outside the designated historic district may be demolished, modified, or otherwise altered without further consultation.
- Develop a historic district management manual for the newly designated representative district.
- Protect the PTRCS site identified by the CTUIR as though it is eligible for the NRHP by limiting off-road vehicular traffic or new construction in the PTRCS site, and by consulting with the CTUIR to develop a protocol allowing tribal member access during certain times of the year to carry out cultural practices.
- Complete additional archaeological surveys in previously undisturbed areas prior to any CUO Expansion and Development ground-disturbing actions in that area.
- Photo-document the wagon road (35UM497) and update the site form. Complete a Light Intensity Distance and Ranging study to better document its track across the CUO.

The ACHP, Oregon SHPO, NGB, and ORARNG executed a PA in 2018. The project would also adhere to the existing ICRMP and inadvertent discovery protocol already in place for the facility until such time as the ORARNG's statewide ICRMP can be updated to include CUO.

4.9 Socioeconomics

For this analysis, significant impacts to socioeconomics are considered to be impacts that would result in a **substantial net loss of sales volume, employment, income, and population** due to proposed activities.

4.9.1 Effects of the Proposed Action

Effects of the Proposed Action include short-term effects associated with construction activities and long-term effects associated with site operations. As described below, because the Proposed Action would not result in a substantial net loss of sales volume, employment, income, and population due to proposed activities, **short- and long-term positive impacts** to socioeconomics would occur.

4.9.1.1 Construction Activities

Implementation of the Proposed Action would require a construction work force of an anticipated 20 to 60 full-time employees at any one time. Construction workers would likely be a mix of local work forces and seasonal relocated workers from the greater northwest Region (Oregon, Washington, Idaho, and northern Montana). Housing pressures due to the short-term increase in demand from the construction workforce are likely to be minimal. Economic activity associated with increases in local and non-local employment and spending in the two-county region during the short-term construction timeframe would provide short-term benefits to the local economy. However, beneficial socioeconomic impacts during construction would likely be negligible on a regional scale.

4.9.1.2 Site Operations

CUO currently averages a throughput of all combined personnel of approximately 22,000 man-days a year, and implementation of the Proposed Action would increase average man-days to between 40,000 and 50,000 a year. The number of full-time training site staff is anticipated to be 40 individuals at the outset of operations, increasing to a maximum of 122 individuals at the height of operations. The number of transient personnel is anticipated to be 476 at the outset, with surges of up to 1,240 individuals. An increase in the number of full-time employed personnel, transient personnel, and man-days at CUO would have a beneficial effect on the local economy due to a possible increase in spending by military personnel employed and temporarily present for training at CUO, as well as an increase in the tax base of the area. These impacts, while beneficial, would be negligible at the county level. The increased number of full-time employees would live in the surrounding two-county area; however, the impacts on local housing availability are anticipated to be minimal in context of the already-anticipated growth occurring in these areas. Therefore, there would be no long-term effects to housing associated with operations under this alternative.

4.9.1.3 Impact Summary

As described above, significant impacts to socioeconomics are considered to be impacts that would result in a substantial net loss of sales volume, employment, income, and population due to proposed activities. There would be short- and long-term positive impacts due to increased economic activity associated with construction and operation activities. The Proposed Action would not result in adverse socioeconomic impacts because:

- Housing pressures due to temporary increase in construction workforce would be minimal;

- Economic activity associated with increases in local and non-local employment and spending in the two-county region during the short-term construction timeframe would likely be regionally negligible; and
- There would be no long-term effects to local spending, tax base, or housing due to anticipated increase in operations personnel at CUO.

4.9.2 Effects of the No Action Alternative

Under the No Action Alternative, existing employment levels and Soldier man-days would continue, and extensive additional construction would not be anticipated. Economic activity associated with current uses of CUO would continue. Therefore, the No Action Alternative would have **no impact** to socioeconomics.

4.9.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.10 Environmental Justice

For this analysis, significant impacts to environmental justice are considered to be impacts that would **disproportionately impact minorities, low-income groups or individuals, or children**.

4.10.1 Effects of the Proposed Action

No significant adverse impacts to air quality, noise, hazardous materials, water resources, or socioeconomics have been identified as a result of the Proposed Action. Therefore, the Proposed Action would not cause disproportionately adverse environmental, economic, or health impacts specific to any minorities, low-income groups or individuals, or children at CUO or in Morrow or Umatilla Counties. **No impact** under this alternative.

4.10.1.1 Impact Summary

The Proposed Action would not result in significant short- or long-term adverse impacts to minority or low-income populations because:

- No significant adverse impacts to air quality, noise, hazardous materials, water resources, or socioeconomics have been identified as a result of the Proposed Action, and therefore, there would be no disproportionate impacts on minorities, low-income groups or individuals, or children.

4.10.2 Effects of the No Action Alternative

As described in previous sections of this chapter, impacts associated with the No Action Alternative would be similar to existing conditions. Therefore, there would be no disproportionately adverse effects on minority or low-income populations, and **no impact** would occur under this alternative.

4.10.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.11 Infrastructure

For this analysis, significant impacts to infrastructure are assumed to occur if there is **insufficient local capacity to accommodate the alternative under evaluation**. As described below, impacts to infrastructure would be **long-term and positive**.

4.11.1 Effects of the Proposed Action

For this analysis, potential effects to the potable water system, wastewater system, electrical system, and transportation network were analyzed. The Proposed Action includes upgrades to each of these systems, not necessarily due to a lack of capacity, but rather due to age and condition of each system. These upgrades would result in a **long-term positive impact.**

4.11.1.1 Potable Water System

Effects of the Proposed Action on the potable water system include short-term effects associated with construction activities and long-term effects associated with site operations.

4.11.1.1.1 Construction Activities

Under the Proposed Action, there would be short-term increases in water demand as construction activities occur. Construction-related water demand would occur as shown in the implementation schedule in Table 2.1. Water needed for construction would primarily be sourced from groundwater wells at CUO. Water use levels and type would be consistent with the Army's allocated water rights.

4.11.1.1.2 Site Operations

Under the Proposed Action, water demand would increase as a result of increased site operations and use of CUO. It is estimated that the maximum daily water demand under the Proposed Action would be 604 gpm, and the peak hour demand would be 905 gpm on full build-out of the Proposed Action (Kennedy/Jenks Consultants 2014).

For the first several years of the Proposed Action, potable water would continue to be supplied to CUO through existing wells and distribution systems. This would require a temporary easement for the use of Wells 4 and 5. The Proposed Action would construct a new water line and pump that would convey water from Wells 6 and 7 south, and connect to an existing water line near the southern boundary of CUO; and then to the Cantonment Use Area, where the majority of water usage would occur. An existing elevated tank near Well 6 would be used for water storage for CUO, and a new 400,000-gallon surface tank would be constructed in the Cantonment Use Area. New distribution lines would also be constructed in the Cantonment Use Area. Existing water rights provide sufficient water supply to satisfy the water demand under the Proposed Action (Kennedy/Jenks Consultants 2014).

4.11.1.2 Wastewater System

Effects of the Proposed Action on the wastewater system include short-term effects associated with construction activities and long-term effects associated with site operations.

4.11.1.2.1 Construction Activities

Temporary sanitation facilities would be used to handle additional sanitary waste generated during construction activities. The existing wastewater system would be kept online until the new wastewater system is constructed; therefore, there would be no construction-related impacts to the wastewater system.

4.11.1.2.2 Site Operations

There would be an estimated wastewater flow of 55 gallons per capita per day (gpcpd) for full-time staff and 35 gpcpd for transient personnel, resulting in an estimated maximum wastewater generation of up to 6,710 gpd for full-time staff and 21,700 gpd for transient staff at average occupancy, and 43,400 gpd for transient staff at maximum occupancy (Kennedy/Jenks Consultants 2016). For the first several years of the Proposed Action, the small Imhoff tank would continue to be used to manage wastewater generated from the Cantonment Use Area. Repairs to the tank and drain field have been completed to handle the anticipated short-term capacity of 2,480 gpd. Because the existing wastewater facility was determined to be unsuitable for continued extended service (Kennedy/Jenks 2017), a new wastewater facility would be constructed. The new facility would use a denitrification process for treating wastewater generated from the Cantonment Use Area. Portable toilets would be brought in as necessary to accommodate additional sanitation needs during high-capacity training events. The wastewater system would be designed and constructed to handle the maximum flow expected at CUO. The OMD would obtain a WPCF permit for the wastewater facility from DEQ, and treated wastewater would be discharge in accordance with the permit.

The OMD has adopted a Net Zero goal with respect to water consumption at CUO. To meet this goal, the new wastewater treatment facility would convey treated effluent to a recycled water application, such as irrigation, vehicle wash water, and non-potable plumbing fixtures when possible (Kennedy Jenks 2017).

4.11.1.3 Electrical System

Effects of the Proposed Action on the electrical system include short-term effects associated with construction activities and long-term effects associated with site operations.

4.11.1.3.1 Construction Activities

Additional power would be required during construction for operation of construction equipment. Power required for construction beyond what is available at CUO would be supplied by construction contractors so that CUO would maintain sufficient capacity to operate while construction activities are taking place.

4.11.1.3.2 Site Operations

The primary power feed would be from the southern UEC substation, the UEC Chemical Substation, or UEC's Irrigon distribution system, near the northeastern corner of the CUO boundary. All three potential power feeds have the capacity to supply the full power need without adversely impacting local power needs. Long-term, the existing electrical system would require upgrades from its current substandard condition to provide system redundancy to maximize power availability and provide sufficient power to meet the projected need (Dana Engineering, Inc. 2014).

4.11.1.4 Communication System

Under the Proposed Action, the communication system would be maintained in working order at all times during construction and operation of the site. There would be no impacts to communications systems under the Proposed Action.

4.11.1.5 Transportation Network

Effects of the Proposed Action on the transportation network include **short-term impacts** associated with construction activities and **long-term positive impacts** associated with site operations.

4.11.1.5.1 Construction Activities

A short-term increase in traffic associated with construction of the Proposed Action would occur, including delivery of construction materials and equipment, and construction workers traveling to and from the work site. These increases in traffic would occur intermittently over the course of the next 5 years as construction projects occur. These intermittent construction-related traffic increases would not exceed the capacity of the transportation network that serves CUO.

4.11.1.5.2 Site Operations

Under the Proposed Action, use of vehicles and the transportation network would increase, including vehicle and equipment movement in CUO, as well as Soldiers and staff traveling to and from CUO. This additional traffic is not expected to generate a substantial amount of new trips in the area (Kittelson and Associates, Inc. 2014a). I-84 and I-82 provide access to CUO; both of these interstates have high capacity and would not be affected by the additional traffic expected to be generated as a result of the Proposed Action. Within the CUO boundary, a perimeter road would be constructed in areas where one currently does not exist to improve site security. There would be approximately 5 miles of new roads and 17.8 miles of new trails throughout CUO under the Proposed Action. These new and upgraded transportation systems would accommodate the increased number of personnel and training activities that would result under the Proposed Action. Transportation of all Army convoys from home station (armories) or other locations to CUO and back would comply with the Defense Transportation Agency DTR 4500.9-R Defense Transportation Regulations Part III, Mobility (specifically, Appendix F-Military Movement on Public Roads; DOD 2016).

4.11.1.5.3 Impact Summary

As described above, significant impacts to infrastructure are assumed to occur if there is insufficient capacity to accommodate the alternative under evaluation. The Proposed Action would result in **short- and long-term positive** impacts to infrastructure because:

- Proposed expansion of the existing potable water system would provide sufficient capacity for the anticipated long-term water demand;
- Existing wastewater facilities would manage anticipated short-term increases in capacity; the proposed new wastewater facility would be designed and constructed to handle maximum anticipated flow at CUO, and be constructed under IAW federal, state, and local regulations;
- Initial power feed would be relocated using power from UEC; in the long-term, the existing electrical system capacity would be upgraded in phases to provide system redundancy;
- There would be no impacts to the existing communication system; and
- Construction- and operations-related traffic increases would not exceed the capacity of the transportation network currently serving CUO; new and upgraded roads and trails throughout CUO would accommodate increased number of personnel and training activities resulting from the Proposed Action.

4.11.2 Effects of the No Action Alternative

Under the No Action Alternative, there would be no major expansion of regular military training activities; therefore, impacts would be **less than significant**. Improvements would be made to the potable water system and wastewater system to accommodate existing uses at CUO.

4.11.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.12 Hazardous and Toxic Materials/Wastes

For this analysis, impacts that result in a **substantial increase in the generation of HTMW, exposure of persons to HTMW, or presence of HTMW in the environment, or that place restrictions on property use in or adjacent to the project area due to HTMW are considered significant**.

4.12.1 Effects of the Proposed Action

Under the Proposed Action, **less-than-significant** short-term and long-term impacts related to HTMW would occur. Implementation of the Proposed Action would not substantially affect the ORARNG's hazardous materials storage and handling procedures, hazardous waste disposal processes, or spill prevention practices.

4.12.1.1 Construction Activities

Anticipated increases in generation of HTMW during construction would result from additional vehicle and equipment use, construction/renovation of training facilities, and infrastructure improvements. These activities would result in increased use of operating fluids and maintenance materials. However, spill prevention and response practices would be followed during construction as part of NPDES construction stormwater permitting requirements to avoid and minimize release of hazardous and non-hazardous materials to the environment during construction. During construction activities, hazardous building materials and waste identified in the ECOP/EBS Report (AMEC 2012) would be surveyed and abated/remediated. These materials currently pose a potential risk to human receptors and the environment; therefore, the Proposed Action would result in long-term beneficial impacts due to the removal of the hazardous building materials and universal waste.

CUO has and is currently undergoing remediation and clean-up activities in response to past site uses as a chemical depot. Those remediation activities are not associated with the Proposed Action analyzed in this EA.

4.12.1.2 Site Operations

Long-term impacts associated with training activities at CUO would produce increases in handling, storage, use, transportation, and disposal of HTMW. The largest generation of hazardous waste would result from the increased firing of ammunition, which could result in elevated lead levels in the Live-Fire Use Area.

The ORARNG is a RCRA CESQG for CUO and submits an annual Toxics Release Inventory and Oregon State Fire Marshal Hazardous Substance Information System report for reportable quantities of hazardous materials stored or used at CUO. The storage and management of HTMW would continue to be performed in accordance with the ORARNG's HMWSMP, and SPCC and ISC Plans, which would be updated to include the expanded activities under the Proposed Action. These management plans provide BMPs to prevent or minimize the migration of contaminants from HTMW areas. The OMD would also implement sustainable-range BMPs to maintain and improve the environmental condition of the operational ranges. BMPs commonly focus on measures to maintain vegetation on range floors and post-target impact areas to reduce soil erosion.

Long-term beneficial impacts would result from management of ACM, including abatement, in existing buildings where ACM was previously identified (AMEC 2012). ACM would be managed in accordance with federal and state regulations to prevent human health exposure during demolition and construction activities. Pre-construction ACM surveys would be conducted prior to disturbance. Identified ACM would be abated prior to demolition and disposed of properly to avoid potential release to the environment.

Therefore, impacts associated with the generation, transport, use, and storage of hazardous materials and wastes are expected to be **less than significant**.

4.12.1.3 Impact Summary

As described above, significant impacts related to HTMW are considered to be impacts that would result in a substantial increase in the generation of HTMW, exposure of persons to HTMW, or presence of HTMW in the environment; or that place restrictions on property use in or adjacent to the project area due to HTMW. The Proposed Action would result in **less–than-significant** impacts related to HTMW because:

- The amount of HTMW generated or stored at CUO would not be significantly increased;
- HTMW would be managed in accordance with federal, state, and local requirements, including ORARNG requirements, to avoid exposure of persons to HTMW or release of HTMW to the environment;
- The Proposed Action would not result in restrictions on property use due to HTMW; and
- Existing HTMW in buildings would be abated as part of the Proposed Action.

4.12.2 Effects of the No Action Alternative

Implementation of the No Action Alternative would have no effects with respect to HTMW used or generated at CUO. HTMW, universal waste, and/or ACM abatement/mitigation would occur as needed. Impacts would be **less than significant**.

4.12.3 Mitigation Measures

No mitigation measures are necessary to reduce any adverse environmental impacts to below significant levels.

4.13 Mitigation Measures

Mitigation measures are project-specific and unique to the specific action under evaluation. For the Proposed Action, mitigation measures are required for adverse effects to cultural resources. These mitigation measures are described in Section 4.8, Table 4.4, and are the subject of the PA found in Appendix C.

ORARNG routinely implements BMPs as standard “business practices” for any project, including compliance with regulatory requirements (e.g., NPDES permitting requirements) and the requirements of environmental management plans (e.g., timing construction to avoid sensitive species from the INRMP, limiting noise-producing activities from the SONMP). These BMPs would be implemented as part of the Proposed Action to minimize environmental impacts, and are described Section 2.2.5 and in the following management plans.

- Hazardous Material, Waste, and Spill Management Plan

The HMWSMP prescribes responsibilities, policies, and procedures for storing and managing hazardous materials, accumulating and managing wastes, and responding to spills of hazardous materials and wastes in the ORARNG. The HMWSMP was completed in accordance with AR 200-1 to ensure ORARNG compliance with applicable federal, state, and local environmental laws and regulations.

- Integrated Natural Resource Management Plan

In accordance with the requirements of the Sikes Act, as amended, the ORARNG and OMD would prepare an INRMP for CUO. The INRMP would include management actions that would focus on sustaining natural resource conditions to provide natural environmental conditions for military training activities.

- Integrated Training Area Management Program

The ITAM Program is a management program that integrates Army training and other mission requirements for land use and sound natural resource management on maneuver lands. Program activities could include management actions such as marking cultural or environmentally sensitive areas for avoidance, and actions to prevent or repair damage resulting from vehicle maneuver training.

- Integrated Cultural Resource Management Plan

In accordance with Army requirements, the ORARNG and OMD would revise the existing state-wide ICRMP to include CUO. The ICRMP would be completed in accordance with AR 200-1 and ARNG Guidance to ensure ORARNG compliance with applicable federal and state cultural resources management laws.

- Integrated Wildland Fire Management Plan

The IWFMP is currently in the process of being developed. The IWFMP would describe policies and actions to reduce fire ignitions, the potential for fire to spread, and fire response times; and outline other relevant fire prevention and response strategies.

- Spill Prevention, Control, and Countermeasures Plan

An SPCC Plan would be completed for CUO. The SPCC Plan identifies potential spill sites, and provides a framework for ensuring that the CUO has the resources, structures, and equipment in place to prevent, control, and respond to oil or hazardous substance spills. The SPCC Plan would be completed in accordance with the Oil Pollution Prevention regulations at 40 CFR 112 and AR 200-1. The SPCC Plan is reviewed annually to determine if possible changes in the physical structures or operational procedures have occurred, or if more effective prevention and control technologies are available.

- State Operational Noise Management Plan

The SONMP provides a strategy for noise management at ORANRG facilities. Elements of the SONMP include education about noise and Army noise metrics; complaint management; and when necessary, noise abatement procedures (ORARNG 2010). OMD would revise the Statewide Noise Plan as funding becomes available.

- Construction BMPs

Construction BMPs would be implemented to control dust, avoid and minimize erosion and sediment migration, avoid the take of migratory birds during nesting season, and prevent release of toxic or hazardous chemicals to the environment. BMPs could include dust abatement, Regulated Building Materials surveys and abatement, mulching, storm sewer inlet protection, and water run-on and run-off controls.

4.14 Cumulative Effects

4.14.1 Introduction

This section discusses the relevant anticipated cumulative effects of the Proposed Action on those resources affected when considering other actions in the area. The CEQ defines cumulative effects as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. A cumulative impact results from the additive effect of all projects in a common geographical area.

Because of the number of past, present, and reasonably foreseeable future actions on CUO, cumulative effects are the most difficult to analyze. NEPA requires the analysis of cumulative environmental effects of a Proposed Action on resources that may often be manifested only at the cumulative level, such as traffic congestion, air quality, noise, biological resources, cultural resources, socioeconomic conditions, and utility system capacities. The primary factor that has influenced the CUO study area is the former UCD, which—as described in Chapters 1, 2, and 3—has resulted in extensive disturbance of soils, vegetation, and habitat, as well as environmental contamination, throughout many areas of the CUO. Agricultural land uses surround much of the former UCD to the extent that native vegetation and habitat are generally lacking in the immediate vicinity of CUO. Wildland fires have also influenced the landscape, resulting in the proliferation of cheatgrass and decline of sagebrush in the former UCD.

Past, present, and reasonably foreseeable actions in the immediate vicinity of CUO include the following.

- **BRAC Land Use Realignment Process**

As discussed in Chapter 1, the Army closed the UCD as an active military installation on August 1, 2012, and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 BRAC process. Approximately 7,500 acres of the property were transferred to ORARNG. The remaining 9,555 acres will be transferred to a number of local government entities to be developed for commercial and industrial uses, with approximately 5,700 acres to be conserved as wildlife habitat. The CDA estimated that full redevelopment of the former UCD would generate approximately 4,249 new positions for the region, $285 million in direct and indirect payroll benefits, and $3.6 million in property taxes to support community services. However, these beneficial economic impacts could take decades to be realized (CDA 2016).

- **Additional CUO Improvements**

Several activities that were considered for inclusion with the Proposed Action of this EA were removed because they are not currently validated or funded projects; however, they may still occur in the reasonably foreseeable future. These actions are as follows.

  - Construct permanent field latrine facilities at live-fire range complex.
  - Construct a Light Demolition Range (within existing range SDZ area).
  - Construct TCPC in the SDZ area for Heavy (off-road) maneuver.
  - Construct Unit Training Equipment Site.
  - Construct Centralized Vehicle Wash Facility (with soaking capability).
  - Construct 400-person dining facility.
  - Construct a multi-story RTI "schoolhouse" consisting of the RTI Headquarters/administrative area, educational or general instruction building area, and student/cadre barracks.
  - Construct two Enlisted Barracks (2 story, 168 person each).
  - Construct multi-story Readiness Center of approximately 28,000 to 44,000 square feet with privately owned vehicle parking.
  - Construct Centralized Heat Plant (biomass) or replace individual building heat sources.
  - Demolish unneeded buildings and structures.
  - Construct a Leadership Reaction Course.
  - Construct a Structural Collapse Venue Site with nearby staging area.
  - Designate Engineer Medium-/Heavy-Equipment Training Area.
  - Construct multi-use sports field with running track.
  - Construct two tactical training bases: one improved and the other unimproved.
  - Designate one aviation Forward Area Refueling Point site.
  - Continue use of existing Land Navigation Course.
  - Construct a Chemical, Biological, Radiological, Nuclear, and Explosive Training Chamber; either as a new building, or possibly by re-using an existing igloo.
  - Construct 60-foot rappel tower to support Air Assault School training.
  - Construct Confidence Course.
  - Construct range operations and range maintenance facilities.
  - Repair or construct road or railroad facilities for OMD military equipment, arriving or departing CUO via either road or rail, and storage of equipment.
  - Construct a solar energy array to provide clean energy for use by CUO.
  - Repair/replace Electrical System as needed.
  - Repair/replace Telecommunication System as needed.
  - Repair/replace Rail Network.

- **Interchange Plans**

To support the reuse and redevelopment of the former UCD and the associated changes to traffic and access, interchange improvements have been identified for three highway interchanges near the former UCD:

  - I-82 and Lamb Road: Improvements would enhance roadway connectivity in the former UCD site that would provide public roadway connections between the I-84/Army Depot Access Road and I-82/Lamb Road interchanges (Kittelson and Associates 2014b).

  - I-84/Army Depot Access Road: Improvements would enhance roadway connectivity in the former UCD site that would provide public roadway connections between the I-84/Army Depot Access Road and I-82/Lamb Road interchanges (Kittelson and Associates 2014a).
  - I-84/Paterson Road: Improvements would enhance roadway connectivity in the former UCD site that would provide public roadway connections between the I-84/Paterson Ferry Road, I-84/Army Depot Access Road, and I-82/Lamb Road interchanges (Kittelson and Associates 2014c).

- **Boardman to Hemingway (B2H) Transmission Project**

The B2H project proposes to construct and operate a new 500-kilovolt electrical transmission line that would run from Boardman, Oregon, to the Hemingway substation near Melba, Idaho. The project is proposed by Idaho Power, PacifiCorp, and the Bonneville Power Administration; and would provide additional capacity for exchanging energy between the Pacific Northwest and the Intermountain West. The BLM is currently analyzing public comments received on the Draft EIS, and preparing for the Final EIS. Idaho Power estimates that the in-service date for the B2H project would be in 2022 or later (B2H 2016). The B2H project is approximately 5.5 miles due west of CUO at its closest point.

- **Naval Weapons System Training Facility Boardman**

The U.S. Navy, in cooperation with the NGB and the ORARNG, is proposing several actions to ensure that critical training and testing requirements are met, and NWSTF Boardman continues serving as a vital training resource. NWSTF Boardman is approximately 6 miles southwest of CUO at its closest point. These actions include the following (U.S. Navy 2016):

  - Maintain baseline training and testing activities at current levels.
  - Increase certain training activities from current levels to support the Navy and ORARNG requirements.
  - Develop appropriate ranges and facilities, as necessary, to support training requirements.
  - Accommodate mission requirements associated with force structure changes and introduction of new weapons systems for training.
  - Implement range enhancements.

- **Road Maintenance and Repairs**

There are no projects currently listed on the Oregon Department of Transportation or county websites for roadway repairs that would overlap in time or geography with the Proposed Action (ODOT 2016). However, it is likely that minor road construction and repair projects may occur during the 10-year timeframe of this EA in the vicinity of CUO.

- **Lost Valley Ranch (formerly Willow Creek Dairy)**

Lost Valley Ranch (formerly Willow Creek Dairy) is a concentrated animal feeding operation (CAFO), defined by the U.S. Department of Agriculture (USDA) as an animal feeding operation that has over 1,000 animals confined for more than 45 days per year. Lost Valley Ranch began operations in spring of 2017. Lost Valley Ranch is approved to house 30,000 animals, with 16,500 animals expected to be housed during the first year of operation. The size of the herd would be increased over the course of 3 years, until the maximum is reached (DEQ 2018). This dairy would be the second large-scale CAFO in Eastern Oregon, and would generate an estimated 187 million gallons of liquid manure per year. The purchase of the approximately 7,000 acres of land needed for the dairy included the transfer of water rights, and the dairy is anticipated to use 325 million gallons of water per year (Loew 2016). The proposed Willow Creek Dairy is approximately 5.5 miles southwest of CUO in Boardman, Oregon.

In March 2017, Lost Creek Ranch received an approved NPDES permit through the ODA and DEQ that specifies surface and groundwater protection measures required during operations. Protection measures include prohibition of discharge to surface water, containment of waste in a lined detention feature, and installation of 11 groundwater wells to establish a long-term groundwater monitoring program. The protection measures were designed to lead to improvements in the Lower Umatilla Ground Water Management Area aquifer over time, and will be measured through the ongoing groundwater monitoring program (DEQ 2018). The ODA and DEQ determined that the proper implementation of the protective measures specified in the permit would result in no cumulative impact on water quality.

The ODA and DEQ coordinated with the OWRD during the permit approval process to ensure the amount of water necessary for operation of the Lost Creek Ranch facility is legally available. Groundwater use was determined to remain consistent with pre-operation levels because Lost Valley Ranch was transferring existing surface water rights to another landowner in exchange for groundwater rights. Lost Valley Ranch has an agreement to purchase drinking and process water from the Port of Morrow if additional water is needed.

Air quality was not addressed during the ODA and DEQ permit review process; however, the DEQ determined the protective measures and BMPs specified in the Lost Valley Ranch's operational plan would mitigate air emissions from dairy operations (DEQ 2018).

4.14.2 Cumulative Effects within the Area

Overall, CUO is in an area that is predominantly agricultural/grazing. The two-county area experienced population growth of 7.7 percent from 2000-2014, representing a lower growth rate than the national average of 11.6 percent. The 2008 economic downturn slowed growth in the area; however, growth has continued steadily, but slowly, over the last decade.

This slow, steady growth has increased traffic congestion, air quality impacts, and other environmental effects, placing some increased demands on services, utilities, and infrastructure; and consuming former open-space areas with new development. Development of former open space has resulted in associated natural and cultural resources impacts, and the conversion of prime and unique farmlands.

4.14.3 Cumulative Effects of the Proposed Action

The Preferred Action Alternative would result in the impacts identified throughout **Section 5**. These include potential less-than-significant adverse impacts to land use, air quality, the noise environment, soils, water resources, biological resources, socioeconomic, infrastructure, and HTMW. These impacts would be further reduced through implementation of standard ORARNG BMPs, as identified throughout **Section 5**. Potential significant cultural resources impacts are identified, but are mitigable to less-than-significant levels; mitigation measures are summarized in **Section 4.8.3**. No adverse impacts to environmental justice are anticipated.

Implementation of the Preferred Action Alternative is not expected to cumulatively significantly adversely impact any technical area discussed in this EA. Cumulative net positive impacts to the local socioeconomic environment and infrastructure could be realized. The Proposed Action would not noticeably contribute to the ongoing regional decline in natural or cultural resources, because impacts to such resources would be mitigated to acceptable levels, or standard BMPs would be used to reduce impacts. In terms of air quality and traffic, the Proposed Action would not significantly cumulatively increase regional impacts; the action primarily involves staff and activities currently present in the area, and would relocate operational traffic (and associated air emissions) to different locations in the area; full-time staffing increases would be negligible to the region. The Preferred Action Alternative would maintain or enhance the local socioeconomic environment through providing short-term construction jobs and long-term benefits through increased training use of the site, with consequent increases in local spending.

Although positive cumulative impacts to the socioeconomic environment are anticipated, the Proposed Action would likely produce localized, less-than-significant adverse impacts to the human environment through less-than-significant potential increases in local area traffic (i.e., during training events), associated air quality emissions, and noise. As noted above, this does not represent a regional cumulative impact.

Under the No Action Alternative, the ORARNG would not construct the Proposed Action and would continue with operations as currently conducted across CUO. The CUO would remain as is under current conditions, and continue to operate under current, effective environmental management plans. Under the No Action Alternative, less-than-significant short- and long-term cumulative impacts would be anticipated; however, short- and long-term positive impacts to the socioeconomic environment from new construction jobs or increased training use benefits would not be realized.

4.14.4 Inter-relationship of Cumulative Effects

The environment on and surrounding CUO is slowly changing due to ongoing development, producing environmental effects. The ORARNG's Preferred Action Alternative is to expand operations at CUO, including several infrastructure development projects; this would produce environmental effects. In the surrounding area and region, a need for land to accommodate the area's increasing population and economic development, including additional agricultural and industrial uses, businesses, homes, and related services and infrastructure, would produce environmental effects. These two factors are interrelated in two ways:

> (1) One of the missions of the ORARNG is to service the emergency needs of the people of the State of Oregon. Land and facilities are necessary to accommodate training so that the ORARNG can service the community effectively (as well as the entire country, in terms of National defense). Therefore, the growth of the region, Oregon, and the Nation as a whole drives the need for this training and support capability; and
>
> (2) Both factors produce pressures on the environment in the region.

Interrelated cumulative impacts place demands on the local area, planning organizations, and the military's natural resource management, cultural resource management, and public works personnel. Through sound, integrated, long-range planning on both sides of the proverbial fence, these impacts are minimized. The BRAC and Local Reuse Authority processes, working closely with the ORARNG, have developed an overall vision for the former UCD property and surrounding region. This vision, including recent investments in infrastructure, public amenities, and other planning elements, has enabled CUO and the surrounding area to grow in a planned and measured way, absorbing the pressures of new development. The Oregon SHPO and the CTUIR, working closely with the ORARNG, have assisted in the environmentally sensitive development of this Preferred Action Alternative to ensure environmental impacts are minimized.

No significant adverse cumulative impacts to the environment, induced by changes under the Preferred Action Alternative, are anticipated in the region. Close coordination between the ORARNG and local planning and regulatory authorities would serve to minimize any potential future land use conflicts. Implementation of land use and resource management plans would serve to control the extent of environmental impacts, and proper planning would ensure that future socioeconomic conditions maintain or improve the quality of life for area residents. Implementation of effective environmental management plans and programs would minimize or eliminate any potential cumulative degradation of the natural ecosystem.

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SECTION 5: COMPARISON OF ALTERNATIVE AND CONCLUSIONS

5.1 Comparison of the Environmental Consequences of the Alternative

Table 5.1 compares the potential impacts that could occur under the Proposed Action and No Action alternatives, by resource.

Table 5.1: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Land Use	**No Impact.** No new installation infrastructure and no change to use type or levels.	**Less than significant.** No conflict with overall authorized land use. Site activities would not change, but would be expanded in scope. Long-term positive impact would occur through development of the CUO consistent with existing land use and zoning.
Air Quality	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to pollutant emissions.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to the potential for dust generation and air emissions from construction activities. Long-term, less–than-significant, adverse impacts from emissions associated with increased equipment and vehicle use and increased fugitive dust during training operations.
Noise	**No Impact.** Training and operations would continue under current conditions at current locations and levels; no change to local noise environment.	**Less than significant.** Short-term, less-than-significant adverse impacts due to construction noise. Long-term, less-than-significant adverse impacts due to increased noise generation from increased training activities that would be performed consistent with the Statewide Operational Noise Management Plan (SONMP) and existing noise-related Right-of-Way, and would not impact sensitive land uses.
Geology, Topography, and Soils	**Less than significant.** No short-term impacts would occur. Long-term, less–than-significant, adverse impacts due to soil compaction from continued training activities.	**Less than significant.** Short-term, less-than-significant adverse impact through vegetation removal, ground disturbance, and potential compaction during construction. Long-term, less-than-significant, adverse impacts through loss of soil function resulting from creation of impervious surfaces. Proposed ground disturbance in identified areas of severe soil hazards would be conducted using erosion control best management practices (BMPs).

Table 5.1: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Water Resources	**Less than significant.** No short-term impacts would occur. Long-term, less–than-significant, adverse impacts due to soil erosion during training operations and continued water usage at current levels.	**Less than significant.** Short-term, less-than-significant adverse impacts due to the potential for release of toxic or hazardous materials during construction, which would be completed in accordance with permit requirements. Long-term, less-than-significant adverse impacts due to increased water usage that would remain within allocated water rights. Contamination to groundwater from operations, including the proposed wastewater treatment plant, would be unlikely to occur due to implementation of BMPs.
Biological (Vegetation, Fish and Wildlife, and Wildland Fire)	**Less than significant.** No short-term impacts would occur. Long-term, less-than-significant, adverse impacts due to trampling and degradation of non-native vegetation during training activities and impacts to species due to continued human presence in areas previously disturbed by current training and operational activities. Long-term, less-than-significant adverse impacts would occur due to lack of firebreaks at CUO; however, an Integrated Wildland Fire Management Plan would be created for the site.	**Less than significant.** Short-term, less-than-significant, adverse impacts due to vegetation removal and disturbance, habitat loss and degradation during construction, and potential for more frequent fire starts. Long-term, less–than-significant adverse impacts due to vegetation removal and disturbance during operations and training that would occur primarily in areas dominated by non-native and invasive species, and due to habitat conversion, noise, and/or human presence from training and operational activities to be conducted in accordance with the Integrated Natural Resource Management Plan (INRMP). Impacts would be reduced by implementation of exotic/invasive species reduction goals established in the INRMP. Long-term, less-than-significant adverse impact due increased fire risk from increased training; however, offset by incorporation of BMPs, including firebreaks and creation of the Integrated Wildland Fire Management Plan.
Cultural Resources	**Less than significant.** Short-term impacts would not occur. Long-term, less–than-significant adverse impacts due to continued training and operations activities that could potentially result in occasional cultural resource discoveries and required building maintenance/upkeep that would be performed in existing management plan.	**Mitigated to less than Significant**. Short-term, less-than-significant adverse impacts due to the potential for cultural resource discovery during construction. Long-term, significant adverse impacts due to impacts to 563 National Register of Historic Places (NRHP)-eligible buildings and structures associated with the UCD Historic District; an NRHP-eligible wagon road; and a potentially eligible property of traditional religious and cultural significance identified by the Confederated Tribes of the Umatilla Indian Reservation. Impacts would be reduced to less-than-significant levels with implementation of mitigation measures discussed in Section 4 and the 2018 Programmatic Agreement.

Table 5.1: Comparison of Environmental Impacts of Each Alternative

Resource	Alternatives	
	No Action	**Proposed Action**
Socioeconomics	**No impact.** Economic activity associated with current uses of Camp Umatilla Oregon (CUO) would continue and use levels of CUO would not change.	**Less than significant.** Short-term positive impact due to increased economic activity during construction. Long-term positive impact due to increased long-term employment, income, and population levels and corresponding purchases of goods and services.
Environmental Justice	**No impact.** Activity and use levels would remain the same; no impacts to environmental justice populations.	**No impact.** No disproportionate adverse environmental, economic, or health-specific impact to minority or low-income populations. No disproportionate environmental or health risks to children.
Infrastructure	**Less than significant.** Minor improvements to water and wastewater systems to accommodate CUO use levels would result in short- and long-term positive impacts due to improvements to the potable water system and wastewater system to accommodate existing uses.	**Less than significant.** Short- and long-term positive impacts due to improvements of existing infrastructure and construction of additional on-site utility infrastructure with sufficient capacity to accommodate increased activity levels.
Hazardous and Toxic Materials/ Wastes	**Less than significant.** Long-term positive impacts due to management of Regulated Building Material (RBM) and hazardous wastes remaining at the site.	**Less than significant.** Short- and long-term beneficial impacts would occur due to abatement of existing RBM and management of hazardous materials during operations.

5.2 Conclusions

The scope of this EA includes analysis of the current military training activities (No Action) and those proposed increased military training activities and related infrastructure development projects over the next 5 years (Proposed Action). As described in Sections 4.2 through 4.14 and summarized in Table 5.1, neither the Proposed Action nor the No Action alternatives is expected to result in significant impacts. Implementation of the Proposed Action Alternative, provided that BMPs and mitigation measures specified in this EA are implemented, would incur impacts that are within acceptable levels and best fulfill the purpose of and need for the Proposed Action, allowing the ORARNG to accomplish its mission while minimizing potential impacts to the local and regional natural, cultural, and socioeconomic environment. This EA's analysis determines, therefore, that an EIS is unnecessary for implementation of the Proposed Action Alternative, and that a FNSI is appropriate. The Proposed Action Alternative was determined by the ORARNG to provide the best combination of land and resources to sustain quality military training, and to maintain and improve the units' readiness postures. The No Action Alternative was not found to satisfy the purpose of and need for the project. This alternative would limit the capability of the ORARNG to carry out its assigned mission. Therefore, this EA recommends implementation of the Proposed Action Alternative.

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SECTION 6: REFERENCES

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SECTION 7: GLOSSARY

100-year Flood – A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1 percent chance of its occurring in a given year.

Aesthetics – Pertaining to the quality of human perception of natural beauty.

Ambient – The environment as it exists around people, plants, and structures.

Ambient Air Quality Standards – Those standards established according to the CAA to protect health and welfare (AR 200-1).

Aquifer – An underground geological formation containing usable amounts of groundwater that can supply wells and springs.

Attainment Area – Region that meets the NAAQS for a criteria pollutant under the CAA.

Berm – Earthen berm placed at the end of a firing range to stop the travel of fired projectiles.

Bedrock – The solid rock that underlies all soil, sand, clay, gravel and loose material on the earth's surface.

Best Management Practices (BMPs) – Methods, measures, or practices to prevent or reduce the contributions of pollutants to U.S. waters. BMPs may be imposed in addition to, or in the absence of, effluent limitations, standards, or prohibitions (AR 200-1).

Commercial Land Use – land use that includes private and public businesses (retail, wholesale, etc.), institutions (schools, churches, etc.), health services (hospitals, clinics, etc.), and military buildings and installations.

Compaction – The packing of soil together into a firmer, denser mass, generally caused by the pressure of great weight.

Company – A military unit that is the next smaller unit of a battalion; the most basic administrative and tactical unit (approximately 50 to 200 persons, depending on the type of unit).

Contaminants – Any physical, chemical, biological or radiological substances that have an adverse effect on air, water or soil.

Council on Environmental Quality (CEQ) – An executive office of the President composed of three members appointed by the President, subject to approval by the senate. Each member shall be exceptionally qualified to analyze and interpret environmental trends; to appraise programs and activities of the federal government. Members are to be conscious of and responsive to the scientific, economic, social, aesthetic, and cultural needs of the nation, and to formulate and recommend national policies to promote the improvement of the quality of the environment.

Criteria Pollutants – The CAA of 1970 required the EPA to set air quality standards for common and widespread pollutants to protect human health and welfare. There are six "criteria pollutants": ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), nitrogen dioxide (NO_2), and particulate matter.

Cultural Resources – Cultural resources are historic properties as defined by the NHPA, cultural items as defined by the Native American Graves Protection and Repatriation Act, archaeological resources as defined by the Archaeological Resources Protection Act, sacred sites as defined by EO 13007 to which access is afforded under the American Indian Religious Freedom Act, and collections and associated records as defined by 36 CFR §79.

Cumulative Impact – The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7).

dBA – “A-weighted” non-impulse noise measurement in decibels, weighted to match human hearing frequency response.

Decibel (dB) – A unit of measurement of sound pressure level.

Emission – A release of a pollutant.

Endangered Species – Any species that is in danger of extinction throughout all or a significant portion of its range.

Environmental Assessment (EA) – An EA is a publication that provides sufficient evidence and analysis to show whether a proposed system would adversely affect the environment or be environmentally controversial.

Erosion – The wearing away of the land surface by detachment and movement of soil and rock fragments through the action of moving water and other geological agents.

Farmland – Cropland, pastures, meadows, and planted woodland.

Floodplain – The relatively flat area or lowlands adjoining a river, stream, ocean, lake, or other body of water that is susceptible to being inundated by floodwaters.

FNSI – Finding of No Significant Impact, a NEPA document.

Fugitive Dust – Particles light enough to be suspended in air that are not caught in a capture or filtering system. For this document, this refers to particles put in the air by moving vehicles and air movement over disturbed soils at construction sites.

Geology – Science that deals with the physical history of the earth, the rocks of which it is composed, and physical changes in the earth.

Groundwater – Water found below the ground surface. Groundwater may be geologic in origin and as pristine as it was when it was entrapped by the surrounding rock or it may be subject to daily or seasonal effects depending on the local hydrologic cycle. Groundwater may be pumped from wells and used for drinking water, irrigation, and other purposes. It is recharged by precipitation or irrigation water soaking into the ground. Thus, any contaminant in precipitation or irrigation water may be carried into groundwater.

Hazardous Substance – Hazardous materials are defined within several laws and regulations to have certain meanings. For this document, a hazardous material is any one of the following:

- Any substance designated pursuant to section 311 (b)(2) (A) of the Clean Water Act.
- Any element, compound, mixture, solution or substance designated pursuant to Section 102 of CERCLA.
- Any hazardous as defined under the RCRA.
- Any toxic pollutant listed under TSCA.
- Any hazardous air pollutant listed under Section 112 of CAA.
- Any imminently hazardous chemical substance or mixture with respect to which the EPA Administrator has taken action pursuant to Subsection 7 of TSCA.

The term does not include: 1) Petroleum, including crude oil or any thereof, which is not otherwise specifically listed or designated as a hazardous substance in a above, or 2) Natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). A list of hazardous substances is found in 40 CFR §302.4.

Hazardous Waste – A solid waste, which when improperly treated, stored, transported, or disposed of poses a substantial hazard to human health or the environment. Hazardous wastes are identified in 40 CFR §261.3 or applicable foreign law, rule, or regulation (see also solid waste).

Hazardous Waste Storage – As defined in 40 CFR §260.10, ". . . the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere".

Hydric Soil – A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-lacking) conditions that favor the growth and regeneration of hydrophytic vegetation. A wetland indicator.

Inactive Duty Training – Authorized training performed by a member of a Reserve component not on active duty or active duty for training and consisting of regularly scheduled unit training assemblies, additional training assemblies, periods of appropriate duty or equivalent training, and any special additional duties authorized for Reserve component personnel by the Secretary concerned, and performed by them in connection with the prescribed activities of the organization in which they are assigned with or without pay. Does not include work or study associated with correspondence courses.

Indirect Impact – An indirect impact is caused by a Proposed Action, but occurs later in time or farther removed in distance, but is still reasonably foreseeable. Indirect impacts may include induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, and other natural and social systems. For example, referring to the possible direct impacts described above, the clearing of trees for new development may have an indirect impact on area wildlife by decreasing available habitat.

Industrial Land Use – Land uses of a relatively higher intensity that are generally not compatible with residential development. Examples include light and heavy manufacturing, mining, and chemical refining.

Listed Species – Any plant or animal designated as a state or federal threatened, endangered, special concern, or candidate species.

Man-days – Soldiers on site per day. Example: 50 Soldiers on site for training for a 2-day weekend is 100 man-days.

Mitigation – Measures taken to reduce adverse impacts on the environment.

Mobile Sources – Vehicles, aircraft, watercraft, construction equipment, and other equipment that use internal combustion engines for energy sources.

Monitoring – A process of inspecting and recording the progress of mitigation measures implemented.

National Ambient Air Quality Standards (NAAQS) – Nationwide standards set up by the EPA for widespread air pollutants, as required by Section 109 of the CAA. Currently, six pollutants are regulated by primary and secondary NAAQS: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter, and sulfur dioxide (SO_2).

National Environmental Policy Act (NEPA) – U.S. statute that requires all federal agencies to consider the potential effects of Proposed Actions on the human and natural environment.

Nonattainment Area – An area that has been designated by the EPA or the appropriate state air quality agency as exceeding one or more national or state ambient air quality standards.

Particulates or Particulate Matter – Fine liquid or solid particles such as dust, smoke, mist, fumes or smog found in air.

Physiographic Region – A portion of the Earth's surface with a basically common topography and common morphology.

Pollutant – A substance introduced into the environment that adversely affects the usefulness of a resource.

Potable Water – Water that is suitable for drinking.

Prime Farmland – A special category of highly productive cropland that is recognized and described by the U.S. Department of Agriculture’s Soil Conservation Service (now the Natural Resources Conservation Service [NRCS]) and receives special protection under the Surface Mining Law.

Remediation – A long-term action that reduces or eliminates a threat to the environment.

Riparian Areas – Areas adjacent to rivers and streams that have a high density, diversity, and productivity of plant and animal species relative to nearby uplands.

Sedimentation – Deposition of eroded material in an alternate location by dispersing agents such as water or wind.

Sensitive Receptors – Include, but are not limited to, asthmatics, children, and the elderly, as well as specific facilities, such as long-term health care facilities, rehabilitation centers, convalescent centers, retirement homes, residences, schools, playgrounds, and childcare centers.

Short Term Impacts – Direct or indirect impacts resulting from an action in the near term. In this context, short-term does not refer to any rigid time period and is determined on a case-by-case basis in terms of the environmental consequences of the Proposed Action.

