FINAL
Site Inspection Report
Army Aviation Support Facility #2
Pendleton, Oregon

Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS) at ARNG Installations, Nationwide

September 2023

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASR	Aquifer Storage and Recovery
bgs	below ground surface
cfs	cubic feet per second
CRBG	Columbia River Basalt Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DO	dissolved oxygen
DOT	Department of Transportation
DQO	data quality objective
DUA	data usability assessment
EDR™	Environmental Data Resources, Inc.™
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS/MSD	matrix spike/ matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
OMD	Oregon Military Department
ORARNG	Oregon Army National Guard
ORDEQ	Oregon Department of Environmental Quality
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
OWRD	Oregon Water Resources Department

PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
TSi	Terra Sonic
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Executive Summary

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS). These compounds are collectively referred to as “relevant compounds” throughout the document, and the applicable screening levels (SLs) are provided in **Table ES-1**.

The PA identified three Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at the Pendleton Army Aviation Support Facility (AASF #2) in Pendleton, Oregon and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1, AOI 2, and AOI 3. Pendleton AASF #2 will also be referred to as the “facility” throughout this document.

Pendleton AASF #2 is located at 2100 NW 56th Street, adjacent to the Eastern Oregon Regional Airport, in Umatilla County, in Pendleton, Umatilla County, Oregon. The Pendleton AASF #2 is home to the 1st Battalion, 168th Aviation Regiment, Task Force Long Knife, 40th Combat Aviation Brigade, which operates rotary-winged aircraft such as helicopters and unmanned aerial vehicles for the ORARNG. Operations at the Pendleton AASF #2 include aviation safety training, controls utilization, and maintenance, modification, and repair of rotary-winged aircraft. In addition to AASF #2, Pendleton has a readiness center for training exercises, natural disaster relief, or combat, a helicopter parking ramp, training area, one aircraft wash rack, and one ground vehicle wash rack.

The PA identified three AOIs for investigation during the SI phase. SI sampling results from the three AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation (RI) for AOI 1, AOI 2, and AOI 3.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter
a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.
b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-2: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Eastern Detention Basin	●	●	●	Proceed to RI
2	Ramp Area	◐	●	●	Proceed to RI
3	Readiness Center	◐	◐	N/A	Proceed to RI

Legend:
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at Pendleton Army Aviation Support Facility (AASF) #2 in Pendleton, Oregon. Pendleton AASF #2 is also referred to as the "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; United States [US] Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations.

1.2 SI Purpose

A PA was performed at Pendleton AASF #2 (AECOM Technical Services, Inc. [AECOM], 2020) that identified three Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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2. Facility Background

2.1 Facility Location and Description

Pendleton AASF #2 is located at 2100 NW 56th Street, adjacent to the Eastern Oregon Regional Airport in Pendleton, Umatilla County, Oregon. Pendleton AASF #2 is on the northwestern city limits of Pendleton, directly west of the airport and north of Interstate Highway 84 (**Figure 2-1**). The southern communities of Rieth and Green Meadows, and the eastern communities of Riverside, Gopher Flats, Mission, and Tutuilla, lie within 10 miles of the facility.

The Oregon ARNG (ORARNG), by and through the Oregon Military Department (OMD), entered a lease with the City of Pendleton in 1987 for the use and occupancy of 14.38 acres of land adjacent to the Eastern Oregon Regional Airport. In 1995, the lease was amended to grant the ORARNG permission to build AASF #2 by July 1999. The amended lease included the addition of 9.21 acres, with the facility currently totaling 23.59 acres. The Pendleton AASF #2 was constructed between 1996 and 1999, approximately 550 feet south of Runway 7/25. The amended lease may be renewed up to a period of 62 years from the original term, with an expiration date of 2049.

The Pendleton AASF #2 is home to the 1st Battalion, 168th Aviation Regiment, Task Force Long Knife, 40th Combat Aviation Brigade, which operates rotary-winged aircraft such as helicopters and unmanned aerial vehicles for the ORARNG. Operations at the Pendleton AASF #2 include aviation safety training, controls utilization, and maintenance, modification, and repair of rotary-winged aircraft. In addition to AASF #2, Pendleton has a readiness center for training exercises, natural disaster relief, or combat, a helicopter parking ramp, training area, one aircraft wash rack, and one ground vehicle wash rack. The Pendleton AASF #2 facility is closed to the public and secured with a 6-foot chain-link fence topped with barbed wire. The security gate is guarded while the facility is open and locked when the facility is closed (Dudek, 2018).

2.2 Facility Environmental Setting

The facility is within the Umatilla River Basin in northeastern Oregon, along the south-central edge of the Columbia Plateau, which extends north into Washington State. The Oregon portion of the plateau is made up entirely of lowlands that extend from the western Cascade Mountains to the southeastern Blue Mountains. The topography around the facility is varied, with flat to gently sloping lowlands and terraces along the Umatilla River that transition to steeper slopes on the hills to the north and south. The approximate center of the facility is located at 1,490 feet above mean sea level (amsl). The urbanized City of Pendleton is a center of grain, vegetable production, and ranching, and it sits roughly 1,200 feet amsl (City of Pendleton, 2023).

Much of the facility is paved with either asphalt or concrete, with some small unpaved grassy areas along the eastern boundary of the facility. The land around the facility is relatively undeveloped, nonresidential land, except for the Pendair Heights Industrial Park located immediately south of the airport (Dudek, 2018). The zoning designations for the immediate and surrounding area are largely classified as airport activities and light industrial (Alford, 2015). Interstate 84 passes near the facility, to the south and east of the downtown area.

2.2.1 Geology

The facility is in the south-central portion of the Columbia Plateau physiographic province. The plateau is a structural basin that drains to the Columbia River through its major tributaries: the Snake, Yakima, John Day, Umatilla, Spokane, Klickitat, and Deschutes Rivers. The portion of the Columbia Plateau in Oregon is formally known as the Deschutes-Umatilla Plateau, or the

Columbia-Deschutes Plateau. The basalt plateau dips gently north-northwest and ranges from 3,000 feet amsl near the base of the Blue Mountains to less than 300 feet amsl near the Columbia River (Gonthier, 1990). The Deschutes-Umatilla Plateau axis extends laterally east-west and is bound in the north by the Columbia River and to the south by the Blue Mountain Anticline. The Columbia Plateau is comprised of basaltic lavas that extruded during the Miocene. The large flood basalts are formally named the Columbia River Basalt Group (CRBG) and underlay parts of Oregon, Washington, and Idaho. The rock group is made up of five major basalt flows, including the Steens Basalt, Imnaha Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt.

Northwest-trending fissure volcanic eruptions during the late Miocene and early Pliocene produced the series of wide-spread flood basalts that engulfed the Pacific Northwest. The flood basalts flows were regionally confined to the north by the Okanogan Highlands, to the east by the Rocky Mountains, and to the west by the Cascade Mountains. The southern margin of the flood basalt's boundaries is not distinctive, and flows diminish in thickness from the source fissures. The thickness of the CRBG varies widely, with the maximum thickness over 14,000 feet, near Pasco, Washington, and the average thickness of approximately 3,300 feet. Individual flows of the subgroups of the CRBG are typically 30 to 50 feet thick but can range from several inches to hundreds of feet. Basalt thicknesses are influenced by the existing topographical setting during the eruptions, with thick flows in the existing depressions and thinner where flows butted against higher elevations (Gonthier, 1985).

Few sedimentary interbeds are present between select individual basalt flows. Sedimentary interbeds of clay, silt, sand, and occasional gravel were deposited in the Miocene epoch, between active eruptions. Where present, these interbeds are used to distinguish between the discrete flows. The combination of these sedimentary interbeds is referred to as the Ellensburg Formation (Gonthier, 1990).

The majority of the CRBG is dominated by the Yakima Basalt Subgroup consisting of the Grande Ronde Basalt, the Wanapum Basalt, and the Saddle Mountains Basalt. The Grande Ronde Basalt, underlying a large extent of the Columbia Plateau, is comprised of 131 individual flows with varying thicknesses. The Grande Ronde Basalt accounts for up to 85 percent (%) of the total volume of the CRBG. Sedimentary interbeds between these flows generally range from non-existent to several feet thick and are limited in lateral extent, indicating the relatively short lag times between eruptions. The upper extent of the Grande Ronde Basalt is difficult to distinguish from the overlying Wanapum Basalt, and where present, a weathering zone and/or the Wanapum-Grande Ronde can be used to identify the contact between the igneous units (Gonthier, 1990). The interbed is comprised of primarily claystone and siltstone and varies from non-existent to 100 feet thick; however, the thickness averages around 25 feet. These interbeds are formally known as Vantage Member of the Ellensberg Formation in the regional area of the facility.

The Wanapum Basalt superimposes the Grande Ronde Basalt, and where present, the weathering zone/sedimentary interbeds locally around the facility. Wanapum Basalt is composed of approximately 33 individual flows, with more prevalent sedimentary interbeds than the underlying Grande Ronde Basalt. Sedimentary interbeds within the Wanapum Basalt are typically thin and limited in spatial distribution, varying from 0 to 100 feet. The Wanapum is exposed at the surface to the north of the facility in the Missouri, Despain, and Stage Gulches. To the south of the facility, Wanapum Basalt is exposed along the Umatilla River Valley and its tributaries.

Due to the lithostatic load of these flood basalts, the crust beneath began to subside, producing the large, slightly depressed lava plain of the Columbia Plateau, which encompasses more than 63,000 square miles (Winterbrook Planning, 2012). North-south horizontal tectonic stresses generated regional uplifting known as the Blue Mountains. The northern margin of the Blue Mountains near the City of Pendleton consists of a series of northeast-trending, faulted monoclines and associated anticlines and synclines (Walker, 1990).

Alluvium deposits from the Umatilla River and its tributaries covers the basalt throughout the lowland floodplains (Winterbrook, 2012). Additionally, wind-blown loess deposits are present overlying the basalt at the facility and its vicinity. These aeolian deposits are characterized as clayey silt and fine sand, with local interbeds of soil, caliche, and some water-laid silt and gravel, and range from Pleistocene to Holocene in age (Walker, 1973; Walker, 1977). Based on a review of available boring logs, loess deposits within the vicinity of the facility range in thickness from approximately 12 feet to 23 feet (Oregon Water Resources Department [OWRD], 2023). The soils in the Pendleton area are characterized by well-drained silt loams of the Anderly, Pilot Rock, and Walla Walla series. A majority of these soils are found in depressions on the floodplains (Winterbrook, 2012).

During the SI, borings were completed to depths ranging between 20 to 33 feet below ground surface (bgs). Soils observed generally consisted of dry silts with varying quantities of sand and gravel. Weathered and broken basalt bedrock was observed as shallow as 3.5 feet bgs, and strong, intact basalt was observed as shallow as 12 feet bgs. Based on surveyed elevation data collected at the permanent well locations, the basalt bedrock surface was measured at higher elevations in the southwest and decreased in elevation toward the northeast (**Figure 2-4**). The basalt was generally observed to be aphanitic and variably oxidized. Water-bearing vesicles were observed in basalt in borings within AOI 2 and AOI 3 from 15 to 33 feet bgs. Small quantities of clay were observed within fractures at AOI02-02 and AOI03-01, at depths ranging between 26 to 33 feet bgs. The clay appears to be a byproduct of water weathering the parent basalt rock.

The observed silts consist of a mixture of fill and loess, and the basalt encountered appears consistent with the mapped Wanapum Basalt underneath the facility. Boring logs are presented in **Appendix E**.

2.2.2 Hydrogeology

The Columbia Plateau Basaltic Aquifer system is a large regional groundwater resource that occupies approximately 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 the primary source of groundwater for municipal, industrial, and irrigation uses. The alluvial and shallow basalt aquifers provide the main source of domestic water for rural residents, with depths to groundwater ranging from approximately 5 to 25 feet bgs in the alluvial aquifer and 50 to 340 feet bgs in the basalt aquifers (Hogenson, 1964). The CRBG contains permeable aquifers separated by less permeable confining units. The productive aquifers typically consist of interflow zones separated by low permeability flow interiors (US Geological Survey [USGS], 2016). While interflow zones generally yield large volumes of water initially, continued withdrawals result in large declines in water level due to low storage properties and slow aquifer recharge.

The Columbia Plateau Basaltic Aquifer System is a layered series of fractured basalt formations of the CRBG, separated by confining units of sedimentary interbeds and unconsolidated deposits of loose silt, sand, and occasionally gravel, all underlain by pre-Miocene sedimentary rocks (Whitehead, 1994). Over 300 individual flows have been identified within the Columbia Plateau (USGS, 2016). The top and bottom of individual flows within the CRBG, which is an important source of water supply in the Umatilla Basin, are vesicular, brecciated, and permeable.

Alluvial sand and gravel deposits are found in the lower basin between Boardman and Cold Springs Reservoir and within the flood plains of major streams. Groundwater in the shallow depths of the alluvial aquifer is unconfined and generally has a strong hydraulic connection with surface water, with most recharge in this aquifer being supplied by leaky canals and ditches, as well as applied irrigation water (USGS, 2016). However, recharge from precipitation is a relatively small proportion of total recharge, given the low yearly average rainfall the City of Pendleton receives. Groundwater below the alluvial aquifer occurs in a series of basalt aquifers: the Wanapum Basalt, a confining unit, Grand Ronde Basalt, and then pre-Miocene rocks. Based on available information, the regional alluvial aquifer was not expected to be present at the facility.

Regional groundwater flow in the CRBG is generally from upland areas in the southeast and north, towards the Umatilla River. However, the facility is near a groundwater divide. Also, a regional-scale anticline extending east-northeast/west-southwest is mapped within the northern vicinity of the facility, identified as the "Rieth Anticline" (Walker, 1977; USGS, 2002; USGS, 2017), and a south-southeast-dipping normal fault is locally mapped extending approximately along-strike of the anticline (McConnell, 2006). Based on these factors, groundwater flow direction in the CRBG may differ within the vicinity of the facility.

Public drinking water for the City of Pendleton is managed by an Aquifer Storage and Recovery (ASR) Program (further discussed in **Section 2.2.3**). Although the degree of uncertainty of their reported geographical locations is up to 1-mile, several private drinking water wells, irrigation wells, and other wells are reported within a 4-mile radius of the facility, and several are discussed below (OWRD, 2023):

- One privately-owned domestic well located less than 0.5 miles to the north (well report 5603). First encountered water was noted at 72 feet bgs, and static water level is noted at 21 feet bgs. The well appears to be down-gradient of the facility; however, the well is proximal to the hanging wall of the mapped normal fault, which may affect localized groundwater flow directions.

- One privately-owned domestic well located approximately 1.75 miles to the northwest (well report 1381). First encountered water was noted at 483 feet bgs.

- One privately-owned domestic well located approximately 0.75 miles to the southwest (well report 537). First encountered water was noted at 365 feet bgs, but the well is downhill and at a different elevation from the facility.

- One privately-owned domestic well located approximately 1.35 miles to the east (well report 1406). Groundwater was not initially encountered in the depth drilled to 595 feet bgs, although static level was noted at 370 feet bgs.

- More than 10 additional wells within 2 miles to the north, south, and east.

Based on these available well logs, depth to groundwater in the CRBG within the vicinity of the facility is variable but may be first encountered as shallow as 72 feet bgs and as deep as greater than 595 feet bgs. However, perched groundwater may also be present within the overlying loess within the vicinity of the facility. If encountered, this perched groundwater may be discontinuous, but flow is expected to follow surface topography towards the northeast.

A Rieth Water District public drinking water well is located 2 miles to the south-southwest of the facility (well report UMAT55330). The well was completed in 1942 at 287 feet bgs and static groundwater was reported 65 feet bgs (Oregon Health Authority, 2023).

Depths to water measured in December 2022 during the SI ranged from 15.81 to 23.87 feet bgs. Groundwater elevations were generally measured higher in the southwest and decreased toward the northeast. Based on lithologic observations during drilling and measured elevations, groundwater appears to flow primarily to the northeast through fractures and vesicles within the basalt bedrock. The groundwater flow direction appears to generally follow the direction of bedrock dip (discussed in **Section 2.2.1**).

However, groundwater flow direction may also be seasonally impacted by nearby agricultural activities. Additionally, groundwater flow conditions were assessed within shallow basalt underlying the facility. Groundwater within deeper basalt and interbedded sedimentary layers may exhibit alternative flow paths. Depth to water-bearing basalt rock may also differ outside of the facility boundary due to the incongruent depositional nature of basalt lava. Groundwater and bedrock surface elevation contours from the SI are presented on **Figure 2-4**.

2.2.3 Hydrology

The facility is in the central part of the Umatilla River basin, approximately 50 river miles southeast of the confluence with the Columbia River and about 30 miles from its headwaters in the Blue Mountains to the east. The City of Pendleton is developed along the Umatilla River and on the adjacent hills to the north and south. Multiple intermittent and perennial streams draining to the Umatilla River are present on the hills.

The facility lies within the southern portion of the Upper Stage Gulch Watershed, with portions of the nearby Eastern Oregon Regional Airport located in the northern region of the Cottonwood Creek-Umatilla River Watershed (**Figure 2-5**). The Umatilla River is the nearest surface water body, located approximately 1.5 miles south of the facility; the most recent Spill Prevention, Control, and Countermeasure Plan for the facility identified associated activities as having the potential to impact the Umatilla River (Dudek, 2018). To the north and south of Pendleton AASF #2, several mapped freshwater emergent wetlands and drainage swales function as unnamed tributaries to the Umatilla and Columbia Rivers. The facility is located adjacent to a surface water divide. Generally, surface water flow direction within, around, and to the north of the facility is to the northeast. Immediately south of the facility, in the Cottonwood Creek-Umatilla River Watershed, surface water flow is to the south and southeast, towards the nearby Umatilla River.

Due to a minimal annual rainfall, areas of ponding or standing water were not noted within or around the facility, and no known wetlands exist within the vicinity of the facility. However, two unlined stormwater detention basins are located to the east and northwest of the aircraft parking ramp and receive most surface water runoff from catch basins and trench drains located throughout the facility (Dudek, 2018). Both detention basins allow surface water runoff and stormwater to gradually infiltrate into the ground. During high volume events, overflow drains in these basins help carry excess volume to the adjacent Eastern Oregon Regional Airport stormwater system (Dudek, 2018). The eastern detention basin is within the boundary of AOI 1, and the northern detention basin is northwest of AOI 2.

Prior to 2003, drinking water for the City of Pendleton was supplied mostly through a series of deep basalt wells throughout and near the city. Starting in 2003, the City of Pendleton began an ASR Program, which consists of five ASR wells, surface water intakes at the Umatilla River, and the Pendleton Water Filtration Plant. Surface water is pumped from Umatilla River to the Water Filtration Plant in the winter/spring when flow is greater than 250 cubic feet per second (cfs). In the summer/fall, when Umatilla River flow is below 250 cfs, source water is pumped from the aquifer into Umatilla River. All water is filtered via membrane ultra-filtration prior to distribution. Additionally, in the winter/spring, excess filtered water is pumped into the aquifer. An average of

800 million gallons of water per year are deposited and stored in the aquifer (City of Pendleton, 2021).

The shift in reliance to surface water has helped to reduce declines in groundwater aquifer storage volumes that were occurring prior to the construction of the Water Filtration Plant. Drinking water that has already been treated through the Water Filtration Plant is stored in the underground basalt aquifer system beneath the city. This treated water is stored during the winter months, when there is greater volume in the Umatilla River, and it is recovered during the summer months when the demand is higher, a process known as ASR (City of Pendleton, 2021). Three ASR wells are located in the City of Pendleton, with Well #14 ASR, the closest one to the facility, depicted on **Figure 2-4**. Approximately 1.9 million meters cubed of treated surface water are collectively injected into the permeable interflow zones of these underground aquifers from January to June, at depths between 60 and 150 meters (Bonneville et al., 2015).

2.2.4 Climate

The facility lies within a semi-arid low humidity climate. Air temperatures are regulated throughout the year by the Pacific Ocean. During the summer months, air from the Pacific is often stalled by high-pressure systems to the north or east, causing temperatures to rise. The resulting dry and hot southerly air allows for increased risk of wildfires in the region surrounding the facility. Wind in the area tends to be channeled along the Umatilla River valley, in conjunction with a prevailing westerly wind direction in the area, resulting in a prevailing west-southwest wind (US Climate Data, 2018).

Average annual precipitation is 12.83 inches, with the majority of rainfall between October through June. Snowfall occurs between October to March, with an annual average of 15.7 inches. The highest temperatures occur in July, at a mean maximum of 89.2 degrees Fahrenheit (°F). The lowest temperatures occur in January, with a mean minimum of 28.0 °F (National Oceanic and Atmospheric Administration, 1991-2020).

2.2.5 Current and Future Land Use

Pendleton AASF #2 encompasses 23.59 acres of land, on the northwestern city limits of Pendleton, Oregon. The facility is bound to the north and east by Eastern Oregon Regional Airport, to the west by farmland and the Pendleton National Weather Service, and to the south by various aviation facilities. A commercial and industrial park is located to the south of the aviation facilities, and a hiking area is located 0.25 miles to the southwest. A hotel is located approximately 0.5 miles to the southeast of the facility. Residential structures within a 1-mile radius of the facility include dispersed residential structures located to the south, east, and west. The closest residential structure is approximately 0.5-miles south of the facility.