Significant Impact – According to 40 CFR §1508.27, "significance" as used in NEPA requires consideration of both context and intensity.

- Context. The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
- Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.

Soil – The mixture of altered mineral and organic material at the earth's surface that supports plant life.

Solid Waste – Any discarded material that is not excluded by section 261.4(a) or that is not excluded by variance granted under sections 260.30 and 260.3 1.

Surficial Aquifer – Comprises all the rocks and sediments from land surface downward to the top of the intermediate confining unit containing usable amounts of groundwater, which can supply wells and springs.

Threatened Species – Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Topography – The relief features or surface configuration of an area.

Toxic Material/Waste – A harmful substance that includes elements, compounds, mixtures, and materials of complex composition.

Wetlands – Areas that are regularly saturated by surface or groundwater and, thus, are characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes and estuaries.

Wildlife Habitat – Set of living communities in which a wildlife population lives.

Zone II – Noise within this zone is not recommended for noise-sensitive land uses.

Zone III – Noise within this zone is normally not recommended with noise-sensitive land uses.

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SECTION 8: LIST OF PREPARERS

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APPENDIX A:

SCOPING LETTERS

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PLANNING DEPARTMENT

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August 29, 2016

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RE: Environmental Assessment for the expansion of military training operations and related infrastructure development at Camp Umatilla Oregon

Dear Mr. Mitchell:

Morrow County appreciates receiving Notice from Roy Swafford dated August 12, 2016, of the upcoming National Environmental Policy Act (NEPA) activities. After reviewing the letter the County Court asked me to request, on their behalf, Cooperating Agency status for Morrow County during the drafting of the Environmental Assessment (EA). As the County Planning Director I will take the lead role for the County and would request you add Carla McLane, Planning Director, to your contact list.

In the letter dated August 12 it identifies "Opportunity for Involvement," but does not offer or define Cooperating Agency status or opportunities. It also indicates that the Oregon Military Department is currently preparing the draft Environmental Assessment, but does not reference that the necessary Scoping has taken place. It would be appreciated if you could provide guidance to the Oregon Military Department process for conducting an EA under the NEPA for Morrow County to better understand how, without Scoping, you are able to move directly to a draft EA.

Morrow County has gained extensive experience with the NEPA process and is currently acting or has recently acted as a Cooperating Agency with three other federal actions - the Boardman-to-Hemingway transmission line (BLM), the suspended Cascade Crossing transmission line (USFS), and the now completed Carty Lateral gas pipeline (FERC). Additionally we have been working with the Navy on actions, now complete, for enhanced uses proposed at the Boardman Bombing Range which was done to also benefit the Oregon Army National Guard. We have an understanding of what it means to take on this role and the impacts it can have.

We look forward to working with you and others on this process. Should you have any questions concerning this letter or our request for Cooperator Agency status please contact me at: 205 NE Third Street, P.O. Box 40, Irrigon, Oregon, 97844, 541-922-4624, cmclane@co.morrow.or.us.

Thank you for your consideration of this request.

Cordially,

Carla McLane

Carla McLane
Planning Director

www.morrowcountyoregon.com

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

City of Boardman
Karen Pettigrew, City Manager
200 City Center Circle
P.O. Box 229
Boardman, OR 97818

Dear Ms. Pettigrew:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background
The former UCD was a nearly 20,000-acre munitions and chemical agent storage and maintenance facility owned by the Army. The Army closed the UCD as an active military installation on August 1, 2012 and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 Base Realignment and Closure (BRAC) land use realignment process. The ORNG has maintained an enclave within the UCD property since the early 1980s to support various military training activities of ORNG Soldiers. The training enclave currently includes 2,100 acres of property and several buildings licensed from the Army to the ORNG. The approved BRAC disposal plan calls for approximately 6,700 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses. Approximately 5,500 acres located on the eastern side of the former UCD would be conserved as wildlife habitat. The Army would retain the balance of the installation, approximately 7,500 acres, as the CUO to be used as an expanded training area for the ORNG. The NEPA analysis for the BRAC real estate transfer of the original UCD is currently being addressed by the Army in a separate EA.

Purpose and Need
The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORNG Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

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The EA will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The EA assumes that the BRAC real estate transfer of 7,500 acres to the ORNG will occur. The EA will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
- Air Quality
- Noise
- Geology, Topology and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement
OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

1859

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Boardman Rural Fire Protection District
Marc Rogelstad, Fire Chief
300 Southwest Wilson Lane
Boardman, OR 97818

Dear Chief Rogelstad:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Purpose and Need

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Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

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Opportunity for Involvement
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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

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JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
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SALEM, OREGON 97309-5047

August 12, 2016

Columbia Development Authority
Mr. Greg Smith, Executive Director
Two Marine Drive, Suite 102
Boardman, OR 97818

Dear Mr. Smith:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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NEPA/Cultural Resources Manager
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Sincerely,

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MAJ (Ret)
Director of Installations

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INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Oregon Department of Environmental Quality
Mr. Pete Shepherd, Office of the Director
811 Southwest Sixth Avenue
Portland, OR 97204

Dear Mr. Shepherd:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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NEPA/Cultural Resources Manager
Oregon Military Department
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Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Ms. Lissa Druback, Department of Environmental Quality Eastern Region, ER Solid Waste Manager

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

U.S. Environmental Protection Agency
Mr. Dennis McLerran, Region X Administrator
1200 Sixth Avenue, Suite 900
Seattle, WA 98101

Dear Mr. McLerran:

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Oregon Military Department
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Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Mr. Harry Craig, EPA Region X Hanford Project Office,
Remedial Project Manager

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

City of Hermiston
Byron Smith, City Manager
180 Northeast 2nd Street
Hermiston, OR 97838

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- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement

OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Hermiston Fire & Emergency Services
Scott Stanton, Fire Chief
320 South 1st Street
Hermiston, OR 97838

Dear Chief Stanton:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background

The former UCD was a nearly 20,000-acre munitions and chemical agent storage and maintenance facility owned by the Army. The Army closed the UCD as an active military installation on August 1, 2012 and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 Base Realignment and Closure (BRAC) land use realignment process. The ORNG has maintained an enclave within the UCD property since the early 1980s to support various military training activities of ORNG Soldiers. The training enclave currently includes 2,100 acres of property and several buildings licensed from the Army to the ORNG. The approved BRAC disposal plan calls for approximately 6,700 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses. Approximately 5,500 acres located on the eastern side of the former UCD would be conserved as wildlife habitat. The Army would retain the balance of the installation, approximately 7,500 acres, as the CUO to be used as an expanded training area for the ORNG. The NEPA analysis for the BRAC real estate transfer of the original UCD is currently being addressed by the Army in a separate EA.

Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORNG Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

Scope of the Environmental Assessment

The EA will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The EA assumes that the BRAC real estate transfer of 7,500 acres to the ORNG will occur. The EA will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
- Air Quality
- Noise
- Geology, Topology and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

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Opportunity for Involvement

OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

City of Irrigon
Aaron Palmquist, City Manager
180 Northeast 2nd Street
Irrigon, OR 97844

Dear Mr. Palmquist:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Purpose and Need

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Summary of the Proposed Action Alternative

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Opportunity for Involvement

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

State of Oregon
Legislative Commission on Indian Services
Ms. Karen Quigley, Executive Director
900 Court St NE, Room 167
Salem, OR 97301

Dear Director Quigley:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Summary of the Proposed Action Alternative

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Opportunity for Involvement

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Morrow County
Ms. Carla McLane, Planning Director
P.O. Box 40
Irrigon, OR 97844

Dear Ms. McLane:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
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Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Morrow County Court
The Honorable Terry Tallman
P.O. Box 788
Heppner, OR 97836

Dear Chairman Tallman:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

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INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

U.S. Navy
Mr. Jerry Sodano, PACFLT RSSC
3730 North Charles Porter Avenue
Oak Harbor, WA 98278

Dear Mr. Sodano:

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Scope of the Environmental Assessment
The EA will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The EA assumes that the BRAC real estate transfer of 7,500 acres to the ORNG will occur. The EA will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
- Air Quality
- Noise
- Geology, Topology and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative
Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative
Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement

OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Ms. Amy Burt, NAVFAC Northwest,
Environmental Planning Supervisor

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Oregon Department of Fish & Wildlife
Mr. Curt Melcher, Interim Director
811 Southwest Sixth Avenue
Portland, OR 97204

Dear Director Melcher:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background

The former UCD was a nearly 20,000-acre munitions and chemical agent storage and maintenance facility owned by the Army. The Army closed the UCD as an active military installation on August 1, 2012 and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 Base Realignment and Closure (BRAC) land use realignment process. The ORNG has maintained an enclave within the UCD property since the early 1980s to support various military training activities of ORNG Soldiers. The training enclave currently includes 2,100 acres of property and several buildings licensed from the Army to the ORNG. The approved BRAC disposal plan calls for approximately 6,700 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses. Approximately 5,500 acres located on the eastern side of the former UCD would be conserved as wildlife habitat. The Army would retain the balance of the installation, approximately 7,500 acres, as the CUO to be used as an expanded training area for the ORNG. The NEPA analysis for the BRAC real estate transfer of the original UCD is currently being addressed by the Army in a separate EA.

Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORNG Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

Scope of the Environmental Assessment

The EA will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The EA assumes that the BRAC real estate transfer of 7,500 acres to the ORNG will occur. The EA will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
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- Noise
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- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement
OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Mr. Steve Cherry, ODFW, Northeast Region, John Day Watershed District, District Wildlife Biologist

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Oregon Water Resources Department
Mr. Tom Byler, Director
725 Summer St. NE, Suite A
Salem, OR 97301

Dear Director Byler:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background

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Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

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Summary of the Proposed Action Alternative
Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative
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Opportunity for Involvement
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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Ms. Jen Woody, Oregon Water Resources Department
Hydrogeologist, Groundwater Section

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Oregon State Historic Preservation Office
Ms. Chrissy Curran
725 Summer Street NE, Suite C
Salem, OR 97301

Dear Ms. Curran:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background

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Purpose and Need

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The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORNG Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

Scope of the Environmental Assessment

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- Land Use
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- Noise
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- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
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- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement
OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

cc:
Dr. Dennis Griffin, Oregon Department of Parks & Recreation,
State Archeologist
Mr. Ian Johnson, Oregon Department of Parks & Recreation,
Associate Deputy State Historic Preservation Officer
Ms. Jessica Gabriel, Oregon Department of Parks & Recreation,
National Register/Review & Compliance/Survey Coordinator

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Confederated Tribes of the Umatilla Indian Reservation
Chairman Gary Burke
46411 Timine Way
Pendleton, OR 97801

Dear Chairman Burke:

The Oregon Military Department is preparing an Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) for the conversion and expansion of an existing 2,100-acre military training enclave into a 7,500-acre training center. This expanded 7,500-acre training center is identified as Camp Umatilla Oregon and is situated within a portion of the former United States Army Umatilla Chemical Depot. Camp Umatilla Oregon is located in portions of both Morrow and Umatilla Counties at the northwest corner of the I-82 and I-84 junction.

Because we recognize the Confederated Tribes of the Warm Springs Reservation of Oregon as a sovereign nation, we would like to begin the government-to-government consultation process with your Tribal leadership and staff to ensure any Tribal concerns regarding significant natural resources, cultural resources, and properties of traditional, customary, religious or cultural importance are addressed.

Background

The former Umatilla Chemical Depot was a nearly 20,000-acre munitions and chemical agent storage and maintenance facility owned by the US Army. The US Army closed the Umatilla Chemical Depot as an active military installation on August 1, 2012. In accordance with requirements of the 2005 Base Realignment and Closure land use realignment process the US Army is proceeding with disposal of the property through land conveyances. The Oregon National Guard has maintained an enclave within the Umatilla Chemical Depot property since the early 1980s in support of various Oregon National Guard Soldier training activities. The training enclave currently includes 2,100 acres of property and several buildings leased from the US Army to the Oregon National Guard. The approved Base Realignment and Closure disposal plan calls for approximately 6,700 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses. Approximately 5,500 acres located on the eastern side of the former Umatilla Chemical Depot would be conserved as wildlife habitat. The US Army would retain a balance of 7,500 acres of the installation as Camp Umatilla Oregon to be used as an expanded training area for the Oregon National Guard. The NEPA analysis for the Base Realignment and Closure real estate transfer of the original Umatilla Chemical Depot is currently being addressed by the US Army in a separate Environmental Assessment.

Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500 acre Camp Umatilla Oregon in an economically-feasible way in order to support the core training and readiness objectives for all Oregon National Guard elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide Oregon National Guard Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

Scope of the Environmental Assessment

The Environmental Assessment will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The Environmental Assessment assumes that the Base Realignment and Closure real estate transfer of 7,500 acres to the Oregon National Guard will occur. The Environmental Assessment will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
- Air Quality
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- Water Resources
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Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500 acre area retained for Oregon National Guard training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of Camp Umatilla Oregon would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, transportation system and firebreak system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at Camp Umatilla Oregon under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500 acre Camp Umatilla Oregon would still be retained for Oregon National Guard training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement
The Oregon Military Department is currently preparing a Draft Environmental Assessment in accordance with National Guard Bureau NEPA guidelines. No formal public comment period for the Draft Environmental Assessment is planned. However, once the Final Environmental Assessment is complete, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final Environmental Assessment and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human or natural environment are identified and cannot be mitigated to a level below significance, the Oregon Military Department will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement, which would afford further opportunities to participate in the environmental review process.

However, we are extending an invitation to the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon to consult in our NEPA and National Historic Preservation Act processes in a manner or level that you feel is appropriate. We look forward to continuing our meaningful and productive relationship with the Confederated Tribes of the Umatilla Indian Reservation. If you have any information, questions, or concerns, please have your staff contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

Michael E Stencel
MICHAEL E. STENCEL
Major General
The Adjutant General

cc:
Ms. Teara Farrow Ferman, Cultural Resources Program Manager
Ms. Catherine Dickson, Cultural Resources Program

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
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1776 MILITIA WAY
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SALEM, OREGON 97309-5047

August 12, 2016

Chairperson, Eugene Austin Greene, Jr.
Confederated Tribes of the Warm Springs Reservation of Oregon
1233 Veterans Street
Warm Springs, OR 97761

Dear Chairperson Greene:

The Oregon Military Department is preparing an Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) for the conversion and expansion of an existing 2,100-acre military training enclave into a 7,500-acre training center. This expanded 7,500-acre training center is identified as Camp Umatilla Oregon and is situated within a portion of the former United States Army Umatilla Chemical Depot. Camp Umatilla Oregon is located in portions of both Morrow and Umatilla Counties at the northwest corner of the I-82 and I-84 junction.

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Summary of the Proposed Action Alternative
Under the Proposed Action, the 7,500 acre area retained for Oregon National Guard training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of Camp Umatilla Oregon would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, transportation system and firebreak system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at Camp Umatilla Oregon under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative
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Opportunity for Involvement
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However, we are extending an invitation to the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon to consult in our NEPA and National Historic Preservation Act processes in a manner or level that you feel is appropriate. We look forward to continuing our meaningful and productive relationship with the Confederated Tribes of the Warm Springs Reservation of Oregon. If you have any information, questions, or concerns, please have your staff contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

Michael E. Stencel
MICHAEL E. STENCEL
Major General
The Adjutant General

cc:
Roberta Kirk, THPO Assistant
Kathleen Sloan, PhD Cultural Resources Department

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Umatilla County Courthouse
Ms. Tamra Mabott, Planning Director
216 Southeast Fourth Street
Pendleton, OR 97801

Dear Ms. Mabott:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

Background

The former UCD was a nearly 20,000-acre munitions and chemical agent storage and maintenance facility owned by the Army. The Army closed the UCD as an active military installation on August 1, 2012 and is proceeding with disposal of the property through a variety of land conveyances consistent with the requirements of the 2005 Base Realignment and Closure (BRAC) land use realignment process. The ORNG has maintained an enclave within the UCD property since the early 1980s to support various military training activities of ORNG Soldiers. The training enclave currently includes 2,100 acres of property and several buildings licensed from the Army to the ORNG. The approved BRAC disposal plan calls for approximately 6,700 acres to be turned over to a number of local government entities to be developed for commercial and industrial uses. Approximately 5,500 acres located on the eastern side of the former UCD would be conserved as wildlife habitat. The Army would retain the balance of the installation, approximately 7,500 acres, as the CUO to be used as an expanded training area for the ORNG. The NEPA analysis for the BRAC real estate transfer of the original UCD is currently being addressed by the Army in a separate EA.

Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

The need for the Proposed Action stems from the State of Oregon's lack of in-state training installations necessary to provide ORNG Soldiers with adequate training opportunities. The need for the Proposed Action has been validated by the National Guard Bureau Training Support Systems Division.

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The EA will evaluate potential impacts from two alternatives: the Proposed Action and the No Action Alternative as summarized below. The EA assumes that the BRAC real estate transfer of 7,500 acres to the ORNG will occur. The EA will analyze potential impacts that could result from the two alternatives within the following resource categories:

- Land Use
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- Noise
- Geology, Topology and Soils
- Water Resources
- Biological Resources
- Cultural Resources
- Socioeconomics
- Environmental Justice
- Infrastructure
- Hazardous Materials and Waste
- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

Under the No Action Alternative, the 7,500-CUO would still be retained for ORNG training activities. However, no infrastructure improvement projects would occur and use levels would remain the same or similar to existing conditions.

Opportunity for Involvement

OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

STATE OF OREGON 1859

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Umatilla County Commission
The Honorable George Murdock
216 Southeast Fourth Street
Pendleton, OR 97801

Dear Chairman Murdock:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Purpose and Need

The purpose of the Proposed Action is to maximize the training opportunities available on the 7,500-acre CUO in an economically-feasible way in order to support the core training and readiness objectives for all ORNG elements as part of the Combined Arms Training Strategy, along with the US Army Training and Doctrine Programs of Instruction required for the Regional Training Institute.

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- Wildland Fire

Summary of the Proposed Action Alternative

Under the Proposed Action, the 7,500-acre area retained for ORNG training would be used for continued and expanded military training activities and associated infrastructure development. Expansion of military training activities and infrastructure would occur over approximately the next 10 years. In general, the strategy for development of the CUO would be to reuse and repurpose existing disturbed areas (buildings, roads, bunker complexes, etc.), where possible, to accomplish the required training and to reduce the environmental impacts associated with native habitat conversion. Although the exact locations of specific proposed activities and development may not be known, "Use Areas" have been identified which describe the geographic areas where general types of military training activities and associated facilities would occur. The Proposed Action also includes infrastructure improvements that would cut across Use Areas. These infrastructure improvements would be primarily utilities-related and would include the potable water system, wastewater treatment system, and transportation system. Implementation of the Proposed Action would approximately double the average annual training use at the site. Training activities that would occur at the CUO under the Proposed Action would be similar to those currently occurring, including live fire and mounted and dismounted maneuver training.

Summary of the No Action Alternative

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Opportunity for Involvement

OMD is currently preparing the Draft EA. Following National Guard Bureau NEPA guidelines, no formal public comment period for the Draft EA is planned. However, once the Final EA is completed, and if a Finding of No Significant Impact (FNSI) is determined to be appropriate based upon the analysis presented, a notification will be sent to concerned agencies, organizations, and the interested public stating that the Final EA and Draft FNSI are available for review. Public and stakeholder comments would be considered prior to a decision and the issuance of a final FNSI. If significant effects on the quality of the human and natural environment are identified and cannot be mitigated to a level below significance, the OMD will re-evaluate project feasibility and may initiate preparation of an Environmental Impact Statement (EIS), which would afford further opportunities to participate in the environmental review process. If you have questions or concerns, or would like additional information on the CUO Project or on the NEPA process, please contact Kris Mitchell at the e-mail address listed below.

Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

City of Umatilla
Russell Pelleberg, City Manager
P.O. Box 130
Umatilla, OR 97882

Dear Mr. Pelleberg:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY. D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

Umatilla Rural Fire Protection District
Mike Roxbury, Chief
621 Sixth Street
P.O. Box 456
Umatilla, OR 97882

Dear Chief Roxbury:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

August 12, 2016

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Mr. Gary Miller, Field Supervisor
3502 Highway 30
La Grande, OR 97850

Dear Mr. Miller:

The Oregon Military Department (OMD) is preparing an Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) for the expansion of military training operations and related infrastructure development on an Oregon National Guard (ORNG) training center in northeastern Oregon. This 7,500-acre training center is identified as Camp Umatilla Oregon (CUO), situated within a portion of the former United States Army (Army) Umatilla Chemical Depot (UCD) within portions of both Morrow and Umatilla counties, and located at the northwest corner of the Interstate (I)-82 and I-84 junction.

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Kris Mitchell
NEPA/Cultural Resources Manager
Oregon Military Department
Kris.C.Mitchell.nfg@mail.mil

Sincerely,

ROY D SWAFFORD
MAJ (Ret)
Director of Installations

OREGON MILITARY DEPARTMENT
JOINT FORCE HEADQUARTERS, OREGON NATIONAL GUARD
INSTALLATIONS DIVISION
1776 MILITIA WAY
P.O. BOX 14350
SALEM, OREGON 97309-5047

AGI-ENV 3 August 2018

MEMORANDUM FOR RECORD, ATTN: ORARNG-AGI, 1776 Militia Way SE, Salem, Oregon 97309-5047

SUBJECT: Camp Umatilla Oregon, Environmental Assessment Tribal & SHPO Consultation

1. National Environmental Policy Act (NEPA) analysis for Expanded Operations at the ORARNG's Camp Umatilla Oregon (CUO) is conducted within an Environmental Assessment (EA).

2. National Historic Preservation Act (NHPA) Section 106 consultation with the Oregon SHPO resulted in a finding of Adverse Effect to Historic Properties. To mitigate the adverse effect, a Programmatic Agreement (PA) was executed among ORARNG, NGB, the Oregon SHPO, and the ACHP (Appendix C of the CUO Expanded Operations EA).

3. Government-to-Government Tribal consultation letters were sent 12 August 2016 to the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Confederated Tribes of the Warm Springs Reservation of Oregon to initiate consultation under both NEPA and NHPA.

4. At the request of the CTUIR, ORARNG NEPA and Cultural Resources Manager, and other ORARNG staff members as needed, traveled to the Nixyáawii Governance Center in Pendleton to meet with tribal representatives October 2016, April 2017, and July 2017 to consult on both the EA and the PA. ORARNG also presented to the Tribal Council's Cultural Resources Committee in May 2017.

5. The draft EA was provided to the CTUIR on 29 June 2017, and draft iterations of the PA were shared back and forth with the CTUIR throughout its development to ensure Coyote Coulee, treated as a property of traditional religious and cultural significant, is protected. All concerns were addressed in the PA. ORARNG will continue our working relationship with CTUIR to develop an access protocol and other matters of importance to the tribe.

6. In addition, ORARNG updated all nine federally-recognized Tribes in Oregon (Burns Paiute Tribe; Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians; Confederated Tribes of the Grand Ronde Community of Oregon; Confederated Tribes of Siletz Indians; CTUIR; Confederated Tribes of Warm Springs; Coquille Indian Tribe; Cow Creek Band of Umpqua Tribe of Indians and the Klamath Tribes) and participating state agency representatives on the EA at each regularly scheduled quarterly meeting of the State's Cultural Resources

Cluster Group and each meeting of the Natural Resources Work Group in late 2016, all of 2017, and early 2018. No concerns were raised at any of these meetings.

7. Questions or concerns should be forwarded to the undersigned via e-mail at kris.c.mitchell.nfg@mail.mil

KRIS C. MITCHELL
NEPA and Cultural Resources Manager

AGI-E 18 September 2018

MEMORANDUM FOR RECORD

SUBJECT: Section 7 Endangered Species Act Consultation; Camp Umatilla expanded operations environmental assessment, Morrow and Umatilla Counties, Oregon

1. The undersigned assessed the potential effects to listed and proposed threatened and endangered species and designated and proposed critical habitat from the Oregon Army National Guard's (ORARNG's) proposed expanded training operations on Camp Umatilla, within Morrow and Umatilla Counties, Oregon.

2. The proposed project would include a variety of activities, including facility demolition and construction and military training operations which are described as the proposed action in the environmental assessment (EA). This memorandum evaluates the potential effects to designated and proposed federal threatened and endangered species and critical habitat from the proposed action.

3. Camp Umatilla does not contain any listed or proposed species, does not contain proposed or designated critical habitat for any listed species, and the proposed action would not adversely affect habitat on which any of the species depend. Therefore the Oregon Army National Guard has concluded that the proposed action described in the EA would have <u>no effect</u> on any of the identified threatened or endangered species and would not destroy or adversely modify designated or proposed critical habitat. Any significant changes in the proposed project or action area will require additional Endangered Species Act review for potential effect analysis and determination.

4. On 18 September 2018, I reviewed the federal listings of threatened and endangered species for Morrow and Umatilla Counties, Oregon, which were current as of that date (accessed at http://ecos.fws.gov/ipac/ and http://www.nmfs.noaa.gov/pr/species/esa/fish.htm). The table below summarizes the listed and proposed federal threatened or endangered species which may occur in the counties, the designated and proposed critical habitat for those species in the counties, and the likely effect of the proposed project on those species and critical habitats.

Common Name	Scientific Name	Habitat Present?	Critical Habitat (CH) in Counties?	Determination
Bull trout	*Salvelinus confluentus*	No	Yes (Nearest CH is >3.5 mi N of proposed project)	No effect.
Chinook salmon (Snake River Basin spring/summer-run and fall-run ESUs and Upper Columbia River spring-run ESU)	*Onchorynchus tsawytscha*	No	Yes (Nearest CH is >3.5 mi N of proposed project)	No effect.

Common Name	Scientific Name	Habitat Present?	Critical Habitat (CH) in Counties?	Determination
Sockeye salmon (Snake River Basin ESU)	*Onchorynchus nerka*	No	Yes (Nearest CH is >3.5 mi N of proposed project)	No effect.
Steelhead trout (Middle Columbia River, Snake River basin, and Upper Columbia River DPSes)	*Onchorynchus mykiss*	No	Yes (Nearest CH is >3.5 mi N of proposed project)	No effect.
Yellow-billed cuckoo	*Coccyzus americanus*	No	No	No effect.
Gray wolf	*Canis lupus*	No	No	No effect.

5. The undersigned is the point of contact for this action and can be contacted by email Jeff.Mach.nfg@mail.mil or by telephone at (503) 584-3493/DSN 355-3493.

JEFF MACH
Natural Resources Conservation Manager

APPENDIX B:

VEGETATION AND WILDLIFE SPECIES THAT OCCUR AT CUO

Special status wildlife species that occur or have potential to occur at the CUO

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Global and State Rank[2]	Other Status[1,3,4]	Occurrence[5,6,7]
Reptiles						
Northern sagebrush lizard	*Sceloporus graciosus graciosus*	Species of Concern	Sensitive- Vulnerable	Global Rank: G5T5; State Rank: S5	ORBIC List 4	Present
Mammals						
Black-tailed jackrabbit	*Lepus californicus*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S4	ORBIC List 4	Present
Long-legged myotis	*Myotis volans*	Species of Concern	Sensitive- Vulnerable	Global Rank: G4G5; State Rank: S3	ORBIC List 4	Potential
Pallid bat	*Antrozous pallidus*	Species of Concern	Sensitive- Vulnerable	Global Rank: G4; State Rank: S2	ORBIC List 2	Potential
Townsend's big-eared bat	*Corynorhinus townsendii*	Species of Concern	Sensitive- Critical	Global Rank: G4; State Rank: S2	ORBIC List 2	Potential
Washington ground squirrel	*Urocitellus washingtoni*	Candidate	Endangered	Global Rank: G2; State Rank: S2	ORBIC List 1	Potential
White-tailed Jackrabbit	*Lepus townsendii*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S4	ORBIC List 3	Potential
Birds						
Bald eagle	*Haliaeetus leucocephalus*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S4B,S4N	Bald and Golden Eagle Protection Act; BCC Region 9; ORBIC List 4; MBTA	Potential; not confirmed, but may be transient visitors to the area [7]
Bobolink	*Dolichonyx oryzivorus*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S2B	ORBIC List 2; MBTA	Present
Brewer's sparrow	*Spizella breweri*	None	None	Global Rank: G5; State Rank: S4B	BCC Region 9; MBTA; DoD M-S Species	Present
Common nighthawk	*Chordeiles minor*	None	None	Global Rank: G5; State Rank: S5B	ORBIC List 4; MBTA; DoD M-S Species	Present
Ferruginous hawk	*Buteo regalis*	None	Sensitive- Vulnerable	Global Rank: G4; State Rank: S3B	BCC Region 9; MBTA	Present
Golden eagle	*Aquila chrysaetos*	None	None	Global Rank: G5; State Rank: S3S4	Bald and Golden Eagle Protection Act; ONHIC List 4; BCC Region 9; MBTA	Present
Grasshopper sparrow	*Ammodramus savannarum*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S2B	MBTA; DoD M-S Species	Present
Lewis' woodpecker	*Melanerpes lewis*	None	Sensitive- Critical	Global Rank: G4; State Rank: S2S3B	BCC Region 9; MBTA; DoD M-S Species	Present
Loggerhead shrike	*Lanius ludovicianus*	None	Sensitive- Vulnerable	Global Rank: G4; State Rank: S3B,S2N	BCC Region 9; MBTA; DoD M-S Species	Present
Long-billed curlew	*Numenius americanus*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S3B	BCC Region 9; MBTA; DoD M-S Species	Present
Merlin	*Falco columbarius*	None	None	Global Rank: G5; State Rank: SHB	ORBIC List 2; MBTA	Present
Peregrine falcon	*Falco peregrinus*	None	Sensitive- Vulnerable	Global Rank: G4; State Rank: S1	BCC Region 9; MBTA	Potential; not confirmed, but may be transient visitors to the area [7]
Prairie falcon	*Falco mexicanus*	None	None	Global Rank: G5; State Rank: S4	MBTA; DoD M-S Species	Present

Special status wildlife species that occur or have potential to occur at the CUO

Sage sparrow	*Amphispiza belli*	None	Sensitive- Critical	Global Rank: G4; State Rank: S?	BCC Region 9; MBTA	Present
Sage thrasher	*Oreoscoptes montanus*	None	None	Global Rank: G4; State Rank: S4B	BCC Region 9; MBTA	Present
Swainson’s hawk	*Buteo swainsoni*	None	Sensitive- Vulnerable	Global Rank: G5; State Rank: S3B	MBTA	Present
Tricolored blackbird	*Agelaius tricolor*	None	None	Global Rank: G3G4; State Rank: S2B	BCC Region 9; MBTA	Potential; not confirmed[7]
Western burrowing owl	*Athene cunicularia hypugaea*	None	Sensitive- Critical	Global Rank: G4T4; State Rank: S3B	MBTA; DoD M-S Species	Present
Western meadowlark	*Sturnella neglecta*	None	Sensitive- Critical	Global Rank: G5; State Rank: S4	ORBIC List 4; MBTA	Present

Sources:

[1] ORBIC 2013
[2] NatureServe 2015
[3] USFWS 2013
[4] USFWS 2008
[5] USFWS 2007
[6] Mach 2016
[7] Blake 2013
[8] TetraTech 2002

Notes:

Global and State Rank codes (NatureServe 2015):

G4: Apparently Secure
G5: Secure
S?: Unranked
S1: Critically Imperiled
S2: Imperiled
S3: Vulnerable
S4: Apparently Secure
S5: Secure
SH: Possibly extirpated
N: Non-breeding population in the state

B: Breeding population in the state

MBTA: Indicates birds protected under the Migratory Bird Treaty Act (80 FR 80594; USFWS 2015).

DoD M-S Species: Indicates birds on the DoD Partners in Flight Program list. These species are those that occur on DoD lands and are at risk of becoming listed as threatened or endangered under the federal Endangered Species Act if current populations trends continue. The purpose of this list is to help DoD resource managers better prioritize monitoring and management efforts on those species (and their habitats) having the highest potential to impact the military mission should they become Federally listed. A secondary focus was on those species with significant conservation concern on DoD lands.

BCC Region 9: Indicates birds of conservation concern identified by the USFWS for Region 9 (USFWS 2008).

ORBIC List 1: Contains taxa that are threatened with extinction or presumed to be extinct throughout their entire range. These are the taxa most at risk, and should be the highest priority for conservation action.

ORBIC List 2: Contains species threatened with extirpation or presumed to be extirpated from the state of Oregon. These are often peripheral or disjunct species which are of concern when considering species diversity within Oregon's borders. They can be very significant when protecting the genetic diversity of a taxon. ORBIC regards extreme rarity as a significant threat and has included species which are very rare in Oregon on this list.
ORBIC List 4: Contains species which are of conservation concern but are not currently threatened or endangered. This includes taxa which are very rare but are currently secure, as well as taxa which are declining in numbers or habitat but are still too common to be proposed as threatened or endangered. While these taxa may not currently need the same active management attention as threatened or endangered taxa, they do require continued

Migratory bird species that occur at the CUO

Common Name	**Scientific Name**
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American pipit	*Anthus rubescens*
American robin	*Turdus migratorius*
Bank swallow	*Riparia riparia*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Black phoebe	*Sayonaris nigricans*
Black-billed magpie	*Pica pica*
Bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer’s sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Bullock’s oriole	*Icterus bullockii*
California gull	*Larus californicus*
Chipping sparrow	*Spizella passerina*
Cliff swallow	*Petrochelidon pyrrhonota*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Cooper's hawk	*Accipiter cooperii*
Dark-eyed junco	*Junco hyemalis*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Grasshopper sparrow	*Ammodramus savannarum*
Great blue heron	*Ardea herodias*
Great horned owl	*Bubo virginianus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
Kildeer	*Charadrius vociferus*
Lark sparrow	*Chondestes grammacus*
Lewis’ woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovincianus*
Long-billed curlew	*Numenius americanus*
Mallard	*Anas platyrhynchos*
Merlin	*Falco columbarius*
Mourning dove	*Zenaida macroura marginella*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Prairie falcon	*Falco mexicanus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*

Migratory bird species that occur at the CUO

Ring-billed gull	*Larus delawarensis*
Rough-legged hawk	*Buteo lagopus*
Ruby-crowned kinglet	*Regulus calendula*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Savannah sparrow	*Passerculus sandwichensis*
Say’s phoebe	*Sayornis saya*
Short-eared owl	*Asio flammeus*
Spotted towhee	*Pipilo maculatus*
Swainson’s hawk	*Buteo swainsoni*
Tree swallow	*Tachycineta bicolor*
Vesper sparrow	*Pooecetes gramineus*
Violet-green swallow	*Tachycineta thalassina*
Western burrowing owl	*Athene cunicularia hypugea*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
Western screech-owl	*Megascops kennicottii*
Western wood-pewee	*Contopus sordidulus*
White-crowned sparrow	*Zonotrichia leucophrys*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Sources: USFWS 2013 Mach 2016 Blake 2013 Tetra Tech 2002	

Wildlife species present in the CUO area (non-special status species).

Common Name	Scientific Name
Amphibians	
Great Basin spadefoot toad	*Scaphiopus intermontanus*
Reptiles	
Bull snake	*Pituophis catenifer sayi*
Great Basin gopher snake	*Pituophis catenifer deserticola*
Northern pacific rattlesnake	*Crotalus viridis oreganus*
Western yellow-bellied racer	*Coluber constrictor mormon*
Birds	
California quail	*Callipepla californica*
Eurasian collared dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
Gray partridge	*Perdix perdix*
House sparrow	*Passer domesticus*
Ring-necked pheasant	*Phasianus colchicus*
Rock pigeon	*Columba livia*
Mammals	
American badger	*Taxidea taxus*
Bushy-tailed woodrat, packrat	*Neotoma cinerea*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Field mouse	*Peromyscus* spp.
Great Basin pocket mouse	*Perognathus parvus*
House mouse	*Mus musculus*
Long-tailed weasel, bridled weasel, big stoat	*Mustela frenata*
North American porcupine	*Erethizon dorsatum*
Northern pocket gopher	*Thomomys talpoides*
Nuttall's cottontail rabbit, mountain cottontail rabbit	*Sylvilagus nuttallii*
Ord's kangaroo rat	*Dipodomys ordii*
Pronghorn antelope	*Antilocapra americana*
Western harvest mouse	*Reithrodontomys megalotis*

Sources:
Mach 2016
Blake 2013
TetraTech 2002

All vegetation species that occur at the CUO

Scientific Name	**Common name**	**2000 Abundance**	**2014 Abundance**	**Other Status**[1,2]
Achillea millifolium	Common yarrow	C	O	---
Achnatherum hymenoides	Indian ricegrass	U	U	---
Agropyron cristatum	Crested wheatgrass	Ar	Ar	---
Agroseris grandiflora	Large-flowered agroseris	X	U	---
Agroseris heterophylla var. *heterophylla*	Annual agroseris	X	O	---
Ailanthus altissima	Tree of heaven	X	U	Oregon Noxious Weed Class B
Ambrosia acanthicarpa	Bur ragweed, flatspine	C	C	---
Amsinckia lycopsoides	Tarweed fiddleneck	X	C	---
Artemesia tridentata	Big sagebrush	Ar	O	---
Asclepias speciosa	Showy milkweed	U	U	---
Astragalus caricinus	Buckwheat milkvetch	X	U	---
Astragalus purshii	Woolypod milkvetch	U	O	---
Astragalus sclerocarpus	Stalked-pod milkvetch, woodypod milkvetch, The Dalles milkvetch	O	U	'Global Rank: G5; State Rank: NR; ORBIC List 3
Astragalus succumbens	Columbia milkvetch	C	O	Global Rank: G4G5; State Rank: S4; ORBIC List 4
Balsamorhiza careyana	Carey's balsamroot	Ar	O	---
Bromus tectorum	Cheatgrass	A	A	---
Calochortus macrocarpus var. *macrocarpus*	Sagebrush mariposa lily	O	O	---
Camissonia contorta	Plains evening primrose	X	U	---
Centaurea diffusa	Diffuse knapweed	Ar	Ar	Oregon Noxious Weed Class B
Chaenactis douglasii var. *douglasii*	False yarrow, Douglas' dustymaiden	O	U	---
Chamaesyce glyptosperma	Ribseed sandmat, corrugate-seeded spurge	C	C	---
Chenopdium album	Lambsquarters	X	U	---
Chondrilla juncea	Rush skeletonweed	Ar	Ar	Oregon Noxious Weed Class B
Chrysothamnus viscidiflorus var. *viscidiflorus*	Green rabbitbrush, yellow rabbitbrush	Ar	Ar	---
Cirsium arvense	Canada thistle	X	U	Oregon Noxious Weed Class B
Crepis atribarba	Slender hawksbeard	U	C	---
Crocidium multicaule	Spring gold, common spring-gold, gold stars	O	U	---

All vegetation species that occur at the CUO

Croton setiger	Dove weed, turkey mullein	O	O	---
Cryptantha circumscissa	Cushion cryptantha	X	O	---
Cryptantha pterocarya	Wingnut cryptantha, winged cryptantha	C	U	---
Cymopterus terebinthinus var. *terebinthinus*	Northern Indian parsnip, turpentine wavewing	C	C	---
Dactylis glomerata	Orchardgrass	X	U	---
Dalea ornata	Western prairie clover, Blue Mountain prairie clover, showy prairie clover	U	U	---
Delphinium nuttallianum	Two-lobe larkspur, upland larkspur	U	O	---
Descurainia nelsonii	Nelson's tansymustard	X	U	---
Descurainia sophia	Herb sophia	X	U	---
Dieteria canescens	Hoary-aster, hoary tansyaster	O	X	---
Draba verna	Spring draba, shadflower, nailwort, whitlow grass, Vernal Whitlow grass, early whitlow grass, spring whitlow grass	C	O	---
Elaegnus angustifolia	Russian olive	X	U	---
Elymus elymoides	Bottlebrush squirreltail	U	O	---
Elymus lanceolatus ssp. *lanceolatus*	Thickspike wheatgrass	C	C	---
Epilobium brachycarpum	Tall annual willowherb, tall fireweed	C	O	---
Eragrostis pectinacea	Tufted lovegrass	X	U	---
Ericameria nauseosa ssp. *speciosa*	Gray rabbitbrush, rubber rabbitbrush	Ar	Ar	---
Erigeron pumilus var. *intermedius*	Shaggy fleabane, shaggy daisy	O	X	---
Erigonium niveum	Snow buckwheat	C	Ar	---
Erigonium vimineum	Wickerstem buckwheat	C	Ar	---
Erodium cicutarium	Redstem stork's bill	C	C	---
Erysimum capitatum var. *capitatum*	Western wallflower	X	U	---
Gilia sinuata	Rosy gilia	X	U	---
Helianthus annuus	Common sunflower	X	U	---
Helianthus petiolaris ssp. *petiolaris*	Prairie sunflower	X	U	---
Hesperostipa comata ssp. *comata*	Needle-and-thread grass	Ar	A	---
Heterotheca villosa	hairy false goldenaster	Ar	Ar	---
Holosteum umbellatum	Jagged chickweed	C	O	---
Idahoa scapigera	Oldstem Idahoan	X	U	---
Lactuca serriola	Prickly lettuce	C	C	---

All vegetation species that occur at the CUO

Ladeania lanceolata	Lanceleaf, yellow scurfpea	Ar	Ar	---
Lagophylla ramosissima	Slender hareleaf, branched hareleaf	C	C	---
Lamium amplexicaule	Henbit deadnettle	X	U	---
Layia glandulosa	Whitedaisy tidytips	X	U	---
Lepidium perfoliatum	Clasping pepperweed	X	U	---
Leymus cinereus	Great Basin wildrye, basin wildrye	X	O	---
Linum perenne	Blue garden flax, perennial flax	X	U	---
Lomatium macrocarpum	Large-fruited lomatium, big-seed bisquitroot	C	C	---
Lygodesmia juncea	Rush-pink, rush skeletonplant	C	C	Global Rank G5; State Rank: NR; ORBIC List 3
Marrubium vulgare	Horehound, white horehound	X	U	---
Medicago sativa	Alfalfa	X	U	---
Melilotus albus	White sweetclover	X	U	---
Mentzelia albicaulis	Whitestem blazingstar	X	O	---
Microsteris gracilis	Slender phlox	X	U	---
Morus alba	White mulberry	X	U	---
Oenthera pallida var. *pallida*	Pale evening primrose, whitestem primrose	C	Ar	---
Onopordum acathium ssp. *acanthium*	Scotch cottonthistle	X	U	Oregon Noxious Weed Class B
Opuntia x columbiana	Starvation pricklypear, Columbia pricklypear, plains pricklypear	C	O	---
Persicaria maculosa	Spotted ladysthumb	X	U	---
Phacelia hastata var. hastata	Whiteleaf phacelia, silverleaf phacelia	O	O	---
Phacelia linearis	Threadleaf phacelia	X	U	---
Phlox longifolia ssp. *longifolia*	Longleaf phlox	O	C	---
Plantago patagonica	Indian wheat, wooly plantain	C	C	---
Plectritis macrocera	Longhorn plectritis, white plectritis	U	U	---
Plypogon monspeliensis	Annual rabbitsfoot grass	X	U	---
Poa bulbosa	Bulbous bluegrass	A	Ar	---
Poa pratensis	Kentucky bluegrass	X	U	---
Poa secunda ssp. *secunda*	Sandberg's bluegrass	A	A	---
Polygonum douglasii ssp. *majus*	Large knotweed	X	U	---
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	X	U	---
Pseudoroegneria spicata	Bluebunch wheatgrass	Ar	U	---
Purshia tridentata	Antelope bitterbrush	Ar	Ar	---
Robinia pseudoacacia	Black locust	X	U	---
Rumex venosus	Winged dock, veiny dock, wild begonia	Ar	O	---
Salix exigua	Narrowleaf willow	X	U	---

All vegetation species that occur at the CUO

Salsola tragus	Russian thistle	C	A	---
Secale cerale	Cereal rye	Ar	O	---
Silybum marianum	Blessed milkthistle	X	U	Oregon Noxious Weed Class B
Sisymbrium altissimum	Tall tumble mustard	Ar	A	---
Sporobolus cryptandrus	Sand dropseed	C	Ar	---
Syringa vulgaris	Common lilac	X	U	---
Taraxacum officinale	Common dandelion	X	U	---
Tragapogon dubius	Yellow salsify, yellow goatsbeard	C	Ar	---
Triteleia grandiflora	Howell's triteleia, largeflower triteleia	O	U	---
Typha latifolia	Broadleaf cattail	X	U	---
Verbascum thapsus	Common mullein	X	U	---
Verbena bracteata	Bigbract verbena	X	U	---
Veronica americana	American seedwell	X	U	---
Veronica anagallis-aquatica	Water speedwell	X	U	---
Vulpia microstachys	Small fescue	X	U	---
Vulpia octoflora	Sixweeks fescue	X	U	---
Yucca filamentosa	Adam's needle	X	U	---

NOTES:

Plant list source: Brown and Meinke 2016

[1] ORBIC 2013

[2] ODA 2016

Local abundance classified as (Brown and Meinke 2016):

- A - Abundant and widespread; seen in >20 places on the installation
- Ar - Locally abundant, but with restricted distribution on the installation
- C - Common, but not a dominant species at any survey site
- O - Encountered occasionally throughout the installation
- U - Uncommon or rarely encountered on the installation
- X - Not encountered

ORBIC List 3 = Taxa for which more information is needed before the status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

ORBIC List 4 = Taxa which are of conservation concern but are not currently threatened or endangered.

Oregon Noxious Weed Class B = Listed by Oregon Department of Agriculture (ODA) as a noxious weed with a rating of "B," meaning that it is a a weed of economic importance which is regionally abundant, but which may have limited distribution in some counties.