The area surrounding the facility largely remains agricultural and rural in nature, with much of the surrounding land vacant. Pendleton City center is located approximately 3 miles southeast of the facility. While there is some growth expected in the overall region, future land use in the immediate area is not expected to change and will remain rural in character (Columbia Plateau Ecoregion, 2019). Pendleton AASF #2 is entirely fenced with restricted site access and is responsible for various training activities and aircraft maintenance. The ARNG lease for Pendleton AASF #2 expires in 2049, and activities and land use within the facility are not expected to change.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, fishes, insects, and mammals are federally endangered, threatened, proposed, and/ or are listed as candidate species in Umatilla County, Oregon (US Fish and Wildlife Service [USFWS], 2023).

- **Birds:** Yellow-billed Cuckoo, *Coccyzus americanus* (threatened)
- **Fishes:** Bull Trout, *Salvelinus confluentus* (threatened)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals:** Little brown bat, *Myotis lucifugus* (under review); Gray wolf, *Canis lupus* (endangered)

2.3 History of PFAS Use

Three AOIs were identified in the PA where AFFF may have been used, stored, disposed, or released historically at RTC (AECOM, 2020).

- AOI 1 – Eastern Detention Basin: AFFF was historically released at this AOI during familiarization training and fire training activities between approximately 1998 to 2013.
- AOI 2 – Ramp Area: AFFF was historically stored and released at this AOI during familiarization training and fire training activities between approximately 1998 to 2013.
- AOI 3 – Readiness Center: From approximately 1988 to 1992, a firetruck that potentially contained AFFF was parked at this former hangar.

The potential release areas were grouped into three AOIs based on preliminary data and presumed groundwater flow directions. A description of each AOI is presented in **Section 3**.

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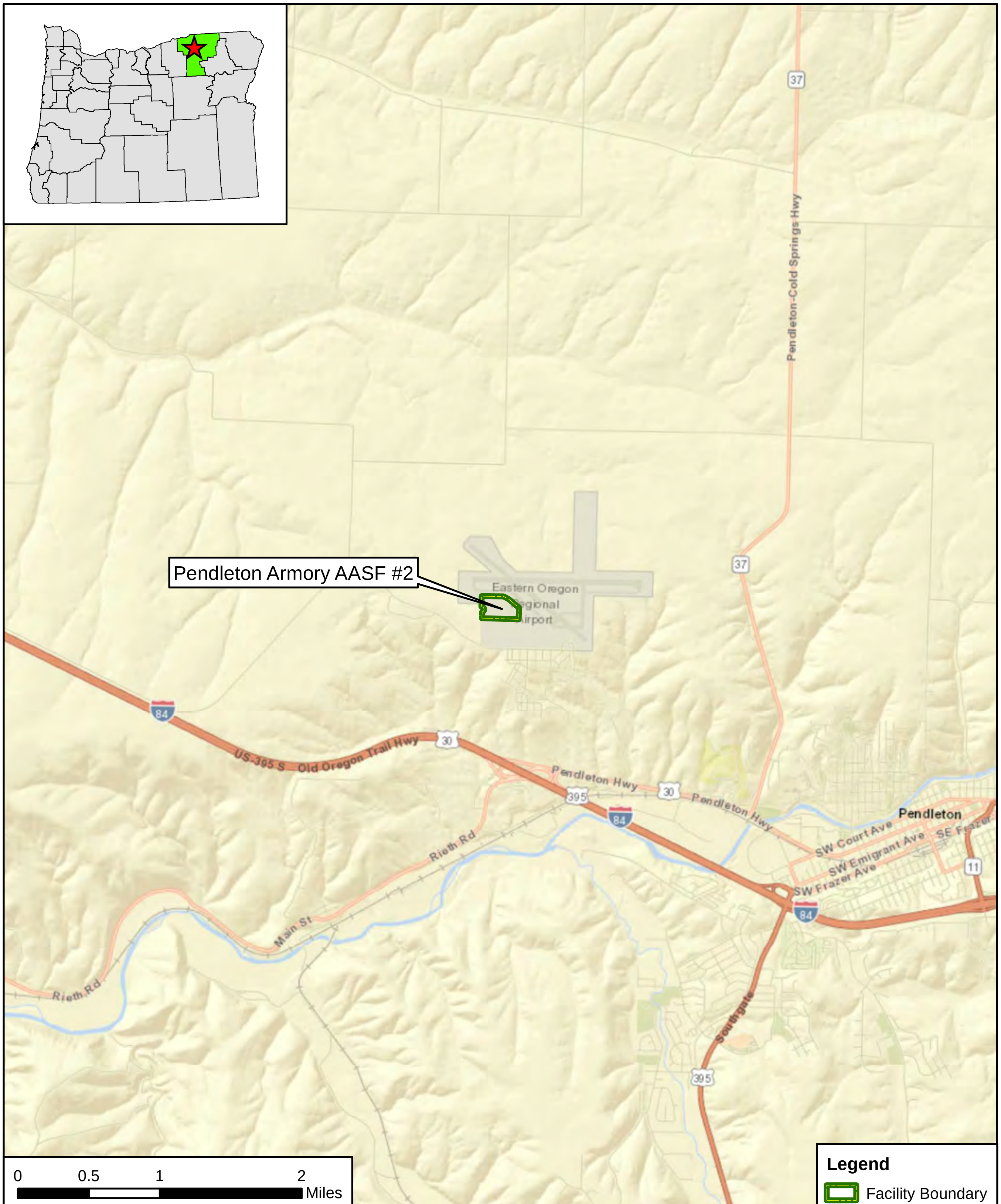


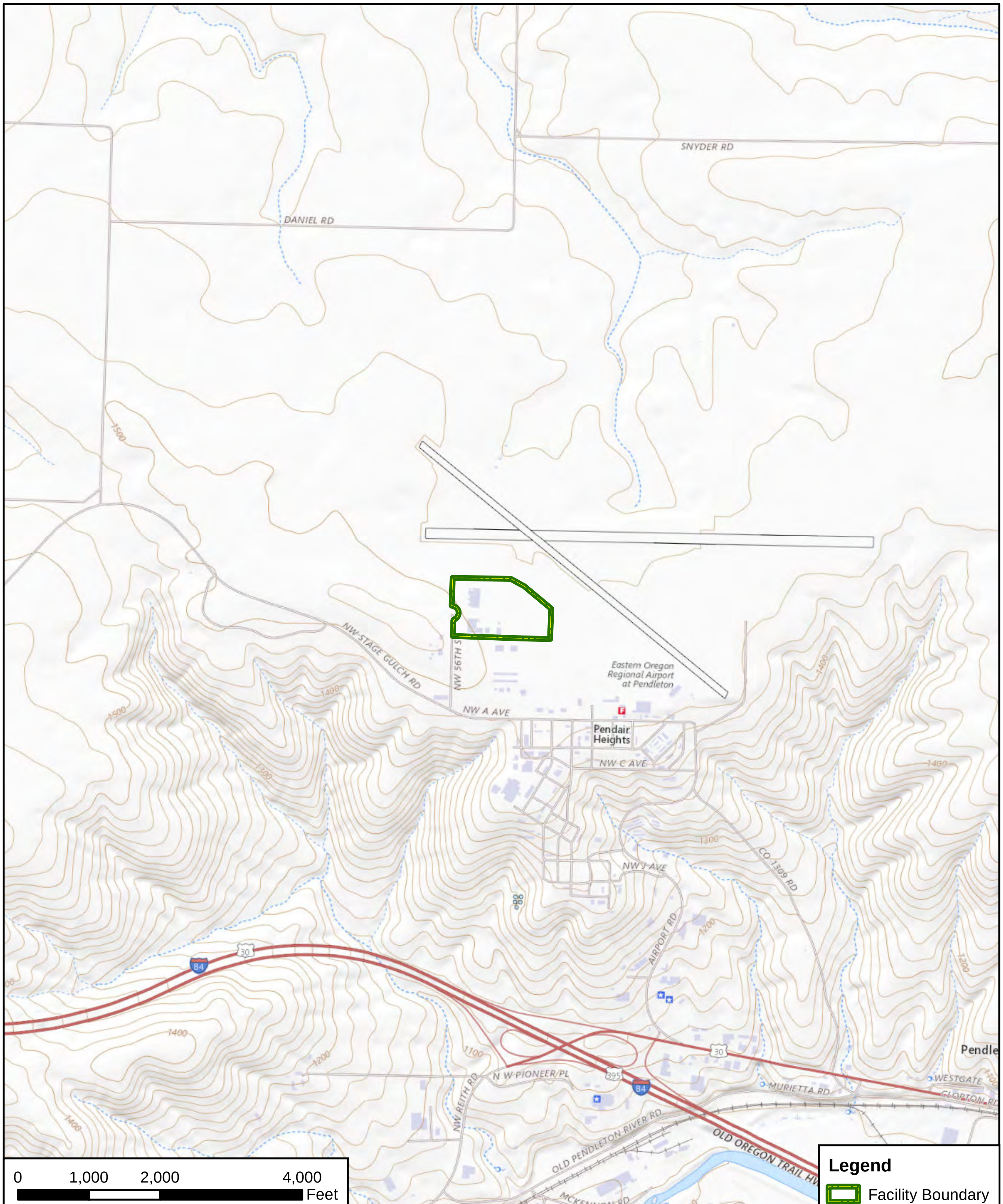
CLIENT	ARNG				
PROJECT	Site Inspection at Pendleton AASF #2, OR				
REVISED	2/2/2023	GIS BY	MS	2/2/2023	
SCALE	1:63,360	CHK BY	AP	2/2/2023	
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	2/2/2023	

N

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



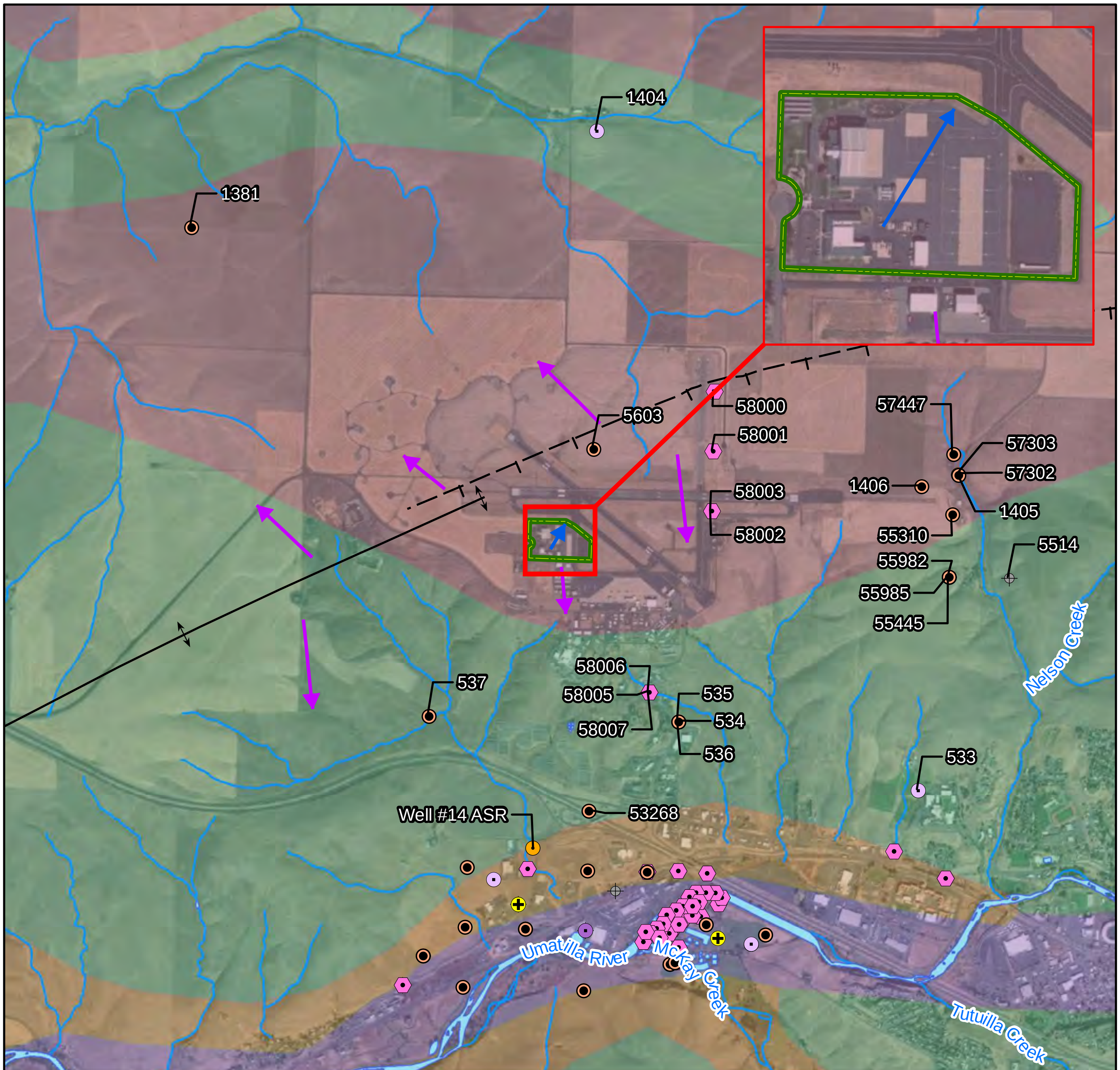
CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	5/11/2023	GIS BY	MS	5/11/2023
SCALE	1:24,000	CHK BY	AP	5/11/2023
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	5/11/2023

N

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Facility Boundary
Water Body
River/Stream
Groundwater Flow Direction
Inferred Groundwater Flow Direction, CRBG

0 1,750 3,500 7,000 Feet

Geology

Alluvial
Loess
Wanapum Basalt
Grand Ronde Basalt
Anticline
Normal Fault - Approximate

Wells

Domestic Well
Industrial Well
Irrigation Well
Community Well
Unknown/Other Well
Geotechnical Boring
ASR Well

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Pendleton AASF #2, OR			
REVISED	2/23/2023	GIS BY	MS	2/23/2023
SCALE	1:42,000	CHK BY	VG	2/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/23/2023

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Groundwater Features

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Germantown, MD 20876

Figure 2-3

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	3/20/2023	GIS BY	MS	3/20/2023
SCALE	1:1,800	CHK BY	VG	3/20/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/20/2023

Permanent Monitoring Well
Facility Boundary
Groundwater Elevation Contour
Inferred Groundwater Elevation Contour
Groundwater Flow Direction
Bedrock Elevation Contour
Inferred Bedrock Elevation Contour

Groundwater and bedrock elevations in ft NAVD88.
*Bedrock elevation contours measured based on depth to basalt observed during drilling.

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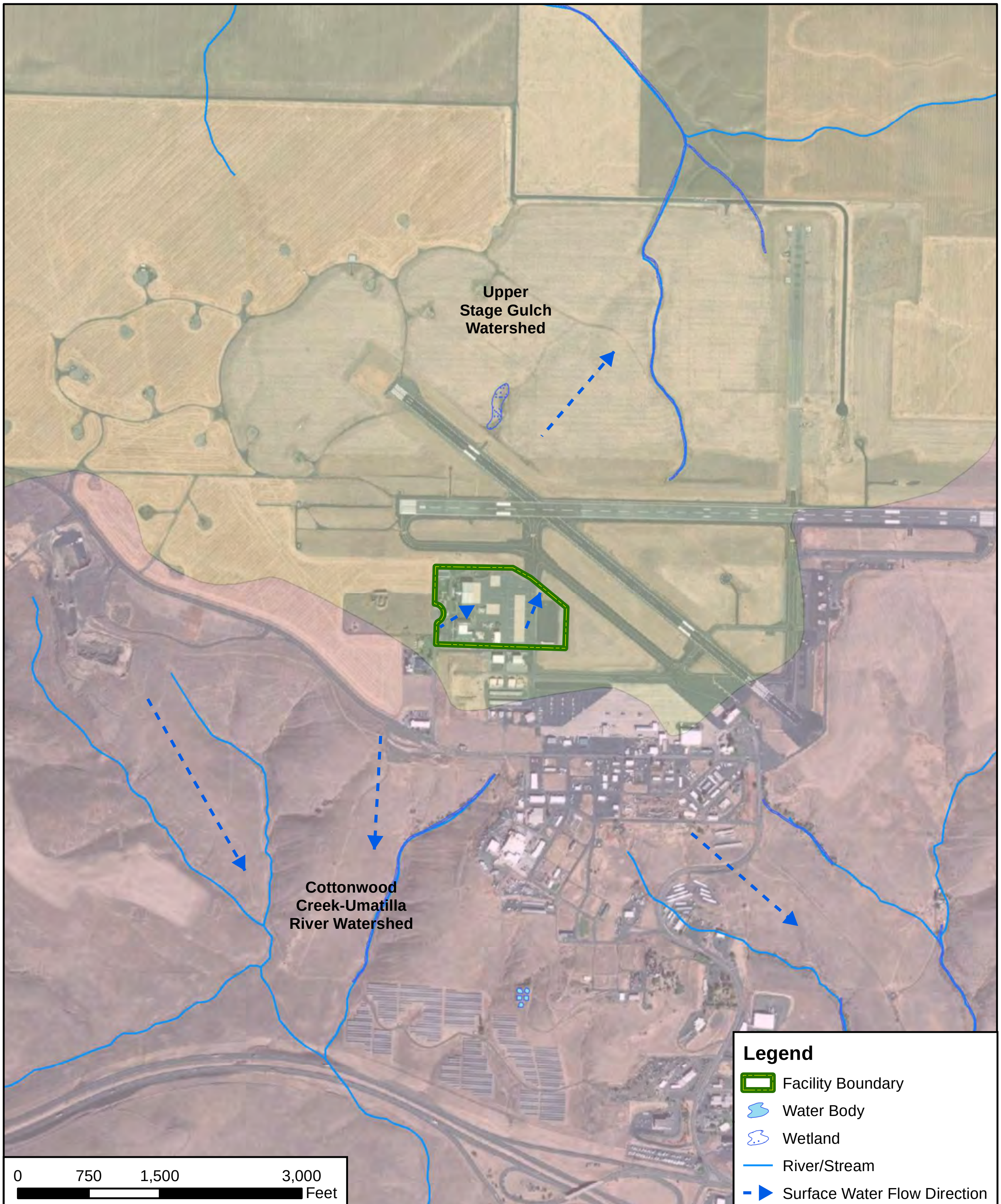
Groundwater Elevations, December 2022

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 2-4



CLIENT	ARNG				
PROJECT	Site Inspection at Pendleton AASF #2, OR				
REVISED	2/2/2023	GIS BY	MS	2/2/2023	
SCALE	1:18,000	CHK BY	AP	2/2/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/2/2023	

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Surface Water Features

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Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, three potential release areas were identified at Pendleton AASF #2 and grouped into three AOIs (AECOM, 2020). The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Eastern Detention Basin

AOI 1 is the Eastern Detention Basin. While two detention basins exist within the Pendleton AASF #2, only the eastern detention pond was used for fire training activities.

Approximately two to three full TriMax™ 30 mobile fire extinguishers, each containing approximately 30 gallons of concentrated AFFF, were released within and near the Detention Basin and edge of the ramp area every 2 to 3 years for nozzle practice and fire training activities. These nozzle releases occurred between approximately 1998 and 2013. Other fire training activities, including previous training events with the City of Pendleton Fire Department, burning of organic debris, and helicopter training exercises, all historically occurred in and around this Detention Basin; however, according to interviews, none of these activities involved the use or release of AFFF.

3.2 AOI 2 Ramp Area

AOI 2 is the Ramp Area used for helicopter staging. This area consists mostly of a mixture of paved asphalt and concrete on the eastern side of the facility, adjacent to the AOI 1 Detention Basin. As stated above, although a majority of the nozzle testing trainings, which occurred from approximately 1998 through 2013, involved the release of AFFF into the Eastern Detention Basin, some of the nozzle testing events carried over onto the edge of the Ramp Area. Additionally, during this same timeframe, 10 TriMax™ 30 mobile fire extinguishers were stored throughout the ramp area for emergency response purposes.

Spills or releases were not reported from TriMax™ 30 mobile fire extinguishers during the duration of their storage on the ramp area; however, long-term storage in non-climate-controlled areas leaves the potential for unintended spills or releases from mobile fire extinguishers. Any potential spills or releases in or around the Ramp Area would be captured in the trench drains and catch basins located throughout the facility and discharged into the western and eastern detention basins at the facility. The Ramp Area is located on the eastern side of the facility, with surface water and groundwater flow to the northeast, towards AOI 1.

3.3 AOI 3 Readiness Center

The Readiness Center is on the southwest corner of the facility. From approximately 1988 to 1992, a firetruck was parked at this former hangar. The firetruck originated from the Salem AASF and was stored at the hangar for several years. While one interviewee claimed the firetruck had AFFF present upon arrival to the facility, another interviewee claimed the firetruck only held non-PFAS containing material. The type, quantity, and concentration of AFFF (if ever present) on the firetruck during the storage period are unknown.

During interviews, it was confirmed that no firefighting material was removed, released, or transferred from the truck during the duration of storage at the Readiness Center. If the firetruck stored AFFF, there is potential for spills or releases from the truck. The Readiness Center is considered a potential release area.