APPENDIX C:

PROGRAMMATIC AGREEMENT

PROGRAMMATIC AGREEMENT
AMONG
THE NATIONAL GUARD BUREAU,
THE OREGON ARMY NATIONAL GUARD,
THE OREGON STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
FOR THE
CAMP UMATILLA OREGON EXPANSION, DEVELOPMENT AND OPERATIONS PROJECT
2018

WHEREAS, the National Guard Bureau (NGB), as a federal agency, is required to comply with the National Historic Preservation Act (NHPA) 54 U.S.C. 300101 et seq., and its implementing regulations, 36 C.F.R. §800, and the NGB, a joint activity of the Department of Defense, provides federal funding and guidance to state Guard organizations such as the Oregon Army National Guard (ORARNG); and

WHEREAS, the Department of the Army (Army) has granted to the ORARNG a real estate license, No. DACA 67-3-17-66, dated 1 December 2017, in 7,500 acres of the former 19,728 acre Umatilla Chemical Depot (as depicted in Appendix A) that is referred to as Camp Umatilla Oregon (CUO); and

WHEREAS, the ORARNG proposes to expand military training operations and associated infrastructure development at CUO. Expanded military training operations would require infrastructure improvements such as new construction of purpose-built modern facilities, modification and reuse of existing buildings and structures, demolition of unneeded buildings and structures, and repair and replacement of transportation and utilities infrastructure. Military training activities at CUO would be expanded to support the training requirements of multiple battalions. Military training and infrastructure development would be accomplished on federal lands using both federal and state funding; and the ORARNG and NGB have determined that this project (i.e., Camp Umatilla Expansion, Development and Operations) constitutes a federal Undertaking as defined by 36 C.F.R. §800.16(y); and

WHEREAS, the ORARNG consulted with the Oregon State Historic Preservation Office (SHPO) pursuant to 36 C.F.R. §800.6(a), *Protection of Historic Properties* and established the Area of Potential Effect (APE) as defined at 36 C.F.R. §800.16(d) (depicted in Appendix A). The historic properties identified within that APE consist of the “Umatilla Chemical Depot Historic District”, an 1874 Wagon Road (35UM497), and a property of traditional religious and cultural significance to the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) known as Coyote Coulee, and determined that the demolition, modifications, new construction and military training required by the CUO Expansion, Development and Operations Project will have an adverse effect on these historic properties; and

WHEREAS, the Army previously identified and evaluated the “Umatilla Chemical Depot Historic District” for eligibility to the National Register of Historic Places (NRHP) at both national and local levels; it consists of 1,516 buildings and structures that once formed the Umatilla Chemical Depot. The Army determined that 1,217 of these buildings and structures are contributing properties and 299 are non-contributing properties to one Historic District that is eligible for inclusion on the NRHP at the national level under Criterion A for its association with World War II-era ammunition storage and Cold War-era Chemical Weapons work. The Army received concurrence with this determination from the Oregon SHPO by correspondence dated May 25, 2016. Appendix B to this PA identifies 563 buildings and structures of the 1,217 contributing properties to the National Register-eligible Umatilla Chemical Depot Historic District that are located inside the APE (the remaining 654 properties are not on ORARNG property and are not subject to this PA) and that the ORARNG will adversely effect as part of the CUO Expansion, Development and Operations Project; and

WHEREAS, 427 buildings and structures of the 563 contributing properties within the APE, marked in Appendix B, are covered under the *Program Comment For World War II and Cold War era (1939-1974) Ammunition Storage Facilities*, approved by the Advisory Council on Historic Preservation (ACHP) and issued on 18 August 2006 to the Department of Defense; and

WHEREAS, a historic wagon road (35UM497) that crosses the southern portion of the APE was identified and determined eligible for inclusion on the NRHP by the Army, with concurrence received from the SHPO by correspondence dated August 18, 2016; and

WHEREAS, in consultation with the ORARNG, the CTUIR have identified a potential property of traditional religious and cultural significance, known as Coyote Coulee, that crosses a portion of the APE and that the ORARNG will treat as eligible for inclusion on the NRHP; and

WHEREAS, 670 acres of the APE have been surveyed for archaeological resources by the Army (some according to older standards), 3,075 acres are previously disturbed and do not warrant archaeological survey, and 4,211 acres remain to be surveyed or re-surveyed prior to ground-disturbing actions (Appendix C); and

WHEREAS, any undertakings as defined at 36 C.F.R. §800.16(y) not included in this PA will be reviewed individually through the standard Section 106 Process as described in 36 C.F.R. §800; and

WHEREAS, the ORARNG notified and offered an opportunity to consult to the federally-recognized Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Confederated Tribes of the Warm Springs Reservation and consulted with the CTUIR at their request; and

WHEREAS, the ORARNG has afforded the public an opportunity to comment on the mitigation plan for the Undertaking through public notices posted in the *East Oregonian*, and *Hermiston Herald* on July 03-04, 2018, and public comments were not received; and

WHEREAS, the ORARNG notified the ACHP of the adverse effect determination and invited the ACHP to participate in this consultation per 36 CFR §800.6 (a)(l) in a letter dated February, 16 2017, and the ACHP has chosen to participate in the consultation by letter dated April 5, 2017; and

NOW, THEREFORE, the ORARNG, NGB, Oregon SHPO and ACHP agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

ORARNG shall ensure that the following stipulations are carried out:

I. MITIGATION

A. Designation of Representative Historic District

1. The ORARNG shall designate a 15.5-acre area within the cantonment and an 8-acre area of Igloos as a smaller discontiguous historic district (proposal depicted in Appendix D – Representative Historic District Map) that is representative of the larger World War II and Cold War-era historic district identified by the Army. The ORARNG will maintain the architectural integrity of the historic buildings and structures indefinitely as outlined in the Historic District Management Manual (HDMM) described in Stipulation I.B. Those buildings and structures outside the representative historic district would no longer be subject to the

Section 106 process or Stipulation II and may be demolished, modified, maintained or otherwise altered without further consultation.

B. Develop a Historic District Management Manual (HDMM)

1. The ORARNG shall develop, in consultation with the Oregon SHPO, a maintenance and management manual for the newly designated representative historic district that will outline in more detail the acceptable building and structure modifications and new construction that are allowable to ensure that the historic buildings and structures are viable long-term contributors to the ORARNG's mission and readiness. The HDMM will be completed within four (4) years of execution of this PA and will require Oregon SHPO review and concurrence in order to be finalized and viable. If ORARNG and the Oregon SHPO are unable to reach agreement on a final HDMM, then ORARNG would follow Stipulation III.G. The HDMM will include the following main outline elements for each of the historic properties included within the representative historic district.

    a. Basic Description: A narrative description of the property's history, architecture, design and function.
    b. Identification of Character-Defining Features: Identifying the aspects of the overall property, including those of individual buildings or structures, that define its historic character.
    c. Alterations or Modifications Present: A statement of "current condition," including changes over time that either support or detract from the character-defining aspects.
    d. Goal: The objective for all maintenance and management activities concerning this particular property including allowable additions and modifications; preservation of character-defining features and integrity of setting, feeling, association, design, workmanship, materials, and location.
    e. Approach: a general statement defining the basic approach to meet the goal. As appropriate, this section may include web links or other references to recommended products, materials or reference documents considered useful to the recommended approach.
    f. Exempt Actions: a descriptive list of specific kinds of future actions that would be exempt from additional Section 106 consultation; all other actions would be addressed under Section II, ORARNG Project Review Procedures.
    g. New Construction: a description of guidelines for any new construction within the historic district.
    h. Landscape: a description of landscape management and alteration guidelines.

C. Coyote Coulee Protection and Access.

1. The ORARNG will treat Coyote Coulee as eligible for the National Register as a property of traditional religious and cultural significance to the CTUIR: 1) by limiting off-road vehicular traffic or new construction within previously undisturbed portions of the potential historic property, and 2) by consulting with the CTUIR to develop, within two years of execution of this PA, a written protocol allowing CTUIR tribal member access during certain times of the year to carry out cultural practices.

D. Archaeological Surveys.

1. The ORARNG will complete additional archaeological pedestrian surveys (approximately 4211 acres) in previously undisturbed un-surveyed areas prior to any CUO Expansion,

Development and Operations Project that involves ground-disturbing actions in that area or within five years of execution of this PA (Appendix C – Archaeological Surveys). Survey results and reports will be prepared according to the most current State of Oregon Field and Reporting Guidelines and will allow 30 day review by the Oregon SHPO and the CTUIR prior to any ground disturbing actions in the related area. Testing will not be conducted unless a site is identified.

E. Historic Wagon Road.

1. The ORARNG will photographically document the portion of the 1874 wagon road (35UM497) that is located on CUO and update the existing Oregon Archaeological Site Form as needed. Prior to any ground disturbance of the 1874 wagon road and within five years of execution of this PA, the ORARNG will complete a Light Detection and Ranging (LIDAR) study of the wagon road (35UM497) to better document its exact track across the CUO. The LIDAR study and products will require Oregon SHPO review and concurrence in order to be finalized and viable. The resulting LIDAR bare-earth data set will be offered to National Historic Oregon Trail Interpretive Center Baker City, Oregon and the Columbia Gorge Discovery Center and Museum The Dalles, Oregon. The historic wagon road would no longer be subject to the Section 106 process or Stipulation II and may be demolished, modified, or otherwise impacted without further consultation.

II. ORARNG PROJECT REVIEW PROCEDURES

A. Determine the Undertaking is one not already mitigated under Stipulation I.

1. The ORARNG Cultural Resources Manager (CRM), who meets the qualifications listed in Stipulation III(B), shall determine if a project is an undertaking as defined in 36 CFR § 800.16(y) and whether that project has Potential to Cause Effects (36 CFR § 800.3(a)(1)).

    a. If the CRM determines the proposed project is an undertaking, the CRM will follow the procedures in Stipulation II.B.

    b. If the CRM determines that a project is not an undertaking or has “No Potential to Cause Effects,” ORARNG has no further obligations under Stipulation II of this agreement.

B. Identification of Historic Properties

1. The CRM shall, in consultation with the SHPO, define and document a site-specific APE appropriate for the scope and scale of the undertaking, considering direct, indirect, and cumulative effects.

2. The CRM shall, in consultation with the SHPO, determine if cultural resource surveys are required for all or a portion of the site specific APE using the following parameters:

    a. The APE encompasses an undisturbed area without any previous cultural resource surveys.

    b. Determines if previous surveys are inadequate.

3. If cultural resource surveys are required, the ORARNG shall follow the Section 106 compliance process at 36 CFR § 800.4(b), *Identify historic properties,* and will proceed to Stipulation II(B)4.

4. If cultural resource surveys have been completed and include identified but unevaluated cultural resources in the APE, the ORARNG shall follow the compliance process at 36 CFR § 800.4(c), *Evaluate historic significance,* and will proceed to Stipulation II(B)5 or II(B)6.

5. If the site-specific APE is outside of the Representative Historic District and surveys have identified all Historic Properties in the APE, as defined by 36 CFR § 800.16(l)(2), the CRM determines one of the following:

   a. "No Historic Properties Affected". The CRM shall document this determination for inclusion in the Annual Report (Stipulation III.C), and ORARNG has no further obligations under Stipulation II of this agreement.

   b. "Historic Properties Affected". The CRM will follow Stipulation II.C.

6. When the site-specific APE is within the Representative Historic District

   a. If an undertaking will not affect the exterior of a contributing property in the Historic District or the integrity of the District overall, the undertaking is confined to a non-contributing building, or the undertaking adheres to the guidelines of the HDMM (Stipulation I.B), the CRM shall determine "No Historic Properties Affected." The CRM shall document that finding in the Annual Report (Stipulation III.C). ORARNG has no further obligations under Stipulation II of this agreement.

   b. If an undertaking has the potential to affect the exterior of any individual property contributing to the Historic District and does not adhere to the guidelines of the HDMM (Stipulation I.B.), the CRM shall determine "Historic Properties Affected" and will follow Stipulation II.C.

C. Assessment of Effects

1. ORARNG shall provide documentation to the SHPO using *Oregon Reporting Guidelines* (2011) consisting of: 1) a detailed description of the proposed undertaking and determination of effect; 2) images of the affected contributing property; and, 3) a planview map of the project location. SHPO shall have thirty (30) calendar days to review documentation and provide a response.

2. ORARNG shall give the CTUIR and interested parties an opportunity to review and comment on proposed undertakings. The CTUIR and interested parties shall have at least thirty (30) calendar days to review documentation and provide a response. ORARNG will make every reasonable effort to address objections within thirty (30) calendar days.

3. If, with concurrence from SHPO, the CRM determines that the undertaking will result in No Adverse Effect, then the CRM shall document the finding in the Annual Report (Stipulation III.C). ORARNG has no further obligations under Stipulation II of this agreement.

4. If ORARNG and SHPO are unable to reach concurrence on a No Adverse Effect, then ORARNG will follow the procedures found in 36 CFR § 800.5(c).

5. If, with concurrence from SHPO, the CRM makes a determination of Historic Properties Adversely Affected (36 CFR § 800.5(d)(2)), ORARNG shall follow Stipulation II(D).

D. Resolution of Adverse Effects

1. The ORARNG shall follow the Section 106 process at 36 CFR § 800.6(b)(1) and (c). The ACHP will not participate in resolving adverse effects unless specifically requested by a consulting party or otherwise choosing to participate. The public will be notified of an adverse effect as stipulated in 36 CFR § 800.6(a)(4).

2. ORARNG shall review and resolve any substantive comments by consulting parties. ORARNG shall consult with the SHPO and other signatories to resolve any objections. ORARNG will make every reasonable effort to resolve comments within thirty (30) calendar days. Project actions which are not the subject of the objections may proceed while the consultation is conducted.

III. ADMINSTRATIVE STIPULATIONS

A. Definition of signatories.

1. For the purposes of this PA the term "signatories to this PA" means the ACHP, NGB, ORARNG and the Oregon SHPO, each of which has authority under 36 C.F.R. §800.6(c)(1) to execute, amend, or terminate the PA.

B. Professional supervision.

1. The ORARNG shall ensure that all activities regarding archaeological or historic preservation related fieldwork, research and reporting that are carried out pursuant to this PA are carried out by or under the direct supervision of a person or persons meeting the *Secretary of the Interior's Professional Qualifications Standards for Archaeology and Historic Preservation* (36 C.F.R. Part 61).

C. Annual Report.

1. ORARNG will submit an annual report to the Oregon SHPO, NGB, and CTUIR not later than December 31 following the previous federal fiscal year. The annual report will follow the outline found in Appendix E – Annual Report Template, and will list the actions that have been taken under this PA during the previous fiscal year. The ORARNG will be available for a follow-up meeting to discuss in greater detail if requested by the Oregon SHPO.

D. Duration.

1. This PA will expire if the timeframes in Section 1 Mitigation are not met, and all parties are unable to agree to an amendment extending the PA as outlined in Section J. This PA shall expire in ten (10) years from the date of its execution. At such time, and prior to work continuing on the undertaking, ORARNG shall: (a) amend the PA as outlined in Section J, (b) execute a Memorandum of Agreement (MOA) pursuant to 36 C.F.R. § 800.6, or (c)

request, take into account, and respond to the comments of the ACHP under 36 C.F.R. § 800.7. Prior to such time, ORARNG may consult with the other signatories to reconsider the terms of the PA and amend it in accordance with Stipulation K below. ORARNG shall notify the signatories and CTUIR, as appropriate, as to the course of action it will pursue.

E. Post-Review Discoveries.

1. In the event that archaeological materials are discovered during construction activities, the ORARNG will stop work in the area of the discovery and follow procedures established under 36 C.F.R. §800.13(b)(3).

F. Inadvertent Discovery of Human Remains.

1. If human remains or other unidentified cultural items, as defined in the Native American Graves Protection and Repatriation Act, 25 USC §3001 et seq., (NAGPRA), are discovered, work in the vicinity of the discovery will immediately cease and the remains or other cultural items will be safeguarded in place. The ORARNG will ensure compliance with NAGPRA consistent with 43 CFR § 10.4, Inadvertent Discoveries and will contact CTUIR and SHPO. The ORARNG will include this requirement in any permit, work order, or contract issued for work at Camp Umatilla.

G. Dispute Resolution.

1. Should any signatory to this PA object at any time to any actions proposed or the manner in which the terms of this PA are implemented, ORARNG shall consult with such party to resolve the objection. If ORARNG determines that such objection by a signatory of this PA cannot be resolved, ORARNG will:

    a. Forward all documentation relevant to the dispute, including the ORARNG’s proposed resolution, to NGB. Once NGB has reviewed the dispute, NGB will forward the information to the ACHP. The ACHP shall provide NGB and ORARNG with its advice on the resolution of the objection within 30 days of receiving adequate documentation of the dispute. Prior to reaching a final decision on the dispute, ORARNG shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories, or consulting parties and provide them with a copy of this written response. ORARNG will then proceed according to its final decision.

    b. If the ACHP does not provide its advice regarding the dispute within the 30 day time period, ORARNG and NGB may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, ORARNG, in cooperation with NGB, shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and consulting parties, and provide them and the ACHP with a copy of such written response.

    c. ORARNG's responsibilities to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

H. Anti-Deficiency Act compliance.

1. All requirements set forth in this PA requiring expenditure of Army funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 U.S.C. Section 1341). No obligation undertaken by the Army under the terms of this PA

shall require or be interpreted to require a commitment to expend funds not appropriated for a particular purpose.

I. Review.

1. The SHPO, CTUIR, and NGB, will review this PA each year upon receipt of the ORARNG's Annual Report described in III. C. 1 above. ORARNG will be available for a meeting after each Annual Report is submitted to discuss in greater detail, if requested by SHPO or CTUIR. Every five (5) years from the date of its execution, the SHPO and ORARNG will conduct a mandatory face-to-face meeting to assess the PA's effectiveness, the usefulness of the Annual Reports, and to identify any PA amendments that might be required.

J. Amendments.

1. This PA may be amended when such an amendment is agreed to in writing by all signatories and reviewed by CTUIR. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

K. Termination.

1. If any signatory to this PA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation K above. If within thirty (30) days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the PA upon written notification to the other signatories and CTUIR.
2. Once this PA is terminated, the ORARNG shall comply with the standard Section 106 process as outlined in 36 CFR § 800.3 through 800.7.

EXECUTION of this PA by the ORARNG, NGB, Oregon SHPO and the ACHP and implementation of its terms evidences that ORARNG and NGB have taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

PROGRAMMATIC AGREEMENT AMONG THE NATIONAL GUARD BUREAU, THE OREGON ARMY NATIONAL GUARD, THE OREGON STATE HISTORIC PRESERVATION OFFICE, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION FOR THE CAMP UMATILLA OREGON EXPANSION, DEVELOPMENT AND OPERATIONS PROJECT

2018

Signature Page

NATIONAL GUARD BUREAU

Date: 21 Aug 2018

William M. Myer
Colonel, US Army
Deputy Chief of Staff, Installations &
Environment
Army National Guard

PROGRAMMATIC AGREEMENT
AMONG
THE NATIONAL GUARD BUREAU,
THE OREGON ARMY NATIONAL GUARD,
THE OREGON STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
FOR THE
CAMP UMATILLA OREGON EXPANSION, DEVELOPMENT AND OPERATIONS PROJECT
2018

Signature Page

OREGON ARMY NATIONAL GUARD

Michael E. Stencel Date: 23 Aug 18
MICHAEL E. STENCEL
Major General
The Adjutant General

PROGRAMMATIC AGREEMENT
AMONG
THE NATIONAL GUARD BUREAU,
THE OREGON ARMY NATIONAL GUARD,
THE OREGON STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
FOR THE
CAMP UMATILLA OREGON EXPANSION, DEVELOPMENT AND OPERATIONS PROJECT
2018

Signature Page

OREGON STATE HISTORIC PRESERVATION OFFICE

Christine Curran Date: 8.27.18
CHRISTINE CURRAN
Oregon Deputy State Historic Preservation Officer

PROGRAMMATIC AGREEMENT
AMONG
THE NATIONAL GUARD BUREAU,
THE OREGON ARMY NATIONAL GUARD,
THE OREGON STATE HISTORIC PRESERVATION OFFICE,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
FOR THE
CAMP UMATILLA OREGON EXPANSION, DEVELOPMENT AND OPERATIONS PROJECT
2018

Signature Page

ADVISORY COUNCIL ON HISTORIC PRESERVATION

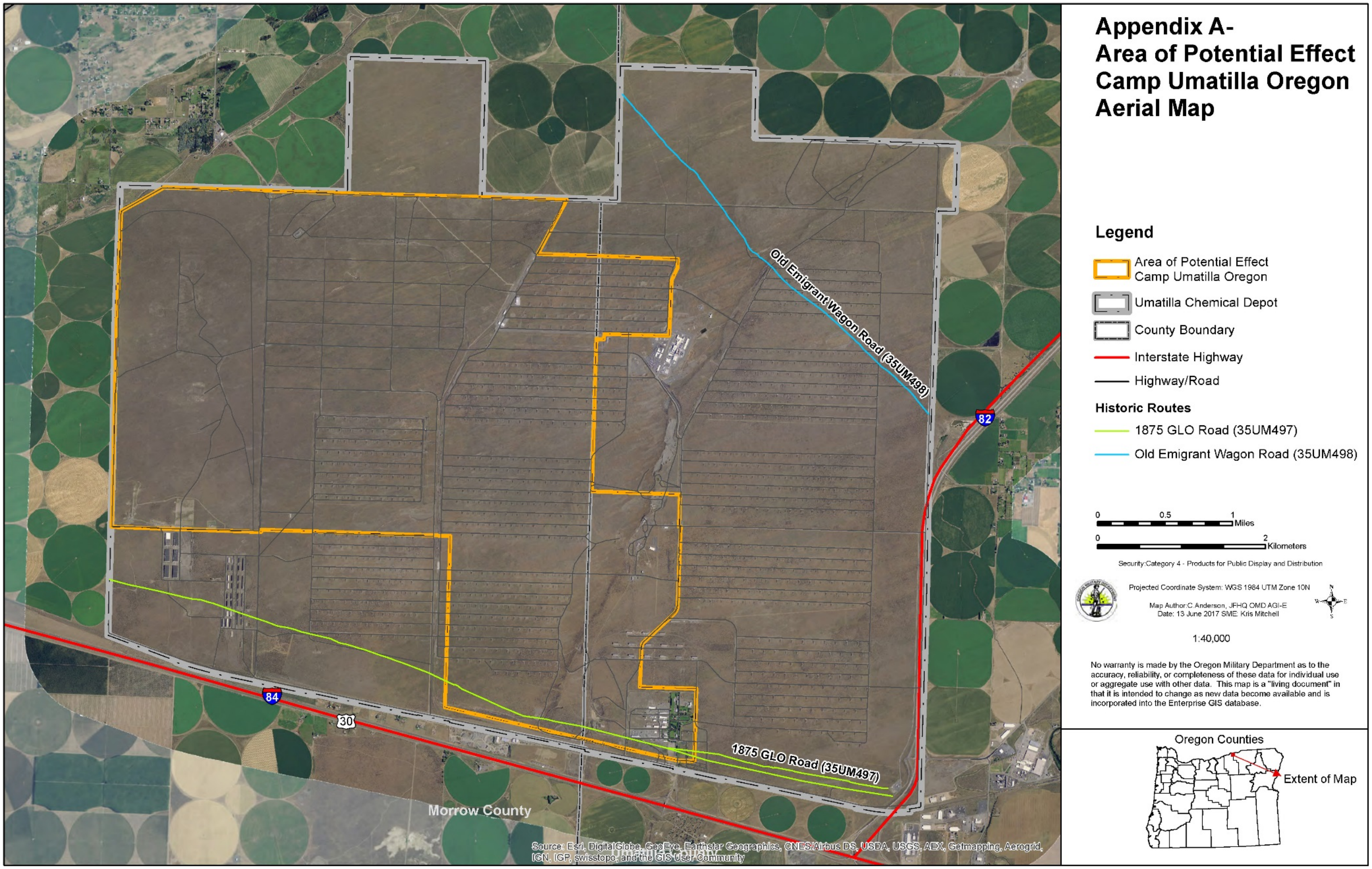
John M. Fowler

Date: 9/18/18

JOHN M. FOWLER
Executive Director

Appendix A – APE Map
Appendix B – List of Historic Properties with Eligibility
Appendix C – Archaeological Surveys
Appendix D – Representative Historic District Map
Appendix E – Annual Report Template
Appendix F – Public Notice

Appendix A – APE Map (Aerial)



Security:Category 4 - Products for Public Display and Distribution

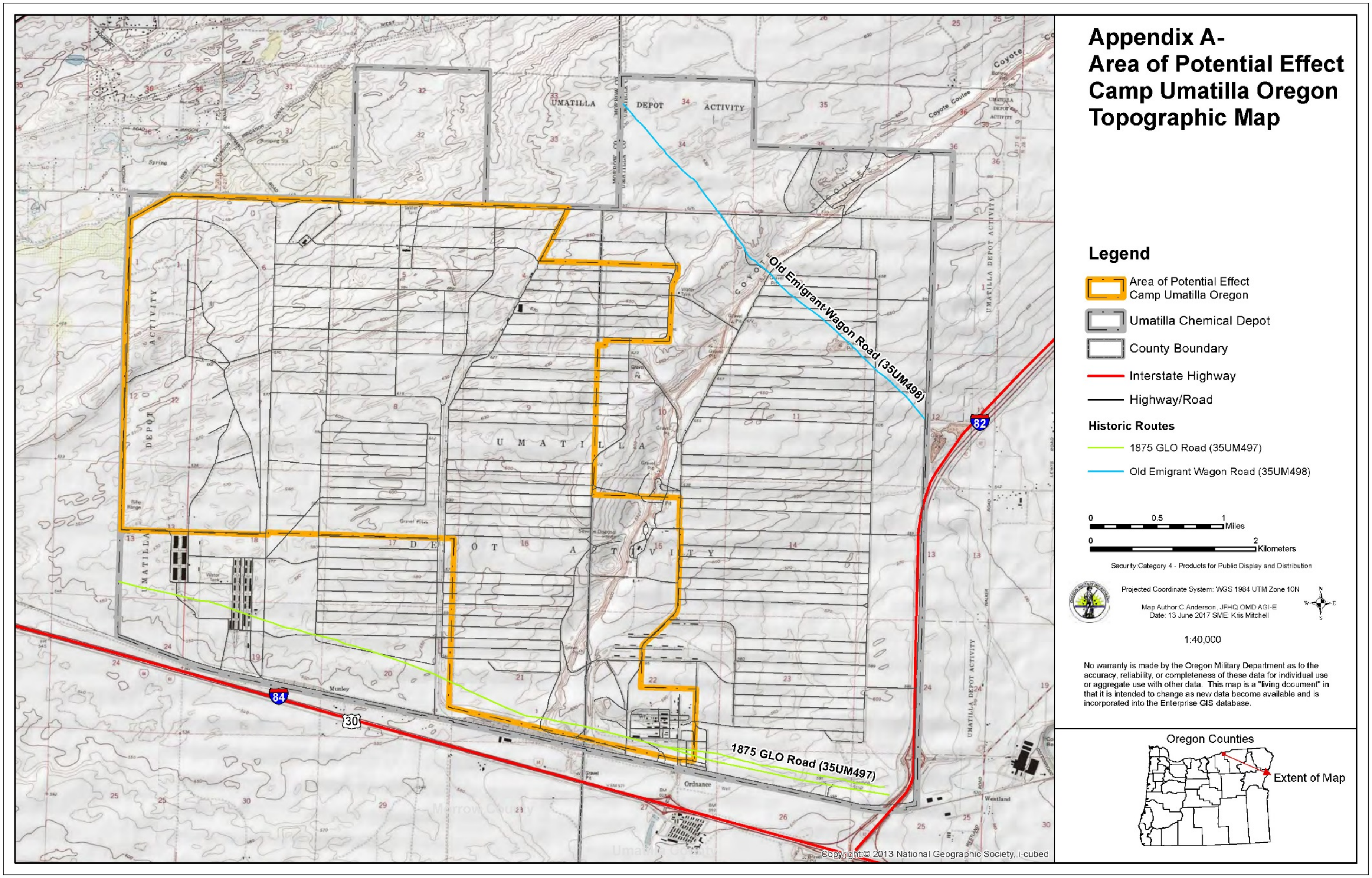
Projected Coordinate System: WGS 1984 UTM Zone 10N

Map Author:C.Anderson, JFHQ OMD AGI-E
Date: 13 June 2017 SME: Kris Mitchell

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document" in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Appendix A – APE Map (Topographic)



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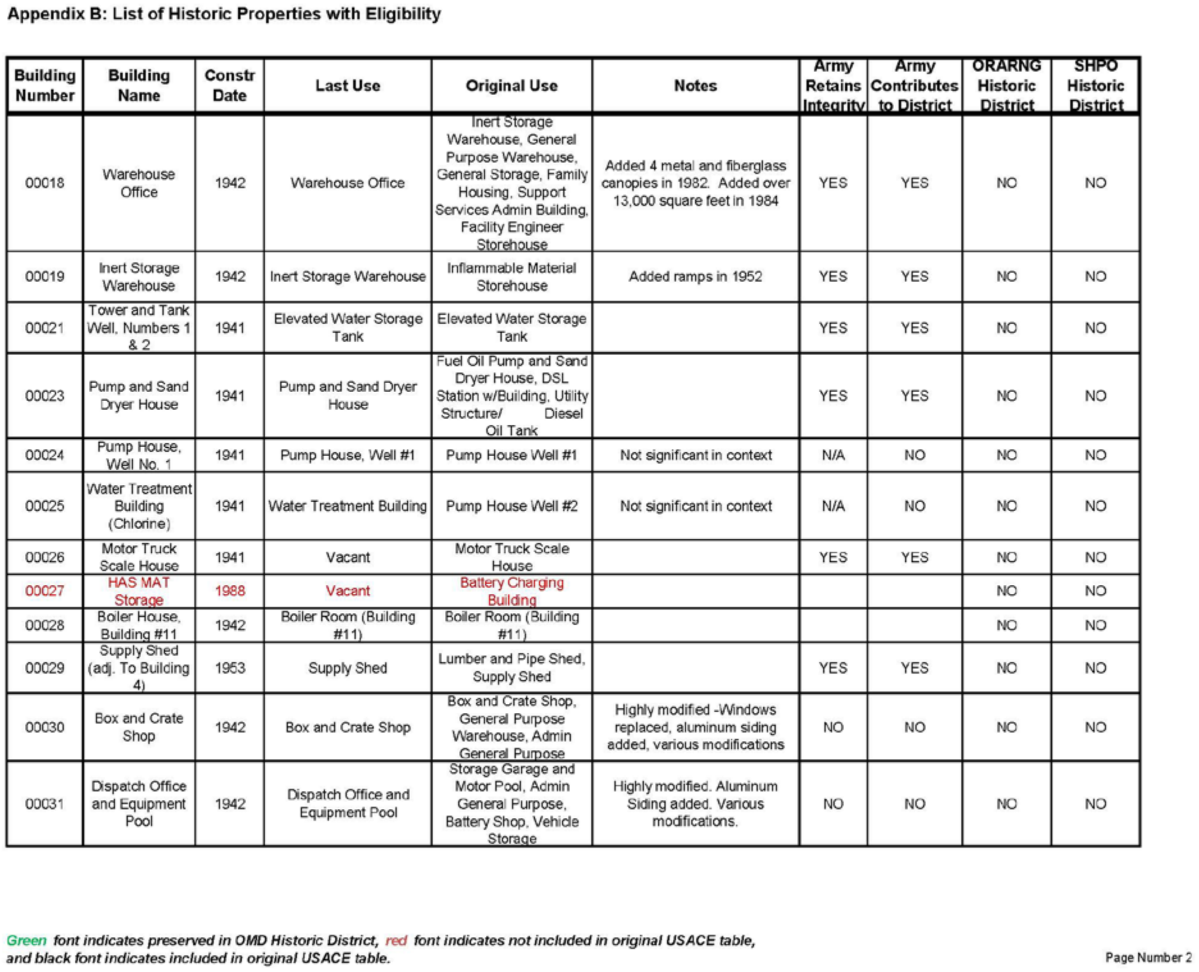
Appendix B: List of Historic Properties with Eligibility

Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00001	Headquarters	1942	Headquarters Building	Headquarters Building		YES	YES	YES	YES
00002	Fire Dept/ Security	1941	Fire Station	Fire and Guard and Dispensary	Also: Administration General Purpose, Police Station, General Store House, Telephone exchange building	YES	YES	YES	YES
00003	Police Headquarters	1942	Police Headquarters	Provost Marshal and Military Police Admin Building		YES	YES	YES	YES
00004	Machine Shop	1942	Machine Shop	Facilities Engineering Maintenance Shop	Also, Vehicle storage, Engineering Administration building, Maintenance Shop, General Purpose	YES	YES	YES	YES
00005	Garage	1942	Garage	Garage	Also, Vehicle Maintenance Shop, Supply Maintenance Warehouse, Administration General Purpose	YES	YES	YES	YES
00006	Motor Fuel Station	1942	Motor Fuel Station	Gas Station with Building	16 Gauge steel tar coated fuel tanks 60,900 gal - installed 1984	YES	YES	YES	YES
00007	Carpenter Shop	1942	Carpenter Shop	Facilities Engineering Maintenance Shop		YES	YES	YES	YES
00008	Pest Control Building	1942	Pest Control Building	Facilities Engineering Maintenance Shop		YES	YES	NO	NO
00009	Housing Warehouse	1942	Housing Warehouse	Paint Storage Building		YES	YES	NO	NO
00010	Locomotive House	1942	Locomotive House	Locomotive House		YES	YES	YES	YES
00011	Dispensary	1942	Dispensary	General Purpose Warehouse	18 Oct 1978 - converted to Dispensary with beds to support chemical mission; calibration facility, engineering Maintenance, shop, medical supply.	YES	YES	NO	NO
00012	Recycle	1953	Recycle	Recycle		YES	YES	NO	NO
00014	Transformer House	1942	Substation Building/ Switching Station	Transformer House		YES	YES	YES	YES
00015	Family Quarters	1942	Family Quarters	NCO Quarters		YES	YES	YES	YES
00016	Family Quarters	1942	Family Quarters	NCO Quarters		YES	YES	YES	YES
00017	Inert Storage Warehouse	1942	General Purpose Warehouse	Inert Storage Warehouse		YES	YES	NO	NO

Green font indicates preserved in OMD Historic District, red font indicates not included in original USACE table, and black font indicates included in original USACE table.



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Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00018	Warehouse Office	1942	Warehouse Office	Inert Storage Warehouse, General Purpose Warehouse, General Storage, Family Housing, Support Services Admin Building, Facility Engineer Storehouse	Added 4 metal and fiberglass canopies in 1982. Added over 13,000 square feet in 1984	YES	YES	NO	NO
00019	Inert Storage Warehouse	1942	Inert Storage Warehouse	Inflammable Material Storehouse	Added ramps in 1952	YES	YES	NO	NO
00021	Tower and Tank Well, Numbers 1 & 2	1941	Elevated Water Storage Tank	Elevated Water Storage Tank		YES	YES	NO	NO
00023	Pump and Sand Dryer House	1941	Pump and Sand Dryer House	Fuel Oil Pump and Sand Dryer House, DSL Station w/Building, Utility Structure/ Diesel Oil Tank		YES	YES	NO	NO
00024	Pump House, Well No. 1	1941	Pump House, Well #1	Pump House Well #1	Not significant in context	N/A	NO	NO	NO
00025	Water Treatment Building (Chlorine)	1941	Water Treatment Building	Pump House Well #2	Not significant in context	N/A	NO	NO	NO
00026	Motor Truck Scale House	1941	Vacant	Motor Truck Scale House		YES	YES	NO	NO
00027	HAS MAT Storage	1988	Vacant	Battery Charging Building				NO	NO
00028	Boiler House, Building #11	1942	Boiler Room (Building #11)	Boiler Room (Building #11)				NO	NO
00029	Supply Shed (adj. To Building 4)	1953	Supply Shed	Lumber and Pipe Shed, Supply Shed		YES	YES	NO	NO
00030	Box and Crate Shop	1942	Box and Crate Shop	Box and Crate Shop, General Purpose Warehouse, Admin General Purpose	Highly modified -Windows replaced, aluminum siding added, various modifications	NO	NO	NO	NO
00031	Dispatch Office and Equipment Pool	1942	Dispatch Office and Equipment Pool	Storage Garage and Motor Pool, Admin General Purpose, Battery Shop, Vehicle Storage	Highly modified. Aluminum Siding added. Various modifications.	NO	NO	NO	NO

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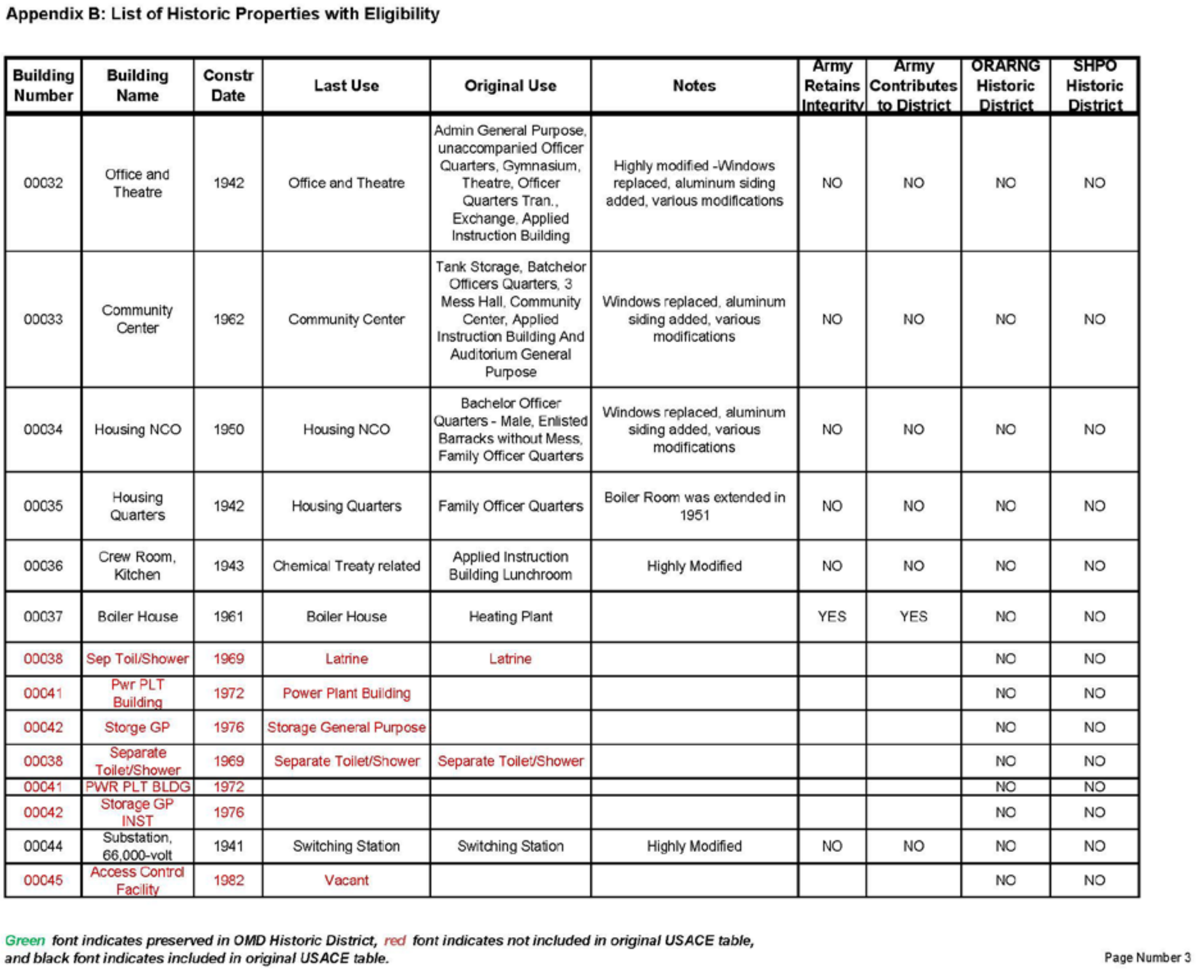

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Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00032	Office and Theatre	1942	Office and Theatre	Admin General Purpose, unaccompanied Officer Quarters, Gymnasium, Theatre, Officer Quarters Tran., Exchange, Applied Instruction Building	Highly modified -Windows replaced, aluminum siding added, various modifications	NO	NO	NO	NO
00033	Community Center	1962	Community Center	Tank Storage, Batchelor Officers Quarters, 3 Mess Hall, Community Center, Applied Instruction Building And Auditorium General Purpose	Windows replaced, aluminum siding added, various modifications	NO	NO	NO	NO
00034	Housing NCO	1950	Housing NCO	Bachelor Officer Quarters - Male, Enlisted Barracks without Mess, Family Officer Quarters	Windows replaced, aluminum siding added, various modifications	NO	NO	NO	NO
00035	Housing Quarters	1942	Housing Quarters	Family Officer Quarters	Boiler Room was extended in 1951	NO	NO	NO	NO
00036	Crew Room, Kitchen	1943	Chemical Treaty related	Applied Instruction Building Lunchroom	Highly Modified	NO	NO	NO	NO
00037	Boiler House	1961	Boiler House	Heating Plant		YES	YES	NO	NO
00038	Sep Toil/Shower	1969	Latrine	Latrine				NO	NO
00041	Pwr PLT Building	1972	Power Plant Building					NO	NO
00042	Storge GP	1976	Storage General Purpose					NO	NO
00038	Separate Toilet/Shower	1969	Separate Toilet/Shower	Separate Toilet/Shower				NO	NO
00041	PWR PLT BLDG	1972						NO	NO
00042	Storage GP INST	1976						NO	NO
00044	Substation, 66,000-volt	1941	Switching Station	Switching Station	Highly Modified	NO	NO	NO	NO
00045	Access Control Facility	1982	Vacant					NO	NO

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Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00046	Valve House for Diesel Fuel Tanks	1944	Valve House for Diesel Fuel Tanks	Pump House for Diesel Fuel Tanks	Not significant in context	N/A	NO	NO	NO
00047	Viewing Platform	1960	Viewing Platform	Loading Platform, Personnel	Highly Modified	NO	NO	NO	NO
00051	Housing Quarters	1941	Commander's Quarters	Housing	Highly Modified	NO	NO	NO	NO
00052	Office Building	1941	Admin General Purpose	Admin General Purpose	Highly Modified	NO	NO	NO	NO
00053	Office Building	1941	Admin General Purpose	Field Office Stock Control	Highly Modified	NO	NO	NO	NO
00054	Treaty Building	1941	Treaty Building	Area Engineer Building, Recreation Building, Civilian Personnel Building	Highly Modified	NO	NO	NO	NO
00055	Office Space	1941	Office Space	Family Quarters	Highly Modified	NO	NO	NO	NO
00057	Info Systems Fac	1995	Info Systems Facility					NO	
00061	Tennis Court	1953	Abandoned	Tennis Court	Not significant in context	NO	NO	NO	NO
00062	Physical Fitness Center	1993	RTI Physical Fitness Center	Physical Fitness Center				NO	NO
00063	Riding Stables	1948	Abandoned	Stable	Dilapidated				NO
00070	NCO Quarters Garage	1942	NCO Quarters Garage	Detached Garage, Family Housing		YES	YES	YES	YES
00071	BOQ Shed Garage	1944	BOQ Shed Garage	Detached Garage, Family Housing	Highly Modified	NO	NO	NO	NO
00072	Garage for Building 35	1942		Garage for Housing				NO	NO
00073	Garage for Building 51	1941	Garage	Garage for Housing	Highly Modified	NO	NO	NO	NO
00074	Garage for Building 55	1941	Garage	Garage for Housing	Highly Modified	NO	NO	NO	NO
00076	Traffic Control Center - Main Gate	1953	Traffic Control	Sentry Station, Police Station		YES	YES	NO	NO
00077	UTES	1975	UTES	Storage Shed General Purpose				NO	NO
00082	Drum Storage Shed	1960	Storage Shed	Tarp Storage Building	Not significant in context	N/A	NO	NO	NO
00328	Storage Shed	1953	Storage Shed	Storage Shed	Not significant in context	N/A	NO	NO	NO
00343	Concrete Vault	1941	Concrete Vault	Imhoff Tank Utility Structure		YES	YES	NO	NO
00344	Imhoff Tank (Large)	1942	Imhoff Tank (Large)	Imhoff Tank (Large)	Not significant in context	N/A	NO	NO	NO

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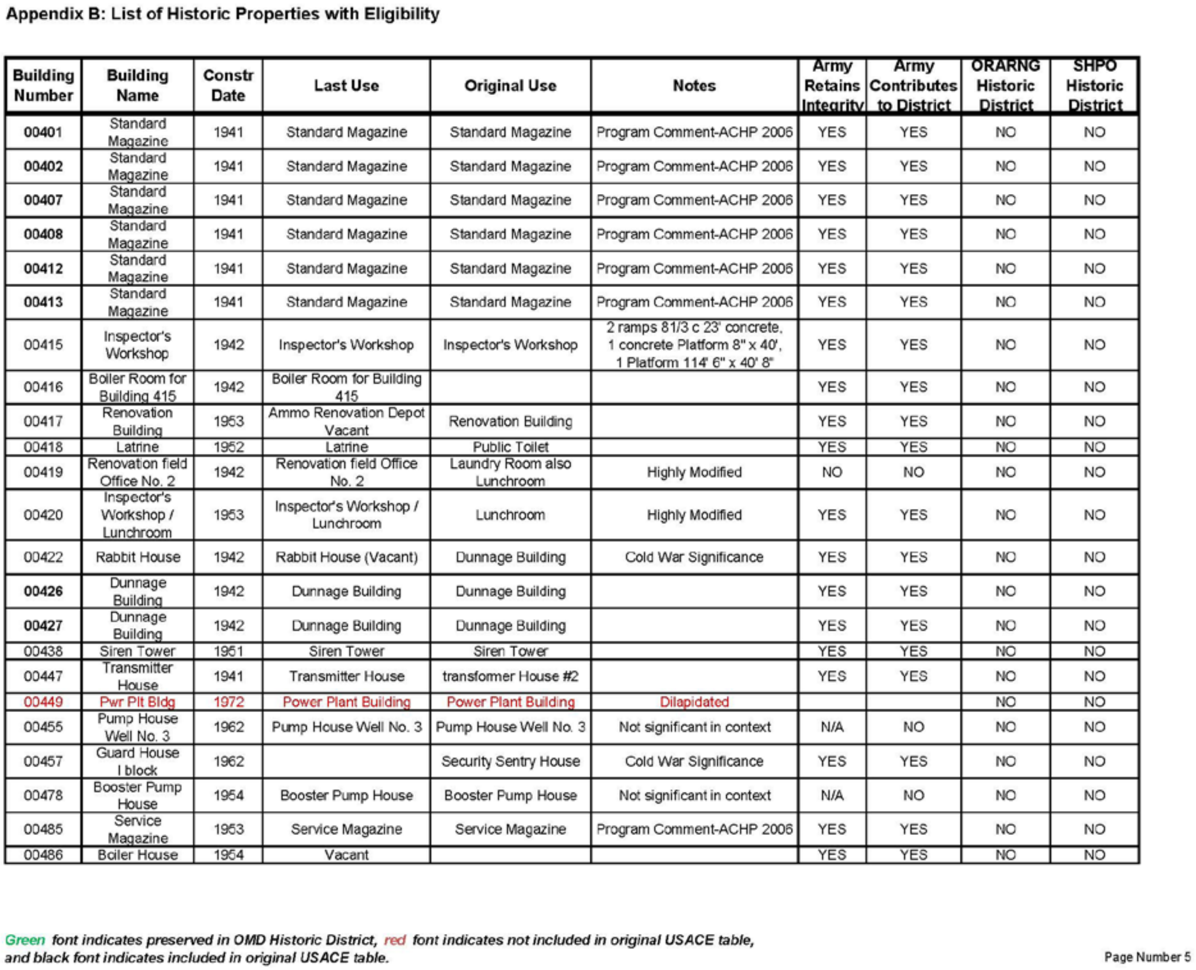