3.4 Adjacent Sources

Two off-facility, potential sources were identified adjacent to Pendleton AASF #2 during the PA and are not associated with ARNG activities. The adjacent potential sources are shown on **Figure 3-1** and described in the following sections for informational purposes only and will not be investigated as part of this SI.

3.4.1 Eastern Oregon Regional Airport

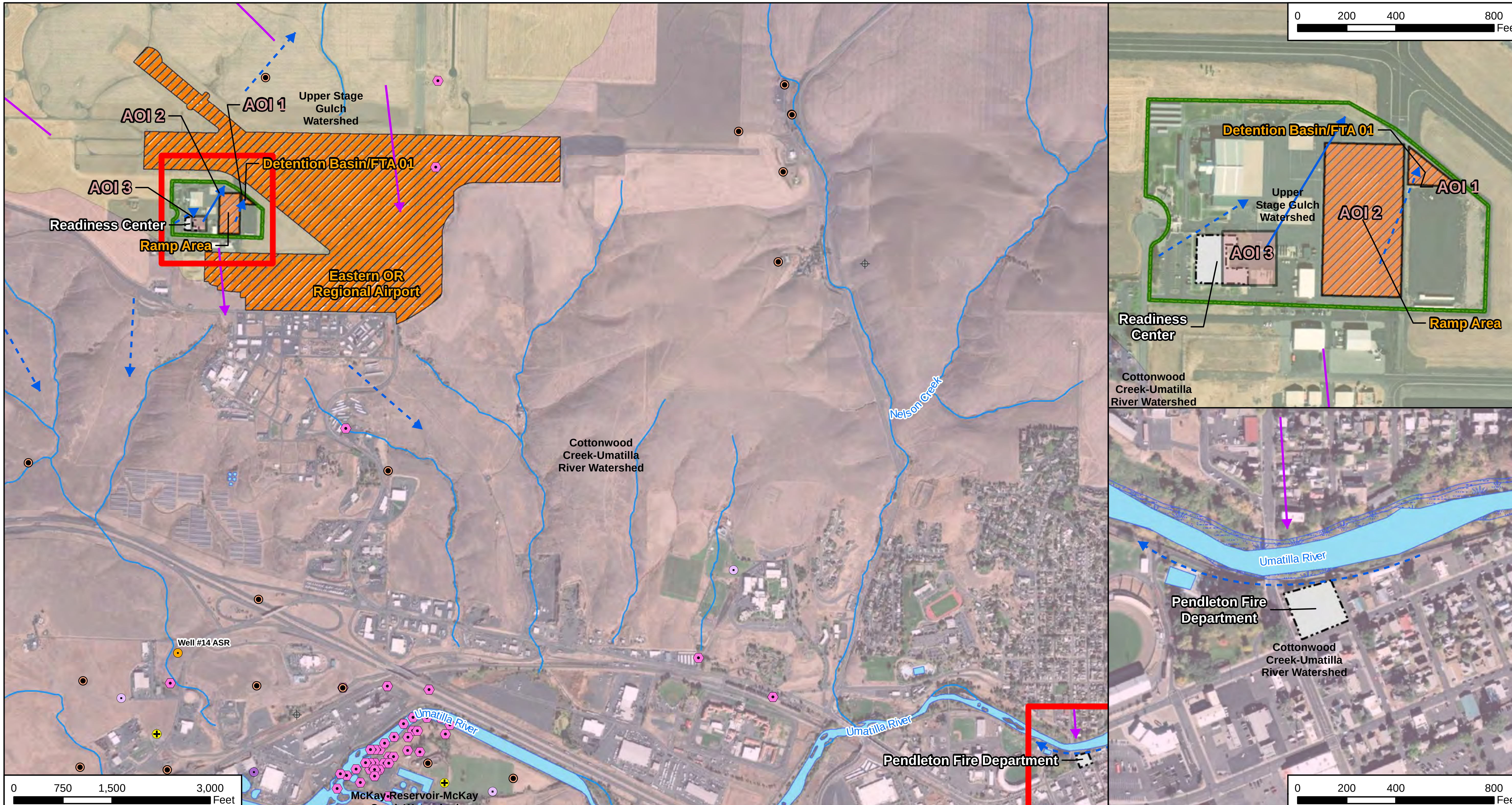
The Eastern Oregon Regional Airport is located directly adjacent to the Pendleton AASF #2, with Runway 7 directly north of the facility and Runway 11 extending diagonally to the eastern boundary of the facility. According to one interviewee, the City of Pendleton Fire Department has an AFFF-capable firetruck stored at the Eastern Oregon Regional Airport for aviation-related emergency response incidents. It is believed that this firetruck was never used or deployed during its storage at the airport; however, the timeframe for storage of this firetruck could not be confirmed, and airport personnel could not confirm if the firetruck is still parked within the airport.

Several emergency response incidents have historically occurred at the Eastern Oregon Regional Airport. During interviews, the City of Pendleton Fire Chief confirmed that an aviation crash occurred in June 2017 that involved the use of AFFF. The crash occurred on the airfield adjacent to the Pendleton AASF #2, and an unknown amount of AFFF from the City of Pendleton fire department was used to suppress the fire. According to the Fire Chief, the City of Pendleton Fire Department has multiple firetrucks with AFFF-capabilities that assists in responding to aviation-related emergency response activities. A mixture of 3% and 6% AFFF were used to aid in fire suppression for this emergency response incident. During the PA, interviewees reported that other emergency response incidents involving the use of AFFF have historically occurred at the Eastern Oregon Regional Airport; however, exact dates and potential quantities of AFFF released during these emergency response incidents are unknown.

The Eastern Oregon Regional Airport conducts yearly nozzle testing as required by the FAA. The two AFFF-capable firetrucks go to various areas throughout the airport to release several gallons of concentrated AFFF during nozzle testing. Interviewees stated that the nozzle testing only occurs once per year and requires the release of several gallons of concentrated AFFF; however, the location of these nozzle tests varies and happens at randomly chosen areas throughout the airport. The Eastern Oregon Regional Airport has bulk AFFF stored inside of the fire station within 5-gallon buckets. This bulk AFFF is only used to refill firetrucks following emergency response activities or yearly nozzle testing activities. The exact quantity and concentration of AFFF stored within the fire station at the airport could not be confirmed.

3.4.2 City of Pendleton Fire Department

The City of Pendleton Fire Department is located approximately 4 miles southeast of the Pendleton AASF #2, along the Umatilla River. This adjacent potential source is identified for informational purposes, and given the presumed and measured groundwater flow of the area, potential PFAS impacts from this adjacent source are not anticipated to migrate towards the facility.



CLIENT	ARNG
PROJECT	Site Inspection at Pendleton AASF #2, OR

REVISED	2/23/2023	GIS BY	MS	2/23/2023
SCALE	1:4,800	CHK BY	AP	2/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/23/2023

Area of Interest
Potential Release Area
No Suspected Release
Facility Boundary
Water Body
Wetland
River/Stream
Surface Water Flow Direction
Inferred Groundwater Flow Direction
Groundwater Flow Direction
Domestic Well Log
Industrial Well Log
Irrigation Well Log
Community Well Log
Unknown/Other Well Log
Geotechnical Hole Well Log
ASR Well

N

Areas of Interest

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2022a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

ARNG will recommend an AOI for Remedial Investigation (RI) if related soil and groundwater samples have concentrations of the relevant compounds above the OSD risk-based SLs. The SLs are presented in **Section 6.1** of this report.

4.2 Information Inputs

Primary information inputs included:

- The PA for Pendleton AASF #2 (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2022a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). Temporal boundaries were limited to the summer season, which was the earliest available time field resources were available to complete the study.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2022a).

4.5 Data Usability Assessment

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2019a; DoD, 2019b; USEPA, 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2022a).

5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and implemented in accordance with the following approved documents:

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Pendleton Army Aviation Support Facility #2, Pendleton* dated May 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility #2, Pendleton, Oregon* dated August 2022 (AECOM, 2022a); and
- *Final Site Safety and Health Plan, Army Aviation Support Facility #2, Pendleton, Oregon* dated August 2022 (AECOM, 2022b).

The SI field activities were conducted from 29 August to 31 August, 1 September to 15 September 2022 and consisted of utility clearance, sonic drilling, soil sample collection, temporary and permanent monitoring well installation, well development, and groundwater sample collection. Land surveying and synoptic depth to groundwater measurement was conducted on 14 December 2022. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a).

The following samples were collected during the SI and analyzed for a subset of 18 compounds by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Thirty-six (36) soil samples from seven (7) sonic borings and nineteen (19) hand auger locations;
- Four (4) grab groundwater samples from three (3) temporary well locations;
- Four (4) groundwater samples from four (4) permanent well locations; and
- Twenty (20) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, and land survey data are provided in **Appendix B3**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

In preparation for the SI field activities, project team members participated in Technical Project Planning (TPP) meetings, performed utility clearance, and sampled decontamination source water. Details for each of these activities are presented below.

5.1.1 Technical Project Planning

The US Army Corps of Engineers (USACE) TPP Process, Engineer Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 18 February 2022, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, ORARNG, USACE, and Oregon Department of Environmental Quality (ORDEQ). Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2022a).

A TPP Meeting 3 was held after the field event (TBD) to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM placed a ticket with the USA North 811 “Call Before You Dig” Oregon utility clearance provider to notify them of intrusive work on 26 September and 24 August 2022. Additionally, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 29 August 2022 with input from the AECOM field team and Pendleton AASF #2 facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger and/or air knife to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

One potable water source at Pendleton AASF #2 was sampled on 9 June 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected from a spigot (PAASF-DECON-01) connected to the Readiness Center confirmed this source to be acceptable for use in this investigation; therefore, it was used throughout the field activities. Water at the facility is provided by the City of Pendleton and is sourced offsite. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water sample associated with the wash rack spigot source used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2022a). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via sonic drilling technology and hand auger in accordance with the SI QAPP Addendum (AECOM, 2022a). A Terra Sonic International (TSi) 150CC Sonic Drill Rig was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and depths are provided **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the saturated soil or bedrock, and one subsurface soil sample at the mid-point between the surface and saturated soil or bedrock. At AOI02-01, subsurface soil samples could not be collected due to shallow bedrock; therefore, only the surface soil sample (0 to 2 feet bgs) was collected. To supplement the drilled boring locations, additional surface soil samples were collected at other locations within each AOI using a hand auger.

The soil cores were continuously logged for lithological descriptions by an AECOM field geologist using the Unified Soil Classification System (USCS). A photoionization detector (PID) was used to screen the breathing zone during boring activities as part of personal safety requirements. Observations and measurements were recorded on boring logs (**Appendix E**) and in a non-treated field logbook (i.e., composition notebook). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded.

During the SI, borings were completed to depths ranging between 20 to 33 feet bgs. Soils observed generally consisted of dry silts with varying quantities of sand and gravel. Weathered and broken basalt bedrock was observed as shallow as 3.5 feet bgs, and strong, intact basalt bedrock was observed as shallow as 12 feet bgs. The basalt was generally observed to be aphanitic and variably oxidized. Water bearing vesicles were observed in basalt in borings within AOI 2 and AOI 3 from 15 to 33 feet bgs. Small quantities of clay were observed within fractures at AOI02-02 and AOI03-01, at depths ranging between 26 to 33 feet bgs. The clay appears to be a byproduct of water weathering the parent basalt rock. The observed silts may consist of a mixture of fill and loess, and the basalt encountered appears consistent with the mapped Wanapum Basalt underneath the facility. Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike/matrix spike duplicates (MS/MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

Sonic borings were converted to temporary wells and/or permanent monitoring wells. The temporary wells were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2022a) using bentonite chips at completion of sampling activities.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Three temporary wells were installed using a TSi 150CC Sonic Drill Rig (AOI01-01S, AOI01-02, and AOI01-03). Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-foot section of 2-inch diameter, 0.020-inch slotted Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-3**.

Location AOI01-01 was initially installed as a temporary well (AOI01-01S). The temporary well was removed after sampling, and location AOI01-01 was drilled to a deeper depth and converted to a permanent monitoring well (AOI01-01D, discussed in **Section 5.4**).

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, turbidity, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected. At two wells (AOI01-01S and AOI01-02), limited groundwater recharge rates were observed. Subsequently, in accordance with the SI QAPP Addendum, samples were collected prior to turbidity stabilization or reduction to ≤ 25 nephelometric turbidity units. As discussed in **Section 5.4**, AOI01-01 was redrilled to a deeper depth and sampled as a permanent well. AOI01-02 was initially sampled after installation, but due to low recharge and high turbidity, it was allowed to recharge overnight and was resampled the following day. However, similar limited recharge conditions were encountered at AOI01-02; therefore, the well was sampled prior to turbidity stabilization or reduction to ≤ 25 nephelometric turbidity units.

Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

The temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2022a) by removing the PVC and backfilling the hole with 3/8-inch hydrated bentonite gravel. Upon completion of well abandonment, the ground surface at each location was patched to match existing surrounding conditions.

5.4 Permanent Well Installation and Groundwater Sampling

During the SI, four permanent monitoring wells (AOI01-01D, AOI02-01, AOI02-02, and AOI03-01) were installed within or in the vicinity of their respective AOIs. The locations of the wells are shown on **Figure 5-2**.

A TSi 150CC Sonic Drill Rig drill rig was used to install four monitoring wells. The monitoring wells were constructed with 2-inch diameter Schedule 40 PVC, flush threaded 10-foot sections of riser, with a 0.020-inch slotted well screen and a threaded bottom cap. The filter pack of 2/12 Cemex sand was installed at least 1 foot above the top of the well screen. A well seal consisting of hydrated bentonite chips was placed above the sand pack. All monitoring wells were completed with flush mount well vaults, with the exception of AOI02-01, which has stickup completion. Bollards were also installed around AOI02-01. Wells were installed, completed, and developed accordance with Oregon Administrative Rules Chapter 690 Division 240. The screen interval of each of the groundwater monitoring wells is provided in **Table 5-3**.

Development and sampling of wells was completed in accordance with the SI QAPP Addendum (AECOM, 2022a). The newly installed monitoring wells were developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Samples were collected no sooner than 24 hours following development via low-flow sampling methods using a peristaltic pump with disposable PFAS-free, HDPE tubing. New tubing was used at each well and the pumps were decontaminated between each well. The wells were purged at a rate determined in the field to reduce draw down prior to sampling. Water quality parameters (e.g., temperature, turbidity, specific conductance, pH, DO, and ORP) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container and a shaker test was completed to identify if there was any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2022a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

5.5 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 14 December 2022. Groundwater elevation measurements were collected from the four new permanent monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.6 Surveying

The northern side of each well casing was surveyed by Oregon-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022a). Survey data from the newly installed wells on the facility were collected on 14 December 2022 in the applicable Universal Transverse Mercator zone projection with both horizontal datums North American Datum of 1983 (NAD83) and World Geodetic System 1984 (WGS84). Survey data was collected in vertical datum North American Vertical Datum 1988 (NAVD88). The surveyed well data are provided in **Appendix B3**.

5.7 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2022a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil and rock IDW (i.e., soil and rock cuttings) generated during the SI activities were contained in labeled, 55-gallon Department of Transportation (DOT)-approved steel drums and left onsite in a designated waste storage area located along the southern boundary of AOI 2. The soil IDW was not sampled and assumes the characteristics of the associated soil samples collected from that source location. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW under a separate contract.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were contained in labeled, 55-gallon DOT-approved steel drums, and left onsite with the soil and rock IDW. The liquid IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location. Containerized liquid IDW will be managed and disposed of by ARNG (either by offsite disposal or onsite disposal with treatment, as appropriate) under a separate contract in accordance with SOP No. 042A (EA, 2021).

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other environmental media generated during the field activities were disposed of at a licensed solid waste landfill.

5.8 Laboratory Analytical Methods

Samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.9 Deviations from SI QAPP Addendum

No deviations from the SI QAPP Addendum were identified during the review of field documentation.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Pendleton AASF #2, Oregon

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	8/31/2022 8:35	0 - 2	X				
AOI01-01-SB-5-7	8/31/2022 11:25	5 - 7	X				
AOI01-01-SB-8.5-10.5	8/31/2022 11:30	8.5 - 10.5	X				
AOI01-02-SB-0-2	8/30/2022 11:10	0 - 2	X				
AOI01-02-SB-5-6	8/30/2022 15:00	5 - 6	X				
AOI01-02-SB-7-8	8/30/2022 15:05	7 - 8	X				
AOI01-03-SB-0-2	8/31/2022 9:25	0 - 2	X				
AOI01-03-SB-5-6	8/31/2022 13:05	5 - 6	X				
AOI01-03-SB-8-10	8/31/2022 13:10	8 - 10	X				
AOI01-04-SB-0-2	8/31/2022 10:20	0 - 2	X				
AOI01-05-SB-0-2	8/31/2022 9:40	0 - 2	X				
AOI01-06-SB-0-2	9/6/2022 13:15	0 - 2	X				
AOI01-07-SB-0-2	9/6/2022 12:50	0 - 2	X				
AOI01-07-SB-0-2-DUP	9/6/2022 12:50	0 - 2	X				FD
AOI01-08-SB-0-2	9/6/2022 12:30	0 - 2	X				
AOI01-09-SB-0-2	8/31/2022 8:55	0 - 2	X				
AOI01-09-SB-0-2-DUP	8/31/2022 8:55	0 - 2	X				FD
AOI01-10-SB-0-1	8/29/2022 15:10	0 - 1	X				
AOI01-10-SB-0-1-MS	8/29/2022 15:10	0 - 1	X				
AOI01-10-SB-0-1-MSD	8/29/2022 15:10	0 - 1	X				MS
AOI01-11-SB-0-1	8/29/2022 15:50	0 - 1	X	X	X		MSD
AOI01-11-SB-0-1-DUP	8/29/2022 15:50	0 - 1	X	X	X		FD
AOI01-12-SB-0-1	8/29/2022 15:50	0 - 1	X				
AOI01-12-SB-0-1-DUP	8/29/2022 15:50	0 - 1	X				FD
AOI01-13-SB-0-2	9/6/2022 11:45	0 - 2	X				
AOI01-14-SB-0-2	9/6/2022 11:30	0 - 2	X				
AOI02-01-SB-1-2	8/30/2022 9:25	1 - 2	X				
AOI02-02-SB-0-2	8/30/2022 8:55	0 - 2	X	X	X		
AOI02-02-SB-5-6	8/31/2022 14:10	5 - 6	X				
AOI02-02-SB-8-10	8/31/2022 14:15	8 - 10	X				
AOI02-03-SB-0-0.5	9/6/2022 13:40	0 - 0.5	X				
AOI02-04-SB-0-0.5	9/6/2022 13:55	0 - 0.5	X				
AOI02-05-SB-0-0.5	9/6/2022 14:05	0 - 0.5	X				
AOI02-06-SB-0-2	8/30/2022 16:30	0 - 2	X				
AOI02-07-SB-0-0.5	9/6/2022 10:30	0 - 0.5	X				
AOI02-08-SB-0-1	9/6/2022 10:00	0 - 1	X				
AOI02-09-SB-0-0.5	9/6/2022 10:50	0 - 0.5	X				
AOI03-01-SB-0-0.5	8/31/2022 15:00	0 - 0.5	X	X	X		
AOI03-01-SB-0-0.5-DUP	8/31/2022 15:00	0 - 0.5	X				FD
AOI03-01-SB-5-6	9/1/2022 9:55	5 - 6	X				
AOI03-01-SB-8-10	9/1/2022 10:00	8 - 10	X				
AOI03-02-SB-0-0.5	8/31/2022 15:05	0 - 0.5	X				
AOI03-02-SB-0-0.5-MS	8/31/2022 15:05	0 - 0.5	X				MS
AOI03-02-SB-0-0.5-MSD	8/31/2022 15:05	0 - 0.5	X				MSD
AOI03-03-SB-0-1	8/31/2022 15:25	0 - 1	X	X	X		
AOI03-03-SB-0-1-MS	9/2/2022 9:00	0 - 1	X	X	X		MS
AOI03-03-SB-0-1-MSD	9/2/2022 9:00	0 - 1	X	X	X		MSD

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Pendleton AASF #2, Oregon

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Groundwater Samples							
AOI01-01-GW	9/1/2022 14:35	NA	X				(AOI01-01S)
AOI01-01-GW-20220915	9/15/2022 9:50	NA	X				(AOI01-01D)
AOI01-01-GW-20220915-D	9/15/2022 9:50	NA	X				(AOI01-01D) FD
AOI01-01-GW-MS	9/15/2022 9:50	NA	X				(AOI01-01D) MS
AOI01-01-GW-MSD	9/15/2022 9:50	NA	X				(AOI01-01D) MSD
AOI01-02-GW	8/31/2022 9:45	NA	X				
AOI01-02-GW-2	9/1/2022 15:45	NA	X				
AOI01-03-GW	9/1/2022 14:10	NA	X				
AOI02-01-GW	9/15/2022 9:00	NA	X				
AOI02-02-GW	9/15/2022 10:35	NA	X				
AOI03-01-GW	9/15/2022 11:20	NA	X				
Quality Control Samples							
PAASF-DECON-01	6/9/2022 7:25	NA	X				Spigot
PAASF-DECON-02	9/1/2022 9:15	NA	X				Decon System
PAASF-ERB-01	8/29/2022 14:40	NA	X				Hand Auger
PAASF-ERB-02	8/29/2022 14:45	NA	X				Shovel
PAASF-ERB-03	9/1/2022 8:15	NA	X				Sonic Bit
PAASF-FRB-01	8/29/2022 14:50	NA	X				