Appendix B: List of Historic Properties with Eligibility

Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00401	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00402	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00407	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00408	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00412	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00413	Standard Magazine	1941	Standard Magazine	Standard Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00415	Inspector's Workshop	1942	Inspector's Workshop	Inspector's Workshop	2 ramps 81/3 c 23' concrete, 1 concrete Platform 8" x 40', 1 Platform 114' 6" x 40' 8"	YES	YES	NO	NO
00416	Boiler Room for Building 415	1942	Boiler Room for Building 415			YES	YES	NO	NO
00417	Renovation Building	1953	Ammo Renovation Depot Vacant	Renovation Building		YES	YES	NO	NO
00418	Latrine	1952	Latrine	Public Toilet		YES	YES	NO	NO
00419	Renovation field Office No. 2	1942	Renovation field Office No. 2	Laundry Room also Lunchroom	Highly Modified	NO	NO	NO	NO
00420	Inspector's Workshop / Lunchroom	1953	Inspector's Workshop / Lunchroom	Lunchroom	Highly Modified	YES	YES	NO	NO
00422	Rabbit House	1942	Rabbit House (Vacant)	Dunnage Building	Cold War Significance	YES	YES	NO	NO
00426	Dunnage Building	1942	Dunnage Building	Dunnage Building		YES	YES	NO	NO
00427	Dunnage Building	1942	Dunnage Building	Dunnage Building		YES	YES	NO	NO
00438	Siren Tower	1951	Siren Tower	Siren Tower		YES	YES	NO	NO
00447	Transmitter House	1941	Transmitter House	transformer House #2		YES	YES	NO	NO
00449	Pwr Plt Bldg	1972	Power Plant Building	Power Plant Building	Dilapidated			NO	NO
00455	Pump House Well No. 3	1962	Pump House Well No. 3	Pump House Well No. 3	Not significant in context	N/A	NO	NO	NO
00457	Guard House I block	1962		Security Sentry House	Cold War Significance	YES	YES	NO	NO
00478	Booster Pump House	1954	Booster Pump House	Booster Pump House	Not significant in context	N/A	NO	NO	NO
00485	Service Magazine	1953	Service Magazine	Service Magazine	Program Comment-ACHP 2006	YES	YES	NO	NO
00486	Boiler House	1954	Vacant			YES	YES	NO	NO

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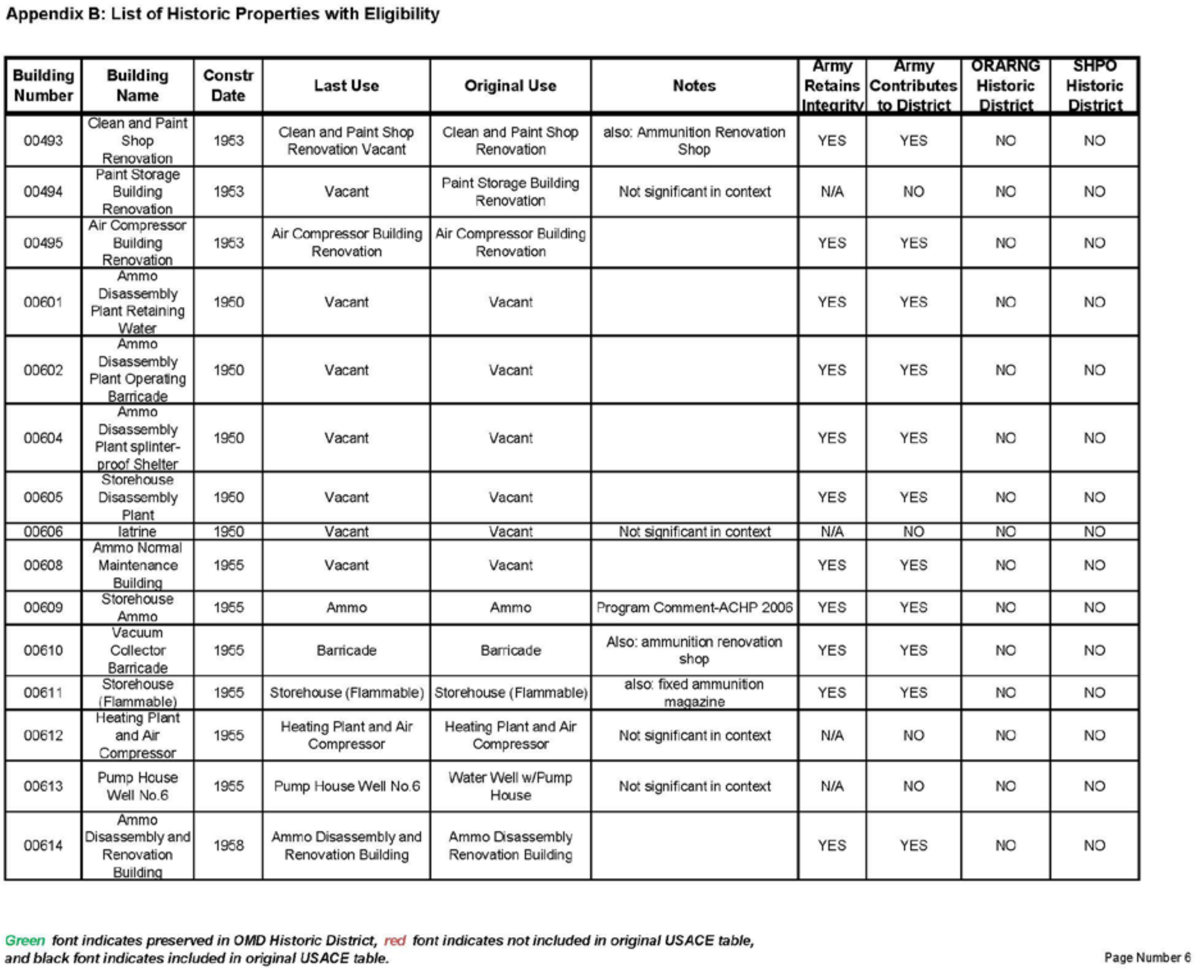

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00493	Clean and Paint Shop Renovation	1953	Clean and Paint Shop Renovation Vacant	Clean and Paint Shop Renovation	also: Ammunition Renovation Shop	YES	YES	NO	NO
00494	Paint Storage Building Renovation	1953	Vacant	Paint Storage Building Renovation	Not significant in context	N/A	NO	NO	NO
00495	Air Compressor Building Renovation	1953	Air Compressor Building Renovation	Air Compressor Building Renovation		YES	YES	NO	NO
00601	Ammo Disassembly Plant Retaining Water	1950	Vacant	Vacant		YES	YES	NO	NO
00602	Ammo Disassembly Plant Operating Barricade	1950	Vacant	Vacant		YES	YES	NO	NO
00604	Ammo Disassembly Plant splinter-proof Shelter	1950	Vacant	Vacant		YES	YES	NO	NO
00605	Storehouse Disassembly Plant	1950	Vacant	Vacant		YES	YES	NO	NO
00606	latrine	1950	Vacant	Vacant	Not significant in context	N/A	NO	NO	NO
00608	Ammo Normal Maintenance Building	1955	Vacant	Vacant		YES	YES	NO	NO
00609	Storehouse Ammo	1955	Ammo	Ammo	Program Comment-ACHP 2006	YES	YES	NO	NO
00610	Vacuum Collector Barricade	1955	Barricade	Barricade	Also: ammunition renovation shop	YES	YES	NO	NO
00611	Storehouse (Flammable)	1955	Storehouse (Flammable)	Storehouse (Flammable)	also: fixed ammunition magazine	YES	YES	NO	NO
00612	Heating Plant and Air Compressor	1955	Heating Plant and Air Compressor	Heating Plant and Air Compressor	Not significant in context	N/A	NO	NO	NO
00613	Pump House Well No.6	1955	Pump House Well No.6	Water Well w/Pump House	Not significant in context	N/A	NO	NO	NO
00614	Ammo Disassembly and Renovation Building	1958	Ammo Disassembly and Renovation Building	Ammo Disassembly Renovation Building		YES	YES	NO	NO

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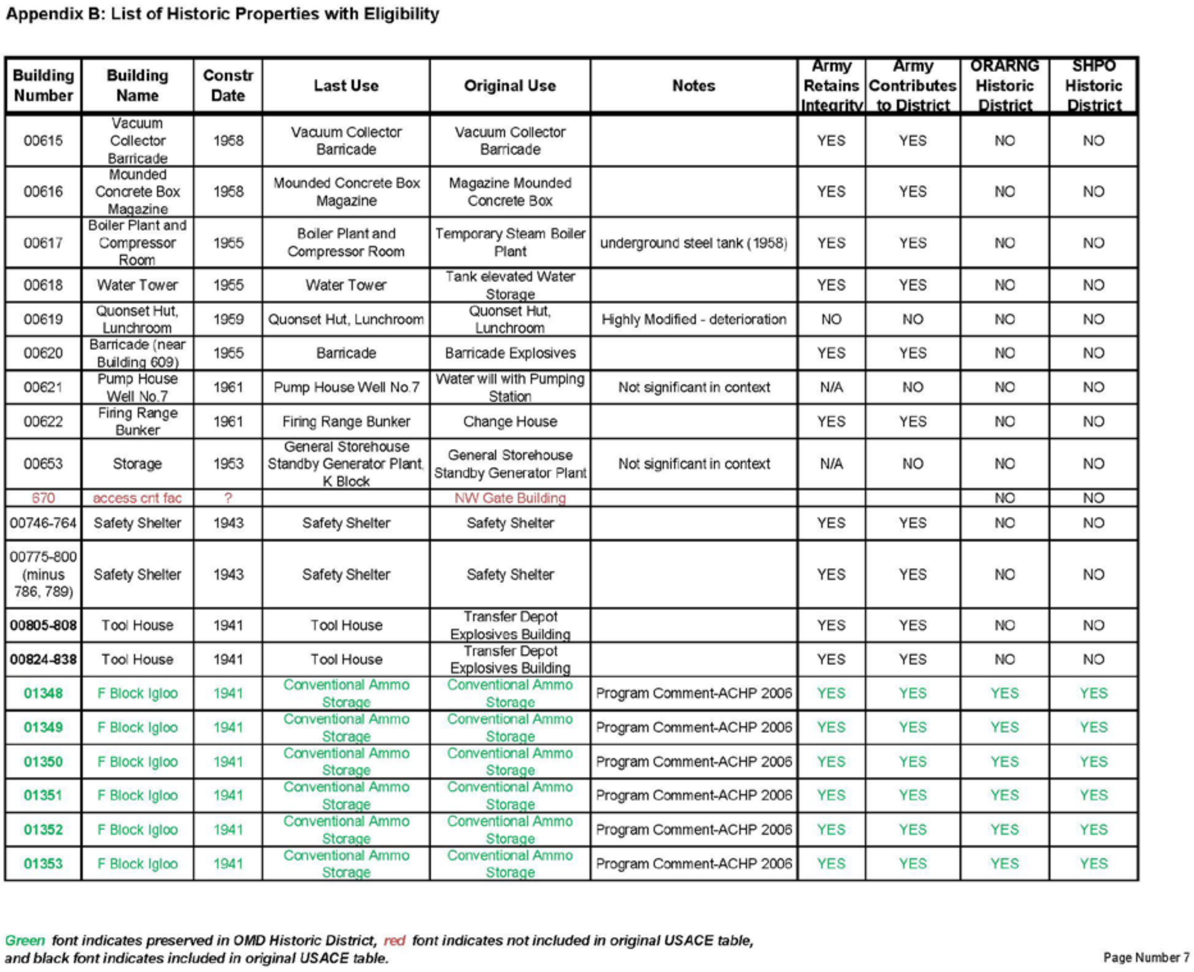

Appendix B: List of Historic Properties with Eligibility

Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
00615	Vacuum Collector Barricade	1958	Vacuum Collector Barricade	Vacuum Collector Barricade		YES	YES	NO	NO
00616	Mounded Concrete Box Magazine	1958	Mounded Concrete Box Magazine	Magazine Mounded Concrete Box		YES	YES	NO	NO
00617	Boiler Plant and Compressor Room	1955	Boiler Plant and Compressor Room	Temporary Steam Boiler Plant	underground steel tank (1958)	YES	YES	NO	NO
00618	Water Tower	1955	Water Tower	Tank elevated Water Storage		YES	YES	NO	NO
00619	Quonset Hut, Lunchroom	1959	Quonset Hut, Lunchroom	Quonset Hut, Lunchroom	Highly Modified - deterioration	NO	NO	NO	NO
00620	Barricade (near Building 609)	1955	Barricade	Barricade Explosives		YES	YES	NO	NO
00621	Pump House Well No.7	1961	Pump House Well No.7	Water will with Pumping Station	Not significant in context	N/A	NO	NO	NO
00622	Firing Range Bunker	1961	Firing Range Bunker	Change House		YES	YES	NO	NO
00653	Storage	1953	General Storehouse Standby Generator Plant, K Block	General Storehouse Standby Generator Plant	Not significant in context	N/A	NO	NO	NO
670	access cnt fac	?		NW Gate Building				NO	NO
00746-764	Safety Shelter	1943	Safety Shelter	Safety Shelter		YES	YES	NO	NO
00775-800 (minus 786, 789)	Safety Shelter	1943	Safety Shelter	Safety Shelter		YES	YES	NO	NO
00805-808	Tool House	1941	Tool House	Transfer Depot Explosives Building		YES	YES	NO	NO
00824-838	Tool House	1941	Tool House	Transfer Depot Explosives Building		YES	YES	NO	NO
01348	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES
01349	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES
01350	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES
01351	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES
01352	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES
01353	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	YES	YES

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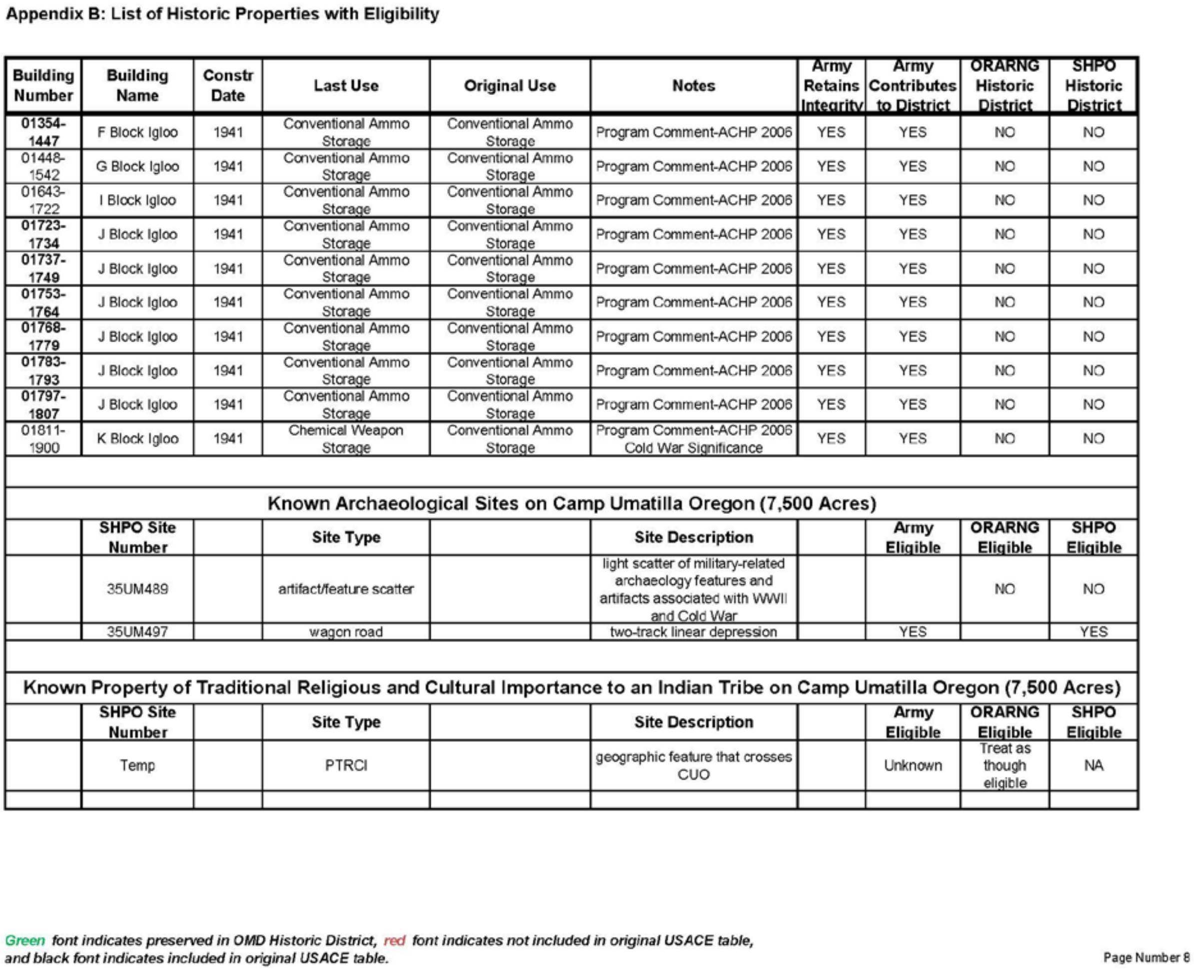

Appendix B: List of Historic Properties with Eligibility

Building Number	Building Name	Constr Date	Last Use	Original Use	Notes	Army Retains Integrity	Army Contributes to District	ORARNG Historic District	SHPO Historic District
01354-1447	F Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01448-1542	G Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01643-1722	I Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01723-1734	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01737-1749	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01753-1764	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01768-1779	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01783-1793	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01797-1807	J Block Igloo	1941	Conventional Ammo Storage	Conventional Ammo Storage	Program Comment-ACHP 2006	YES	YES	NO	NO
01811-1900	K Block Igloo	1941	Chemical Weapon Storage	Conventional Ammo Storage	Program Comment-ACHP 2006 Cold War Significance	YES	YES	NO	NO
Known Archaeological Sites on Camp Umatilla Oregon (7,500 Acres)									
	SHPO Site Number		**Site Type**		**Site Description**		**Army Eligible**	**ORARNG Eligible**	**SHPO Eligible**
	35UM489		artifact/feature scatter		light scatter of military-related archaeology features and artifacts associated with WWII and Cold War			NO	NO
	35UM497		wagon road		two-track linear depression		YES		YES
Known Property of Traditional Religious and Cultural Importance to an Indian Tribe on Camp Umatilla Oregon (7,500 Acres)									
	SHPO Site Number		**Site Type**		**Site Description**		**Army Eligible**	**ORARNG Eligible**	**SHPO Eligible**
	Temp		PTRCI		geographic feature that crosses CUO		Unknown	Treat as though eligible	NA

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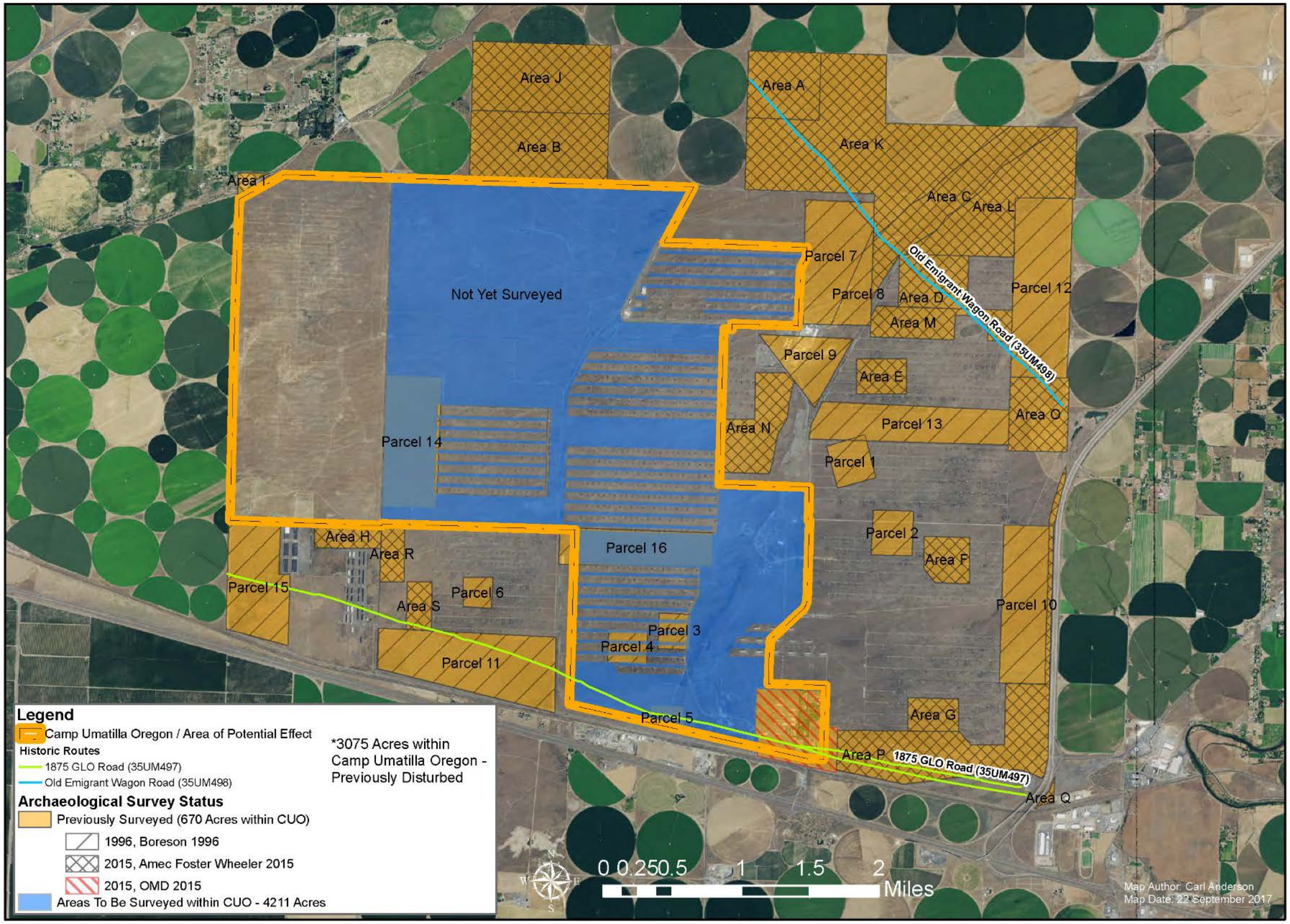
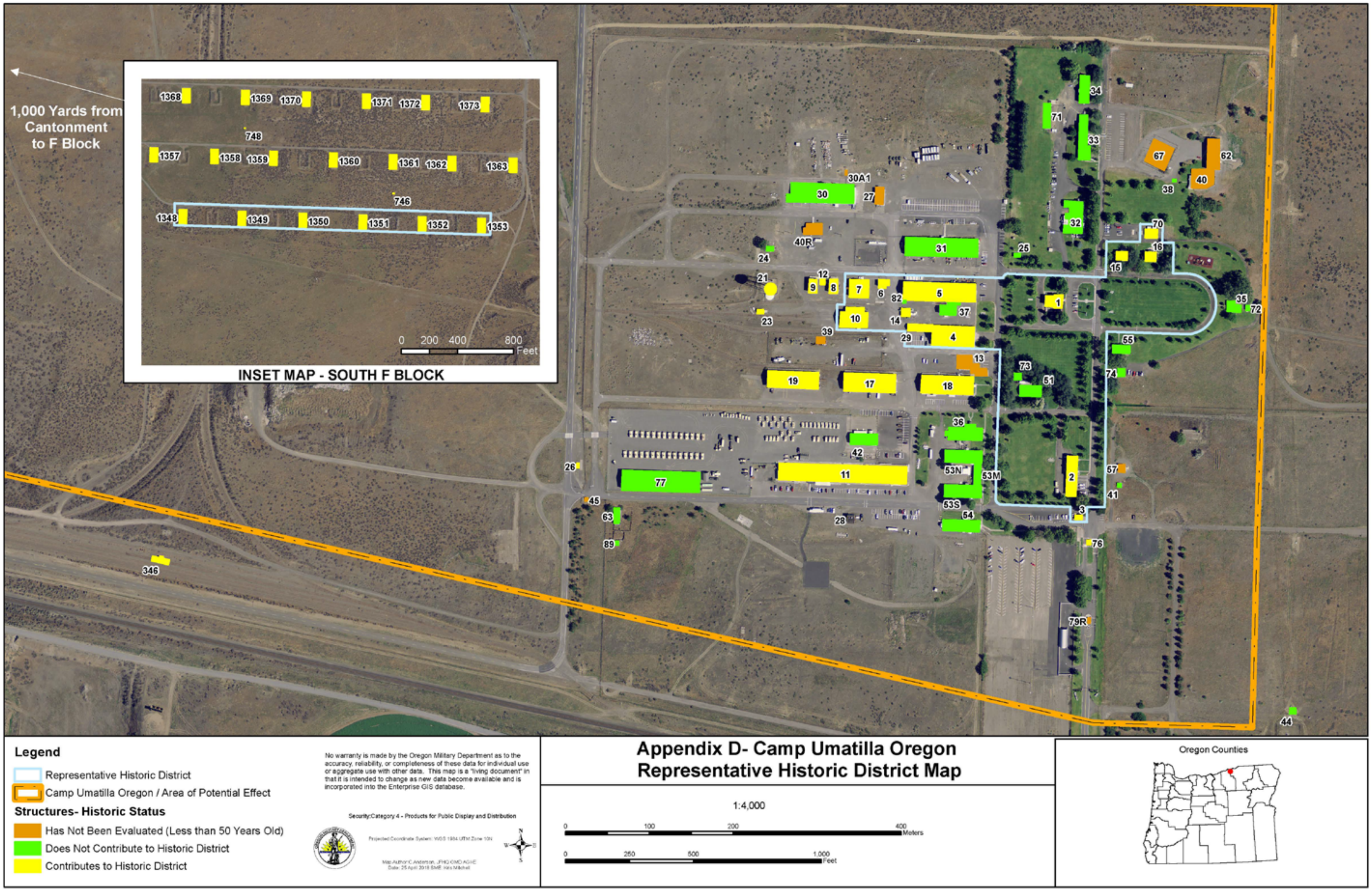
Appendix C – Archaeology Surveys

Appendix D- Camp Umatilla Oregon Archaeology Survey Overview Map



Appendix D – Representative Historic District Map



Appendix E: Annual Report Template

Programmatic Agreement
Camp Umatilla Oregon Development, Expansion and Operations Project
Annual Report Template
2017

I. Provide status update on the following PA stipulations (original stipulations in *italics*).

A. ***Designation of representative historic district****. The ORARNG shall designate an area within the central cantonment as a smaller historic district that is representative of the larger World War II and Cold War-era historic district identified by the Corps of Engineers. This smaller historic district would be reflected in the Final Environmental Assessment for Expanded Operations at the Oregon National Guard's Camp Umatilla Oregon and Finding of No Significant Impact (CUO EA/FNSI) and in the updated Site Development Plan. The ORARNG will maintain this designated historic district for the foreseeable future maintaining the architectural integrity of the historic buildings and structures as outlined in the Historic District Management Manual (HDMM) discussed below. Those buildings and structures outside the designated historic district would no longer be subject to the Section 106 process and may be demolished, modified, maintained or otherwise altered without further consultation.*

Status:

B. ***Develop a Historic District Management Manual****. The ORARNG shall develop, in consultation with the Oregon SHPO, a maintenance and management manual for the newly designated representative historic district that will outline in more detail the acceptable building and structure modifications and new construction that are allowable to ensure that the historic buildings and structures are viable long-term contributors to the ORARNG's mission and readiness. The HDMM would be completed within four years of execution of this PA and would allow 30 day Oregon SHPO review of contract scope and draft HDMM. The HDMM would include the following main outline elements for those historic properties included within the representative historic district.*

Status:

C. ***Potential Property of Traditional Religious and Cultural Significance to an Indian Tribe Protection and Access****. The ORARNG will protect the potential property of traditional religious and cultural significance to an Indian tribe identified by CTUIR as though it is eligible for the National Register by 1) limiting off-road vehicular traffic or new construction within previously undisturbed portions of the potential historic property and 2) by consulting with the CTUIR to develop within two years of execution of this PA a protocol allowing tribal member access during certain times of the year to carry out cultural practices.*

Status:

D. ***Archaeological Surveys****. The ORARNG will complete additional archaeological pedestrian surveys in previously undisturbed and un-surveyed areas prior to any CUO Expansion, Development and Operations Project ground-disturbing actions in that area or within five years of execution of this PA. Survey results and reports will be prepared according to State of Oregon Field and Reporting Guidelines and will allow 30 day review by the Oregon SHPO and the CTUIR prior to any ground disturbing actions in the related area. Testing will not be conducted unless a site is identified*.

Status:

E. ***Historic Wagon Road****. The ORARNG will photographically document that portion of the 1874 wagon road (35UM497) that is located on CUO and update the existing SHPO site form as needed. Within five years of execution of this PA, the wagon road (35UM497) will be included in a Light Detection and Ranging (LIDAR) study to better document its exact track across the CUO.*

Status:

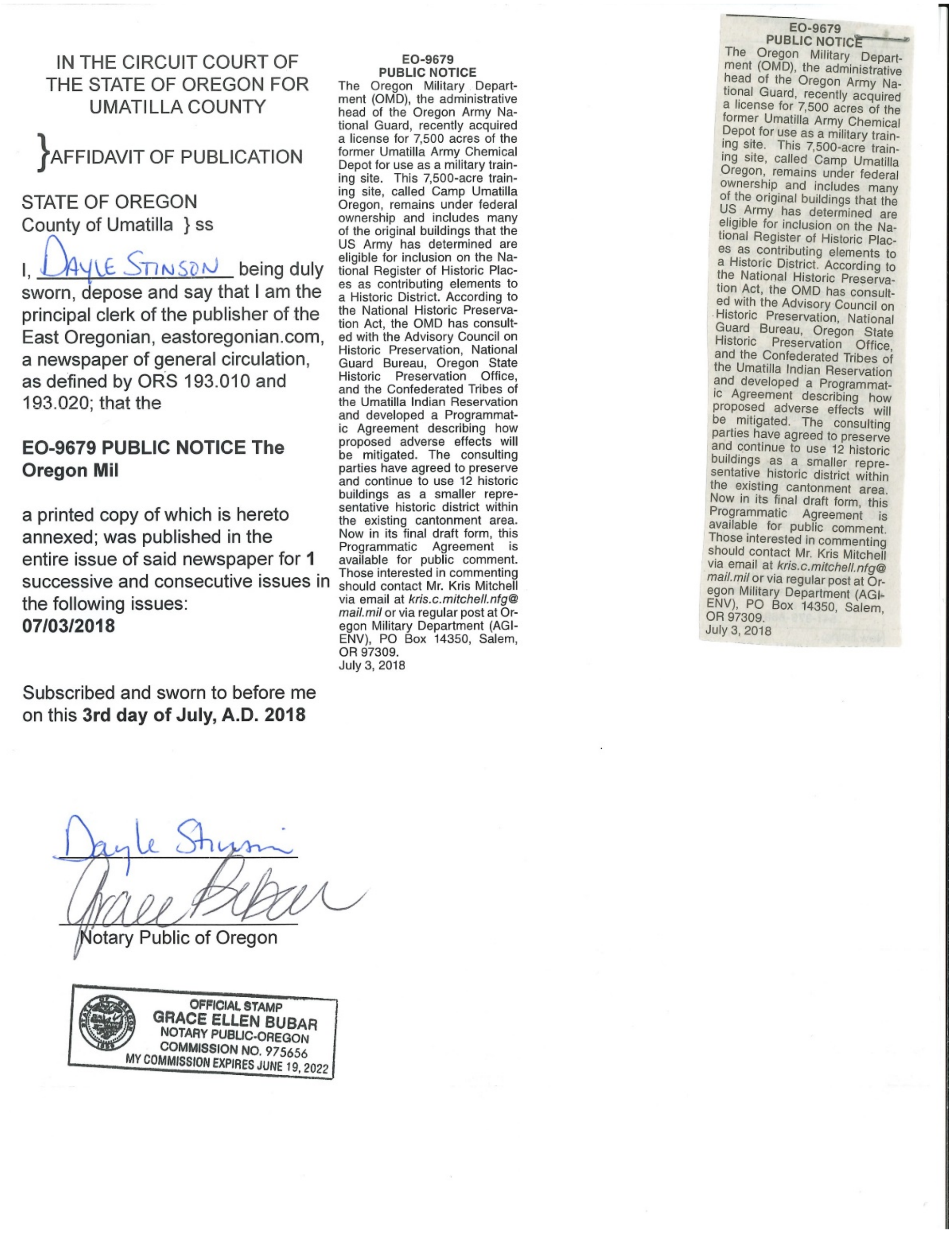
II. ORARNG will document the status of the undertaking completed during the reporting year.

Status:

Started	**Under Construction**	**Completed**
(Example) Construct Unit Training Equipment Site (UTES)		
	(Example) Construct Centralized Vehicle Wash Facility	
		(Example) Construct 400-person dining facility

APPENDIX F

Public Notice



IN THE CIRCUIT COURT OF
THE STATE OF OREGON FOR
UMATILLA COUNTY

}AFFIDAVIT OF PUBLICATION

STATE OF OREGON
County of Umatilla } ss

I, DAYLE STINSON being duly sworn, depose and say that I am the principal clerk of the publisher of the East Oregonian, eastoregonian.com, a newspaper of general circulation, as defined by ORS 193.010 and 193.020; that the

EO-9679 PUBLIC NOTICE The Oregon Mil

a printed copy of which is hereto annexed; was published in the entire issue of said newspaper for **1** successive and consecutive issues in the following issues:
07/03/2018

Subscribed and sworn to before me on this **3rd day of July, A.D. 2018**

EO-9679
PUBLIC NOTICE

The Oregon Military Department (OMD), the administrative head of the Oregon Army National Guard, recently acquired a license for 7,500 acres of the former Umatilla Army Chemical Depot for use as a military training site. This 7,500-acre training site, called Camp Umatilla Oregon, remains under federal ownership and includes many of the original buildings that the US Army has determined are eligible for inclusion on the National Register of Historic Places as contributing elements to a Historic District. According to the National Historic Preservation Act, the OMD has consulted with the Advisory Council on Historic Preservation, National Guard Bureau, Oregon State Historic Preservation Office, and the Confederated Tribes of the Umatilla Indian Reservation and developed a Programmatic Agreement describing how proposed adverse effects will be mitigated. The consulting parties have agreed to preserve and continue to use 12 historic buildings as a smaller representative historic district within the existing cantonment area. Now in its final draft form, this Programmatic Agreement is available for public comment. Those interested in commenting should contact Mr. Kris Mitchell via email at *kris.c.mitchell.nfg@mail.mil* or via regular post at Oregon Military Department (AGI-ENV), PO Box 14350, Salem, OR 97309.
July 3, 2018

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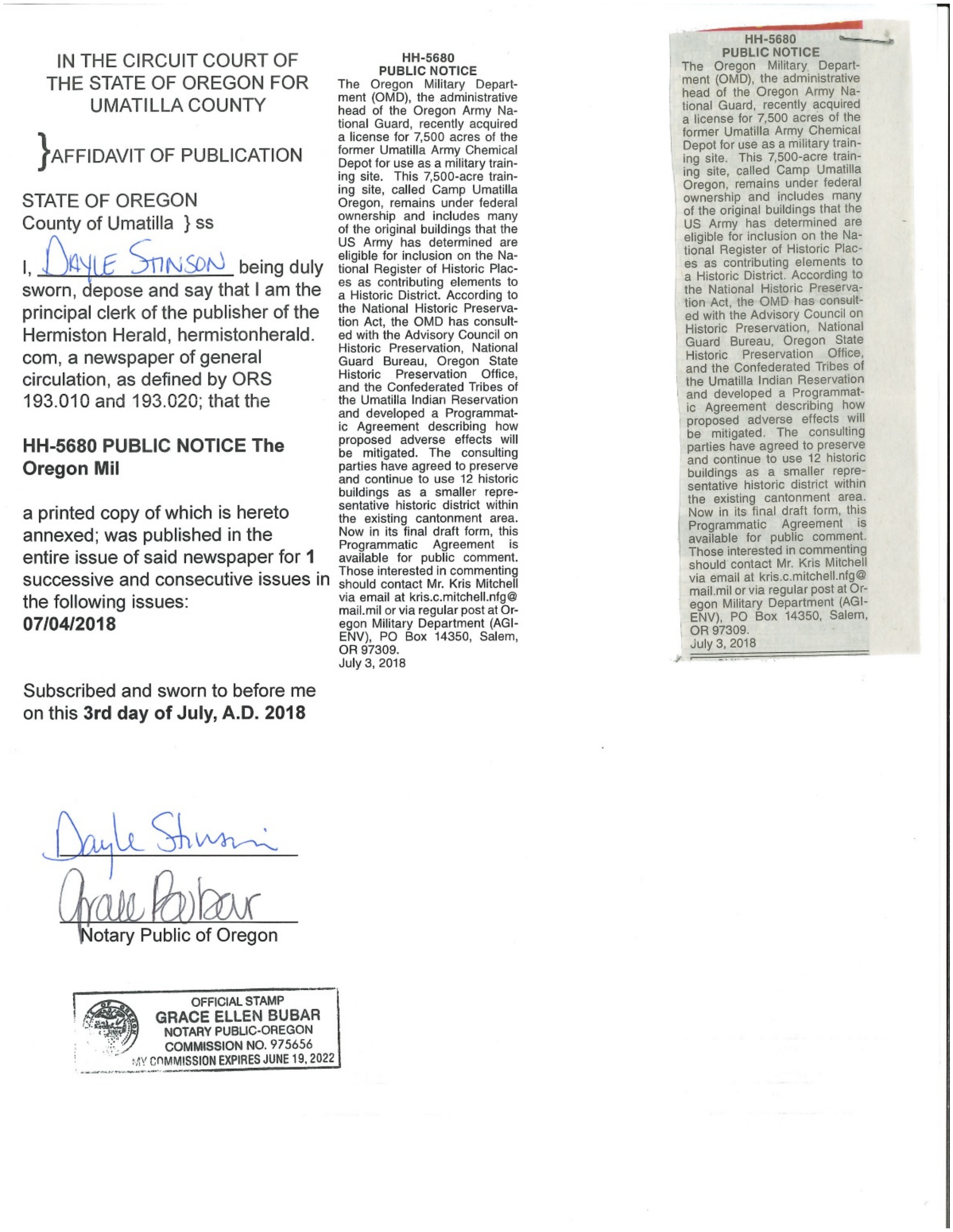
July 3, 2018

Dayle Stinson

Grace Bubar
Notary Public of Oregon

OFFICIAL STAMP
GRACE ELLEN BUBAR
NOTARY PUBLIC-OREGON
COMMISSION NO. 975656
MY COMMISSION EXPIRES JUNE 19, 2022



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UMATILLA COUNTY

}AFFIDAVIT OF PUBLICATION

STATE OF OREGON
County of Umatilla } ss

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HH-5680 PUBLIC NOTICE The Oregon Mil

a printed copy of which is hereto annexed; was published in the entire issue of said newspaper for **1** successive and consecutive issues in the following issues:
07/04/2018

Subscribed and sworn to before me on this **3rd day of July, A.D. 2018**

Dayle Stinson

Grace Bubar
Notary Public of Oregon

OFFICIAL STAMP
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COMMISSION NO. 975656
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July 3, 2018

APPENDIX F

Public Notice

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APPENDIX D:

MEMORANDUM OF AGREEMENT

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Order and Agreement for the Maintenance of Institutional Controls

Pursuant to ORS 465.260(4), the Oregon Department of Environmental Quality (DEQ), enters into this Order and Agreement for the Maintenance of Institutional Controls (Agreement) with the Oregon Military Department (OMD).

1. Purpose

The Mutual objective of DEQ and OMD in entering into this Agreement is to protect public health, safety and welfare and the environment by continued implementation of institutional controls at the former Umatilla Chemical Depot (UMCD).

2. Recitals

A. OMD is the State licensee for a portion of the former UMCD. The portion of the former UMCD subject to this agreement is approximately 7,500-acres at 78798 Ordinance Road, Hermiston, OR 97838, located north of Interstate 84 at exit 177). The location of the UMCD is shown in Exhibit 1 to this Agreement. The legal description of the site is provided in Exhibit 2 to this agreement.

B. In 1940, the Army selected a 16,000-acre plot of northeastern Oregon sage land for a new depot for munitions and general supply storage. Construction work began in January 1941, and 10 months later, on 14 October 1941, officials opened the U.S. Army Umatilla Ordnance Depot, named for the Umatilla Indian Tribe. The first ordnance shipment arrived on 27 October 1941. During its more than 70 years in operation, the depot grew to almost 20,000 acres and continued to support other war efforts, including the Korean Conflict, Vietnam, Grenada, Panama, and Desert Storm. In addition to its conventional ammunition and general supply missions, the depot received a new mission in 1962 – receiving and storing chemical ammunition. Between 1962 and 1969, the depot received various types of chemical ammunition. In 1988, UMCD was identified for realignment under Base Realignment and Closure (BRAC), which relocated the depot’s conventional ammunition and general supplies missions to other U.S. depots and installations. As a result of the 1988 BRAC decision, OMD worked collaboratively with an Army appointed Local Redevelopment Authority in an effort to preserve a permanent training center that would accommodate the National Guard. These redevelopment planning efforts were reinvigorated by the decision to ultimately close UMCD as a result of 2005 BRAC legislation. Destruction of the chemical agents stored at the depot began in the fall of 2004 and the last stockpiled ton containers filled with mustard chemical agent were incinerated on October 20, 2011. The formal closing of UMCD occurred on August 1, 2012 and resulted in the Department of the Army declaring 19,729 acres of real property as excess to its future needs. On November 27, 2017, OMD finalized a license with the US Army Corps of Engineers for 7,500 acres as described in Exhibits 1 and 2.

C. The UMCD has a RCRA storage permit (DEQ I.D. No. OR6 213 820 917) that was issued in 1984. A RCRA "Part B" Storage Permit Application, to update conditions applicable to hazardous waste storage operations at UMCD, was recently submitted by the U.S. Army, underwent a public comment period and has been determined by DEQ to be substantially complete. The RCRA Part B Storage Permit addresses conventional wastes and governs all aspects of hazardous waste storage operations at UMCD.

D. On September 11, 2011, DEQ issued the Umatilla Chemical Agent Disposal Facility (UMCDF) RCRA permit (DEQ I.D. No. ORQ 000 009 431-01) to the U.S. Army Chemical Materials Agency (CMA) for operation of the UMCDF disposal facility. That permit's closure plan required clean closure of the UMCDF to industrial exposure risk based standards. On April 27, 2017 the CMA submitted certification that the closure standards were met. On December 20, 2017 DEQ accepted certification of clean closure to risk based standards. Institutional controls for the UMCDF were placed in the UMCD RCRA permit and the UMCDF RCRA permit was terminated.

E. Closure of the UMCD and UMCDF to risk based standard will leave hazardous substances in place above levels that would be acceptable for the protection of human health and the environment if the site were allowed to be used for unrestricted uses.

F. In order to clean close the UMCD permit to industrial risk based standards, institutional controls limiting the use of the property to industrial uses are necessary

G. The contaminants described in Subsection 2.E are "hazardous substances" within the meaning of ORS 465.200(16) and the presence of hazardous substances in the soil, soil vapor, ambient air, or groundwater constitutes a "release" or threat of release" into the environment within the meaning of ORS 465.200(22). The UMCD is a "facility" within the meaning of ORS 465.200(13).

H. The institutional controls required by this agreement are necessary to protect the public health, safety, and the welfare and the environment.

3. Institutional controls

OMD agrees that it will not allow the following use and operations at the site:

A. Residential and Agricultural Use Restriction. The property located in the K-Block, J-Block, I-Block, Administration Area, building 419 area, Groundwater Pump and Treat Area, and the Ammunition Disposal Area shall not be used for the following purposes:

1. Residential use of any type (military barracks or billets related to military training are exempt from residential use restrictions);
2. Agricultural (food crop) use of any type;
2. Child care facilities; and nursing home or assisted living facilities; and
3. Educational facilities for children/young adults in grades K through 12.

B. Groundwater Restriction. Groundwater underlying the Groundwater Pump and Treat Area contains the contaminant Hexahydro-1,3,5 trinitro-1,3,5,-triazine (RDX), and 2,4,6-

Trinitrotoluene (TNT) which is actively undergoing a pump and treat groundwater remedy. Neither withdrawal of groundwater nor any activity that may interfere with the groundwater remedy is allowed within the Groundwater Pump and Treat Area without prior written approval of the Army National Guard Environmental Programs Division (ARNG-ILE), USEPA, and DEQ. For the purpose of this restriction, "groundwater" shall have the same meaning as in section 101(12) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

C. Groundwater Remedy Equipment and Monitoring Wells. The Property contains groundwater remedy equipment, infiltration galleries, and associated piping, both above and below the ground, and monitoring wells. OMD shall not disturb or permit others to disturb the groundwater remedy equipment, infiltration galleries, associated piping, and monitoring wells located on the Property now or in the future without the prior approval from ARNG-ILE, USEPA, and DEQ. Upon the appropriate regulatory agency determination that the infiltration galleries or a monitoring well is no longer necessary, they will be decommissioned in accordance with applicable laws, regulations, and ordinances.

D. Ammunition Disposal Area (ADA) Access Restrictions. The ADA has on-going remediation and munitions response actions. Until completion of remediation, access to this area or other interference with on-going remediation in this area is prohibited without prior written approval of the Army BRAC Division, USEPA, and DEQ.

4. DEQ Access

During reasonable hours, and subject to reasonable security requirements imposed by OMD, DEQ may enter upon and inspect any portion of the Site to determine whether the requirements of this Agreement have been or are being complied with. Except when necessary to address an imminent threat to human health or the environment or effectively determine whether the requirements of this Agreement have been or are being complied with, DEQ will use its best efforts to provide OMD 72 hours advance notice. DEQ may enter upon the site at any time to abate, mitigate, or cure a violation of any condition or restriction contained in this Agreement, provided DEQ first gives written notice of the violation to OMD describing what is necessary to correct the violation and OMD fails to cure the violation within the time specified in such notice. Any such entry upon the Site by DEQ to evaluate compliance or to abate, mitigate, or cure a violation may not be deemed a trespass.

5. Reporting

OMD will immediately notify DEQ of any condition or occurrence at the UMCD that does not conform with provisions of this Agreement.

6. Release of Institutional Controls

OMD may request release of any or all of the conditions or restrictions contained in this Agreement by submitting such request to the DEQ in writing, with evidence that the conditions or restrictions are no longer necessary to protect human health and the environment. The decision to release any or all of the conditions or restrictions in this Agreement will be within the sole discretion of DEQ. DEQ will, as appropriate, issue written confirmation of a release of specific conditions or restrictions.

7. Enforcement

This Agreement is an enforceable order under ORS 465.260 and 465.900.

8. Termination of Agreement

This agreement will remain in effect until the OMD no longer occupies or uses the property or has been released of institutional controls by DEQ. If the OMD in any way transfers its interest in the property to another party other than the Army OMD will continue to be responsible for the maintenance of the institutional controls contained in this agreement unless DEQ agrees in writing otherwise.

IN WITNESS WHEREOF OMD and DEQ have executed this Agreement for the Maintenance of Institutional Controls as of the date and year first set forth below.

Oregon Military Department

By: ____ Date: _____________
Roy D. Swafford
Director of Installations
Oregon Military Department

STATE OF OREGON)
) ss.
County of _______________)

The foregoing instrument is acknowledged before me this ______ day of ______________________, 2018, by ________________________ [Name] of the Oregon Military Department, on its behalf.

____
NOTARY PUBLIC FOR OREGON
My commission expires:___________________

State of Oregon, acting by and through the Oregon Department of Environmental Quality

By: ____ Date: _____________

David Anderson, Cleanup, Emergency Response, and Hydrogeology Programs Manager, Eastern Region

STATE OF OREGON)
) ss.
County of ________________)

The foregoing instrument is acknowledged before me this _______ day of _______________________, 2018, by _________________________ [Name] of the Oregon Department of Environmental Quality, on its behalf.

____
NOTARY PUBLIC FOR OREGON
My commission expires:____________________

Exhibit 1

Location of Umatilla Chemical Depot (UMCD)

Exhibit 2

Legal Description and Survey Depiction

APPENDIX E

WATER RIGHTS AGREEMENT

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

ARNG-IER

23 MAY 2017

MEMORANDUM FOR The US Army Corps of Engineers, Seattle District, Attn: CENWS-RE, PO Box 3755, Seattle, WA 98124-3755

SUBJECT: Reassignment of 7500 Acres and Related Interests at the Former Umatilla Army Chemical Depot to the United States Property and Fiscal Officer for Oregon and Subsequent License for Use by the Oregon Army National Guard (ORARNG)

1. References: nine references are listed in the enclosures.

2. In anticipation of DASA(IH&P) approval of the NGB request for the subject reassignment of real estate interests, request that the Seattle District prepare the necessary documents to execute the action as described in the enclosures. In addition, request a license be prepared to the ORARNG for use of the reassigned interests and submitted with the execution package. This will reduce delay to the overall process. The final documents will be subject to the terms and conditions approved by DASA(IH&P). Any administrative fees for these actions will be the responsibility of the ORARNG.

3. The point of contact for this memorandum is Mr. Robert McCabe, Chief, Real Estate Branch at DSN 329-6900, 703-601-6900, or robert.e.mccabe.civ@mail.mil.

ERIK T. GORDON
COL, GS
I&E, Army National Guard

Encls
as

CF: (w/encls)
CFMO, OR
USPFO, OR

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

ARNG-IER

15 MAY 2017

MEMORANDUM FOR Deputy Assistant Secretary of the Army for Installations, Housing and Partnerships (DASA(IH&P)), 110 Army Pentagon, Room 3E475, Washington, DC 20310-0110

SUBJECT: Request for Reassignment of 7500 Acres and Related Interests at the Former Umatilla Chemical Depot (UMCD), OR to the United States Property and Fiscal Officer for Oregon and Subsequent Licensing to the Oregon Army National Guard (ORARNG)

1. References: thirteen references are listed in the enclosures.

2. The former UMCD is located in eastern Oregon and contains approximately 17,148.75 acres of land, 2,668.40 acres of safety easements, and eight water right certificates. UMCD was recommended for closure and published in the Federal Register on 16 May 2005. In accordance with the Defense Base Closure and Realignment Act of 1990 (Public Law No. 101-510 or 10 U.S.C. § 2687 note), as amended, it was published in the Federal Register on 17 November 2008 with a surplus property determination. A Local Redevelopment Authority, now the CDA, completed The U.S. Army Umatilla Chemical Depot Base Redevelopment Plan and HUD Application, dated August 2010, which identified military reuse by the Oregon Army National Guard as one of the three overarching goals and a site of 7,421 acres was specified for that purpose. Public Law 112-74 authorized the Army to retain 7,500 acres for a training enclave for reserve components of the Armed Forces.

3. As a result, the ORARNG conducted substantial studies to justify use of the 7500 acres and related interests. The resulting requirements were documented in a Real Estate Action Plan (REAP) and a series of REAP Modifications at references (a-d). The required NEPA documentation to support the reassignment has been completed in accordance with AR 200-1. National Guard Bureau (NGB) has reviewed these documents and concurs with the reassignment for the proposed establishment of the Umatilla Training Center, subject to the following conditions:

a. Environmental Remediation and Land Use Controls. Reference (e) outlines the environmental responsibilities of both NGB and DAIM-ODB to ensure that the property is adequate, both before and after reassignment, for ORARNG training requirements. In addition, NGB will ensure any use of the property is subject to the land use restrictions in reference (f).

b. Water Rights. There is a need to retain water rights equivalent to 1,186 gpm from wells 1, 2, 3 and 6 for ORARNG use. An agreement on the division of water rights has been reached with the CDA, as detailed in references (g) and (h).

c. Land and Facilities. A total of 7,500 acres with 1,404,989 SF of improvements will be reassigned for ORARNG use. The site was determined by a formal survey completed by

Ferguson Survey & Engineering for the ORARNG, and recorded in Morrow and Umatilla Counties. The facilities within the 7,500 acres were verified by record review and field verification. See legal description and map at reference (i).

d. Easements.

i. Safety Easements. North of the 7500 acres and the firing ranges, perpetual easements across Tracts 108E, 109E and 110E (totaling 1,092.61 acres) will be assigned to the United States Property and Fiscal Officer (USPFO) for Oregon to maintain safety areas. See maps at reference (j).

ii. Rights of Way (ROWs). Perpetual and Temporary ROWs for roads, railroad, safety, noise, and utilities will be assigned to the USPFO for Oregon. These will be reserved as easements in the quit claim deed of surrounding lands to the CDA. See descriptions at reference (k).

4. In accordance with reference (l), this office requests approval of the reassignment to allow the USPFO for Oregon to accept real property accountability for the property via a DD Form 1354, and for subsequent execution by USACE of an indefinite term license to the State of Oregon for use by the ORARNG. If approved, USACE is prepared to submit a request to remove the lands and interests from surplus status. The reassignment request has been duly coordinated with the IMCOM as the agency assigned accountability of the former UMCD per reference (m).

5. The point of contact for this memorandum is Mr. Robert McCabe, Chief, Real Estate Branch at DSN 329-6900, 703-601-6900, or robert.e.mccabe.civ@mail.mil.

Encls
as

ERIK T. GORDON
COL, GS
I&E, Army National Guard

CF: (w/encls)
CENWS-RE
CFMO, OR
DAIM-ODB
USPFO, OR

Enclosure Contents:

a. Memorandum, AGI, 30 March 2012, subject: Real Estate Action Plan (REAP)/Umatilla Chemical Depot (UMCD) License DACA67-3-08-109 (enclosure 1).

b. Memorandum, AGI-CFMO, 22 April 2014, subject: Modification (Safety Easements) to Real Estate Action Plan (REAP) dated 30 Mar 2012/Umatilla Chemical Depot (UMCD) License DACA67-3-08-109, Hermiston, Oregon (enclosure 2).

c. Memorandum, AGI, 20 April 2015, subject: Modification 2 (Water Rights and Supporting Easements) to Real Estate Action Plan (REAP) dated 30 Mar 12/Umatilla Chemical Depot (UMAD) License DACA67-3-08-109, Hermiston, Oregon (enclosure 3).

d. Memorandum, AGI, 22 December 2016, subject: Modification 3 (Noise) to Real Estate Action Plan (REAP) dated 30 Mar 12/Umatilla Army Depot (UMAD) License DACA67-3-08-109, Hermiston, Oregon (enclosure 4).

e. Memorandum of Agreement between the National Guard Bureau and the U.S. Army Base Realignment and Closure Division, 2 August 2016, subject: Real Property Assignment and Transfer of Responsibility for Real Property Located on the Former Umatilla Chemical Depot, Umatilla and Morrow Counties, Oregon (enclosure 5).

f. Land Use Restrictions for Environmental Sites on Property at UMCD, 4 April 2017 (enclosure 6).

g. Letter from Mr. Lederle, Chief, OACSIM BRAC Division, to the Columbia Development Authority (CDA), 22 December 2016 (enclosure 7).

h. Table on Umatilla Water Wells and Rights (enclosure 8).

i. Legal Description and Map for the Proposed Umatilla Training Center, 16 April 2015 (enclosure 9).

j. Maps for Tracts 108E, 109E, and 110E, 6 February 2017 (enclosure 10).

k. Summary of Rights of Way Estates to be Retained by Army (enclosure 11).

l. Memorandum, ASA IEE, 25 Nov 2013, subject: U.S. Army Installations and Sites Accountability Policy (enclosure 12).

m. General Orders No. 2012-12, 25 June 2013 (enclosure 13).

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON, DC 20310-0600

December 22, 2016

Don Russell
Chair, Columbia Development Authority
Two Marine Drive
P.O. Box 200
Boardman, OR 97818

Dear Mr. Russell:

I am writing in response to your letter of 16 December 2016 addressed to COL Gordon, Chief of Installations & Environmental Division for the Army National Guard, regarding water rights at Umatilla Chemical Depot.

I am pleased to confirm that the Army is now in agreement with the division of water rights described in the Memorandum of Agreement between the Columbia Development Authority (CDA) and the Oregon Military Department in July 2016. The Army will retain water rights sufficient to pump up to 1,186 gallons per minute and will convey to the CDA water rights sufficient to pump up to 3,231 gallons per minute.

This agreement will be included in the Economic Development Conveyance Memorandum of Agreement between the Army and the CDA.

Respectfully,

Thomas E Lederle
Thomas E. Lederle
Chief, Base Realignment and Closure Division
Office of the Assistant Chief of Staff
for Installation Management

Umatilla Water Wells and Rights

	Aquifer	Well	Depth	Pumping Capacity	Status	Permitted (gpm)		Permitted Use
Army Retain	Shallow Basalt Aquifer	1	327	750	Requires well repair	153; 449	1186 gpm	Irrigation; Fire Protection
		2	360	375	Requires well repair	350		Domestic
		3	453	-		10		Fire Protection
	Deep Basalt Aquifer	6	710	550	Requires pipeline	224		Domestic
		7	682	500	Requires pipeline	0		
Transfer to CDA		4	600	400	Temp Easement	498	3231 gpm	Fire Protection
		5	618	800	Temp Easement	498		Fire Protection
	CDA subject to transfer application from well #1					449		Fire Protection
	CDA subject to transfer application well #7					1014		Manufacturing
	CDA subject to transfer application from well #7					772		Fire Protection

Pumping capacity of wells 1 & 2 may differ depending on repair or replacement

Well #7 is permitted to be used equally with well #6 (either/or)

Current split is 26.85% Army, 73.15% CDA

Wells #1 & #2 have inherent Federal Reserve Water Right status

Certificates for Fire Protection state "limited to maintaining the fire suppression system and to periods of actual fire emergency."

MEMORANDUM OF AGREEMENT BETWEEN

OREGON MILITARY DEPARTMENT ("OMD")
AND
COLUMBIA DEVELOPMENT AUTHORITY (CDA)

1. **<u>PARTIES</u>. THIS MEMORANDUM OF AGREEMENT,** dated 25 July 2016 is by and between the **OREGON MILITARY DEPARTMENT** (hereafter referred to as **OMD**) and the **COLUMBIA DEVELOPMENT AUTHORITY (CDA)** (hereafter referred to as **CDA**). The OMD's supervising representative for this agreement is the OMD's Adjutant General Deputy Director. The CDA authorized representative for this agreement is the CDA Executive Director.

2. **<u>PURPOSE</u>**. This MOA formalizes an agreement between the parties concerning the division of water rights at the former Umatilla Army Depot. Both parties were directed by the U.S. Army Base Realignment and Closure Office (BRAC) to enter into an agreement for how water rights supporting this site are to be assigned to the parties.

3. **<u>BACKGROUND</u>**. The United States Army, by and through its Base Realignment and Closure (BRAC) Office, accepted in 2011 the proposal submitted by the Local Reuse Authority (LRA) for reutilization of the federal lands declared excess. Within that accepted proposal, the Oregon Army National Guard (ORARNG) was to receive a federal license for 7,500 acres, retained in the federal register, as training lands. Umatilla County, Morrow County and the Confederated Tribes of the Umatilla Indian Reservation will also be future property owners, or have in interest in former Depot lands.

   Enclosure1 is a map showing the location of the water infrastructure. Of note are well locations. Current water infrastructure use does not match with future property ownership (boundaries). Example: Wells 4 and 5 are on future Morrow County property, and are the primary potable water source for the ORARNG. Wells on future ORARNG property do not have infrastructure connecting them to the buildings / location where the water use is needed. The Oregon Military Department (OMD) contracted a Water Study in 2012. This study defined requirements based on soldier population, patterns of use, and planned build out of infrastructure to facilitate training of up to 1,200 soldiers.

   In May 2016 the BRAC Office directed OMD and the CDA to come to a joint agreement recommending division of water rights. The OMD and CDA did conduct meetings and have arrived at an amicable solution. We believe that this solution provides adequate water to meet the ORARNG training mission, and that with some constructed build-out for water storage will allow the OMD to meet the 3,000 GPM for 3 hour pumping requirement for compliance with fire code. ARNG and CDA's to discuss and come to an amicable solution to determine the percentage of water rights for each entity.

4. **<u>DIVISION OF WATER RIGHTS</u>**.

   The following represents the agreement for disposition of water rights by well:

Well	Water Rights	Type Water Right	Conveyance To
Well 4	1.11 cfs/498 gpm	Fire Protection	CDA
Well 5	1.11 cfs/498 gpm	Fire Protection	CDA
Well 7	2.26 cfs/1014 gpm	Fire Protection/Manufacturing	CDA
Well 7	1.72 cfs/772 gpm	Fire Protection	CDA
Well 3	0.02 cfs/10 gpm	Fire Protection	Army
Well 1	2.0 cfs/898 gpm	Fire Protection	CDA / Army
Well 1	0.34 cfs/153 gpm	Irrigation	Army
Well 2	0.78 cfs/350 gpm	Domestic	Army
Well 6	0.5 cfs/224 gpm	Domestic	Army

Following the negotiating between the ORARNG and the CDA, it was agreed that an equal split of the fire protection water rights in Well 1 could still allow for the military mission to be met. This results in 27% of the water being retained by the Army for the military mission and the remaining 73% to be transferred to the CDA through the BRAC disposal process.

5. **SEVERABILITY**. The Army and the National Guard Bureau (NGB) has expressed interest in the net water rights to be retained for the site from a water resource and security position. The Oregon Water Resources Department has also provided input for the transfer criteria, the aquifers, and states water rights interests. These positions are separate and aside from the negotiations between the ORARNG and CDA. Both Office of Secretary of Defense (OSD) and Army water rights retention policy were considered.

6. **GOVERNING LAW.** This Agreement shall be governed and construed to be in accordance with the water rights Oregon Law as directed through the Oregon Water Rights Division.

7. **MERGER.** This agreement constitutes the entire agreement between the parties. There are no understandings, agreements, or representations, oral or written, not specified herein regarding this agreement. No amendment, consent, or waiver of terms of this agreement shall bind either party unless in writing and signed by all parties. Any such amendment, consent or waiver, shall be effective only in the specific instance and for the specific purpose given. OMD and USCG by the signatures below of its authorized representatives acknowledge having read and understood this agreement and agree to be bound by its terms and conditions.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed by their duly authorized officers as of the dates shown

APPROVED BY:

Michael E Stencel

Michael E. Stencel
Major General
The Adjutant General

Date: 25 Jul 16

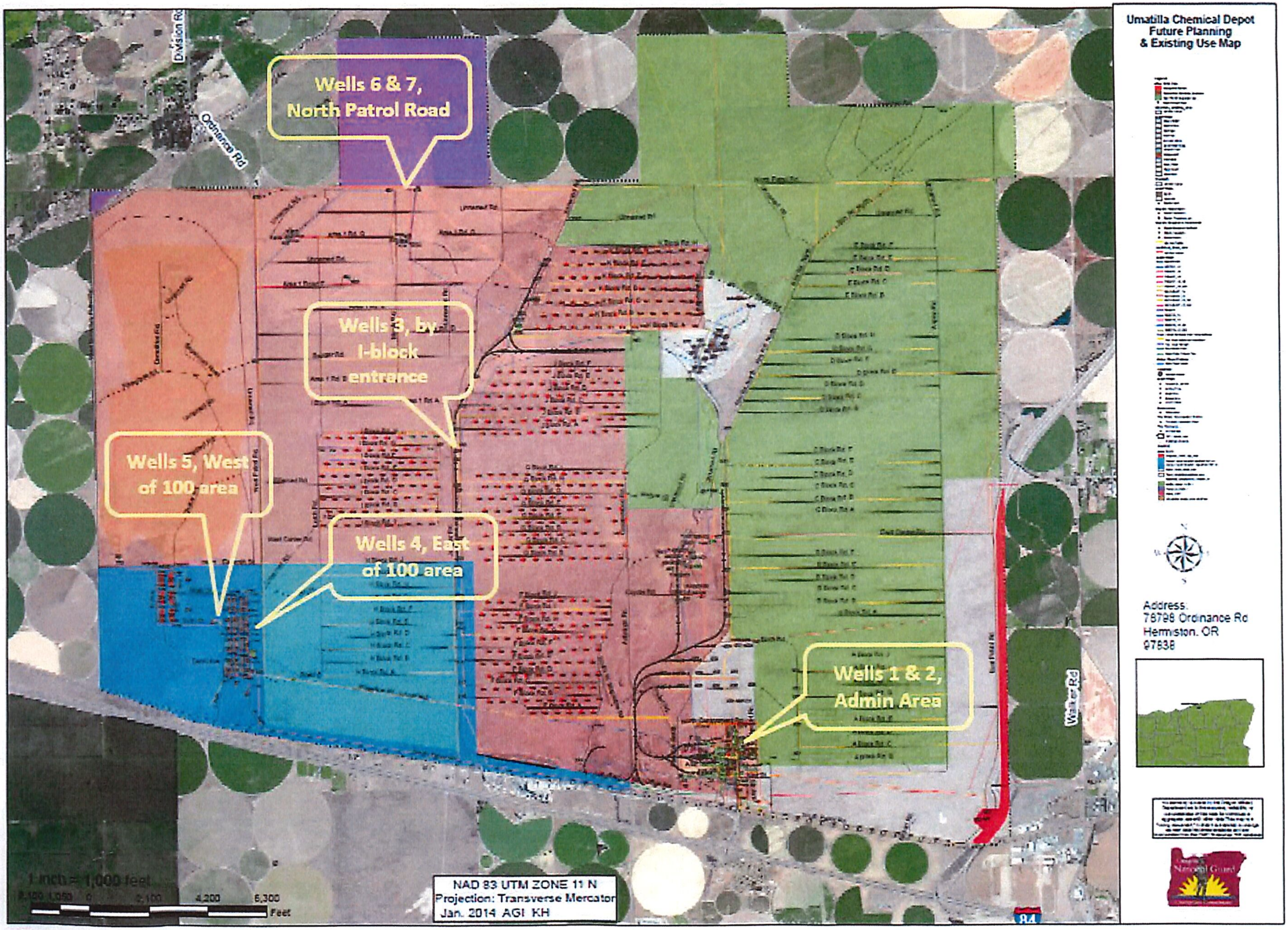
Gregory V. Smith

GREGORY V. SMITH
Executive Director
Columbia Development Authority

Date: 7/26/16

Umatilla Chemical Depot Well Locations

Oregon National Guard



Address:
78798 Ordinance Rd
Hermiston, OR
97838

Columbia Development Authority

December 16, 2016

COL Erik Gordon
Chief, Installations & Environmental Division (ARNG-IEZ)
Office of the Under Secretary for Personnel and Readiness
Arlington Hall Station
111 S. George Mason Dr.
Arlington, VA 22204-1382

Dear COL Erik Gordon:

At the conclusion of our meeting and conference call on November 28, 2016 involving representatives of the Columbia Development Authority (CDA), Oregon Military Department/Oregon Army National Guard (ORANG), National Guard Bureau (NGB), Army Corps of Engineers (ACOE) and BRAC office representatives, we understood there was an agreement among all participants to move forward with an allocation of water rights as described in the Memorandum of Agreement entered into between the OMD and CDA in July, 2016. We viewed the letters sent by the ACOE to the Oregon Water Resources Department on December 2, 2016, regarding the change from "specific" to "general" industrial uses for some of the water rights, as an indication of the joint agreement and first step toward implementation.

At this point, however, we are concerned about the lack of an affirmative statement from NGB or the BRAC to confirm acceptance of the water rights distribution plan. As we have previously stated, acceptance of the water rights plan is of paramount concern to the CDA. We cannot proceed with the title transfer process without this commitment.

Because time is of the essence, we ask that you please respond promptly to clarify the status of the water rights agreement.

Best Regards,

Don Russell

Don Russell, Chair
Columbia Development Authority

cc: Congressman Greg Walden
cc: Randy Chambers

Two Marine Drive
P.O. Box 200
Boardman, OR 97818
541-481-3693
www.columbiadevelopmentauthority.com

Site # 41A82
Camp Umatilla
Oregon

Legend

- ▲ AccessControl_P
- ▣ CommUtilityNode
- ✳ emergency_eyewash_point
- 🟨 EnvironmentalSampleLocation
- ■ ElectricalUtilityNode_Xformer
- ■ ElectricalUtilityNode_Generatr
- 🟥 ElectricalUtilityNode_Meter
- ● HazmatStorageLocation_Tank_P
- ⊗ spill_response_feature_point
- ◆ HazmatStorageLocation_P
- ◇ HazwasteStorageLocation_P
- ◉ StormWaterUtilityNode_Junction
- ■ storm_culvert_point
- ■ GeneralUtilityNode_OilWatSprtr
- ■ StormWaterUtilityNode_Fitting
- ■ StormWaterUtilityNode_Inlet
- ◆ ut_undefined_feature_point
- ✚ UtilityFeature_SupportStr_P
- ◐ Well
- ● WaterUtilityNode_Junction
- ■ WaterUtilityNode_Valve
- ● WaterUtilityNode_Hydrant
- 🟩 WastewaterUtilityNode_Fitting
- ⊛ WastewaterUtilityNode_Junction
- ● WastewaterUtilityNode_Tank
- — AccessControl_L
- — Roads
- — electrical_lines_Rng
- — ElectricalUtilitySegment
- ×—× Existing Fence
- — fuel_line_segment
- — GasUtilitySegment
- — WaterUtilitySegment
- — WastewaterUtilitySegment
- — wastewater_line
- — Culvert_L
- — StormWaterUtilitySegment
- - - CommUtilitySegment_TwistedPair
- — CommUtilitySegment_Fiberoptic
- — New_Proposed_Sewerline
- — Alt_waterline_easement
- — New_Comms_easement
- — New_Electrical_easement
- — New_Gasline_easement
- — New_road_easements
- — New_Sewer_easements
- ■ Proposed_easement_Rails
- ■ AmmunitionStorage_A
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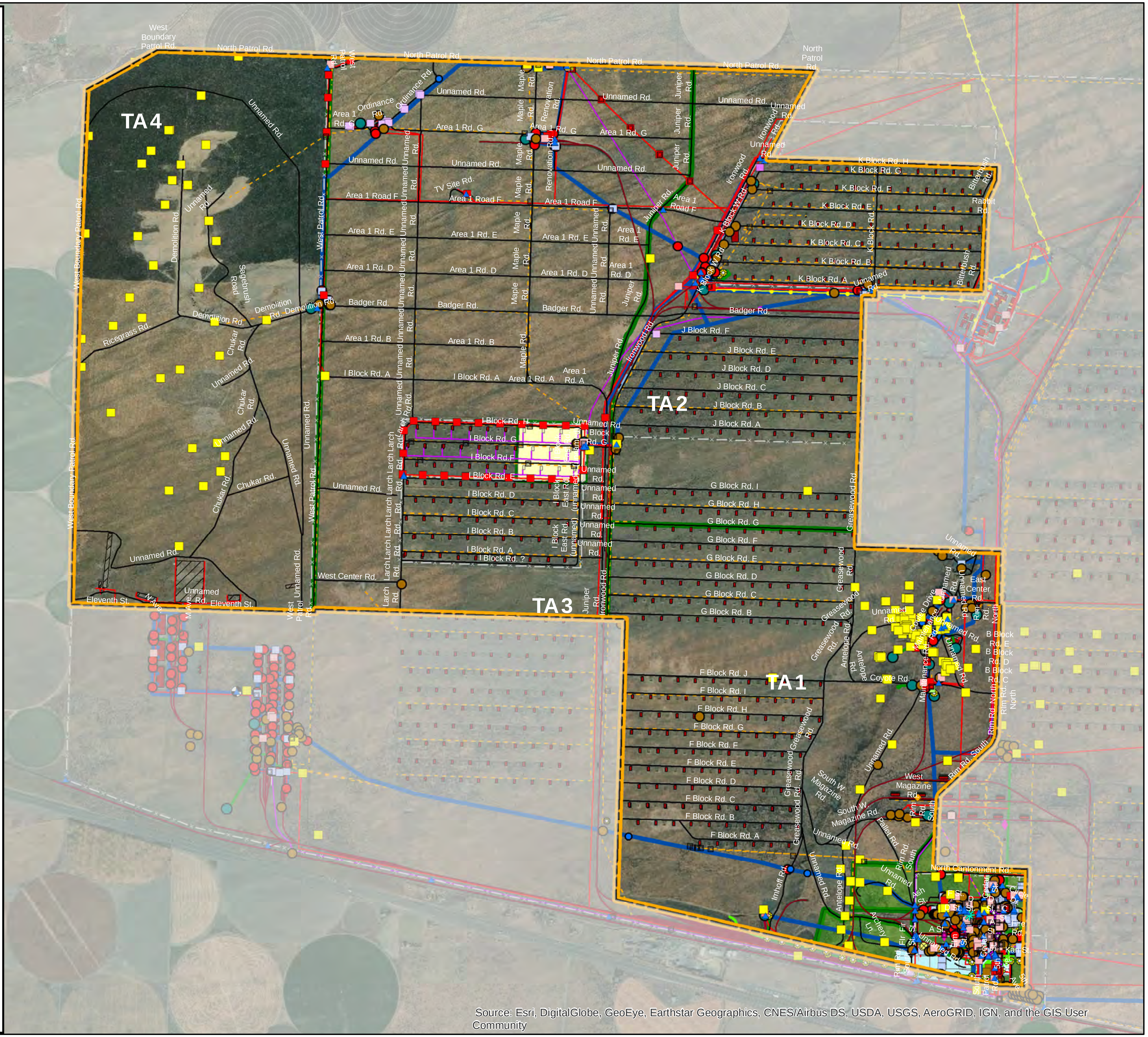
- 🟩 GroundsMaintenance
- ▨ HazmatStorageLocation_A
- ▨ MilitaryRange
- ▭ Training Area
- ■ PavementSection_Road_A
- 🟦 Structure_A
- ■ VehicleParking



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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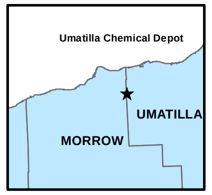

Address:
78798 Ordinance Rd
Hermiston, OR
97838

0 1,000 2,000 4,000
Feet

T: 7 S R: 3 W Sec: 36
NAD 83 UTM Zone 10 North
Projection: Transverse Mercator
Aug 2018

No warranty is made by the Oregon Military Department as to the accuracy, reliability, or completeness of this data for individual or aggregate use with other data. This map is a "Living document," in that it is intended to change as new data becomes available and are incorporated into the OMD Enterprise GIS database

Fax To: AECOM
Contact: Brittany Kirchmann
Fax : 000-000-0000
Date: 02/13/2019

Fax From: Sean McLaughlin
EDR
Phone: 1-800-352-0050

EDR PUR-IQ® Report

"the intelligent way to conduct historical research"

for
Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838
Lat./Long. 45.807862 / 119.42031
EDR Inquiry # 5560731.2s

The EDR PUR-IQ report facilitates historical research planning required to complete the Phase I ESA process. The report identifies the *likelihood* of prior use coverage by searching proprietary EDR-Prior Use Reports® comprising nationwide information on: city directories, fire insurance maps, aerial photographs, historical topographic maps, flood maps and National Wetland Inventory maps.

Potential for EDR Historical (Prior Use) Coverage - Coverage in the following historical information sources may be used as a guide to develop your historical research strategy:

1. City Directory:	Coverage exists for portions of HERMISTON, OR for 1965-2003
2. Fire Insurance Map:	When you order online any EDR Package or the EDR Radius Map with EDR Sanborn Map Search/Print, you receive site specific Sanborn Map coverage information at no charge.
3. Aerial Photograph:	Aerial photography coverage may exist for portions of Umatilla County. Please contact your EDR Account Executive for information about USGS photos available through EDR.
4. Topographic Map:	The USGS 7.5 min. quad topo sheet(s) associated with this site:

Historical: Coverage exists for UMATILLA County

Current: Target Property: TP | 2014 | 6067356 Ordnance, OR

EDR's network of professional researchers, located throughout the United States, accesses the most extensive national collections of city directory, fire insurance maps, aerial photographs and historical topographic map resources available for Hermiston, OR. These collections may be located in multiple libraries throughout the country. To ensure maximum coverage, EDR will often assign researchers at these multiple locations on your behalf. Please call or fax your EDR representative to authorize a search.

EDR™ Environmental Data Resources Inc

EDR - HISTORICAL SOURCE(S) ORDER FORM

AECOM
Brittany Kirchmann
Account # 1861179

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838
UMATILLA County
Lat./Long. 45.807862 / 119.42031
EDR Inquiry # 5560731.2s

Should you wish to change or add to your order, fax this form to your EDR account executive:

Sean McLaughlin
Ph: 1-800-352-0050 Fax: 1-800-231-6802

Reports

___ EDR Sanborn Map® Search/Print

___ EDR Fire Insurance Map Abstract

___ EDR Multi-Tenant Retail Facility® Report

___ EDR City Directory Abstract

___ EDR Aerial Photo Decade Package

___ USGS Aerial 5 Package

___ USGS Aerial 3 Package

___ EDR Historical Topographic Maps

___ Paper Current USGS Topo (7.5 min.)

___ Environmental Lien Search

___ Chain of Title Search

___ NJ MacRaes Industrial Directory Report

___ EDR Telephone Interview

Shipping:

___ Email
___ Express, Next Day Delivery RUSH SERVICE IS AVAILABLE
___ Express, Second Day Delivery
___ Express, Next day Delivery Customer Account Acct # ________________
___ Express, Second Day Delivery Customer Account Acct # ________________
___ U.S. Mail

Thank you

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838

Inquiry Number: 5560731.3
February 12, 2019

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

02/12/19

Site Name:

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838
EDR Inquiry # 5560731.3

Client Name:

AECOM
12120 Shamrock Plaza
Omaha, NE 68154
Contact: Brittany Kirchmann

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AECOM were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification #	E55D-4BE7-ADB9
PO #	NA
Project	Camp Umatilla

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: E55D-4BE7-ADB9

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ☑ Library of Congress
- ☑ University Publications of America
- ☑ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Camp Umatilla

78000-78028 Ordnance Rd

Hermiston, OR 97838

Inquiry Number: 5560731.5

February 13, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

02/13/19

Site Name:

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838
EDR Inquiry # 5560731.5

Client Name:

AECOM
12120 Shamrock Plaza
Omaha, NE 68154
Contact: Brittany Kirchmann

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	*Scale*	*Details*	*Source*
2016	1"=500'	Flight Year: 2016	USDA/NAIP
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1994	1"=500'	Acquisition Date: May 07, 1994	USGS/DOQQ
1989	1"=500'	Flight Date: July 27, 1989	USGS
1977	1"=500'	Flight Date: July 01, 1977	USGS
1970	1"=500'	Flight Date: July 06, 1970	USGS
1952	1"=500'	Flight Date: October 17, 1952	USGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.


INQUIRY #: 5560731.5

YEAR: 2016

= 500'

INQUIRY #: 5560731.5

YEAR: 2012

= 500'

INQUIRY #: 5560731.5

YEAR: 2009

= 500'

N

INQUIRY #: 5560731.5

YEAR: 2006

= 500'

N


INQUIRY #: 5560731.5

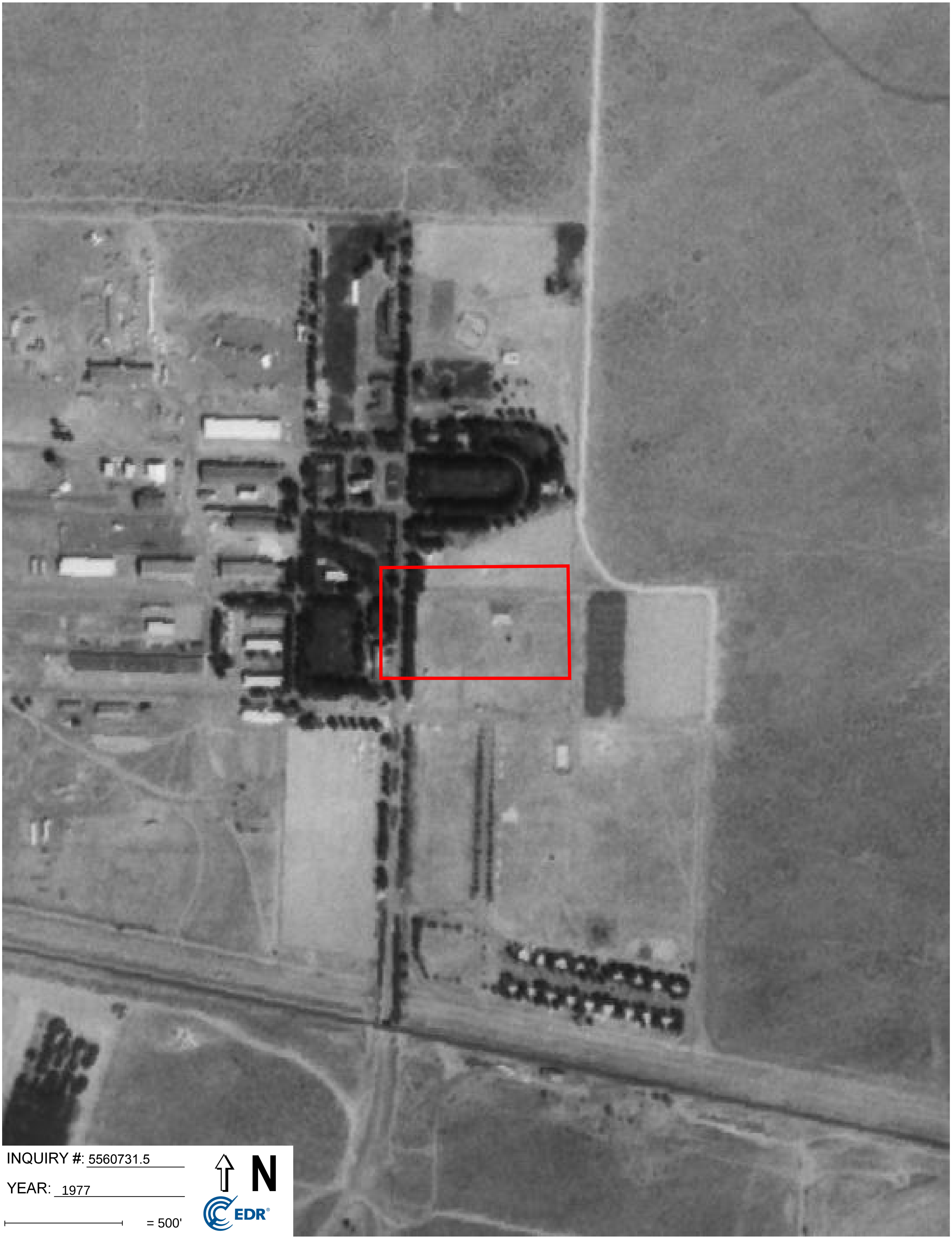
YEAR: 1994

= 500'

INQUIRY #: 5560731.5

YEAR: 1989

= 500'


INQUIRY #: 5560731.5
YEAR: 1977
= 500'
N
EDR®

INQUIRY #: 5560731.5

YEAR: 1970

= 500'

INQUIRY #: 5560731.5

YEAR: 1952

= 500'

N

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838

Inquiry Number: 5560731.2s
February 13, 2019

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA’s Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

78000-78028 ORDNANCE RD
HERMISTON, OR 97838

COORDINATES

Latitude (North):	45.8078620 - 45˚ 48’ 28.30’’
Longitude (West):	119.4203100 - 119˚ 25’ 13.11’’
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	311938.0
UTM Y (Meters):	5075331.0
Elevation:	581 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	6067356 ORDNANCE, OR
Version Date:	2014

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140707
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
78000-78028 ORDNANCE RD
HERMISTON, OR 97838

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	CAMP UMATILLA		NPDES		TP
A2	CAMP UMATILLA	I-84 & EXIT 178	NPDES		TP
Reg	UMATILLA CHEMICAL DE		DOD	Same	1 ft.
3	HERMISTON GUN CLUB	77034 GUN CLUB RD.	ECSI	Lower	5090, 0.964, WSW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
CAMP UMATILLA HERMISTON, OR	NPDES WQ File Nbr: 91000	N/A
CAMP UMATILLA I-84 & EXIT 178 HERMISTON, OR 97838	NPDES WQ File Nbr: 91000	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
NPL LIENS	Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL	National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY	Federal Facility Site Information listing
SEMS	Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE	Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS	Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF	RCRA - Treatment, Storage and Disposal

EXECUTIVE SUMMARY

Federal RCRA generators list

RCRA-LQG	RCRA - Large Quantity Generators
RCRA-SQG	RCRA - Small Quantity Generators
RCRA-CESQG	RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS	Land Use Control Information System
US ENG CONTROLS	Engineering Controls Sites List
US INST CONTROL	Sites with Institutional Controls

Federal ERNS list

ERNS	Emergency Response Notification System

State- and tribal - equivalent CERCLIS

CRL	Confirmed Release List and Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF	Solid Waste Facilities List

State and tribal leaking storage tank lists

LUST	Leaking Underground Storage Tank Database
INDIAN LUST	Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST	Underground Storage Tank Listing
UST	Underground Storage Tank Database
AST	Aboveground Storage Tanks
INDIAN UST	Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

ENG CONTROLS	Engineering Controls Recorded at ESCI Sites
INST CONTROL	Institutional Controls Recorded at ESCI Sites

State and tribal voluntary cleanup sites

VCP	Voluntary Cleanup Program Sites
INDIAN VCP	Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS	Brownfields Projects

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS	A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF	Old Closed SW Disposal Sites
SWRCY	Recycling Facility Location Listing
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
ODI	Open Dump Inventory
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
AOCONCERN	Columbia Slough
CDL	Uninhabitable Drug Lab Properties
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Spill Database
OR HAZMAT	Hazmat/Incidents
SPILLS 90	SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees

INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
UXO	Unexploded Ordnance Sites
ECHO	Enforcement & Compliance History Information
DOCKET HWC	Hazardous Waste Compliance Docket Listing
FUELS PROGRAM	EPA Fuels Program Registered Listing
AIRS	Oregon Title V Facility Listing
COAL ASH	Coal Ash Disposal Sites Listing
DRYCLEANERS	Drycleaning Facilities
Enforcement	Enforcement Action Listing
Financial Assurance	Financial Assurance Information Listing
HSIS	Hazardous Substance Information Survey
MANIFEST	Manifest Information
UIC	Underground Injection Control Program Database

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historical Auto Stations
EDR Hist Cleaner	EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

STANDARD ENVIRONMENTAL RECORDS

State- and tribal - equivalent CERCLIS

ECSI: The Environmental Cleanup Site Information System records information about sites in Oregon that may be of environmental interest. The data come from the Department of Environmental Quality.

A review of the ECSI list, as provided by EDR, and dated 10/01/2018 has revealed that there is 1 ECSI site within approximately 1 mile of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
HERMISTON GUN CLUB Investigation: Suspect State ID Number: 4649	77034 GUN CLUB RD.	WSW 1/2 - 1 (0.964 mi.)	3	9

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

DOD: Consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1 DOD site within approximately 1 mile of the target property.

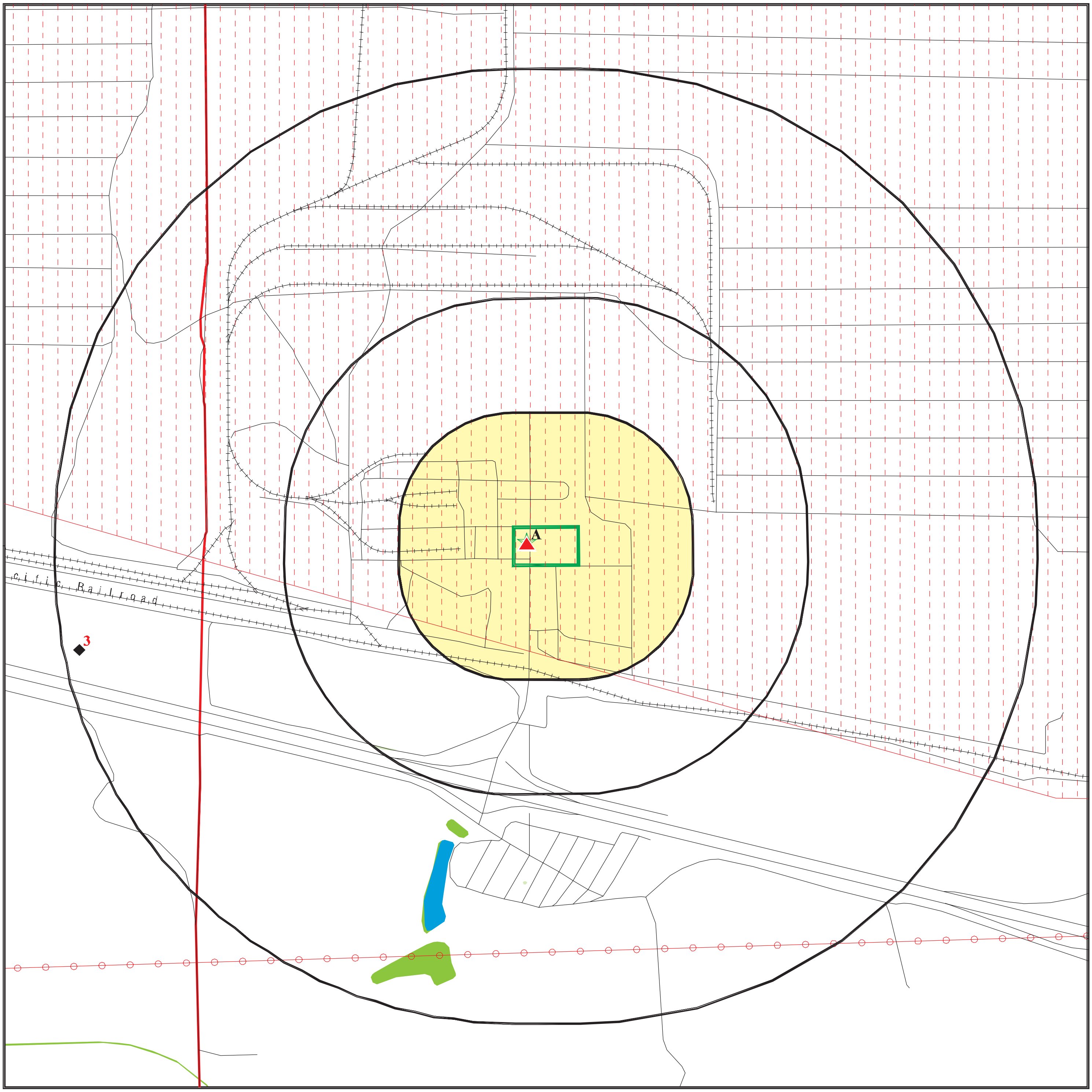
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
UMATILLA CHEMICAL DE		0 - 1/8 (0.000 mi.)	0	9

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 1 records.