Notes:
AOI = Area of Interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
PAASF = Pendleton AASF #2
QSM = Quality Systems Manual
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals
Site Inspection Report, Pendleton AASF #2, Pendleton, Oregon

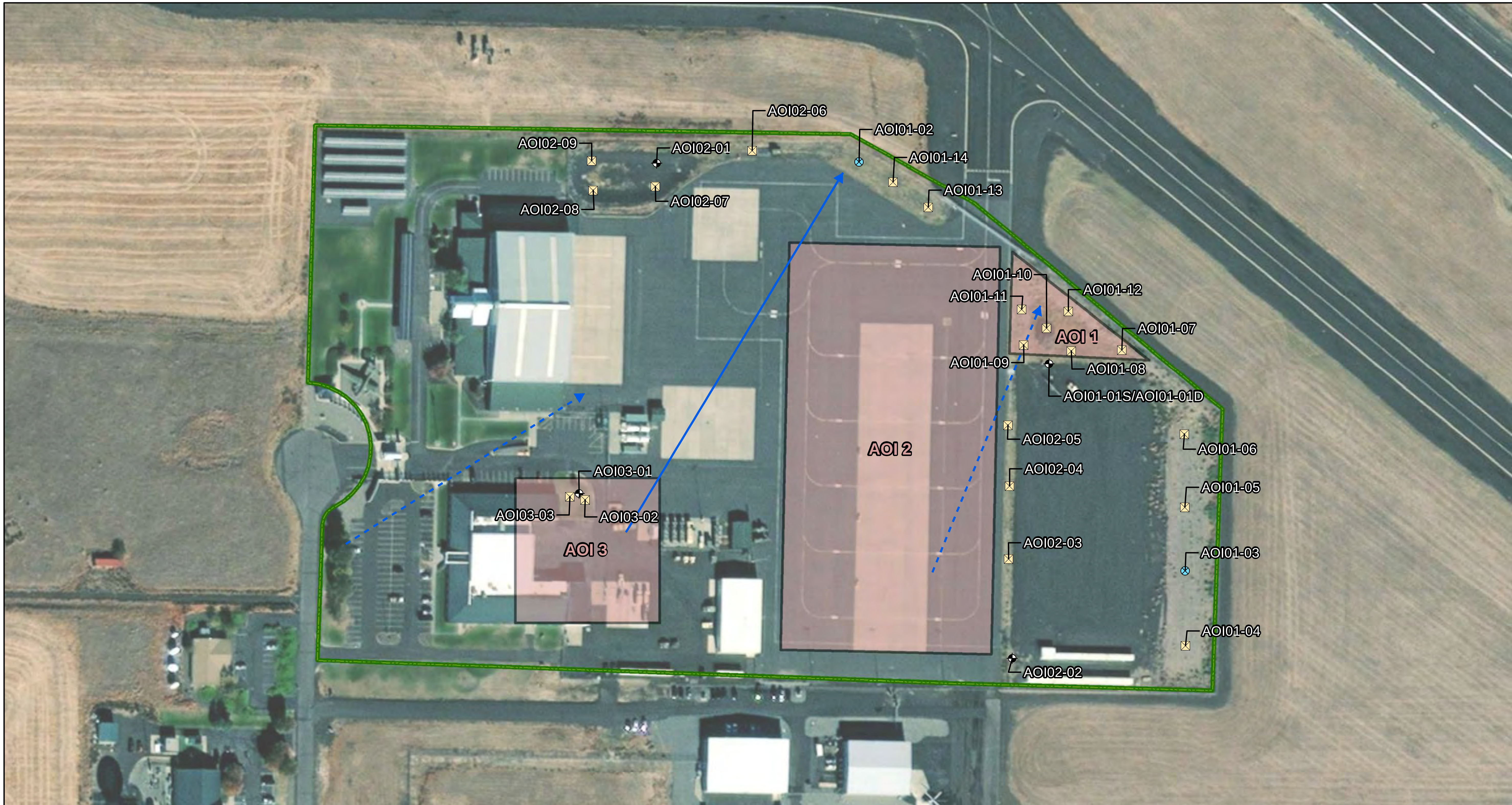
Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Permanent Well Screen Interval (feet bgs)
1	AOI01-01S*	20	15 - 20
	AOI01-01D*	33	13 - 33
	AOI01-02	20	15 - 20
	AOI01-03	20	15 - 20
2	AOI02-01	31	15 - 30
	AOI02-02	33	13 - 33
3	AOI03-01	40	20 - 40

Notes:
*AOI01-01S was later overdrilled and replaced with permanent monitoring well AOI01-01D (see Table 5-3)
AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
S = shallow
D = deep

Table 5-3
Permanent Monitoring Well Screen Intervals and Groundwater Elevations
Site Inspection Report, Pendleton AASF #2, Pendleton, Oregon

Area of Interest	Monitoring Well ID	Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	AOI01-01D*	13 - 33	1485.60	1485.89	18.56	18.85	1467.04
2	AOI02-01	15 - 30	1485.13	1482.59	18.35	15.81	1466.78
	AOI02-02	13 - 33	1487.78	1488.00	18.92	19.14	1468.86
3	AOI03-01	20 - 40	1494.17	1494.52	23.52	23.87	1470.65

Notes:
*Location originally installed as a temporary well (AOI01-01S, as shown in Table 5-2) and was later overdrilled to install permanent well AOI01-01D
AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
btoc = below top of casing
D = deep
S = shallow
NA = not applicable
NAVD88 = North American Vertical Datum 1988



CLIENT	ARNG				
PROJECT	Site Inspection at Pendleton AASF #2, OR				
REVISED	2/23/2023	GIS BY	MS	2/23/2023	
SCALE	1:1,800	CHK BY	AP	2/23/2023	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/23/2023	

Legend

- Permanent Monitoring Well
- Temporary Monitoring Well
- Surface Soil Sample
- Area of Interest
- Facility Boundary
- Surface Water Flow Direction
- Groundwater Flow Direction

0 75 150 300 Feet

N

Site Inspection Sample Locations

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.5**. **Table 6-2** through **Table 6-4** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 6 July 2022 (Assistant Secretary of Defense, 2022). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1** below.

Table 6-1: Screening Levels (Soil and Groundwater)

Analyte[b]	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter
a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.
b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

The data in the subsequent sections are compared against the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the facility: the residential scenario is applied to surface soil results (0 to 2 feet bgs) and the industrial/commercial worker scenario is applied to shallow subsurface soil results (2 to 15 feet bgs). The SLs are not applied to deep subsurface soil results (>15 feet bgs) because 15 feet is the anticipated limit of construction activities.

6.2 Soil Physicochemical Analyses

To provide basic soil parameter information, soil samples were analyzed for TOC and pH, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC and pH sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy, 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Eastern Detention Basin. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-4**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI01-01 through AOI01-14. Soil was also sampled from shallow subsurface soil (5 to 10.5 feet bgs) from boring locations AOI01-01 through AOI01-03. Deep subsurface samples (>15 feet bgs) were not collected. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

In surface soil, PFOS exceeded the 13 micrograms per kilogram (µg/kg) SL at two locations, at concentrations of 31.0 µg/kg (AOI01-06) and 17.8 µg/kg (AOI01-12). PFOA, PFBS, PFHxS, and PFNA were detected in surface soil at concentrations at least one order of magnitude below the SLs. The maximum detected concentration was PFHxS at 11.2 µg/kg at AOI01-06.

In shallow subsurface soil, PFOS was detected at two locations. Detected concentrations were at least one order of magnitude below the 160 µg/kg SL, with a maximum concentration of 3.79 J+ µg/kg at AOI01-01 (5 to 7 feet bgs). PFOA, PFBS, PFHxS, and PFNA were not detected in shallow subsurface soil at AOI 1.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater was sampled from permanent monitoring well AOI01-01D and temporary monitoring wells AOI01-01S, AOI01-02, and AOI01-03. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-4** summarizes the groundwater results.

The following exceedances of the SLs were measured:

- PFOA was detected above the 6 nanograms per liter (ng/L) SL at one of the four wells, with a concentration of 7.84 J ng/L at AOI01-02.
- PFOS was detected above the 4 ng/L SL at two of the four wells, with concentrations of 31.0 J ng/L at AOI01-02 and 4.54 J ng/L at AOI01-03.

- PFHxS was detected above the 39 ng/L SL at one of the four wells, with a maximum concentration of 124 J ng/L at AOI01-02.
- PFNA was detected above the 6 ng/L SL at one of the four wells, with a concentration of 12.1 ng/L at AOI01-02.

PFBS was detected in groundwater at four of the wells at AOI 1, but below the below the 601 ng/L SL.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOS was detected in soil above the SLs. PFOA, PFOS, PFHxS, and PFNA were detected in groundwater at concentrations above the SLs. Based on the exceedances of the SLs in soil and groundwater, further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2: Ramp Area. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI02-01 through AOI02-09. Soil was also sampled from shallow subsurface soil (5 to 10 feet bgs) from boring location AOI02-02. Deep subsurface soil samples (>15 feet bgs) were not collected. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

In surface soil, PFOA, PFOS, PFHxS, and PFNA were detected at concentrations below the SLs. The maximum detected concentration was PFOS at 7.38 µg/kg at AOI02-08. PFBS was not detected in surface soil. Relevant compounds were not detected in shallow subsurface soil at AOI 2.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from permanent monitoring wells AOI2-01 and AOI2-02. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-4** summarizes the groundwater results. The following exceedances of the SLs were measured:

- PFOA was detected above the 6 ng/L SL at one of the two wells, with a concentration of 18.1 ng/L at AOI02-1.
- PFOS was detected above the 4 ng/L SL at both wells, with concentrations of 5.15 ng/L at AOI02-01 and 6.67 ng/L at AOI02-02.
- PFHxS was detected above the 39 ng/L SL at one of the two wells, with a concentration of 519 ng/L at AOI02-01.

PFBS and PFNA were detected in groundwater at AOI 2 below the SLs.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, relevant compounds were detected in soil below the SLs. PFOA, PFOS and PFHxS were detected in groundwater at concentrations above the SLs. Well AOI02-02 is located along the facility boundary and is in the upgradient portion of the facility based on the groundwater elevations measured during the SI, indicating that there may be an adjacent, offsite source. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 2 is warranted.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3: Readiness Center. The results in soil and groundwater are presented in **Table 6-2** through **Table 6-4**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.5.1 AOI 3 Soil Analytical Results

Soil was sampled from surface soil (0 to 1 feet bgs) from boring locations AOI03-01 through AOI03-03. Soil was also sampled from shallow subsurface soil (5 to 10 feet bgs) from boring location AOI03-01. Deep subsurface soil samples (>15 feet bgs) were not collected. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

In surface soil, PFOA, PFOS, PFBS, PFHxS, and PFNA were detected at concentrations below the SLs. The maximum detected concentration was PFOS at 1.61 µg/kg at AOI03-01.