Site Name	Database(s)
US ARMY UMATILLA CHEMICAL DEPOT	FINDS, ECHO

OVERVIEW MAP - 5560731.2S



0 1/4 1/2 1 Miles

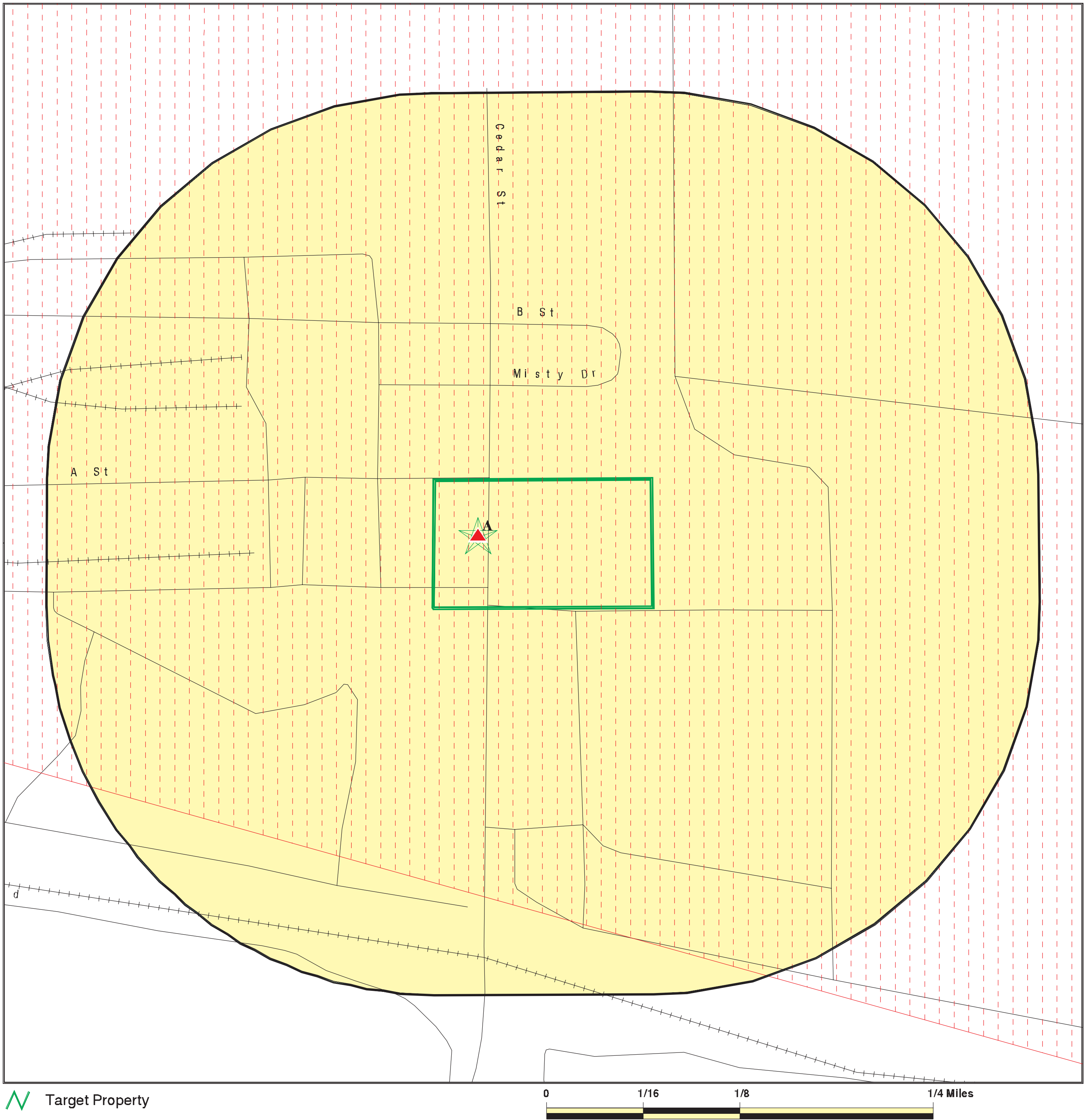
- Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Power transmission lines
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory
- State Wetlands
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Camp Umatilla
ADDRESS: 78000-78028 Ordnance Rd
Hermiston OR 97838
LAT/LONG: 45.807862 / 119.42031

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5560731.2s
DATE: February 13, 2019 1:25 pm

DETAIL MAP - 5560731.2S



- Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- ▦ Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Umatilla	CLIENT:	AECOM
ADDRESS:	78000-78028 Ordnance Rd Hermiston OR 97838	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5560731.2s
LAT/LONG:	45.807862 / 119.42031	DATE:	February 13, 2019 1:28 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
ECSI	1.000		0	0	0	1	NR	1
CRL	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
HIST LF	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
AOCONCERN	1.000		0	0	0	0	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
OR HAZMAT	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		1	0	0	0	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Enforcement	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
HSIS	TP		NR	NR	NR	NR	NR	0
MANIFEST	0.250		0	0	NR	NR	NR	0
NPDES	TP	2	NR	NR	NR	NR	NR	2
UIC	TP		NR	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		2	1	0	0	1	0	4

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 **CAMP UMATILLA** **NPDES** **S122879037**
Target **N/A**
Property **HERMISTON, OR**

Site 1 of 2 in cluster A

Actual:
581 ft.

NPDES:
WQ File Nbr: 91000
Legal Name: Oregon Military Department
Region: Not reported
Pri SIC: 9711
Facility Type: Not reported
Latitude: Not reported
Longitude: Not reported
Category: Not reported
Permit Type: WPCFOS-Bi
Permit Active: Not reported
Is Active?: FALSE
Permit Description: Not reported
Expiration Date: Not reported
EPA Number: Not reported
UIC Facility: Not reported
Admin Agent: Not reported
Last Action Date: Not reported
Permit Writer: Not reported
Compliance Inspector: Not reported
DMR Reviewer: Not reported
Application Number: Not reported
Class: Not reported
Start Date: Not reported
Region Decode: Not reported

A2 **CAMP UMATILLA** **NPDES** **S122879038**
Target **I-84 & EXIT 178** **N/A**
Property **HERMISTON, OR 97838**

Site 2 of 2 in cluster A

Actual:
581 ft.

NPDES:
WQ File Nbr: 91000
Legal Name: Oregon Military Department
Region: ER
Pri SIC: 9711
Facility Type: DEPARTMENT OF DEFENSE
Latitude: 45.8287
Longitude: -119.4274
Category: DOM
Permit Type: WPCFOS-Bi
Permit Active: True
Is Active?: Not reported
Permit Description: Standard or alternative subsurface system with design flow of 20,000 gpd or more
Expiration Date: 02/28/2015
EPA Number: N/A
UIC Facility: True
Admin Agent: Pendleton Office
Last Action Date: 05/10/2018
Permit Writer: Nadler
Compliance Inspector: Nadler
DMR Reviewer: Nadler

CAMP UMATILLA (Continued) **S122879038**

Application Number:	953128
Class:	N/A
Start Date:	11/29/2000
Region Decode:	East Region

DOD
Region

< 1/8
1 ft.

UMATILLA CHEMICAL DEPOT (CLOSED) **DOD** **CUSA103056**
N/A

UMATILLA CHEMICAL DEPOT ((County), OR

DOD:

Feature 1:	Army DOD
Feature 2:	Not reported
Feature 3:	Not reported
URL:	Not reported
Name 1:	Umatilla Chemical Depot (Closed)
Name 2:	Not reported
Name 3:	Not reported
State:	OR
DOD Site:	Yes
Tile name:	ORMORROW

3
WSW
1/2-1
0.964 mi.
5090 ft.

HERMISTON GUN CLUB **ECSI** **S118374548**
77034 GUN CLUB RD. **N/A**
IRRIGON, OR 97844

Relative:
Lower

Actual:
570 ft.

ECSI:

State ID Number:	4649
Brown ID:	0
Study Area:	False
Region ID:	1
Legislatve ID:	0
Investigation:	Suspect
FACA ID:	97240
Further Action:	0
Lat/Long (dms):	45 48 16.20 / -119 26 25.80
County Code:	25.00
Score Value:	Not reported
Cerclis ID:	Not reported
Township Coord.:	4.00
Township Zone:	N
Range Coord:	27.00
Range Zone:	E
Section Coord:	28
Qtr Section:	Not reported
Tax Lots:	Not reported
Size:	Not reported
NPL:	False
Orphan:	False
Updated By:	GWISTAR
Update Date:	10/27/2015
Created Date:	06/27/2006
Decode For RegionID:	Eastern Region

HERMISTON GUN CLUB (Continued) **S118374548**

Decode For BrownID: Not reported
Decode For Furtheract: Not reported
Decode For Investstat: Suspect
Decode For Legislative: Not reported

Narrative:

NARR ID: 5748257
NARR Code: Contamination
Created By: DCROUSE
Created Date: 06/27/2006
Updated By: DCROUSE
Updated Date: 06/27/2006
Decode for NarcdID: Contamination
NARR Comments: (6/27/06 DMC/SAS) Site added to database for tracking as an active shooting range.

NARR ID: 5748258
NARR Code: Data Sources
Created By: DCROUSE
Created Date: 06/27/2006
Updated By: DCROUSE
Updated Date: 06/27/2006
Decode for NarcdID: Data Sources
NARR Comments: 1. DMC/SAS driveby (6/17/06). 2. Internet searches.

NARR ID: 5748260
NARR Code: Site Ownership
Created By: DCROUSE
Created Date: 06/27/2006
Updated By: DCROUSE
Updated Date: 06/27/2006
Decode for NarcdID: Site Ownership
NARR Comments: Gun Club number (541) 567-1855.

NARR ID: 5748259
NARR Code: Remedial Action
Created By: DCROUSE
Created Date: 06/27/2006
Updated By: DCROUSE
Updated Date: 06/27/2006
Decode for NarcdID: Remedial Action
NARR Comments: (6/27/06 DMC/SAS) Site screening recommended; however, low priority for screening unless site is closed and redeveloped.

Administrative Action:

Action ID: 9424
Region: Not reported
Complete Date: 06/27/2006
Rank Value: Not reported
Cleanup Flag: False
Created Date: 06/27/2006
Decode for AgencyID: Department of Environmental Quality
Decode for RegionID: Not reported
Category: Administrative Action
Action Code Flag: False
Action: Site added to database
Further Action: Not reported
Comments: Not reported

HERMISTON GUN CLUB (Continued) **S118374548**

Action ID: 9508
Region: Eastern Region
Complete Date: 06/27/2006
Rank Value: Not reported
Cleanup Flag: False
Created Date: 06/27/2006
Decode for AgencyID: Department of Environmental Quality
Decode for RegionID: Eastern Region
Category: Remedial Action
Action Code Flag: False
Action: Site Screening recommended (EV)
Further Action: 0
Comments: Not reported

Operations:
Operation Id: 135180
Operation Status: Active
Common Name: Hermiston Gun Club
Yrs of Operation: Not reported
Comments: Active gun club (skeet shooting, trapshooting & sporting clays).
Updated Date: 06/27/2006
Updated By: DCROUSE
Decode for OpstatID: Active
Operations SIC Id: 198634
SIC Code: 3482
Created By: DCROUSE
Created Date: 06/27/2006

Count: 1 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HERMISTON	1018324224	US ARMY UMATILLA CHEMICAL DEPOT	CEDAR ST	97838	FINDS, ECHO

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA’s Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA’s Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 11/07/2016
Date Data Arrived at EDR: 01/05/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 01/04/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA’s Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 04/29/2019
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 12/13/2018	Source: EPA
Date Data Arrived at EDR: 12/28/2018	Telephone: 800-424-9346
Date Made Active in Reports: 01/11/2019	Last EDR Contact: 12/28/2018
Number of Days to Update: 14	Next Scheduled EDR Contact: 04/29/2019
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/2018	Source: EPA
Date Data Arrived at EDR: 03/28/2018	Telephone: 800-424-9346
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 10/17/2018	Source: Department of the Navy
Date Data Arrived at EDR: 10/25/2018	Telephone: 843-820-7326
Date Made Active in Reports: 12/07/2018	Last EDR Contact: 02/07/2019
Number of Days to Update: 43	Next Scheduled EDR Contact: 05/27/2019
	Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 07/31/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/28/2018	Telephone: 703-603-0695
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 02/04/2019
Number of Days to Update: 17	Next Scheduled EDR Contact: 03/11/2019
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 07/31/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/28/2018	Telephone: 703-603-0695
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 02/04/2019
Number of Days to Update: 17	Next Scheduled EDR Contact: 03/11/2019
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 09/25/2018
Date Made Active in Reports: 11/09/2018
Number of Days to Update: 45

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 02/08/2019
Next Scheduled EDR Contact: 04/08/2019
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

ECSI: Environmental Cleanup Site Information System

Sites that are or may be contaminated and may require cleanup.

Date of Government Version: 10/01/2018
Date Data Arrived at EDR: 10/03/2018
Date Made Active in Reports: 10/23/2018
Number of Days to Update: 20

Source: Department of Environmental Quality
Telephone: 503-229-6629
Last EDR Contact: 01/03/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

CRL: Confirmed Release List and Inventory

All facilities with a confirmed release.

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 11/15/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 25

Source: Department of Environmental Quality
Telephone: 503-229-6170
Last EDR Contact: 11/15/2018
Next Scheduled EDR Contact: 02/25/2019
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Solid Waste Facilities List

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 11/05/2018
Date Data Arrived at EDR: 11/07/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 33

Source: Department of Environmental Quality
Telephone: 503-229-6299
Last EDR Contact: 01/11/2019
Next Scheduled EDR Contact: 04/29/2019
Data Release Frequency: Semi-Annually

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 10/03/2018
Date Data Arrived at EDR: 11/15/2018
Date Made Active in Reports: 12/11/2018
Number of Days to Update: 26

Source: Department of Environmental Quality
Telephone: 503-229-5790
Last EDR Contact: 11/15/2018
Next Scheduled EDR Contact: 02/25/2019
Data Release Frequency: Quarterly

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 04/01/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/25/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 04/10/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/13/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 05/08/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/24/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 04/12/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 04/12/2018	Source: EPA, Region 5
Date Data Arrived at EDR: 05/18/2018	Telephone: 312-886-7439
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017	Source: FEMA
Date Data Arrived at EDR: 05/30/2017	Telephone: 202-646-5797
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 01/08/2019
Number of Days to Update: 136	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Varies

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST’s are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 10/03/2018	Source: Department of Environmental Quality
Date Data Arrived at EDR: 11/15/2018	Telephone: 503-229-5815
Date Made Active in Reports: 12/10/2018	Last EDR Contact: 11/15/2018
Number of Days to Update: 25	Next Scheduled EDR Contact: 02/25/2019
	Data Release Frequency: Quarterly

AST: Aboveground Storage Tanks
Aboveground storage tank locations reported to the Office of State Fire Marshal.

Date of Government Version: 09/05/2017	Source: Office of State Fire Marshal
Date Data Arrived at EDR: 11/16/2017	Telephone: 503-378-3473
Date Made Active in Reports: 01/09/2018	Last EDR Contact: 01/17/2019
Number of Days to Update: 54	Next Scheduled EDR Contact: 05/11/2019
	Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/12/2018	Source: EPA Region 5
Date Data Arrived at EDR: 05/18/2018	Telephone: 312-886-6136
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 05/08/2018	Source: EPA Region 4
Date Data Arrived at EDR: 05/18/2018	Telephone: 404-562-9424
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/13/2018	Source: EPA, Region 1
Date Data Arrived at EDR: 05/18/2018	Telephone: 617-918-1313
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/24/2018	Source: EPA Region 7
Date Data Arrived at EDR: 05/18/2018	Telephone: 913-551-7003
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/12/2018	Source: EPA Region 10
Date Data Arrived at EDR: 05/18/2018	Telephone: 206-553-2857
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 04/10/2018	Source: EPA Region 9
Date Data Arrived at EDR: 05/18/2018	Telephone: 415-972-3368
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 04/25/2018	Source: EPA Region 8
Date Data Arrived at EDR: 05/18/2018	Telephone: 303-312-6137
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 04/01/2018	Source: EPA Region 6
Date Data Arrived at EDR: 05/18/2018	Telephone: 214-665-7591
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 01/25/2019
Number of Days to Update: 63	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Controls Recorded at ESCI Sites

Engineering controls are physical measures selected or approved by the Director for the purpose of preventing or minimizing exposure to hazardous substances. Engineering controls may include, but are not limited to, fencing, capping, horizontal or vertical barriers, hydraulic controls, and alternative water supplies.

Date of Government Version: 10/01/2018
Date Data Arrived at EDR: 10/03/2018
Date Made Active in Reports: 10/23/2018
Number of Days to Update: 20

Source: Department of Environmental Quality
Telephone: 503-229-5193
Last EDR Contact: 01/03/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

INST CONTROL: Institutional Controls Recorded at ESCI Sites

An institutional control is a legal or administrative tool or action taken to reduce the potential for exposure to hazardous substances. Institutional controls may include, but are not limited to, use restrictions, environmental monitoring requirements, and site access and security measures.

Date of Government Version: 10/01/2018
Date Data Arrived at EDR: 10/03/2018
Date Made Active in Reports: 10/23/2018
Number of Days to Update: 20

Source: Department of Environmental Quality
Telephone: 503-229-5193
Last EDR Contact: 01/03/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 12/19/2018
Next Scheduled EDR Contact: 04/08/2019
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCS: Voluntary Cleanup Program Sites

Responsible parties have entered into an agreement with DEQ to voluntarily address contamination associated with their property.

Date of Government Version: 10/19/2018
Date Data Arrived at EDR: 10/23/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 48

Source: DEQ
Telephone: 503-229-5256
Last EDR Contact: 01/11/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Projects

Brownfields investigations and/or cleanups that have been conducted in Oregon.

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 11/15/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 25

Source: Department of Environmental Quality
Telephone: 503-229-6801
Last EDR Contact: 11/15/2018
Next Scheduled EDR Contact: 02/25/2019
Data Release Frequency: Annually

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/17/2018
Date Data Arrived at EDR: 12/18/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 24

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/18/2018
Next Scheduled EDR Contact: 04/01/2019
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF: Old Closed SW Disposal Sites

A list of solid waste disposal sites that have been closed for a long while.

Date of Government Version: 04/01/2000
Date Data Arrived at EDR: 07/08/2003
Date Made Active in Reports: 07/18/2003
Number of Days to Update: 10

Source: Department of Environmental Quality
Telephone: 503-229-5409
Last EDR Contact: 07/08/2003
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SWRCY: Recycling Facility Location Listing

A listing of recycling facility locations.

Date of Government Version: 08/28/2018
Date Data Arrived at EDR: 08/29/2018
Date Made Active in Reports: 09/24/2018
Number of Days to Update: 26

Source: Department of Environmental Quality
Telephone: 503-229-5353
Last EDR Contact: 11/29/2018
Next Scheduled EDR Contact: 03/11/2019
Data Release Frequency: Quarterly

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 01/29/2019
Next Scheduled EDR Contact: 05/13/2019
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 01/17/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 02/01/2019
Next Scheduled EDR Contact: 05/13/2019
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

AOC COL: Columbia Slough

Columbia Slough waterway boundaries.

Date of Government Version: 08/10/2005
Date Data Arrived at EDR: 05/17/2006
Date Made Active in Reports: 06/16/2006
Number of Days to Update: 30

Source: City of Portland Environmental Services
Telephone: 503-823-5310
Last EDR Contact: 03/13/2007
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

AOC MU: East Multnomah County Area

Approximate extent of TSA VOC plume February , 2002

Date of Government Version: N/A
Date Data Arrived at EDR: 10/07/2002
Date Made Active in Reports: 10/22/2002
Number of Days to Update: 15

Source: City of Portland Environmental Services
Telephone: 503-823-5310
Last EDR Contact: 03/13/2007
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 09/21/2018
Date Data Arrived at EDR: 09/21/2018
Date Made Active in Reports: 11/09/2018
Number of Days to Update: 49

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/26/2018
Next Scheduled EDR Contact: 03/11/2019
Data Release Frequency: No Update Planned

CDL: Uninhabitable Drug Lab Properties

The properties listed on these county pages have been declared by a law enforcement agency to be unfit for use due to meth lab and/or storage activities. The properties are considered uninhabitable until cleaned up by a state certified decontamination contractor and a certificate of fitness is issued by the Oregon Health Division.

Date of Government Version: 09/21/2018
Date Data Arrived at EDR: 09/25/2018
Date Made Active in Reports: 10/22/2018
Number of Days to Update: 27

Source: Department of Consumer & Business Services
Telephone: 503-378-4133
Last EDR Contact: 01/30/2019
Next Scheduled EDR Contact: 05/20/2019
Data Release Frequency: Quarterly

CDL 2: Clandestine Drug Lab Site Listing

A listing of clandestine drug lab site locations included in the Incident database.

Date of Government Version: 10/29/2018
Date Data Arrived at EDR: 10/31/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 40

Source: Oregon State Police
Telephone: 503-373-1540
Last EDR Contact: 01/28/2019
Next Scheduled EDR Contact: 05/11/2019
Data Release Frequency: Varies

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/21/2018
Date Data Arrived at EDR: 09/21/2018
Date Made Active in Reports: 11/09/2018
Number of Days to Update: 49

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/26/2018
Next Scheduled EDR Contact: 03/11/2019
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/26/2018
Date Data Arrived at EDR: 03/27/2018
Date Made Active in Reports: 06/08/2018
Number of Days to Update: 73

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 02/08/2019
Next Scheduled EDR Contact: 04/08/2019
Data Release Frequency: Quarterly

SPILLS: Spill Data

Oil and hazardous material spills reported to the Environmental Response Program.

Date of Government Version: 10/01/2018
Date Data Arrived at EDR: 10/02/2018
Date Made Active in Reports: 10/23/2018
Number of Days to Update: 21

Source: Department of Environmental Quality
Telephone: 503-229-5815
Last EDR Contact: 12/27/2018
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Semi-Annually

HAZMAT: Hazmat/Incidents

Hazardous material incidents reported to the State Fire Marshal by emergency responders. The hazardous material may or may not have been released.

Date of Government Version: 09/05/2018	Source: State Fire Marshal's Office
Date Data Arrived at EDR: 10/31/2018	Telephone: 503-373-1540
Date Made Active in Reports: 12/10/2018	Last EDR Contact: 02/01/2019
Number of Days to Update: 40	Next Scheduled EDR Contact: 05/13/2019
	Data Release Frequency: Semi-Annually

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 05/01/2006	Source: FirstSearch
Date Data Arrived at EDR: 01/03/2013	Telephone: N/A
Date Made Active in Reports: 02/22/2013	Last EDR Contact: 01/03/2013
Number of Days to Update: 50	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 12/03/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015	Source: U.S. Army Corps of Engineers
Date Data Arrived at EDR: 07/08/2015	Telephone: 202-528-4285
Date Made Active in Reports: 10/13/2015	Last EDR Contact: 11/19/2018
Number of Days to Update: 97	Next Scheduled EDR Contact: 03/04/2019
	Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 01/11/2019
Number of Days to Update: 62	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005	Source: U.S. Geological Survey
Date Data Arrived at EDR: 02/06/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 01/11/2019
Number of Days to Update: 339	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/16/2018
Next Scheduled EDR Contact: 02/25/2019
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 08/31/2018
Date Data Arrived at EDR: 09/25/2018
Date Made Active in Reports: 11/09/2018
Number of Days to Update: 45

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 02/04/2019
Next Scheduled EDR Contact: 04/08/2019
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 02/08/2019
Next Scheduled EDR Contact: 05/20/2019
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 02/08/2019
Next Scheduled EDR Contact: 05/20/2019
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/21/2018
Next Scheduled EDR Contact: 04/01/2019
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016	Source: EPA
Date Data Arrived at EDR: 01/10/2018	Telephone: 202-566-0250
Date Made Active in Reports: 01/12/2018	Last EDR Contact: 11/16/2018
Number of Days to Update: 2	Next Scheduled EDR Contact: 03/04/2019
	Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 01/25/2019
Number of Days to Update: 77	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 12/12/2018	Source: EPA
Date Data Arrived at EDR: 12/28/2018	Telephone: 703-416-0223
Date Made Active in Reports: 01/11/2019	Last EDR Contact: 12/28/2018
Number of Days to Update: 14	Next Scheduled EDR Contact: 03/18/2019
	Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 10/26/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/06/2018	Telephone: 202-564-8600
Date Made Active in Reports: 01/11/2019	Last EDR Contact: 01/22/2019
Number of Days to Update: 66	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995	Source: EPA
Date Data Arrived at EDR: 07/03/1995	Telephone: 202-564-4104
Date Made Active in Reports: 08/07/1995	Last EDR Contact: 06/02/2008
Number of Days to Update: 35	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 08/13/2018	Source: EPA
Date Data Arrived at EDR: 10/04/2018	Telephone: 202-564-6023
Date Made Active in Reports: 11/09/2018	Last EDR Contact: 02/08/2019
Number of Days to Update: 36	Next Scheduled EDR Contact: 05/20/2019
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/14/2018	Source: EPA
Date Data Arrived at EDR: 10/11/2018	Telephone: 202-566-0500
Date Made Active in Reports: 12/07/2018	Last EDR Contact: 01/11/2019
Number of Days to Update: 57	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/23/2016	Telephone: 202-564-2501
Date Made Active in Reports: 02/10/2017	Last EDR Contact: 01/07/2019
Number of Days to Update: 79	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 09/08/2016	Telephone: 301-415-7169
Date Made Active in Reports: 10/21/2016	Last EDR Contact: 01/22/2019
Number of Days to Update: 43	Next Scheduled EDR Contact: 05/06/2019
	Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 12/05/2018
Next Scheduled EDR Contact: 03/18/2019
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/03/2018
Next Scheduled EDR Contact: 03/18/2019
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017
Date Data Arrived at EDR: 11/30/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 15

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 01/25/2019
Next Scheduled EDR Contact: 05/06/2019
Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/02/2018
Date Data Arrived at EDR: 10/03/2018
Date Made Active in Reports: 11/09/2018
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 01/03/2019
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 10/01/2018	Source: Department of Transporation, Office of Pipeline Safety
Date Data Arrived at EDR: 10/30/2018	Telephone: 202-366-4595
Date Made Active in Reports: 01/18/2019	Last EDR Contact: 01/29/2019
Number of Days to Update: 80	Next Scheduled EDR Contact: 05/11/2019
	Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 09/30/2018	Source: Department of Justice, Consent Decree Library
Date Data Arrived at EDR: 10/12/2018	Telephone: Varies
Date Made Active in Reports: 12/07/2018	Last EDR Contact: 01/07/2019
Number of Days to Update: 56	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015	Source: EPA/NTIS
Date Data Arrived at EDR: 02/22/2017	Telephone: 800-424-9346
Date Made Active in Reports: 09/28/2017	Last EDR Contact: 11/21/2018
Number of Days to Update: 218	Next Scheduled EDR Contact: 03/04/2019
	Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014	Source: USGS
Date Data Arrived at EDR: 07/14/2015	Telephone: 202-208-3710
Date Made Active in Reports: 01/10/2017	Last EDR Contact: 01/07/2019
Number of Days to Update: 546	Next Scheduled EDR Contact: 04/22/2019
	Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017	Source: Department of Energy
Date Data Arrived at EDR: 09/11/2018	Telephone: 202-586-3559
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 01/31/2019
Number of Days to Update: 3	Next Scheduled EDR Contact: 05/20/2019
	Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 12/14/2018
Next Scheduled EDR Contact: 03/04/2019
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 12/12/2018
Date Data Arrived at EDR: 12/28/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 12/28/2018
Next Scheduled EDR Contact: 04/15/2019
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/01/2018
Date Data Arrived at EDR: 08/29/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 37

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 11/30/2018
Next Scheduled EDR Contact: 03/11/2019
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005	Source: USGS
Date Data Arrived at EDR: 02/29/2008	Telephone: 703-648-7709
Date Made Active in Reports: 04/18/2008	Last EDR Contact: 11/30/2018
Number of Days to Update: 49	Next Scheduled EDR Contact: 03/11/2019
	Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011	Source: USGS
Date Data Arrived at EDR: 06/08/2011	Telephone: 703-648-7709
Date Made Active in Reports: 09/13/2011	Last EDR Contact: 11/30/2018
Number of Days to Update: 97	Next Scheduled EDR Contact: 03/11/2019
	Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 09/10/2018	Source: Department of Interior
Date Data Arrived at EDR: 09/11/2018	Telephone: 202-208-2609
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 12/19/2018
Number of Days to Update: 3	Next Scheduled EDR Contact: 03/25/2019
	Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 11/15/2018	Source: EPA
Date Data Arrived at EDR: 12/05/2018	Telephone: (206) 553-1200
Date Made Active in Reports: 01/11/2019	Last EDR Contact: 01/31/2019
Number of Days to Update: 37	Next Scheduled EDR Contact: 03/18/2019
	Data Release Frequency: Quarterly

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/02/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/05/2018	Telephone: 202-564-2280
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 01/07/2019
Number of Days to Update: 9	Next Scheduled EDR Contact: 03/18/2019
	Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 09/30/2017	Source: Department of Defense
Date Data Arrived at EDR: 06/19/2018	Telephone: 703-704-1564
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 01/14/2019
Number of Days to Update: 87	Next Scheduled EDR Contact: 04/29/2019
	Data Release Frequency: Varies

DOCKET HWC: Hazardous Waste Compliance Docket Listing
A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 07/26/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 71

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 11/30/2018
Next Scheduled EDR Contact: 03/11/2019
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing
This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 08/22/2018
Date Data Arrived at EDR: 08/22/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 44

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 11/19/2018
Next Scheduled EDR Contact: 03/04/2019
Data Release Frequency: Quarterly

AIRS: Oregon Title V Facility Listing
A listing of Title V facility source and emissions information.

Date of Government Version: 10/01/2018
Date Data Arrived at EDR: 10/04/2018
Date Made Active in Reports: 10/26/2018
Number of Days to Update: 22

Source: Department of Environmental Quality
Telephone: 503-229-6459
Last EDR Contact: 12/27/2018
Next Scheduled EDR Contact: 04/17/2047
Data Release Frequency: Annually

COAL ASH: Coal Ash Disposal Sites Listing
A listing of coal ash disposal sites.

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 03/16/2018
Date Made Active in Reports: 05/15/2018
Number of Days to Update: 60

Source: Department of Environmental Quality
Telephone: 541-298-7255
Last EDR Contact: 11/30/2018
Next Scheduled EDR Contact: 03/18/2019
Data Release Frequency: Varies

DRYCLEANERS: Drycleaning Facilities
A listing of registered drycleaning facilities in Oregon.

Date of Government Version: 11/05/2018
Date Data Arrived at EDR: 11/07/2018
Date Made Active in Reports: 12/10/2018
Number of Days to Update: 33

Source: Department of Environmental Quality
Telephone: 503-229-6783
Last EDR Contact: 01/28/2019
Next Scheduled EDR Contact: 05/11/2019
Data Release Frequency: Annually

ENF: Enforcement Action Listing
Enforcement actions

Date of Government Version: 09/18/2018
Date Data Arrived at EDR: 09/19/2018
Date Made Active in Reports: 10/23/2018
Number of Days to Update: 34

Source: Department of Environmental Quality
Telephone: 503-229-5696
Last EDR Contact: 12/19/2018
Next Scheduled EDR Contact: 04/01/2019
Data Release Frequency: Quarterly

Financial Assurance 1: Financial Assurance Information Listing
Financial assurance information for hazardous waste facilities.

Date of Government Version: 05/21/2018
Date Data Arrived at EDR: 06/21/2018
Date Made Active in Reports: 07/23/2018
Number of Days to Update: 32

Source: Department of Environmental Quality
Telephone: 541-633-2011
Last EDR Contact: 11/30/2018
Next Scheduled EDR Contact: 03/18/2019
Data Release Frequency: Semi-Annually

Financial Assurance 2: Financial Assurance Information Listing

Financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 11/15/2018	Source: Department of Environmental Quality
Date Data Arrived at EDR: 11/16/2018	Telephone: 503-229-5521
Date Made Active in Reports: 12/10/2018	Last EDR Contact: 11/15/2018
Number of Days to Update: 24	Next Scheduled EDR Contact: 03/04/2019
	Data Release Frequency: Semi-Annually

HSIS: Hazardous Substance Information Survey

Companies in Oregon submitting the Hazardous Substance Information Survey and either reporting or not reporting hazardous substances.

Date of Government Version: 10/29/2018	Source: State Fire Marshal’s Office
Date Data Arrived at EDR: 10/31/2018	Telephone: 503-373-1540
Date Made Active in Reports: 12/10/2018	Last EDR Contact: 01/30/2019
Number of Days to Update: 40	Next Scheduled EDR Contact: 05/11/2019
	Data Release Frequency: Semi-Annually

OR MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2017	Source: Department of Environmental Quality
Date Data Arrived at EDR: 08/06/2018	Telephone: N/A
Date Made Active in Reports: 08/15/2018	Last EDR Contact: 02/04/2019
Number of Days to Update: 9	Next Scheduled EDR Contact: 05/20/2019
	Data Release Frequency: Annually

NPDES: Wastewater Permits Database

A listing of permitted wastewater facilities.

Date of Government Version: 09/20/2018	Source: Department of Environmental Quality
Date Data Arrived at EDR: 09/20/2018	Telephone: 503-229-5657
Date Made Active in Reports: 10/22/2018	Last EDR Contact: 01/30/2019
Number of Days to Update: 32	Next Scheduled EDR Contact: 05/20/2019
	Data Release Frequency: Varies

UIC: Underground Injection Control Program Database

DEQ’s Underground Injection Control Program is authorized by the Environmental Protection Agency (EPA) to regulate all underground injection in Oregon to protect groundwater resources.

Date of Government Version: 09/25/2018	Source: Department of Environmental Quality
Date Data Arrived at EDR: 09/27/2018	Telephone: 503-229-5945
Date Made Active in Reports: 10/23/2018	Last EDR Contact: 12/21/2018
Number of Days to Update: 26	Next Scheduled EDR Contact: 04/08/2019
	Data Release Frequency: Quarterly

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR’s researchers. Manufactured gas sites were used in the United States from the 1800’s to 1950’s to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Oregon.

Date of Government Version: N/A	Source: Department of Environmental Quality
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/03/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 186	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Oregon.

Date of Government Version: N/A	Source: Department of Environmental Quality
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/13/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 196	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Oregon.

Date of Government Version: N/A	Source: Department of Environmental Quality
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 12/27/2013	Last EDR Contact: 06/01/2012
Number of Days to Update: 179	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 10/01/2018	Source: Department of Environmental Conservation
Date Data Arrived at EDR: 10/31/2018	Telephone: 518-402-8651
Date Made Active in Reports: 12/20/2018	Last EDR Contact: 01/30/2019
Number of Days to Update: 50	Next Scheduled EDR Contact: 05/11/2019
	Data Release Frequency: Quarterly

WI MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2017	Source: Department of Natural Resources
Date Data Arrived at EDR: 06/15/2018	Telephone: N/A
Date Made Active in Reports: 07/09/2018	Last EDR Contact: 12/07/2018
Number of Days to Update: 24	Next Scheduled EDR Contact: 03/25/2019
	Data Release Frequency: Annually

Oil/Gas Pipelines

Source: PennWell Corporation

Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data

Source: PennWell Corporation

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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:

Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Listings
Source: Employment Department
Telephone: 503-947-1420

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory Data
Source: Oregon Geospatial Enterprise Office
Telephone: 503-378-2166

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CAMP UMATILLA
78000-78028 ORDNANCE RD
HERMISTON, OR 97838

TARGET PROPERTY COORDINATES

Latitude (North):	45.807862 - 45˚ 48’ 28.30’’
Longitude (West):	119.42031 - 119˚ 25’ 13.12’’
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	311938.0
UTM Y (Meters):	5075331.0
Elevation:	581 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	6067356 ORDNANCE, OR
Version Date:	2014

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

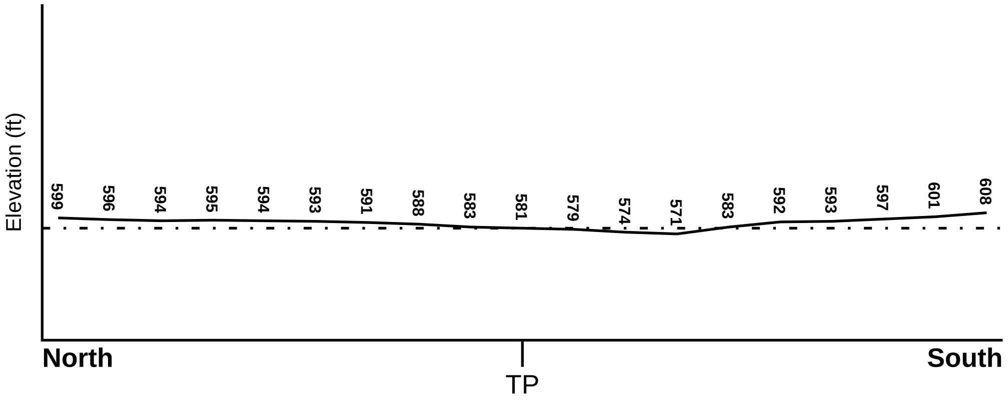
TOPOGRAPHIC INFORMATION

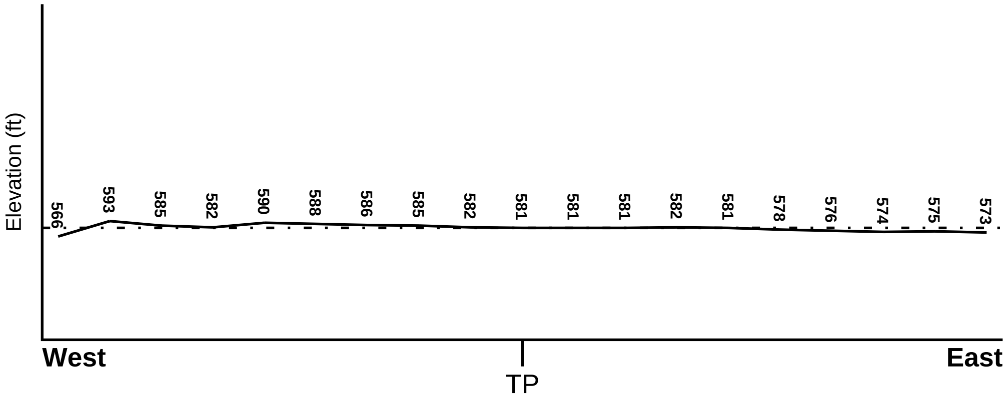
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

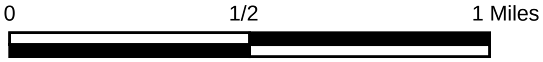
General Topographic Gradient: General SSE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 581 ft.



Source: Topography has been determined from the USGS 7.5’ Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
41049C0200D	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
ORDNANCE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

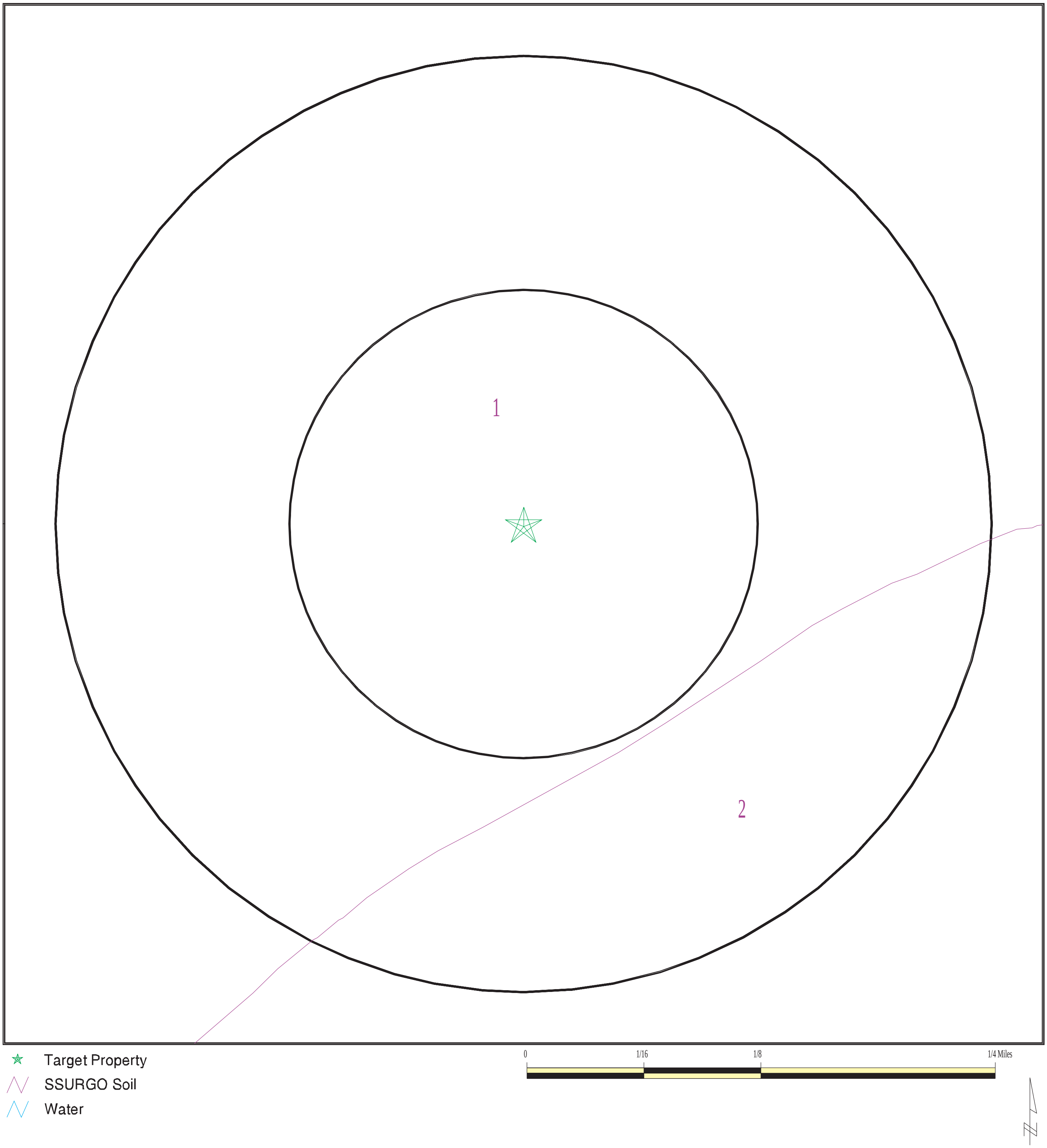
Era:	Cenozoic
System:	Quaternary
Series:	Quaternary
Code:	Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5560731.2s



SITE NAME:	Camp Umatilla	CLIENT:	AECOM
ADDRESS:	78000-78028 Ordnance Rd	CONTACT:	Brittany Kirchmann
	Hermiston OR 97838	INQUIRY #:	5560731.2s
LAT/LONG:	45.807862 / 119.42031	DATE:	February 13, 2019 1:29 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture’s (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name:	Burbank
Soil Surface Texture:	loamy fine sand
Hydrologic Group:	Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
Soil Drainage Class:	Excessively drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	5 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4
2	5 inches	25 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		
3	25 inches	29 inches	very gravelly loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4
4	29 inches	59 inches	extremely gravelly sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name:	Quincy
Soil Surface Texture:	loamy fine sand
Hydrologic Group:	Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
Soil Drainage Class:	Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

Soil Layer Information

	Boundary			Classification			
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**	**Saturated hydraulic conductivity micro m/sec**	**Soil Reaction (pH)**
1	0 inches	3 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9
2	3 inches	40 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9
3	40 inches	59 inches	very gravelly fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

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FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
2	USGS40000995182	1/8 - 1/4 Mile NNE
A7	USGS40000995162	1/4 - 1/2 Mile NW
B10	USGS40000995123	1/4 - 1/2 Mile SE
B12	USGS40000995129	1/4 - 1/2 Mile SE
B15	USGS40000995128	1/2 - 1 Mile SE
C16	USGS40000995126	1/2 - 1 Mile SW
D20	USGS40000995119	1/2 - 1 Mile SSW
G28	USGS40000995120	1/2 - 1 Mile SW
32	USGS40000995115	1/2 - 1 Mile SSW
H37	USGS40000995101	1/2 - 1 Mile SSE
H39	USGS40000995100	1/2 - 1 Mile SSE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

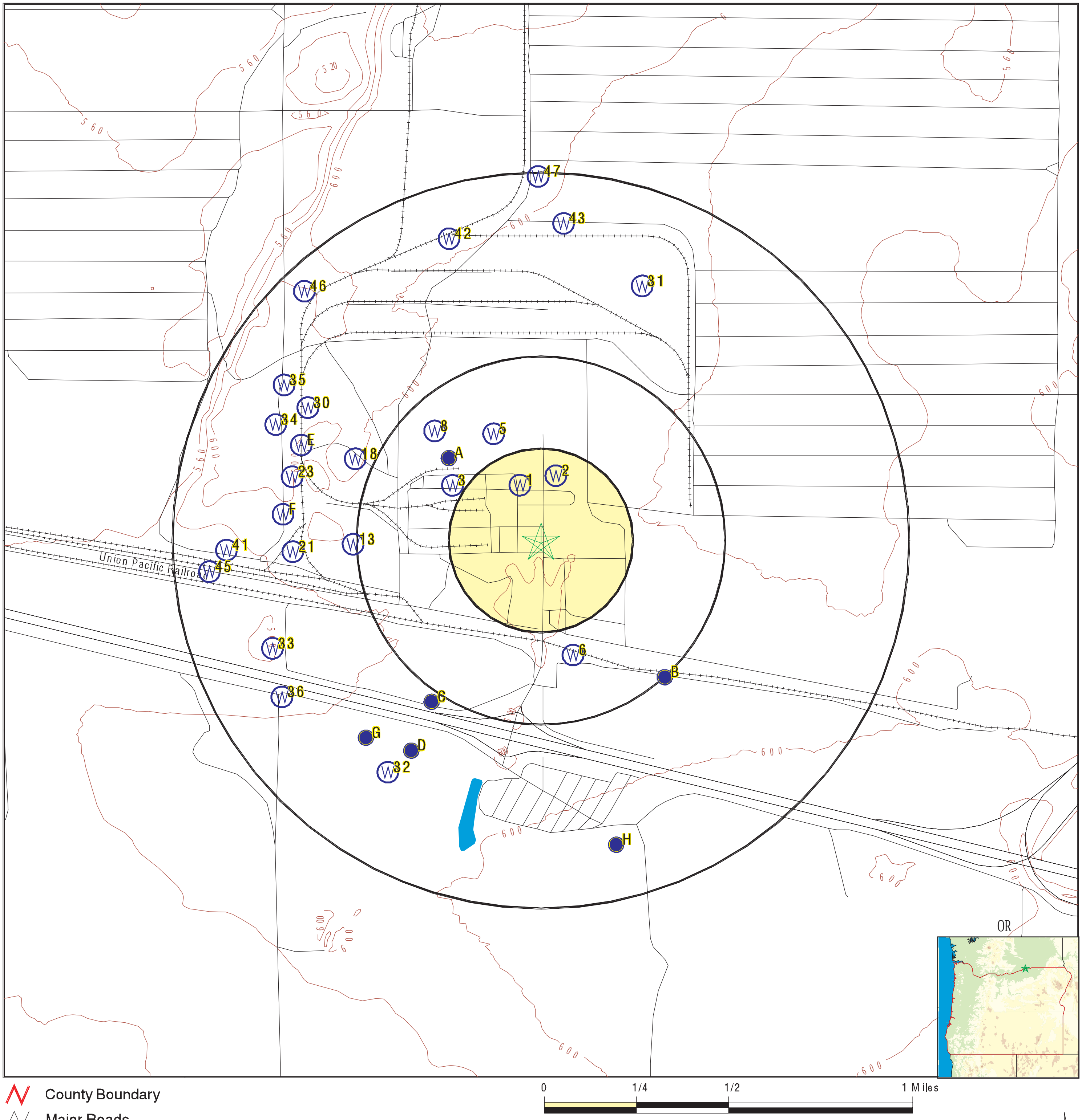
MAP ID	WELL ID	LOCATION FROM TP
1	ORW600000014645	1/8 - 1/4 Mile NNW
3	ORW600000014644	1/4 - 1/2 Mile WNW
A4	ORW600000015114	1/4 - 1/2 Mile NW
5	ORW600000015113	1/4 - 1/2 Mile NNW
6	ORW600000011695	1/4 - 1/2 Mile SSE
8	ORW600000015112	1/4 - 1/2 Mile NW
B9	ORW600000006458	1/4 - 1/2 Mile SE
B11	ORW600000006459	1/4 - 1/2 Mile SE
13	ORW600000015100	1/2 - 1 Mile West
B14	ORW600000006461	1/2 - 1 Mile SE
C17	ORW600000006462	1/2 - 1 Mile SW
18	ORW600000015038	1/2 - 1 Mile WNW
D19	ORW600000006460	1/2 - 1 Mile SSW
21	ORW600000014729	1/2 - 1 Mile West
E22	ORW600000015105	1/2 - 1 Mile WNW
23	ORW600000015101	1/2 - 1 Mile WNW
F24	ORW600000015102	1/2 - 1 Mile West
F25	ORW600000015039	1/2 - 1 Mile West
G26	ORW600000011696	1/2 - 1 Mile SW
G27	ORW600000006463	1/2 - 1 Mile SW
E29	ORW600000015104	1/2 - 1 Mile WNW
30	ORW600000015036	1/2 - 1 Mile WNW
31	ORW600000014895	1/2 - 1 Mile NNE
33	ORW600000017051	1/2 - 1 Mile WSW
34	ORW600000015037	1/2 - 1 Mile WNW
35	ORW600000015035	1/2 - 1 Mile WNW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
36	ORW600000014526	1/2 - 1 Mile WSW
H38	ORW600000006464	1/2 - 1 Mile SSE
H40	ORW600000006474	1/2 - 1 Mile SSE
41	ORW600000014730	1/2 - 1 Mile West
42	ORW600000015122	1/2 - 1 Mile NNW
43	ORW600000014969	1/2 - 1 Mile North
H44	ORW600000006680	1/2 - 1 Mile SSE
45	ORW600000015081	1/2 - 1 Mile West
46	ORW600000014958	1/2 - 1 Mile NW
47	ORW600000015121	1/2 - 1 Mile North

PHYSICAL SETTING SOURCE MAP - 5560731.2s



🟥 County Boundary
Major Roads
Contour Lines
◎ Earthquake epicenter, Richter 5 or greater
Ⓦ Water Wells
Ⓟ Public Water Supply Wells
● Cluster of Multiple Icons

↑ Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location
● Oil, gas or related wells

SITE NAME: Camp Umatilla
ADDRESS: 78000-78028 Ordnance Rd
Hermiston OR 97838
LAT/LONG: 45.807862 / 119.42031

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5560731.2s
DATE: February 13, 2019 1:28 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **NNW** **1/8 - 1/4 Mile** **Higher**	**OR WELLS**	**ORW600000014645**

Well Log ID:	UMAT 1543	Last Update:	01/25/2012
Well Tag:	0	State Obs Well #:	809
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	State Obs Well, Current	Surface Elevation:	585

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2 **NNE** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS40000995182**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-22DBD1	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Not Reported	Formation Type:	Columbia River Basalt Group
Aquifer Type:	Not Reported	Construction Date:	19410101
Well Depth:	360	Well Depth Units:	ft
Well Hole Depth:	360	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 289

		Level reading date:	1984-12-01
Feet below surface:	97	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	1984-11-01	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-01	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-09-01	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-08-01	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-07-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-06-01	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-05-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-01	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-03-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-02-01	Feet below surface:	106

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-01-01	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-12-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-11-01	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-10-01	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-09-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-08-01	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-07-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-06-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-05-01	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-03-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-02-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-01-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-12-17	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-11-22	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-22	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-09-25	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-08-19	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-06-18	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-05-20	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1982-04-15	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-19	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-02-19	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-01-18	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-12-14	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-19	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-16	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-18	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-17	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-20	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-15	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-18	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-17	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-16	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-23	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-19	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-12-15	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-20	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-20	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-19	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-20	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported

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Level reading date: 1980-07-21 Feet below surface: 106
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-06-20 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-05-19 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-04-21 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-03-12 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-02-19 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1980-01-17 Feet below surface: 105
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-12-08 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-11-19 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-10-18 Feet below surface: 105
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-09-19 Feet below surface: 108
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-08-26 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-07-20 Feet below surface: 106
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-06-19 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-05-18 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-04-16 Feet below surface: 105
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-03-20 Feet below surface: 109
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-02-20 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1979-01-19 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1978-12-02 Feet below surface: 108
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1978-11-01 Feet below surface: 106
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1978-10-02	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-09	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-01	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-01	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-01	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-02	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-03	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12	Feet below surface:	112
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11	Feet below surface:	112
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10	Feet below surface:	111
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03	Feet below surface:	114
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02	Feet below surface:	114
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-01	Feet below surface:	114
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-31	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-28	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-30	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-30	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-30	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-10-30	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-09-01	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-08-01	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-07-01	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-06-01	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-05-01	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-04-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-03-01	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-02-01	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1975-01-01	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-12-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-11-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-10-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-09-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-08-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-07-01	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-06-12	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-05-08	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-04-10	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-03-13	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-02-13	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-01-09	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-12	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-11-12	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-10-16	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-09-04	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-08-13	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-07-06	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-06-12	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-05-15	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1973-04-10 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1973-03-13 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1973-02-13 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1973-01-16 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-12-12 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-11-14 Feet below surface: 102
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-10-10 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-09-12 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-08-08 Feet below surface: 102
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-07-05 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-06-21 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-05-09 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-04-11 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-03-07 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-02-01 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-01-03 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1971-12-14 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1971-11-16 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1971-10-09 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1971-09-14 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1971-08-10 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1971-07-06	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-06-01	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-05-03	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-04-06	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-03-01	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-02-01	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-01-05	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-12-15	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-11-17	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-10-13	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-09-22	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-08-25	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-07-14	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-06-23	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-05-26	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-04-28	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-03-24	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-02-24	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-01-27	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-12-30	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-11-25	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1969-10-21 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-09-23 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-08-19 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-07-22 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-06-24 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-05-20 Feet below surface: 103
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-04-22 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-03-18 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-02-18 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-01-21 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-12-17 Feet below surface: 97
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-11-19 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-10-22 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-09-17 Feet below surface: 102
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-08-20 Feet below surface: 105
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-07-23 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-06-18 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-05-21 Feet below surface: 98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-04-16 Feet below surface: 93
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-03-19 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-02-20 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1968-01-16	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-12-12	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-11-21	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-10-17	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-09-19	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-08-22	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-07-18	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-06-20	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-05-16	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-04-18	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-03-14	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-02-07	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-01-10	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-12-13	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-11-15	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-10-25	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-10-11	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-09-20	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-09-06	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-08-16	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-07-12	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1966-06-14	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-05-17	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-04-19	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-03-15	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-02-15	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-01-11	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-12-21	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-11-09	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-10-26	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-10-12	Feet below surface:	91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-09-28	Feet below surface:	91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-09-14	Feet below surface:	91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-08-24	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-08-10	Feet below surface:	92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-07-27	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-07-06	Feet below surface:	111
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-06-29	Feet below surface:	91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-06-08	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-05-25	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-05-11	Feet below surface:	91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-04-20	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1965-04-06 Feet below surface: 88
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-03-30 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-03-16 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-02-23 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-02-09 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-01-19 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-12-23 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-12-08 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-11-17 Feet below surface: 93
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-10-20 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-10-06 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-09-22 Feet below surface: 97
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-09-08 Feet below surface: 102
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-08-18 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-08-05 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-07-21 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-07-07 Feet below surface: 106
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-06-16 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-06-02 Feet below surface: 106
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-05-19 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1964-05-05 Feet below surface: 97
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1964-04-01	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-03-01	Feet below surface:	88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-02-01	Feet below surface:	86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-01-01	Feet below surface:	85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-12-01	Feet below surface:	85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-11-01	Feet below surface:	85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-10-01	Feet below surface:	86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-09-01	Feet below surface:	87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-08-01	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-07-01	Feet below surface:	88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-06-01	Feet below surface:	85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-05-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-04-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-03-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-02-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-01-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-12-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-11-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-10-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-09-01	Feet below surface:	85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-08-01	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1962-07-01	Feet below surface:	87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-06-01	Feet below surface:	93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-05-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-04-01	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-02-01	Feet below surface:	81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-01-01	Feet below surface:	82
Feet to sea level:	Not Reported	Note:	Not Reported

3
WNW
1/4 - 1/2 Mile
Higher

OR WELLS **ORW600000014644**

Well Log ID:	UMAT 1544	Last Update:	01/25/2012
Well Tag:	0	State Obs Well #:	810
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	State Obs Well, Noncurrent	Surface Elevation:	587

A4
NW
1/4 - 1/2 Mile
Higher

OR WELLS **ORW600000015114**

Well Log ID:	UMAT 5854	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Not Reported	Recorder Well:	Not Reported
Obs Well Flag:	Not Reported	Surface Elevation:	590.099975585937

5
NNW
1/4 - 1/2 Mile
Higher

OR WELLS **ORW600000015113**

Well Log ID:	UMAT 5853	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Not Reported	Recorder Well:	Not Reported
Obs Well Flag:	Not Reported	Surface Elevation:	591.299987792969

6
SSE
1/4 - 1/2 Mile
Higher

OR WELLS **ORW600000011695**

Well Log ID:	UMAT 55721	Last Update:	06/24/2009
Well Tag:	82868	State Obs Well #:	0

Observation Well: Current
Recorder Well: Not Reported
Obs Well Flag: Other Obs Well, Current
Surface Elevation: 582

A7
NW
1/4 - 1/2 Mile
Higher

FED USGS **USGS40000995162**

Organization ID: USGS-OR
Organization Name: USGS Oregon Water Science Center
Monitor Location: 04N/27E-22CAD1
Type: Well
Description: Not Reported
HUC: 17070103
Drainage Area: Not Reported
Drainage Area Units: Not Reported
Contrib Drainage Area: Not Reported
Contrib Drainage Area Unts: Not Reported
Aquifer: Not Reported
Formation Type: Columbia River Basalt Group
Aquifer Type: Not Reported
Construction Date: 19410101
Well Depth: 327
Well Depth Units: ft
Well Hole Depth: 327
Well Hole Depth Units: ft

Ground water levels,Number of Measurements: 375
Level reading date: 1984-12-01
Feet below surface: 99
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-11-01
Feet below surface: 100
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-10-01
Feet below surface: 100
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-09-01
Feet below surface: 108
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-08-01
Feet below surface: 109
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-07-01
Feet below surface: 107
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-06-01
Feet below surface: 105
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-05-01
Feet below surface: 107
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-04-01
Feet below surface: 105
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-03-01
Feet below surface: 104
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-02-01
Feet below surface: 105
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1984-01-01
Feet below surface: 103
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1983-12-01
Feet below surface: 104
Feet to sea level: Not Reported
Note: Not Reported

Level reading date: 1983-11-01
Feet below surface: 101

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-10-01	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-09-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-08-01	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-07-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-06-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-05-01	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-01	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-03-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-02-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-01-01	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-12-17	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-11-22	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-22	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-09-25	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-08-19	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-07-20	Feet below surface:	183
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-06-18	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-05-20	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-15	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-19	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1982-02-19	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-01-18	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-12-14	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-19	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-16	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-18	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-17	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-20	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-15	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-18	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-17	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-16	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-23	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-19	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-17	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-19	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-17	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-18	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-19	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-18	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-19	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-08-20	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-20	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-19	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-18	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-16	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-20	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-20	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-19	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-02	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-02	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-09-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-01	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-02	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-01	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-03	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-01	Feet below surface:	112
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1977-11-01 Feet below surface: 112
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-10-01 Feet below surface: 114
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-09-01 Feet below surface: 113
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-08-01 Feet below surface: 112
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-07-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-06-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-05-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-04-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-03-01 Feet below surface: 109
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-02-01 Feet below surface: 108
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-01-01 Feet below surface: 108
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-12-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-11-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-10-01 Feet below surface: 110
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-09-01 Feet below surface: 112
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-08-01 Feet below surface: 112
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-07-01 Feet below surface: 112
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-03-31 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-02-28 Feet below surface: 107
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-01-30 Feet below surface: 108
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-12-30 Feet below surface: 109
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1975-11-30	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-10-03	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-09-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-08-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-07-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-06-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-05-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-04-01	Feet below surface:	112
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-03-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-02-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-01	Feet below surface:	112
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-12-01	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-11-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-10-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-09-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-08-01	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-07-01	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-06-12	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-05-08	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-04-10	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-03-13	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1974-02-13	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1974-01-19	Feet below surface:	108
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-12	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-11-12	Feet below surface:	109
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-10-16	Feet below surface:	110
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-07-06	Feet below surface:	107
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-06-12	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-05-15	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-04-10	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-03-13	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-02-13	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-01-09	Feet below surface:	104
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-12-12	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-11-14	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-10-10	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-09-12	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-08-08	Feet below surface:	106
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-07-05	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-06-14	Feet below surface:	105
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-05-09	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-04-11	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1972-03-07	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-02-01	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-01-03	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-12-21	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-11-09	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-10-12	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-09-07	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-08-02	Feet below surface:	103
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-07-06	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-06-01	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-05-03	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-04-06	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-03-01	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-02-01	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-01-05	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-12-15	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-11-17	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-10-13	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-09-22	Feet below surface:	102
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-08-18	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-07-14	Feet below surface:	101
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1970-06-23 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1970-05-26 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1970-04-21 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1970-03-24 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1970-02-24 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1970-01-27 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-12-23 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-11-25 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-10-21 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-09-23 Feet below surface: 101
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-08-19 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-07-22 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-06-17 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-05-20 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-04-22 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-03-18 Feet below surface: 99
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-02-18 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-01-21 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-12-17 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-11-19 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1968-10-22 Feet below surface: 100
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1968-09-17	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-08-20	Feet below surface:	100
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-07-23	Feet below surface:	99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-06-18	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-05-21	Feet below surface:	98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-04-16	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-03-19	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-02-20	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-01-16	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-12-19	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-11-21	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-10-17	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-09-19	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-08-22	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-07-18	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-06-20	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-05-16	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-04-11	Feet below surface:	97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-03-21	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-02-21	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-01-17	Feet below surface:	96
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1966-12-20 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-11-22 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-10-18 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-09-20 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-08-23 Feet below surface: 96
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-07-19 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-06-14 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-05-17 Feet below surface: 95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-04-19 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-03-15 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-02-15 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1966-01-11 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-12-07 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-11-09 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-10-05 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-09-07 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-08-10 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-07-06 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-06-08 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-06 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1965-05-11 Feet below surface: 94
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1965-04-20	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-04-06	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-03-23	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-03-16	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-02-23	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-02-09	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-01-19	Feet below surface:	95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-12-23	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-12-08	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-11-24	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-11-10	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-10-20	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-10-06	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-09-22	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-09-08	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-08-18	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-05-19	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-05-05	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-04	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-02	Feet below surface:	92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1964-01	Feet below surface:	92
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1963-12 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-11 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-10 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-09 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-08 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-07 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-06 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-05 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-04 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-03 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-02 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1963-01 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-12 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-11 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-10 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-09 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-08 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-07 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-06 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-05 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-04 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

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Level reading date: 1962-03 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-02 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1962-01 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-12 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-11 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-10 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-09 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-08 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-07 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-06 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-05 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-04 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-03 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-02 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1961-01 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-12 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-11 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-10 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-09 Feet below surface: 88
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-08 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-07 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-06 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-05 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-04 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-03 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-02 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1960-01 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-12 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-11 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-10 Feet below surface: 88
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-09 Feet below surface: 88
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-08 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-07 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-06 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-05 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-04 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-03 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-02 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1959-01 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1958-12 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1958-11 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1958-10 Feet below surface: 89
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1958-09	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1958-08	Feet below surface:	89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1958-03	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1958-02	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1958-01	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-12	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-11	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-10	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-09	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-08	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-07	Feet below surface:	83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-06	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-05	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-04	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-03	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-02	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1957-01	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1956-12	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1956-11	Feet below surface:	79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1956-10	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1956-09	Feet below surface:	84
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1956-08 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-07 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-06 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-05 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-04 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-03 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-02 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1956-01 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-12 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-11 Feet below surface: 92
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-10 Feet below surface: 91
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-09 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-08 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-07 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-05 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-04 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-03 Feet below surface: 86
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-02 Feet below surface: 85
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1955-01 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-12 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-11 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-10 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-09 Feet below surface: 83
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-08 Feet below surface: 84
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-07 Feet below surface: 80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-06 Feet below surface: 80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-05 Feet below surface: 81
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-04 Feet below surface: 81
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-03 Feet below surface: 80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-02 Feet below surface: 80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1954-01 Feet below surface: 80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-06 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-05 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-04 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-03 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-02 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1951-01 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1950-12 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1950-11 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1950-10 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1950-09 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1950-08 Feet below surface: 90
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1950-07	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1950-06	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1950-05	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1950-04	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1950-03	Feet below surface:	90
Feet to sea level:	Not Reported	Note:	Not Reported

8
NW **OR WELLS** **ORW600000015112**
1/4 - 1/2 Mile
Higher

Well Log ID:	UMAT 5852	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Not Reported	Recorder Well:	Not Reported
Obs Well Flag:	Not Reported	Surface Elevation:	592.299987792969

B9
SE **OR WELLS** **ORW600000006458**
1/4 - 1/2 Mile
Higher

Well Log ID:	UMAT 1559	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	587

B10
SE **FED USGS** **USGS40000995123**
1/4 - 1/2 Mile
Higher

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-26BCB1	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19600610
Well Depth:	108	Well Depth Units:	ft
Well Hole Depth:	108	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements:	17	Level reading date:	1984-09-04
Feet below surface:	92.3	Feet to sea level:	Not Reported
Note:	The site was being pumped.		
Level reading date:	1984-08-16	Feet below surface:	91.1
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	1984-02-14	Feet below surface:	87.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-12	Feet below surface:	94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-30	Feet below surface:	95.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	93.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-03	Feet below surface:	92.36
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-07	Feet below surface:	91.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	93.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-04-12	Feet below surface:	91.60
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1973-02-20	Feet below surface:	91.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-11-14	Feet below surface:	89.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1963-02-04	Feet below surface:	75.44
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-11-13	Feet below surface:	73.83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1962-04-10	Feet below surface:	73.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1961-11-08	Feet below surface:	73.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1960-08-01	Feet below surface:	71.00
Feet to sea level:	Not Reported	Note:	The site was being pumped.

B11
SE
1/4 - 1/2 Mile
Higher

OR WELLS **ORW600000006459**

Well Log ID:	UMAT 1561	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	587

Map ID Direction Distance Elevation	Database	EDR ID Number
B12 **SE** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40000995129**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-26BCB2	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19700224
Well Depth:	101	Well Depth Units:	ft
Well Hole Depth:	105	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 10

Level reading date:	1985-02-13	Feet below surface:	83.0
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-03	Feet below surface:	85.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-13	Feet below surface:	90.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-21	Feet below surface:	89.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-30	Feet below surface:	95.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-17	Feet below surface:	92.16
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	88.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-03	Feet below surface:	91.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-07	Feet below surface:	90.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-02-24	Feet below surface:	76.00
Feet to sea level:	Not Reported	Note:	Not Reported

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13 **West** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000015100**

Well Log ID:	UMAT 53320	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	583.900024414063

Map ID Direction Distance Elevation	Database	EDR ID Number
B14 **SE** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000006461**

Well Log ID:	UMAT 1568	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	587

B15 **SE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS40000995128**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-26BCB3	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19700106
Well Depth:	105	Well Depth Units:	ft
Well Hole Depth:	108	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 14

Level reading date:	1985-02-13	Feet to sea level:	Not Reported
Feet below surface:	82.8	Note:	Not Reported
Level reading date:	1984-03-07	Feet below surface:	83.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-02-15	Feet below surface:	83.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-13	Feet below surface:	90.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-14	Feet below surface:	91.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-30	Feet below surface:	94.29
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	92.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-04	Feet below surface:	91.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-07	Feet below surface:	91.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	93.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-04-12	Feet below surface:	94.60

Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1973-02-20	Feet below surface:	93.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-07-24	Feet below surface:	92.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-01-30	Feet below surface:	81.00
Feet to sea level:	Not Reported	Note:	Not Reported

C16
SW
1/2 - 1 Mile
Higher

FED USGS **USGS40000995126**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27BDB1	Type:	Well
Description:	Not Reported	HUC:	17070101
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19690303
Well Depth:	104	Well Depth Units:	ft
Well Hole Depth:	109	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements:	14	Level reading date:	1985-02-13
Feet below surface:	75.25	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	1984-03-07	Feet below surface:	75.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-02-16	Feet below surface:	76.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-03	Feet below surface:	67.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-13	Feet below surface:	98.17
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-14	Feet below surface:	85.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-30	Feet below surface:	89.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	88.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-03	Feet below surface:	87.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-07	Feet below surface:	85.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	87.40
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1972-11-12	Feet below surface:	82.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-07-02	Feet below surface:	87.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-03-26	Feet below surface:	84.00
Feet to sea level:	Not Reported	Note:	Not Reported

C17
SW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000006462**

Well Log ID:	UMAT 1569	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	582

18
WNW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000015038**

Well Log ID:	UMAT 53288	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	594.099975585937

D19
SSW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000006460**

Well Log ID:	UMAT 1565	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	585

D20
SSW
1/2 - 1 Mile
Higher

FED USGS **USGS40000995119**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27BDC1	Type:	Well
Description:	Not Reported	HUC:	17070101
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19811229
Well Depth:	127	Well Depth Units:	ft
Well Hole Depth:	127	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements:	3	Level reading date:	1985-02-13
Feet below surface:	82.1	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	1984-03-07	Feet below surface:	83.17
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-01-13	Feet below surface:	87.00
Feet to sea level:	Not Reported	Note:	Not Reported

21
West
1/2 - 1 Mile
Higher

OR WELLS ORW600000014729

Well Log ID:	UMAT 53289	Last Update:	03/02/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	585.099975585938

E22
WNW
1/2 - 1 Mile
Higher

OR WELLS ORW600000015105

Well Log ID:	UMAT 53324	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	596.700012207031

23
WNW
1/2 - 1 Mile
Higher

OR WELLS ORW600000015101

Well Log ID:	UMAT 53321	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	595.700012207031

F24
West
1/2 - 1 Mile
Higher

OR WELLS ORW600000015102

Well Log ID:	UMAT 53322	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	592.200012207031

Map ID Direction Distance Elevation	Database	EDR ID Number
F25 **West** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000015039**

Well Log ID:	MORR 50490	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	588.200012207031

G26 **SW** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000011696**

Well Log ID:	UMAT 55731	Last Update:	06/24/2009
Well Tag:	82869	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	573

G27 **SW** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000006463**

Well Log ID:	UMAT 1571	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	583

G28 **SW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS40000995120**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27BCD1	Type:	Well
Description:	Not Reported	HUC:	17070101
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19661012
Well Depth:	121	Well Depth Units:	ft
Well Hole Depth:	121	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 17

		Level reading date:	1985-02-13
Feet below surface:	78.75	Feet to sea level:	Not Reported
Note:	Not Reported		

Level reading date:	1984-03-07	Feet below surface:	79.91
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1983-02-15	Feet below surface:	80.20

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-03	Feet below surface:	82.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-13	Feet below surface:	86.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-21	Feet below surface:	86.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-01	Feet below surface:	92.41
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-16	Feet below surface:	88.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	88.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-04	Feet below surface:	89.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-06	Feet below surface:	90.14
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	90.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-07-11	Feet below surface:	89.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-11-14	Feet below surface:	85.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-12-09	Feet below surface:	83.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-10-18	Feet below surface:	82.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1966-11-04	Feet below surface:	77.00
Feet to sea level:	Not Reported	Note:	Not Reported

E29
WNW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000015104**

Well Log ID:	UMAT 53323	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	597.799987792969

Map ID Direction Distance Elevation	Database	EDR ID Number
30 **WNW** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000015036**

Well Log ID:	UMAT 53286	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	597.799987792969

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31 **NNE** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000014895**

Well Log ID:	UMAT 50117	Last Update:	06/26/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	585.789978027344

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32 **SSW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS40000995115**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27CAB1	Type:	Well
Description:	Not Reported	HUC:	17070101
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Other aquifers	Formation Type:	Quaternary Alluvium
Aquifer Type:	Not Reported	Construction Date:	19680711
Well Depth:	135	Well Depth Units:	ft
Well Hole Depth:	135	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 18

Level reading date:	1984-03-07	Feet below surface:	83.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-02-15	Feet below surface:	83.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-03-03	Feet below surface:	85.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-13	Feet below surface:	90.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-21	Feet below surface:	96.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-01	Feet below surface:	95.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-16	Feet below surface:	93.68

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-02	Feet below surface:	93.24
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-04	Feet below surface:	93.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-01-06	Feet below surface:	92.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	94.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-07-11	Feet below surface:	93.83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-04-12	Feet below surface:	85.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-02-19	Feet below surface:	0.00
Feet to sea level:	Not Reported		
Note:	An obstruction was encountered in the well above the water surface (no water level recorded).		
Level reading date:	1972-11-14	Feet below surface:	10.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-07-24	Feet below surface:	92.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-12-09	Feet below surface:	87.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-07-11	Feet below surface:	99.00
Feet to sea level:	Not Reported	Note:	Not Reported

33
WSW **OR WELLS** **ORW600000017051**
1/2 - 1 Mile
Lower

Well Log ID:	MORR 52256	Last Update:	04/11/2015
Well Tag:	106756	State Obs Well #:	0
Observation Well:	Not Reported	Recorder Well:	Not Reported
Obs Well Flag:	Not Reported	Surface Elevation:	540

34
WNW **OR WELLS** **ORW600000015037**
1/2 - 1 Mile
Higher

Well Log ID:	MORR 50529	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	598.900024414063

Map ID Direction Distance Elevation	Database	EDR ID Number
35 **WNW** **1/2 - 1 Mile** **Higher**	**OR WELLS**	**ORW600000015035**

Well Log ID:	UMAT 53285	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	600.599975585938

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36 **WSW** **1/2 - 1 Mile** **Lower**	**OR WELLS**	**ORW600000014526**

Well Log ID:	UMAT 55720	Last Update:	11/16/2011
Well Tag:	82867	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	573

H37 **SSE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS40000995101**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27DAD1	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Not Reported	Formation Type:	Columbia River Basalt Group
Aquifer Type:	Not Reported	Construction Date:	19420101
Well Depth:	543	Well Depth Units:	ft
Well Hole Depth:	543	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 37

Level reading date:	1985-02-13	Feet below surface:	252.00
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	1984-02-14	Feet below surface:	228.8
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1982-02-23	Feet below surface:	250.7
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-15	Feet below surface:	251.0
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-15	Feet below surface:	251
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-01	Feet below surface:	258
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-14	Feet below surface:	229

Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-05-10 Feet below surface: 239
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-02-09 Feet below surface: 223
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-12-04 Feet below surface: 236
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-05-05 Feet below surface: 230
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-02-10 Feet below surface: 219
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1973-02-19 Feet below surface: 205
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1972-11-13 Feet below surface: 211
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1972-04-24 Feet below surface: 212
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1972-01-25 Feet below surface: 206
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1971-12-08 Feet below surface: 208
Feet to sea level: Not Reported Note: The site had been pumped recently.

Level reading date: 1971-02-23 Feet below surface: 198
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1970-10-26 Feet below surface: 220.5
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1970-08-03 Feet below surface: 237
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1970-05-04 Feet below surface: 198.5
Feet to sea level: Not Reported Note: The site had been pumped recently.

Level reading date: 1970-03-10 Feet below surface: 183
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1969-11-17 Feet below surface: 210
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1969-08-11 Feet below surface: 233
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1969-05-05 Feet below surface: 209
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1969-02-17 Feet below surface: 190
Feet to sea level: Not Reported Note: The site was being pumped.

Level reading date: 1968-11-18 Feet below surface: 195
Feet to sea level: Not Reported Note: Not Reported

Level reading date:	1968-08-05	Feet below surface:	223
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1968-05-06	Feet below surface:	200.5
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1968-02-05	Feet below surface:	173.5
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1967-11-06	Feet below surface:	197.5
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1967-08-07	Feet below surface:	210
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1967-05-01	Feet below surface:	191
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1967-02-06	Feet below surface:	178
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1966-05-02	Feet below surface:	186.5
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1966-02-14	Feet below surface:	158.5
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-12-10	Feet below surface:	164
Feet to sea level:	Not Reported	Note:	Not Reported

H38
SSE
1/2 - 1 Mile
Higher

OR WELLS **ORW600000006464**

Well Log ID:	UMAT 1574	Last Update:	04/19/2005
Well Tag:	54999	State Obs Well #:	832
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	State Obs Well, Current	Surface Elevation:	603

H39
SSE
1/2 - 1 Mile
Higher

FED USGS **USGS40000995100**

Organization ID:	USGS-OR	Organization Name:	USGS Oregon Water Science Center
Monitor Location:	04N/27E-27DAD2	Type:	Well
Description:	Not Reported	HUC:	17070103
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Not Reported	Formation Type:	Not Reported
Aquifer Type:	Not Reported	Construction Date:	19650916
Well Depth:	140	Well Depth Units:	ft
Well Hole Depth:	140	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements: 52

Level reading date:	1985-02-13	Feet below surface:	100.1
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date: 1983-07-18 Feet below surface: 101.56
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1981-12-03 Feet below surface: 101.72
Feet to sea level: Not Reported
Note: A nearby site that taps the same aquifer was being pumped.

Level reading date: 1979-03-12 Feet below surface: 99.98
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1978-12-15 Feet below surface: 104.22
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1978-05-08 Feet below surface: 105.82
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-12-01 Feet below surface: 106.52
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-08-08 Feet below surface: 106.25
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-05-09 Feet below surface: 105.39
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1977-02-14 Feet below surface: 104.46
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-12-02 Feet below surface: 105.09
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-08-16 Feet below surface: 104.80
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-05-10 Feet below surface: 105.37
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1976-02-08 Feet below surface: 104.94
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-12-04 Feet below surface: 104.40
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-10-27 Feet below surface: 104.95
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-08-04 Feet below surface: 104.79
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-05-05 Feet below surface: 105.03
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1975-02-10 Feet below surface: 104.53
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1974-11-04 Feet below surface: 104.97
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1974-08-05 Feet below surface: 104.08
Feet to sea level: Not Reported Note: Not Reported

Level reading date: 1974-05-06 Feet below surface: 105.33

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-12-05	Feet below surface:	105.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-08-27	Feet below surface:	107.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-05-21	Feet below surface:	109.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1973-02-19	Feet below surface:	115.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-11-13	Feet below surface:	108.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-08-28	Feet below surface:	127.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-04-24	Feet below surface:	109.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1972-01-26	Feet below surface:	103.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-12-08	Feet below surface:	110.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-10-01	Feet below surface:	103.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-08-09	Feet below surface:	103.19
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-05-10	Feet below surface:	102.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1971-02-23	Feet below surface:	101.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-10-26	Feet below surface:	106.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-08-03	Feet below surface:	102.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-05-04	Feet below surface:	102.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1970-03-10	Feet below surface:	103.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-11-17	Feet below surface:	101.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-08-11	Feet below surface:	102.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1969-05-05	Feet below surface:	102.99
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1969-02-17	Feet below surface:	101.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-11-18	Feet below surface:	101.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-08-05	Feet below surface:	104.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-05-06	Feet below surface:	100.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1968-02-05	Feet below surface:	98.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-11-06	Feet below surface:	98.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-08-07	Feet below surface:	98.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-05-01	Feet below surface:	98.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-02-06	Feet below surface:	98.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1965-09-16	Feet below surface:	100.00
Feet to sea level:	Not Reported	Note:	Not Reported

H40
SSE
1/2 - 1 Mile
Higher

OR WELLS **ORW600000006474**

Well Log ID:	UMAT 1572	Last Update:	04/19/2005
Well Tag:	0	State Obs Well #:	833
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	State Obs Well, Noncurrent	Surface Elevation:	603

41
West
1/2 - 1 Mile
Lower

OR WELLS **ORW600000014730**

Well Log ID:	MORR 50489	Last Update:	03/02/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Current
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	556

42
NNW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000015122**

Well Log ID:	UMAT 5856	Last Update:	10/04/2012
Well Tag:	0	State Obs Well #:	0

Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	593.400024414063

43
North
1/2 - 1 Mile
Higher

OR WELLS **ORW600000014969**

Well Log ID:	UMAT 5919	Last Update:	07/20/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	587.489990234375

H44
SSE
1/2 - 1 Mile
Higher

OR WELLS **ORW600000006680**

Well Log ID:	UMAT 55443	Last Update:	08/30/2005
Well Tag:	76142	State Obs Well #:	0
Observation Well:	Current	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Current	Surface Elevation:	603

45
West
1/2 - 1 Mile
Lower

OR WELLS **ORW600000015081**

Well Log ID:	MORR 50512	Last Update:	10/03/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	563

46
NW
1/2 - 1 Mile
Higher

OR WELLS **ORW600000014958**

Well Log ID:	UMAT 50118	Last Update:	07/20/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	597.630004882812

47
North
1/2 - 1 Mile
Higher

OR WELLS **ORW600000015121**

Well Log ID:	UMAT 5855	Last Update:	10/04/2012
Well Tag:	0	State Obs Well #:	0
Observation Well:	Noncurrent	Recorder Well:	Not Reported
Obs Well Flag:	Other Obs Well, Noncurrent	Surface Elevation:	596.5

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OR Radon

Radon Test Results

Zipcode	Num Tests	Maximum	Minimum	Average	# > 4 pCi/L
97838	8	4	0.6	2.3	0

Federal EPA Radon Zone for UMATILLA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.
Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory Data
Source: Oregon Geospatial Enterprise Office
Telephone: 503-378-2166

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Data
Source: Department of Water Resources
Telephone: 503-986-0843

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Locations
Source: Department of Geology and Mineral Industries
Telephone: 971-673-1540
A listing of oil and gas well locations in the state.

RADON

State Database: OR Radon
Source: Oregon Health Services
Telephone: 503-731-4272
Radon Levels in Orgeon

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

Camp Umatilla
78000-78028 Ordnance Rd
Hermiston, OR 97838

Inquiry Number: 5560731.2s
February 13, 2019

EDR Summary Radius Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

78000-78028 ORDNANCE RD
HERMISTON, OR 97838

COORDINATES

Latitude (North):	45.8078620 - 45˚ 48' 28.30''
Longitude (West):	119.4203100 - 119˚ 25' 13.11''
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	311938.0
UTM Y (Meters):	5075331.0
Elevation:	581 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	TP
Source:	U.S. Geological Survey

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140707
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
78000-78028 ORDNANCE RD
HERMISTON, OR 97838

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	CAMP UMATILLA		NPDES		TP
A2	CAMP UMATILLA	I-84 & EXIT 178	NPDES		TP
Reg	UMATILLA CHEMICAL DE		DOD	Same	1 ft.
3	HERMISTON GUN CLUB	77034 GUN CLUB RD.	ECSI	Lower	5090, 0.964, WSW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
CAMP UMATILLA HERMISTON, OR	NPDES WQ File Nbr: 91000	N/A
CAMP UMATILLA I-84 & EXIT 178 HERMISTON, OR 97838	NPDES WQ File Nbr: 91000	N/A

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State- and tribal - equivalent CERCLIS

ECSI: A review of the ECSI list, as provided by EDR, and dated 10/01/2018 has revealed that there is 1 ECSI site within approximately 1 mile of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
HERMISTON GUN CLUB Investigation: Suspect State ID Number: 4649	77034 GUN CLUB RD.	WSW 1/2 - 1 (0.964 mi.)	3	8

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

DOD: A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1

EXECUTIVE SUMMARY

DOD site within approximately 1 mile of the target property.

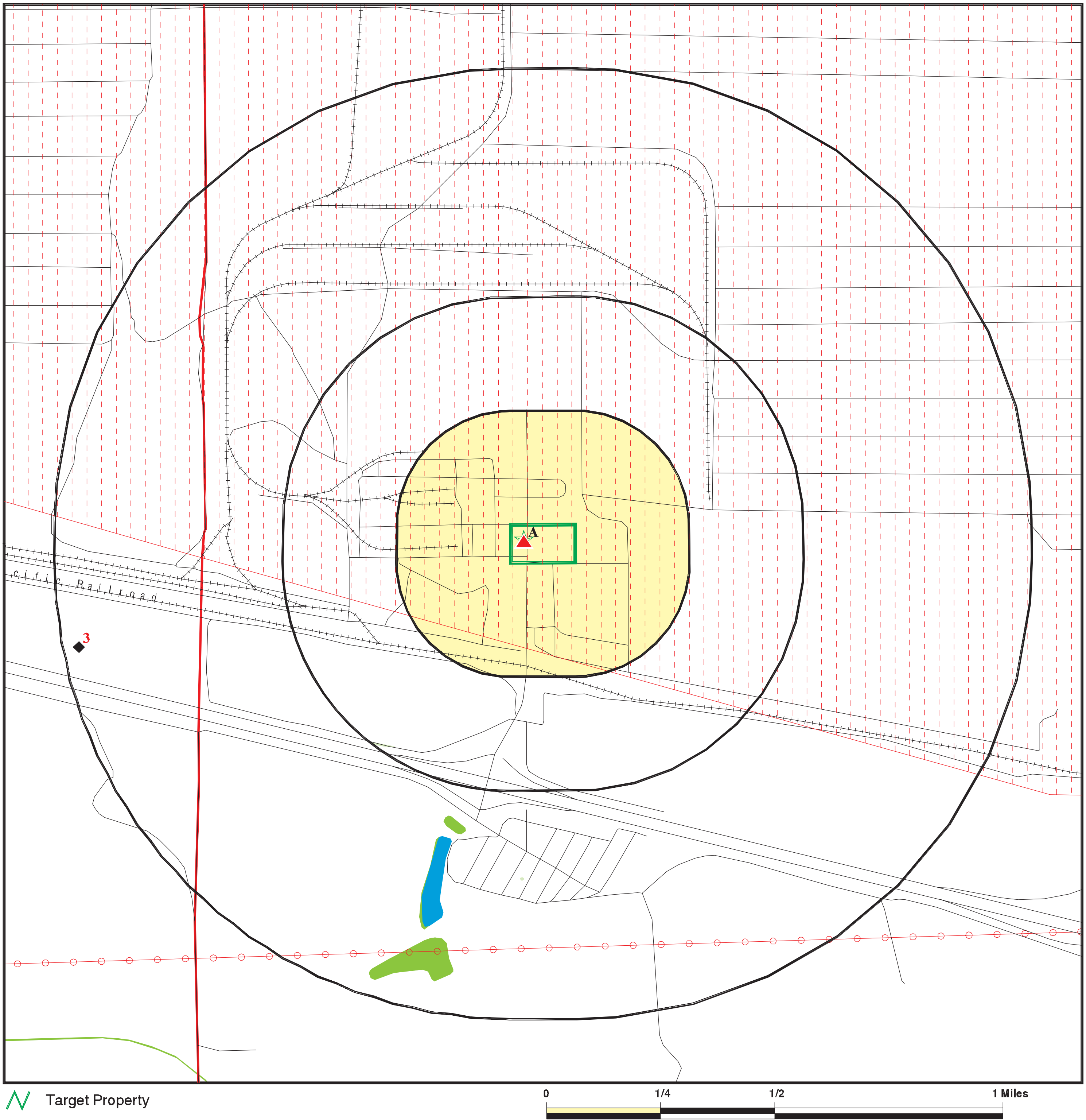
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
UMATILLA CHEMICAL DE		0 - 1/8 (0.000 mi.)	0	8

Count: 1 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
HERMISTON	1018324224	US ARMY UMATILLA CHEMICAL DEPOT	CEDAR ST	97838	FINDS, ECHO

OVERVIEW MAP - 5560731.2S

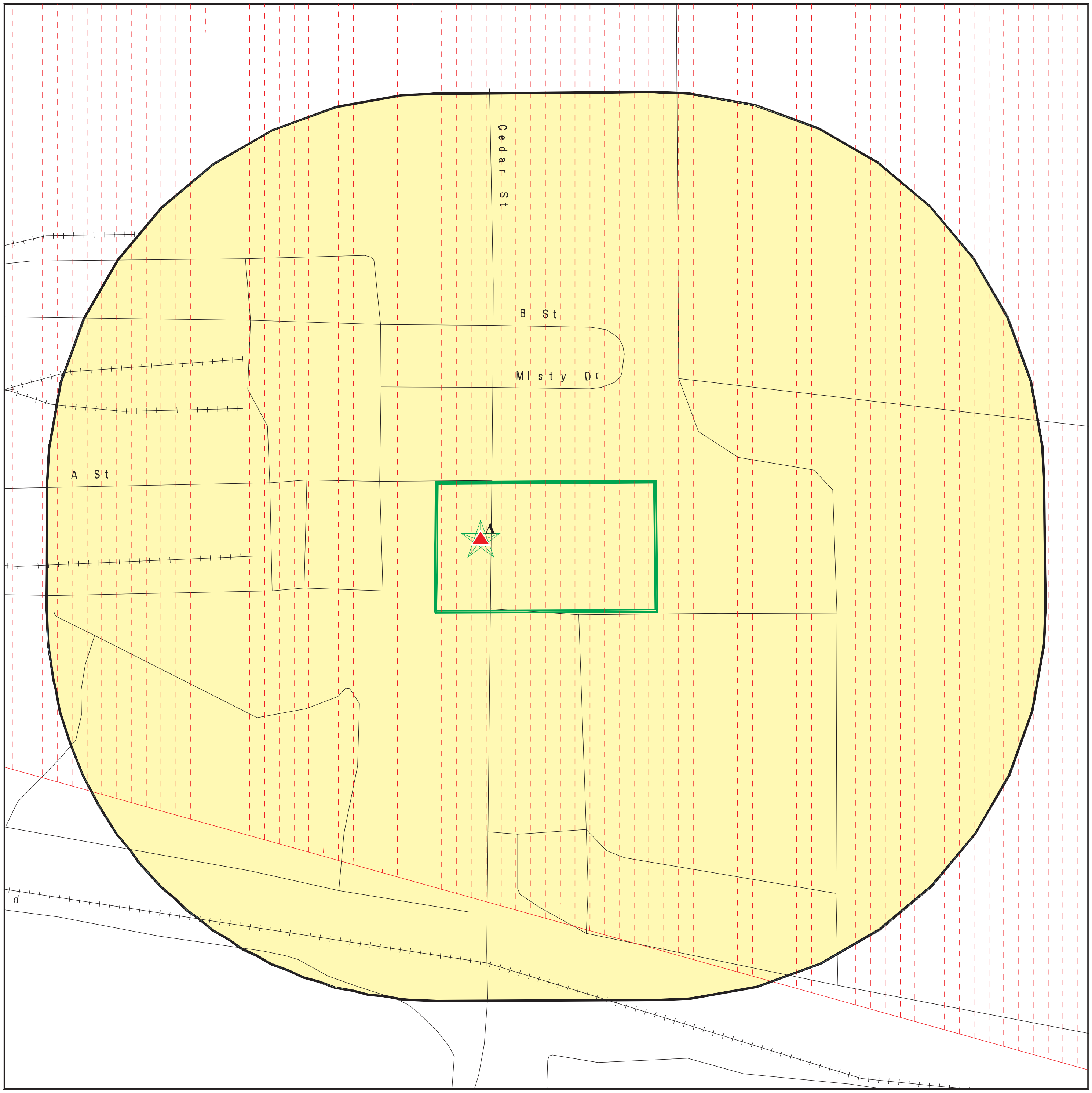


- Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Power transmission lines
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory
- State Wetlands
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Umatilla	CLIENT:	AECOM
ADDRESS:	78000-78028 Ordnance Rd Hermiston OR 97838	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5560731.2s
LAT/LONG:	45.807862 / 119.42031	DATE:	February 13, 2019 1:25 pm

DETAIL MAP - 5560731.2S



- Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- ▦ Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Umatilla	CLIENT:	AECOM
ADDRESS:	78000-78028 Ordnance Rd Hermiston OR 97838	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5560731.2s
LAT/LONG:	45.807862 / 119.42031	DATE:	February 13, 2019 1:28 pm

MAP FINDINGS SUMMARY

STANDARD ENVIRONMENTAL RECORDS

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
ECSI	1.000		0	0	0	1	NR	1
CRL	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
HIST LF	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
AOCONCERN	1.000		0	0	0	0	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
OR HAZMAT	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		1	0	0	0	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Enforcement	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
HSIS	TP		NR	NR	NR	NR	NR	0
MANIFEST	0.250		0	0	NR	NR	NR	0
NPDES	TP	2	NR	NR	NR	NR	NR	2
UIC	TP		NR	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		2	1	0	0	1	0	4

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 **Target** **Property**	**CAMP UMATILLA** **HERMISTON, OR**	**NPDES**	**S122879037** **N/A**

Actual:
581 ft.

Click here for full text details

NPDES
WQ File Nbr: 91000

A2 **Target** **Property**	**CAMP UMATILLA** **I-84 & EXIT 178** **HERMISTON, OR 97838**	**NPDES**	**S122879038** **N/A**

Actual:
581 ft.

Click here for full text details

NPDES
WQ File Nbr: 91000

DOD **Region** **< 1/8** **1 ft.**	**UMATILLA CHEMICAL DEPOT (CLOSED)** **UMATILLA CHEMICAL DEPOT ((County), OR**	**DOD**	**CUSA103056** **N/A**

Click here for full text details

3 **WSW** **1/2-1** **0.964 mi.** **5090 ft.**	**HERMISTON GUN CLUB** **77034 GUN CLUB RD.** **IRRIGON, OR 97844**	**ECSI**	**S118374548** **N/A**

Relative:
Lower

Click here for full text details

ECSI
State ID Number: 4649
Investigation: Suspect

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
OR	AIRS	Oregon Title V Facility Listing	Department of Environmental Quality	10/01/2018	10/04/2018	10/26/2018
OR	AOC COL	Columbia Slough	City of Portland Environmental Services	08/10/2005	05/17/2006	06/16/2006
OR	AOC MU	East Multnomah County Area	City of Portland Environmental Services		10/07/2002	10/22/2002
OR	AST	Aboveground Storage Tanks	Office of State Fire Marshal	09/05/2017	11/16/2017	01/09/2018
OR	BROWNFIELDS	Brownfields Projects	Department of Environmental Quality	11/01/2018	11/15/2018	12/10/2018
OR	CDL	Uninhabitable Drug Lab Properties	Department of Consumer & Business Services	09/21/2018	09/25/2018	10/22/2018
OR	CDL 2	Clandestine Drug Lab Site Listing	Oregon State Police	10/29/2018	10/31/2018	12/10/2018
OR	COAL ASH	Coal Ash Disposal Sites Listing	Department of Environmental Quality	12/31/2017	03/16/2018	05/15/2018
OR	CRL	Confirmed Release List and Inventory	Department of Environmental Quality	11/01/2018	11/15/2018	12/10/2018
OR	DRYCLEANERS	Drycleaning Facilities	Department of Environmental Quality	11/05/2018	11/07/2018	12/10/2018
OR	ECSI	Environmental Cleanup Site Information System	Department of Environmental Quality	10/01/2018	10/03/2018	10/23/2018
OR	ENF	Enforcement Action Listing	Department of Environmental Quality	09/18/2018	09/19/2018	10/23/2018
OR	ENG CONTROLS	Engineering Controls Recorded at ESCI Sites	Department of Environmental Quality	10/01/2018	10/03/2018	10/23/2018
OR	Financial Assurance 1	Financial Assurance Information Listing	Department of Environmental Quality	05/21/2018	06/21/2018	07/23/2018
OR	Financial Assurance 2	Financial Assurance Information Listing	Department of Environmental Quality	11/15/2018	11/16/2018	12/10/2018
OR	HAZMAT	Hazmat/Incidents	State Fire Marshal’s Office	09/05/2018	10/31/2018	12/10/2018
OR	HIST LF	Old Closed SW Disposal Sites	Department of Environmental Quality	04/01/2000	07/08/2003	07/18/2003
OR	HSIS	Hazardous Substance Information Survey	State Fire Marshal’s Office	10/29/2018	10/31/2018	12/10/2018
OR	INST CONTROL	Institutional Controls Recorded at ESCI Sites	Department of Environmental Quality	10/01/2018	10/03/2018	10/23/2018
OR	LUST	Leaking Underground Storage Tank Database	Department of Environmental Quality	10/03/2018	11/15/2018	12/11/2018
OR	NPDES	Wastewater Permits Database	Department of Environmental Quality	09/20/2018	09/20/2018	10/22/2018
OR	OR MANIFEST	Manifest Information	Department of Environmental Quality	12/31/2017	08/06/2018	08/15/2018
OR	RGA HWS	Recovered Government Archive State Hazardous Waste Facilitie	Department of Environmental Quality		07/01/2013	01/03/2014
OR	RGA LF	Recovered Government Archive Solid Waste Facilities List	Department of Environmental Quality		07/01/2013	01/13/2014
OR	RGA LUST	Recovered Government Archive Leaking Underground Storage Tan	Department of Environmental Quality		07/01/2013	12/27/2013
OR	SPILLS	Spill Data	Department of Environmental Quality	10/01/2018	10/02/2018	10/23/2018
OR	SPILLS 90	SPILLS90 data from FirstSearch	FirstSearch	05/01/2006	01/03/2013	02/22/2013
OR	SWF/LF	Solid Waste Facilities List	Department of Environmental Quality	11/05/2018	11/07/2018	12/10/2018
OR	SWRCY	Recycling Facility Location Listing	Department of Environmental Quality	08/28/2018	08/29/2018	09/24/2018
OR	UIC	Underground Injection Control Program Database	Department of Environmental Quality	09/25/2018	09/27/2018	10/23/2018
OR	UST	Underground Storage Tank Database	Department of Environmental Quality	10/03/2018	11/15/2018	12/10/2018
OR	VCS	Voluntary Cleanup Program Sites	DEQ	10/19/2018	10/23/2018	12/10/2018
US	2020 COR ACTION	2020 Corrective Action Program List	Environmental Protection Agency	09/30/2017	05/08/2018	07/20/2018
US	ABANDONED MINES	Abandoned Mines	Department of Interior	09/10/2018	09/11/2018	09/14/2018
US	BRS	Biennial Reporting System	EPA/NTIS	12/31/2015	02/22/2017	09/28/2017
US	COAL ASH DOE	Steam-Electric Plant Operation Data	Department of Energy	12/31/2005	08/07/2009	10/22/2009
US	COAL ASH EPA	Coal Combustion Residues Surface Impoundments List	Environmental Protection Agency	07/01/2014	09/10/2014	10/20/2014
US	CONSENT	Superfund (CERCLA) Consent Decrees	Department of Justice, Consent Decree Library	09/30/2018	10/12/2018	12/07/2018
US	CORRACTS	Corrective Action Report	EPA	03/01/2018	03/28/2018	06/22/2018
US	DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations	EPA, Region 9	01/12/2009	05/07/2009	09/21/2009
US	DOCKET HWC	Hazardous Waste Compliance Docket Listing	Environmental Protection Agency	05/31/2018	07/26/2018	10/05/2018
US	DOD	Department of Defense Sites	USGS	12/31/2005	11/10/2006	01/11/2007
US	DOT OPS	Incident and Accident Data	Department of Transporation, Office of Pipeli	10/01/2018	10/30/2018	01/18/2019
US	Delisted NPL	National Priority List Deletions	EPA	12/12/2018	12/28/2018	01/11/2019
US	ECHO	Enforcement & Compliance History Information	Environmental Protection Agency	09/02/2018	09/05/2018	09/14/2018
US	EDR Hist Auto	EDR Exclusive Historical Auto Stations	EDR, Inc.			
US	EDR Hist Cleaner	EDR Exclusive Historical Cleaners	EDR, Inc.			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	EDR MGP	EDR Proprietary Manufactured Gas Plants	EDR, Inc.			
US	EPA WATCH LIST	EPA WATCH LIST	Environmental Protection Agency	08/30/2013	03/21/2014	06/17/2014
US	ERNS	Emergency Response Notification System	National Response Center, United States Coast	09/24/2018	09/25/2018	11/09/2018
US	FEDERAL FACILITY	Federal Facility Site Information listing	Environmental Protection Agency	11/07/2016	01/05/2017	04/07/2017
US	FEDLAND	Federal and Indian Lands	U.S. Geological Survey	12/31/2005	02/06/2006	01/11/2007
US	FEMA UST	Underground Storage Tank Listing	FEMA	05/15/2017	05/30/2017	10/13/2017
US	FINDS	Facility Index System/Facility Registry System	EPA	11/15/2018	12/05/2018	01/11/2019
US	FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA/Office of Prevention, Pesticides and Toxi	04/09/2009	04/16/2009	05/11/2009
US	FTTS INSP	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA	04/09/2009	04/16/2009	05/11/2009
US	FUDS	Formerly Used Defense Sites	U.S. Army Corps of Engineers	01/31/2015	07/08/2015	10/13/2015
US	FUELS PROGRAM	EPA Fuels Program Registered Listing	EPA	08/22/2018	08/22/2018	10/05/2018
US	FUSRAP	Formerly Utilized Sites Remedial Action Program	Department of Energy	08/08/2017	09/11/2018	09/14/2018
US	HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HIST FTTS INSP	FIFRA/TSCA Tracking System Inspection & Enforcement Case Lis	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HMIRS	Hazardous Materials Information Reporting System	U.S. Department of Transportation	03/26/2018	03/27/2018	06/08/2018
US	ICIS	Integrated Compliance Information System	Environmental Protection Agency	11/18/2016	11/23/2016	02/10/2017
US	IHS OPEN DUMPS	Open Dumps on Indian Land	Department of Health & Human Serivces, Indian	04/01/2014	08/06/2014	01/29/2015
US	INDIAN LUST R1	Leaking Underground Storage Tanks on Indian Land	EPA Region 1	04/13/2018	05/18/2018	07/20/2018
US	INDIAN LUST R10	Leaking Underground Storage Tanks on Indian Land	EPA Region 10	04/12/2018	05/18/2018	07/20/2018
US	INDIAN LUST R4	Leaking Underground Storage Tanks on Indian Land	EPA Region 4	05/08/2018	05/18/2018	07/20/2018
US	INDIAN LUST R5	Leaking Underground Storage Tanks on Indian Land	EPA, Region 5	04/12/2018	05/18/2018	07/20/2018
US	INDIAN LUST R6	Leaking Underground Storage Tanks on Indian Land	EPA Region 6	04/01/2018	05/18/2018	07/20/2018
US	INDIAN LUST R7	Leaking Underground Storage Tanks on Indian Land	EPA Region 7	04/24/2018	05/18/2018	07/20/2018
US	INDIAN LUST R8	Leaking Underground Storage Tanks on Indian Land	EPA Region 8	04/25/2018	05/18/2018	07/20/2018
US	INDIAN LUST R9	Leaking Underground Storage Tanks on Indian Land	Environmental Protection Agency	04/10/2018	05/18/2018	07/20/2018
US	INDIAN ODI	Report on the Status of Open Dumps on Indian Lands	Environmental Protection Agency	12/31/1998	12/03/2007	01/24/2008
US	INDIAN RESERV	Indian Reservations	USGS	12/31/2014	07/14/2015	01/10/2017
US	INDIAN UST R1	Underground Storage Tanks on Indian Land	EPA, Region 1	04/13/2018	05/18/2018	07/20/2018
US	INDIAN UST R10	Underground Storage Tanks on Indian Land	EPA Region 10	04/12/2018	05/18/2018	07/20/2018
US	INDIAN UST R4	Underground Storage Tanks on Indian Land	EPA Region 4	05/08/2018	05/18/2018	07/20/2018
US	INDIAN UST R5	Underground Storage Tanks on Indian Land	EPA Region 5	04/12/2018	05/18/2018	07/20/2018
US	INDIAN UST R6	Underground Storage Tanks on Indian Land	EPA Region 6	04/01/2018	05/18/2018	07/20/2018
US	INDIAN UST R7	Underground Storage Tanks on Indian Land	EPA Region 7	04/24/2018	05/18/2018	07/20/2018
US	INDIAN UST R8	Underground Storage Tanks on Indian Land	EPA Region 8	04/25/2018	05/18/2018	07/20/2018
US	INDIAN UST R9	Underground Storage Tanks on Indian Land	EPA Region 9	04/10/2018	05/18/2018	07/20/2018
US	INDIAN VCP R1	Voluntary Cleanup Priority Listing	EPA, Region 1	07/27/2015	09/29/2015	02/18/2016
US	INDIAN VCP R7	Voluntary Cleanup Priority Lisitng	EPA, Region 7	03/20/2008	04/22/2008	05/19/2008
US	LEAD SMELTER 1	Lead Smelter Sites	Environmental Protection Agency	12/12/2018	12/28/2018	01/11/2019
US	LEAD SMELTER 2	Lead Smelter Sites	American Journal of Public Health	04/05/2001	10/27/2010	12/02/2010
US	LIENS 2	CERCLA Lien Information	Environmental Protection Agency	12/12/2018	12/28/2018	01/11/2019
US	LUCIS	Land Use Control Information System	Department of the Navy	10/17/2018	10/25/2018	12/07/2018
US	MLTS	Material Licensing Tracking System	Nuclear Regulatory Commission	08/30/2016	09/08/2016	10/21/2016
US	NPL	National Priority List	EPA	12/12/2018	12/28/2018	01/11/2019
US	NPL LIENS	Federal Superfund Liens	EPA	10/15/1991	02/02/1994	03/30/1994
US	ODI	Open Dump Inventory	Environmental Protection Agency	06/30/1985	08/09/2004	09/17/2004
US	PADS	PCB Activity Database System	EPA	09/14/2018	10/11/2018	12/07/2018
US	PCB TRANSFORMER	PCB Transformer Registration Database	Environmental Protection Agency	05/24/2017	11/30/2017	12/15/2017

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	PRP	Potentially Responsible Parties	EPA	08/13/2018	10/04/2018	11/09/2018
US	Proposed NPL	Proposed National Priority List Sites	EPA	12/12/2018	12/28/2018	01/11/2019
US	RAATS	RCRA Administrative Action Tracking System	EPA	04/17/1995	07/03/1995	08/07/1995
US	RADINFO	Radiation Information Database	Environmental Protection Agency	10/02/2018	10/03/2018	11/09/2018
US	RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-CESQG	RCRA - Conditionally Exempt Small Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-LQG	RCRA - Large Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-SQG	RCRA - Small Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-TSDF	RCRA - Treatment, Storage and Disposal	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RMP	Risk Management Plans	Environmental Protection Agency	10/26/2018	11/06/2018	01/11/2019
US	ROD	Records Of Decision	EPA	12/12/2018	12/28/2018	01/11/2019
US	SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing	Environmental Protection Agency	01/01/2017	02/03/2017	04/07/2017
US	SEMS	Superfund Enterprise Management System	EPA	12/12/2018	12/28/2018	01/11/2019
US	SEMS-ARCHIVE	Superfund Enterprise Management System Archive	EPA	12/13/2018	12/28/2018	01/11/2019
US	SSTS	Section 7 Tracking Systems	EPA	12/31/2009	12/10/2010	02/25/2011
US	TRIS	Toxic Chemical Release Inventory System	EPA	12/31/2016	01/10/2018	01/12/2018
US	TSCA	Toxic Substances Control Act	EPA	12/31/2016	06/21/2017	01/05/2018
US	UMTRA	Uranium Mill Tailings Sites	Department of Energy	06/23/2017	10/11/2017	11/03/2017
US	US AIRS (AFS)	Aerometric Information Retrieval System Facility Subsystem (	EPA	10/12/2016	10/26/2016	02/03/2017
US	US AIRS MINOR	Air Facility System Data	EPA	10/12/2016	10/26/2016	02/03/2017
US	US BROWNFIELDS	A Listing of Brownfields Sites	Environmental Protection Agency	12/17/2018	12/18/2018	01/11/2019
US	US CDL	Clandestine Drug Labs	Drug Enforcement Administration	09/21/2018	09/21/2018	11/09/2018
US	US ENG CONTROLS	Engineering Controls Sites List	Environmental Protection Agency	07/31/2018	08/28/2018	09/14/2018
US	US FIN ASSUR	Financial Assurance Information	Environmental Protection Agency	08/31/2018	09/25/2018	11/09/2018
US	US HIST CDL	National Clandestine Laboratory Register	Drug Enforcement Administration	09/21/2018	09/21/2018	11/09/2018
US	US INST CONTROL	Sites with Institutional Controls	Environmental Protection Agency	07/31/2018	08/28/2018	09/14/2018
US	US MINES	Mines Master Index File	Department of Labor, Mine Safety and Health A	08/01/2018	08/29/2018	10/05/2018
US	US MINES 2	Ferrous and Nonferrous Metal Mines Database Listing	USGS	12/05/2005	02/29/2008	04/18/2008
US	US MINES 3	Active Mines & Mineral Plants Database Listing	USGS	04/14/2011	06/08/2011	09/13/2011
US	UXO	Unexploded Ordnance Sites	Department of Defense	09/30/2017	06/19/2018	09/14/2018
NY	NY MANIFEST	Facility and Manifest Data	Department of Environmental Conservation	10/01/2018	10/31/2018	12/20/2018
WI	WI MANIFEST	Manifest Information	Department of Natural Resources	12/31/2017	06/15/2018	07/09/2018
US	AHA Hospitals	Sensitive Receptor: AHA Hospitals	American Hospital Association, Inc.			
US	Medical Centers	Sensitive Receptor: Medical Centers	Centers for Medicare & Medicaid Services			
US	Nursing Homes	Sensitive Receptor: Nursing Homes	National Institutes of Health			
US	Public Schools	Sensitive Receptor: Public Schools	National Center for Education Statistics			
US	Private Schools	Sensitive Receptor: Private Schools	National Center for Education Statistics			
OR	Daycare Centers	Sensitive Receptor: Child Care Listings	Employment Department			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	Flood Zones	100-year and 500-year flood zones	Emergency Management Agency (FEMA)			
US	NWI	National Wetlands Inventory	U.S. Fish and Wildlife Service			
OR	State Wetlands	Wetlands Inventory Data	Oregon Geospatial Enterprise Office			
US	Topographic Map		U.S. Geological Survey			
US	Oil/Gas Pipelines		PennWell Corporation			
US	Electric Power Transmission Line Data		PennWell Corporation			

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CAMP UMATILLA
78000-78028 ORDNANCE RD
HERMISTON, OR 97838

TARGET PROPERTY COORDINATES

Latitude (North):	45.807862 - 45˚ 48’ 28.30’’
Longitude (West):	119.42031 - 119˚ 25’ 13.12’’
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	311938.0
UTM Y (Meters):	5075331.0
Elevation:	581 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	6067356 ORDNANCE, OR
Version Date:	2014

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

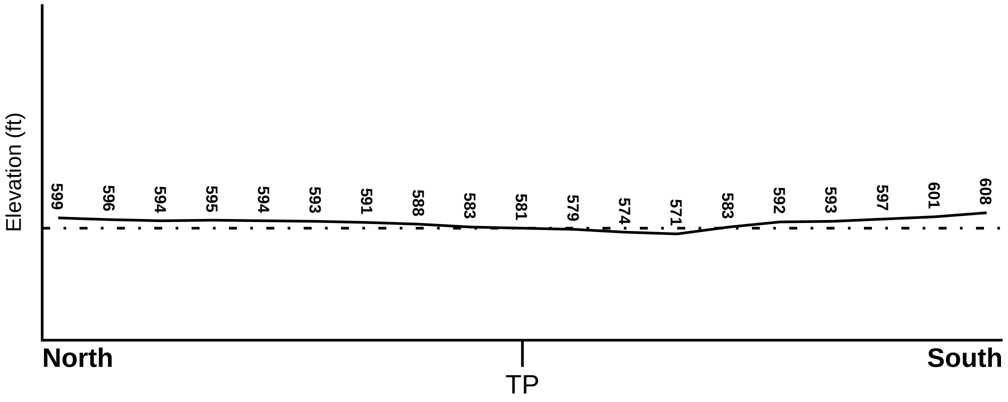
TOPOGRAPHIC INFORMATION

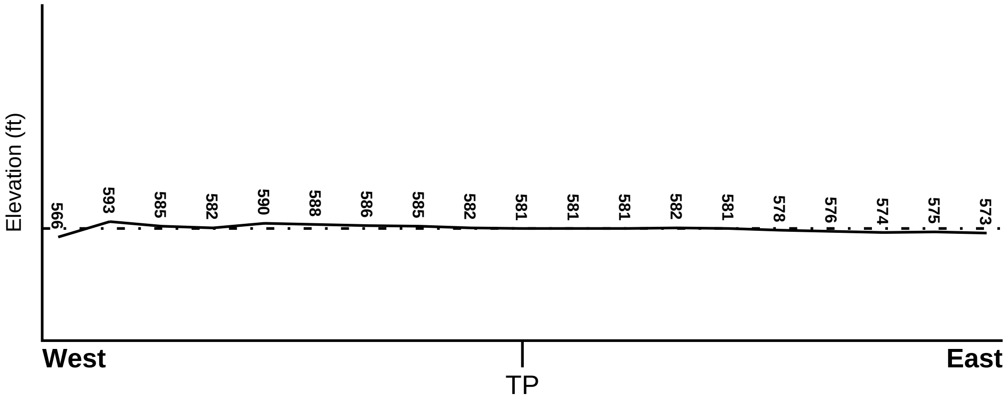
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

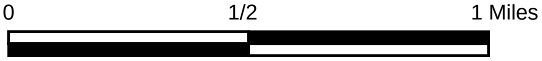
General Topographic Gradient: General SSE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 581 ft.



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
41049C0200D	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
ORDNANCE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

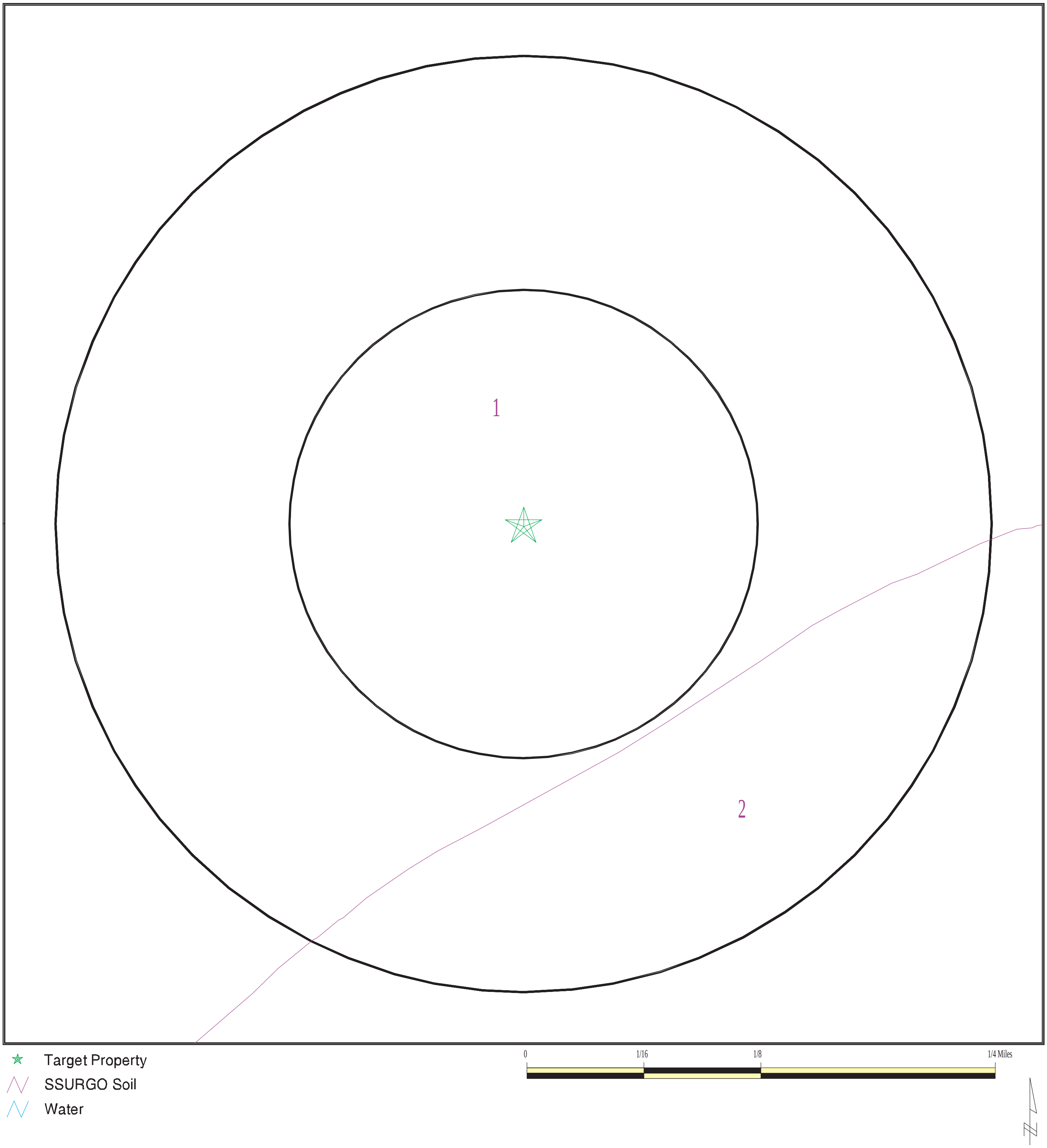
Era: Cenozoic
System: Quaternary
Series: Quaternary
Code: Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5560731.2s



SITE NAME: Camp Umatilla
ADDRESS: 78000-78028 Ordnance Rd
Hermiston OR 97838
LAT/LONG: 45.807862 / 119.42031

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5560731.2s
DATE: February 13, 2019 1:29 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture’s (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name:	Burbank
Soil Surface Texture:	loamy fine sand
Hydrologic Group:	Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
Soil Drainage Class:	Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	5 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4
2	5 inches	25 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	25 inches	29 inches	very gravelly loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4
4	29 inches	59 inches	extremely gravelly sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 705 Min: 141	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name:	Quincy
Soil Surface Texture:	loamy fine sand
Hydrologic Group:	Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
Soil Drainage Class:	Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

Soil Layer Information

	Boundary			Classification			
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**	**Saturated hydraulic conductivity micro m/sec**	**Soil Reaction (pH)**
1	0 inches	3 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9
2	3 inches	40 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9
3	40 inches	59 inches	very gravelly fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 8.4 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
2	USGS40000995182	1/8 - 1/4 Mile NNE
A7	USGS40000995162	1/4 - 1/2 Mile NW
B10	USGS40000995123	1/4 - 1/2 Mile SE
B12	USGS40000995129	1/4 - 1/2 Mile SE
B15	USGS40000995128	1/2 - 1 Mile SE
C16	USGS40000995126	1/2 - 1 Mile SW
D20	USGS40000995119	1/2 - 1 Mile SSW
G28	USGS40000995120	1/2 - 1 Mile SW
32	USGS40000995115	1/2 - 1 Mile SSW
H37	USGS40000995101	1/2 - 1 Mile SSE
H39	USGS40000995100	1/2 - 1 Mile SSE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

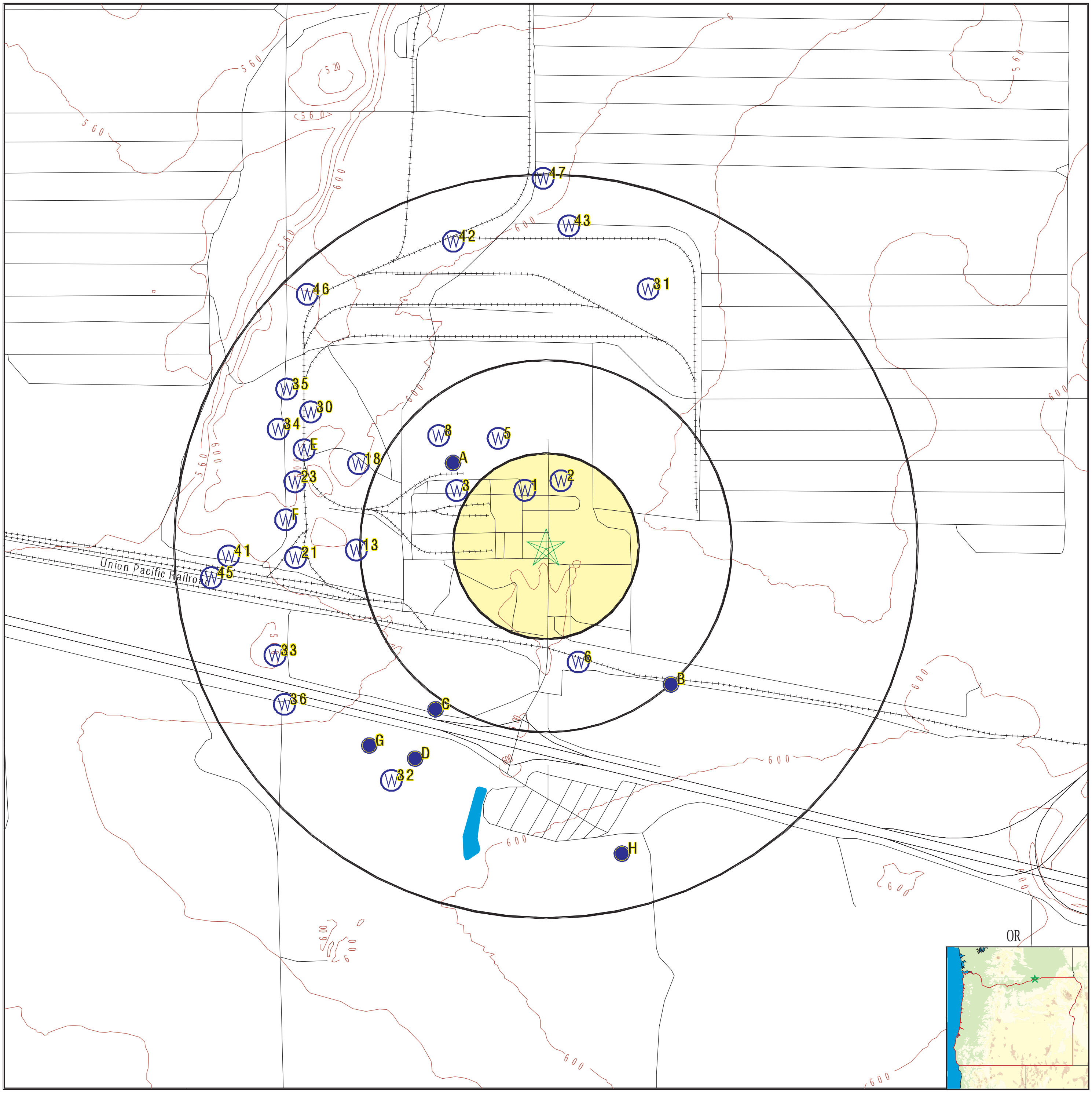
MAP ID	WELL ID	LOCATION FROM TP
1	ORW600000014645	1/8 - 1/4 Mile NNW
3	ORW600000014644	1/4 - 1/2 Mile WNW
A4	ORW600000015114	1/4 - 1/2 Mile NW
5	ORW600000015113	1/4 - 1/2 Mile NNW
6	ORW600000011695	1/4 - 1/2 Mile SSE
8	ORW600000015112	1/4 - 1/2 Mile NW
B9	ORW600000006458	1/4 - 1/2 Mile SE
B11	ORW600000006459	1/4 - 1/2 Mile SE
13	ORW600000015100	1/2 - 1 Mile West
B14	ORW600000006461	1/2 - 1 Mile SE
C17	ORW600000006462	1/2 - 1 Mile SW
18	ORW600000015038	1/2 - 1 Mile WNW
D19	ORW600000006460	1/2 - 1 Mile SSW
21	ORW600000014729	1/2 - 1 Mile West
E22	ORW600000015105	1/2 - 1 Mile WNW
23	ORW600000015101	1/2 - 1 Mile WNW
F24	ORW600000015102	1/2 - 1 Mile West
F25	ORW600000015039	1/2 - 1 Mile West
G26	ORW600000011696	1/2 - 1 Mile SW
G27	ORW600000006463	1/2 - 1 Mile SW
E29	ORW600000015104	1/2 - 1 Mile WNW
30	ORW600000015036	1/2 - 1 Mile WNW
31	ORW600000014895	1/2 - 1 Mile NNE
33	ORW600000017051	1/2 - 1 Mile WSW
34	ORW600000015037	1/2 - 1 Mile WNW
35	ORW600000015035	1/2 - 1 Mile WNW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
36	ORW600000014526	1/2 - 1 Mile WSW
H38	ORW600000006464	1/2 - 1 Mile SSE
H40	ORW600000006474	1/2 - 1 Mile SSE
41	ORW600000014730	1/2 - 1 Mile West
42	ORW600000015122	1/2 - 1 Mile NNW
43	ORW600000014969	1/2 - 1 Mile North
H44	ORW600000006680	1/2 - 1 Mile SSE
45	ORW600000015081	1/2 - 1 Mile West
46	ORW600000014958	1/2 - 1 Mile NW
47	ORW600000015121	1/2 - 1 Mile North

PHYSICAL SETTING SOURCE MAP - 5560731.2s



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- ◎ Earthquake epicenter, Richter 5 or greater
- Ⓦ Water Wells
- Ⓟ Public Water Supply Wells
- ● Cluster of Multiple Icons

- ↑ Groundwater Flow Direction
- (GI) Indeterminate Groundwater Flow at Location
- (GV) Groundwater Flow Varies at Location
- ● Oil, gas or related wells

SITE NAME:	Camp Umatilla	CLIENT:	AECOM
ADDRESS:	78000-78028 Ordnance Rd	CONTACT:	Brittany Kirchmann
	Hermiston OR 97838	INQUIRY #:	5560731.2s
LAT/LONG:	45.807862 / 119.42031	DATE:	February 13, 2019 1:28 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
1 **NNW** **1/8 - 1/4 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000014645**
2 **NNE** **1/8 - 1/4 Mile** **Higher**	**Click here for full text details**	**FED USGS**	**USGS40000995182**
3 **WNW** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000014644**
A4 **NW** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000015114**
5 **NNW** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000015113**
6 **SSE** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000011695**
A7 **NW** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**FED USGS**	**USGS40000995162**
8 **NW** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000015112**
B9 **SE** **1/4 - 1/2 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000006458**

Map ID Direction Distance Elevation		Database	EDR ID Number
B10 **SE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995123**
B11 **SE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000006459**
B12 **SE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995129**
13 **West** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015100**
B14 **SE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000006461**
B15 **SE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995128**
C16 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995126**
C17 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000006462**
18 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015038**

Map ID Direction Distance Elevation		Database	EDR ID Number
D19 **SSW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000006460**
D20 **SSW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995119**
21 **West** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000014729**
E22 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015105**
23 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015101**
F24 **West** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015102**
F25 **West** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015039**
G26 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000011696**
G27 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000006463**

Map ID Direction Distance Elevation		Database	EDR ID Number
G28 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995120**
E29 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015104**
30 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015036**
31 **NNE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000014895**
32 **SSW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000995115**
33 **WSW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OR WELLS**	**ORW600000017051**
34 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015037**
35 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OR WELLS**	**ORW600000015035**
36 **WSW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OR WELLS**	**ORW600000014526**

Map ID Direction Distance Elevation		Database	EDR ID Number
H37 **SSE** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**FED USGS**	**USGS40000995101**
H38 **SSE** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000006464**
H39 **SSE** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**FED USGS**	**USGS40000995100**
H40 **SSE** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000006474**
41 **West** **1/2 - 1 Mile** **Lower**	**Click here for full text details**	**OR WELLS**	**ORW600000014730**
42 **NNW** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000015122**
43 **North** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000014969**
H44 **SSE** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000006680**
45 **West** **1/2 - 1 Mile** **Lower**	**Click here for full text details**	**OR WELLS**	**ORW600000015081**

Map ID Direction Distance Elevation		Database	EDR ID Number
46 **NW** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000014958**
47 **North** **1/2 - 1 Mile** **Higher**	**Click here for full text details**	**OR WELLS**	**ORW600000015121**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OR Radon

Radon Test Results

Zipcode	Num Tests	Maximum	Minimum	Average	# > 4 pCi/L
97838	8	4	0.6	2.3	0

Federal EPA Radon Zone for UMATILLA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.
Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory Data
Source: Oregon Geospatial Enterprise Office
Telephone: 503-378-2166

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Data
Source: Department of Water Resources
Telephone: 503-986-0843

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Locations
Source: Department of Geology and Mineral Industries
Telephone: 971-673-1540
A listing of oil and gas well locations in the state.

RADON

State Database: OR Radon
Source: Oregon Health Services
Telephone: 503-731-4272
Radon Levels in Orgeon

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR’s Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

Appendix B
Preliminary Assessment Documentation

Appendix B.1
Interview Records

PA Interview Questionnaire – Fire Station

Facility: Camp Umatilla
Interviewer: [redacted]
Date/Time: 10/1/18 + 10/2/18

Interviewee: [redacted] **Title:** Fire Manager officer / Ret. Wildlands Fire Officer **Phone Number:** **Email:**	Can your name/role be used in the PA Report? Y or N Can you recommend anyone we can interview? Y or N

1. Roles or activities with the Facility/years working at the Facility.

[redacted] - Wildlands Fire Training + associated activities since 2011

[redacted] - Retired wildlands Fire Officer (1987-2016)

2. What can you tell us about the history of AFFF at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map.

Maintenance (e.g., ~~ramp~~ truck washing) Routiney occurred
Fire Training Areas One across from fire station, plus burn pit
Firefighting (Active Fire) Class A only, historically
Crash None
Fire Suppression Systems (Hangers/Dining Facilities) None
Fire Protection at Fueling Stations Only non-PFAS (ABC or dry chemical)
Non-Technical/Recreational/ Pest Management None

3. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing at the AFFF/suppression systems?

No AFFF fire suppression systems

4. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam?

N/A

5. How is AFFF procured? Do you have an inventory/procurement system that tracks use?

Unsure

PA Interview Questionnaire – Fire Station

Facility:____________
Interviewer:____________
Date/Time:____________

6. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)?

one half full 5-gallon bucket of Angus Tridol AFFF; no other AFFF @ Umatilla
Remainder of foam is class A wildland FFF

7. Is AFFF formulated on base? If so, where is the solution mixed, contained, transferred, etc.?

N/A

8. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material?

1/2 full 5-gallon bucket in cage near bay door of firestation; closed; stored w/ other class A buckets

9. How is the AFFF transferred to emergency response vehicles, suppression systems, flightline extinguishers? Is/was there a specified area on the facility where vehicles are filled with AFFF and does this area have secondary containment in case of spills? How and where are vehicles storing AFFF cleaned/decontaminated?

Historically 5-gallon buckets would be manually transferred into firetrucks when needed; usually outside F.S. but no designated area

10. Provide a list of vehicles that carried AFFF, now and in the past, and where are/were they located?

At least 1-2 AFFF-capable fire trucks in past during ~~him~~ employment of [redacted] (years, quantity, capacity, frequency of use is unknown)

11. Any vehicles have a history of leaking AFFF? Do you/did you test the vehicles spray patterns to make sure equipment is working properly? How often are/were these spray tests performed and can you provide the locations of these tests, now and in the past?

No knowledge of historic leaks
Nozzle testing occurred "routinely" (est. yearly) but testing would be "everywhere"; no designated location

Trucks would routinely be washed outside fire station; sometimes AFFF would be used on engines to clean

12. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them?

One previous area where nozzles were tested across from fire station

Burn pit near old FTA (~100 yards); foam used but unsure what type

13. What types of fuels/flammables were used at the FTAs?

None, only foam used for fire training/nozzle practice

14. What was the frequency of AFFF use at each location? When a release of AFFF occurs during a fire training exercise, now and in the past, how is/was the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

Nozzle testing @ FTA was generally yearly; burn pit was frequent (daily during winter, less during summer)

No cleanup of AFFF

15. Are there mutual aid/use agreements between county, city, local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement? Can you recall specific times when city, county, state personnel came on-post for training? If so, please state which state/county agency, military entity? Do you have any records, including photographs to share with us?

NO

16. Did individual units come on-post with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances?

NO / N/A

PA Interview Questionnaire – Fire Station

Facility: ____________
Interviewer: ____________
Date/Time: ____________

17. Did military routinely or occasionally fire train off-post? List units that you can recall used/trained at various areas.

No

18. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder?

No

* Brush fire in ~May 2016 (10,000+acres) but no AFFF used, only Class A (multiple entities responded)

19. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires?

No

20. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved?

No, never
only Class A Wildland Fire Fighting Foam

21. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste water treatment plants, and AFFF ponds)?

No / NA

↓ Camp Withycombe takes old trucks filled w/ foam throughout Oregon
old TriMax's go here too

PA Interview Questionnaire – Fire Station

Facility:_______________
Interviewer:_______________
Date/Time:_______________

22. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved? Only @ burn pit
23. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L? Unsure
24. Do you recommend anyone else we can interview? If so, do you have contact information for them?

PA Interview Questionnaire - Other

Facility: Camp Umatilla
Interviewer: [redacted]
Date/Time: 10/1/18
10/2/18

Interviewee: [redacted]
Title: Env. Specialist / Env. Specialist
Phone Number: N/A / [redacted]
Email: ____________

Can your name/role be used in the PA Report? [✓ Y] or N
Can you recommend anyone we can interview?
Y or N ____________

Roles or activities with the Facility/Years working at the Facility:

[redacted]
Env. Specialist

[redacted]
Env. Specialist

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

* Previous FTA located across from fire station; [redacted] recalls nozzle release/practice/training @ empty field for. unknown time period (unsure type of foam used)

* Nozzle testing occurred "routinely"

* Burn pit (organic debris) burned + fire suppressed w/ unknown type of foam

* Large brush fire (~2016) didn't use AFFF

Known Uses
- Use
- Procurement
- Disposition
- Storage (Mixed)
- Storage (Solution)
- Inventory, Off-Spec
- Containment
- SOP on Filling
- Leaking Vehicles
- Nozzle and Suppression System Testing
- Dining Facilities
- Vehicle Washing
- Ramp Washing
- Fuel Spill Washing and Fueling Stations
- Chrome Plating or Waterproofing

PA Interview Questionnaire - Other

Facility:
Interviewer:
Date/Time:

*No procurement of AFFF

*Unsure how long 5-gallon bucket in fire station has been there

Appendix B.2
Visual Site Inspection Checklists

Visual Survey Inspection Log

Recorded by: [redacted]
ARNG Contact: [redacted]
Date: 10/2/18

Source/Release Information

Site Name / Area Name / Unique ID: Camp Umatilla
Site / Area Acreage: ~7,500 acres total (mostly chemical/weapon storage iglo
Historic Site Use (Brief Description): chemical warfare materials + ammunition storage + supply
Current Site Use (Brief Description): Training facility + munitions storage

1. Was AFFF used (or spilled) at the site/area? [✓ Y] / N

2. Has usage been documented? Y / [✓ N]
2a. If yes, keep a record (place electronic files on a disk):

3. What types of businesses are located near the site? [✓ Industrial] / [✓ Commercial] / Plating / Waterproofing / Residential
3a. Indicate what businesses are located near the site
Some commercial businesses to east

4. Is this site located at an airport/flightline? Y / [✓ N]
4a. If yes, provide a description of the airport/flightline tenants

Other Significant Site Features:

1. Does the facility have a fire suppression system? Y / [✓ N]
1a. If yes, indicate which type of AFFF has been used:
1b. If yes, describe maintenance schedule/leaks:
1c. If yes, how often is the AFFF replaced:
1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? Y / N
1a. If so, note observation and location:

2. Is there channelized flow within the site/area? [✓ Y] / N
2a. If so, please note observation and location:
storm drains collect rainwater/surface water + send to storm sewer → discharges to Columbia Riv

very little flow in
eneral due to
ittle precipitation

3. Are monitoring or drinking water wells located near the site? [✓ Y] / N
3a. If so, please note the location:
See associated figures

4. Are surface water intakes located near the site? Y / [✓ N]
4a. If so, please note the location:

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? Y / [✓ N]
1a. If so, please describe change (ex. Structures no longer exist):

Visual Survey Inspection Log

2. Is the site/area vegetated? [✓ Y] / N

2a. If not vegetated, briefly describe the site/area composition:

w/ shrubs, tumblweed

3. Does the site or area exhibit evidence of erosion? Y / [✓ N]

3a. If yes, describe the location and extent of the erosion:

4. Does the site/area exhibit any areas of ponding or standing water? Y / [✓ N]

4a. If yes, describe the location and extent of the ponding:

Receptor Information

1. Is access to the site restricted? [✓ Y] / N

1a. If so, please note to what extent:

Gated + guarded entrance

2. Who can access the site? [✓ **Site Workers / Construction Workers**] **/ Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

3. Are residential areas located near the site? Y / [✓ N]

3a. If so, please note the location/distance:

4. Are any schools/day care centers located near the site? Y / [✓ N]

4a. If so, please note the location/distance/type:

5. Are any wetlands located near the site? [✓ Y] / N

5a. If so, please note the location/distance/type:

One small freshwater emergent wetland along western boundary

Additional Notes

Photographic Log

Photo ID/Name	Date & Location	Photograph Description

Appendix B.3
Conceptual Site Model Information

Preliminary Assessment – Conceptual Site Model Information

Site Name: Camp Umatilla

Why has this location been identified as a site?

Multiple potential AFFF release areas along with historic storage and use of AFFF-capable firetrucks

Are there any other activities nearby that could also impact this location?

No

Training Events

Have any training events with AFFF occurred at this site? Yes

If so, how often? Various dates at multiple locations, dates estimated between 1990 and 2016

How much material was used? Is it documented? Unsure of quantity; no documentation of use

Identify Potential Pathways: Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

Surface Water:

Surface water flow direction? Low annual rainfall so surface water infiltrates to permeable soils; closest surface water body is Umatilla River 2 miles east

Average rainfall? 8.85 inches/year

Any flooding during rainy season? No

Direct or indirect pathway to ditches? Indirect

Direct or indirect pathway to larger bodies of water? Indirect pathway

Does surface water pond any place on site? No

Any impoundment areas or retention ponds? No

Any NPDES location points near the site? No

How does surface water drain on and around the flight line? N/A

Groundwater:

Groundwater flow direction? Generally northwest

Depth to groundwater? Typically 60-100 ft bgs in the area surrounding the facility

Uses (agricultural, drinking water, irrigation)? Drinking and industrial

Any groundwater treatment systems? No

Preliminary Assessment – Conceptual Site Model Information

Any groundwater monitoring well locations near the site? Yes

Is groundwater used for drinking water? Yes

Are there drinking water supply wells on installation? Yes

Do they serve off-post populations? No

Are there off-post drinking water wells downgradient? No

Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? No

If so, do we understand the process and which water is/was treated at the plant? N/A

Do we understand the fate of sludge waste? No

Is surface water from potential contaminated sites treated? No. Any surface water would permeate to surrounding soils. Stormwater runoff would be collected in storm drains throughout facility

Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go?

Yes, firetrucks were previously washed in and directly outside of fire station routinely and following fire training activities

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles?

Nozzles were tested routinely (estimated yearly); however, no designated area for testing. Nozzles were not cleaned after but common for firetrucks to be cleaned in/directly outside fire station following training activities

3. Other?

Preliminary Assessment – Conceptual Site Model Information

Identify Potential Receptors:

Site Worker: Yes

Construction Worker: Yes

Recreational User: No

Residential: No

Child: No

Ecological: No

Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

Some local industrial areas; City of Hermiston and Umatilla located several miles east and northeast of the facility, respectively

Documentation

Ask for Engineering drawings (if applicable): Done

Has there been a reconstruction or changes to the drainage system? When did that occur?: No

Appendix C
Photographic Log

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Umatilla	Hermiston, Oregon

Photograph No. 1

Description:

Storage cage inside of the Fire Station. This cage currently has one half-filled 5-gallon bucket of AFFF; the remaining buckets contain non-PFAS Class A wildland fire fighting foam.

Photograph No. 2

Description:

Half-filled 5-gallon bucket of Tridol AFFF within the fire station.

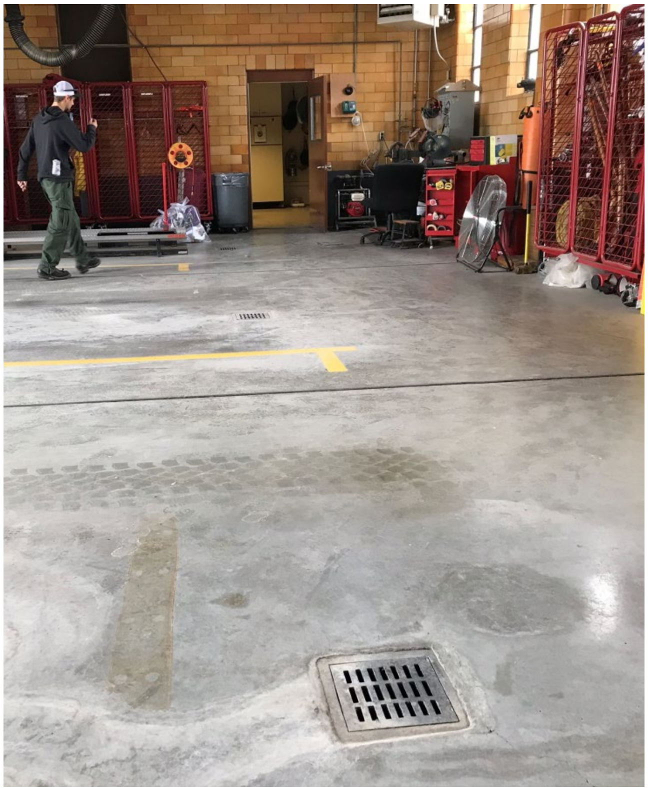
APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Umatilla	Hermiston, Oregon

Photograph No. 3

Description:

Floor drains inside of the Fire Station at Camp Umatilla.



Photograph No. 4

Description:

Facing West. Approximate location of former FTA 01 where nozzle testing and fire training activities historically occurred. The fire station can be seen directly across the street.

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	**Camp Umatilla**	**Hermiston, Oregon**

Photograph No. 5

Description:

Facing North. Approximate location of former FTA 01.

Photograph No. 6

Description:

Facing North. Location of Burn Pit with some partially burned organic debris visible.

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	**Camp Umatilla**	**Hermiston, Oregon**

Photograph No. 7

Description:

Facing East. Location of Burn Pit with some partially burned organic debris visible.

Photograph No. 8

Description:

Facing West. Location of a Fueling Station at Camp Umatilla. No AFFF-containing portable extinguishers or fire suppression systems are located here.