In shallow subsurface soil, PFOA, PFOS, PFBS, PFHxS, and PFNA were detected at concentrations below the SLs. The maximum detected concentration was PFNA at 59.4 µg/kg at AOI03-01 (5 to 6 feet bgs).

6.5.2 AOI 3 Groundwater Analytical Results

Groundwater was sampled from permanent monitoring well AOI03-01. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-4** summarizes the groundwater results. PFOA, PFBS, and PFHxS were detected in groundwater at concentrations below the SLs. The maximum detected concentration was PFBS at 22.5 ng/L. PFOS and PFNA were not detected in groundwater at AOI 3.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, relevant compounds were detected in soil and groundwater below the SLs. However, as AOI 3 is located upgradient of AOI 1 and AOI 2 at which exceedances of soil and groundwater were observed, further evaluation of AOI 3 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Pendleton Army Aviation Support Facility #2

	Area of Interest	AOI01																			
	Sample ID	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOIO1-04-SB-0-2		AOI01-05-SB-0-2		AOI01-06-SB-0-2		AOI01-07-SB-0-2		AOI01-07-SB-0-2-D		AOI01-08-SB-0-2		AOI01-09-SB-0-2	
	Sample Date	08/31/2022		08/30/2022		08/31/2022		08/31/2022		08/31/2022		09/06/2022		09/06/2022		09/06/2022		09/06/2022		08/31/2022	
	Depth	0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	UJ	0.539	J	0.028	J	ND	UJ	ND	U	ND	U
PFHxS	130	ND	U	0.036	J	0.040	J	0.033	J	0.061	J+	11.2		0.071	J	0.048	J	3.50		0.116	J
PFNA	19	ND	U	0.167	J	0.023	J	0.025	J	0.069	J+	0.262	J	ND	U	ND	U	ND	U	0.189	J
PFOA	19	ND	U	ND	U	ND	U	0.185	J	0.164	J+	0.953	J	ND	U	ND	U	0.398	J	0.085	J
PFOS	13	0.061	J	0.539	J	0.123	J	0.094	J	0.228	J+	31.0		0.154	J	0.109	J	2.25		0.360	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References
a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers
J = Estimated concentration
J+ = Estimated concentration, biased high
U = The analyte was not detected at a level greater than or equal to the adjusted DL
UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Pendleton Army Aviation Support Facility #2

	Area of Interest	AOI01														AOI02					
	Sample ID	AOI01-09-SB-0-2-DUP		AOI01-10-SB-0-1		AOI01-11-SB-0-1		AOI01-12-SB-0-1		AOI01-12-SB-0-1-DUP		AOI01-13-SB-0-2		AOI01-14-SB-0-2		AOI02-01-SB-1-2		AOI02-02-SB-0-2		AOI02-03-SB-0-0.5	
	Sample Date	08/31/2022		08/29/2022		08/29/2022		08/29/2022		08/29/2022		09/06/2022		09/06/2022		08/30/2022		08/30/2022		09/06/2022	
	Depth	0-2 ft		0-1 ft		0-1 ft		0-1 ft		0-1 ft		0-2 ft		0-2 ft		1-2 ft		0-2 ft		0-0.5 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	0.023	J	ND	U	ND	UJ	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.072	J	0.196	J	0.177	J	0.166	J	0.346	J	0.046	J	ND	U	ND	U	0.051	J	0.034	J
PFNA	19	0.143	J	0.289	J	0.090	J	0.526	J	0.807	J	0.130	J	0.029	J	0.029	J	0.261	J	0.243	J
PFOA	19	ND	UJ	0.225	J	0.583	J	0.367	J	0.764	J	ND	U	ND	U	ND	U	0.086	J	ND	U
PFOS	13	0.223	J	0.819	J	1.02	J	15.6		17.8		0.357	J	0.100	J	0.496	J	0.722	J	0.312	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References
a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers
J = Estimated concentration
J+ = Estimated concentration, biased high
U = The analyte was not detected at a level greater than or equal to the adjusted DL
UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Pendleton Army Aviation Support Facility #2

	Area of Interest	AOI02										AOI03							
	Sample ID	AOI02-04-SB-0-0.5		AOI02-05-SB-0-0.5		AOI02-06-SB-0-2		AOI02-07-SB-0-0.5		AOI02-08-SB-0-1		AOI02-09-SB-0-0.5		AOI03-01-SB-0-0.5		AOI03-01-SB-0-0.5-DUP		AOI03-02-SB-0-0.5		AOI03-03-SB-0-1-20220831	
	Sample Date	09/06/2022		09/06/2022		08/30/2022		09/06/2022		09/06/2022		09/06/2022		08/31/2022		08/31/2022		08/31/2022		08/31/2022	
	Depth	0-0.5 ft		0-0.5 ft		0-2 ft		0-0.5 ft		0-1 ft		0-0.5 ft		0-0.5 ft		0-0.5 ft		0-0.5 ft		0-1 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.031	J
PFHxS	130	ND	U	0.125	J	ND	U	0.050	J	1.02	J	0.056	J	0.068	J	0.049	J	0.085	J	0.147	J
PFNA	19	0.129	J	0.515	J	ND	U	0.078	J	4.88		0.045	J	1.35		1.09		0.730	J	1.52	
PFOA	19	ND	U	0.094	J	ND	U	0.126	J	0.237	J	ND	U	ND	U	ND	U	ND	U	0.083	J
PFOS	13	0.497	J	0.770	J	ND	U	0.158	J	7.38		0.402	J	1.53		1.61		1.12	J+	1.54	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References
a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers
J = Estimated concentration
J+ = Estimated concentration, biased high
U = The analyte was not detected at a level greater than or equal to the adjusted DL
UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Pendleton Army Aviation Support Facility #2

	Area of Interest	AOI01												AOI02				AOI03			
	Sample ID	AOI01-01-SB-5-7		AOI01-01-SB-8.5-10.5		AOI01-02-SB-5-6		AOI01-02-SB-7-8		AOI01-03-SB-5-6		AOI01-03-SB-8-10		AOI02-02-SB-5-6		AOI02-02-SB-8-10		AOI03-01-SB-5-6		AOI03-01-SB-8-10	
	Sample Date	08/31/2022		08/31/2022		08/30/2022		08/30/2022		08/31/2022		08/31/2022		08/31/2022		08/31/2022		09/01/2022		09/01/2022	
	Depth	5-7 ft		8-10.5 ft		5-6 ft		7-8 ft		5-6 ft		8-10 ft		5-6 ft		8-10 ft		5-6 ft		8-10 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.032	J	0.425	J
PFHxS	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	7.70		1.10	J
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	59.4		ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	1.96		ND	U
PFOS	160	3.79	J+	ND	U	ND	U	ND	U	0.064	J+	ND	U	ND	U	ND	U	5.48		ND	UJ

Grey Fill — Detected concentration exceeded OSD Screening Levels

References
a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers
J = Estimated concentration
J+ = Estimated concentration, biased high
U = The analyte was not detected at a level greater than or equal to the adjusted DL
UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Pendleton Army Aviation Support Facility #2

	Area of Interest	AOI01												AOI02				AOI03	
	Sample ID	AOI01-01-GW		AOI01-02-GW-2		AOIO1-02-GW		AOI01-01-GW-20220915		AOI01-01-GW-20220915-D		AOI01-03-GW		AOI02-01-GW		AOI02-02-GW		AOI03-01-GW	
	Sample Date	09/01/2022		09/01/2022		08/31/2022		09/15/2022		09/15/2022		09/01/2022		09/15/2022		09/15/2022		09/15/2022	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)																			
PFBS	601	3.99	J	4.20	J	3.96	J	5.68		6.02		ND	UJ	31.7		3.44	J	22.5	
PFHxS	39	7.31	J	122	J	124	J	12.7		13.6		4.15	J	519		2.77	J	4.97	
PFNA	6	ND	UJ	12.1	J	ND	UJ	1.00	J	1.13	J	1.40	J	1.75	J	ND	U	ND	U
PFOA	6	1.20	J	7.84	J	2.49	J	1.10	J	1.12	J	2.22	J	18.1		ND	U	0.851	J
PFOS	4	0.891	J	31.0	J	2.97	J	1.53	J	1.00	J	4.54	J	5.15		6.67		ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References
a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers
J = Estimated concentration
U = The analyte was not detected at a level greater than or equal to the adjusted DL
UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes
ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
GW	groundwater
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
USEPA	United States Environmental Protection Agency
ng/l	nanogram per liter

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Legend

Facility Boundary

PFOA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	3/13/2023	GIS BY	MS	3/13/2023
SCALE	1:2,520	CHK BY	VG	3/13/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/13/2023

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Figure 6-1

Legend

Facility Boundary

PFOS Results (µg/Kg)

- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	3/13/2023	GIS BY	MS	3/13/2023
SCALE	1:2,520	CHK BY	VG	3/13/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/13/2023

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Figure 6-2

Legend

Facility Boundary

PFBS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	3/13/2023	GIS BY	MS	3/13/2023
SCALE	1:2,520	CHK BY	VG	3/13/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/13/2023

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Figure 6-3


Shallow
AOI02-09
AOI02-08
AOI02-01
AOI02-06
AOI01-02
AOI02-07
AOI01-14
AOI01-13
Detention Basin
AOI01-11
AOI01-10
AOI01-12
AOI01-09
AOI01-07
AOI01-01S/AOI01-01D
AOI01-08
AOI02-05
AOI01-06
AOI03-01
AOI02-04
AOI03-03
AOI03-02
AOI01-05
AOI02-03
AOI01-03
AOI01-04
AOI02-02
Intermediate
AOI01-02
Detention Basin
AOI01-01S/AOI01-01D
AOI03-01
AOI01-03
AOI02-02
Deep
AOI01-02
Detention Basin
AOI01-01S/AOI01-01D
AOI03-01
AOI01-03
AOI02-02
Legend
Facility Boundary
PFHxS Results (µg/Kg)
ND
>ND - 10
>10 - 130
>130 - 1,600
>1,600
N
0
105
210
420
Feet
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.
PFHxS Detections in Soil
CLIENT
ARNG
PROJECT
Site Inspection at Pendleton AASF #2, OR
REVISED
3/13/2023
GIS BY
MS
3/13/2023
SCALE
1:2,520
CHK BY
VG
3/13/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
PM
CM
3/13/2023
AECOM
12420 Milestone Center Drive
Germantown, MD 20876
Figure 6-4

Legend

Facility Boundary

PFNA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFNA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	3/13/2023	GIS BY	MS	3/13/2023
SCALE	1:2,520	CHK BY	VG	3/13/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	3/13/2023

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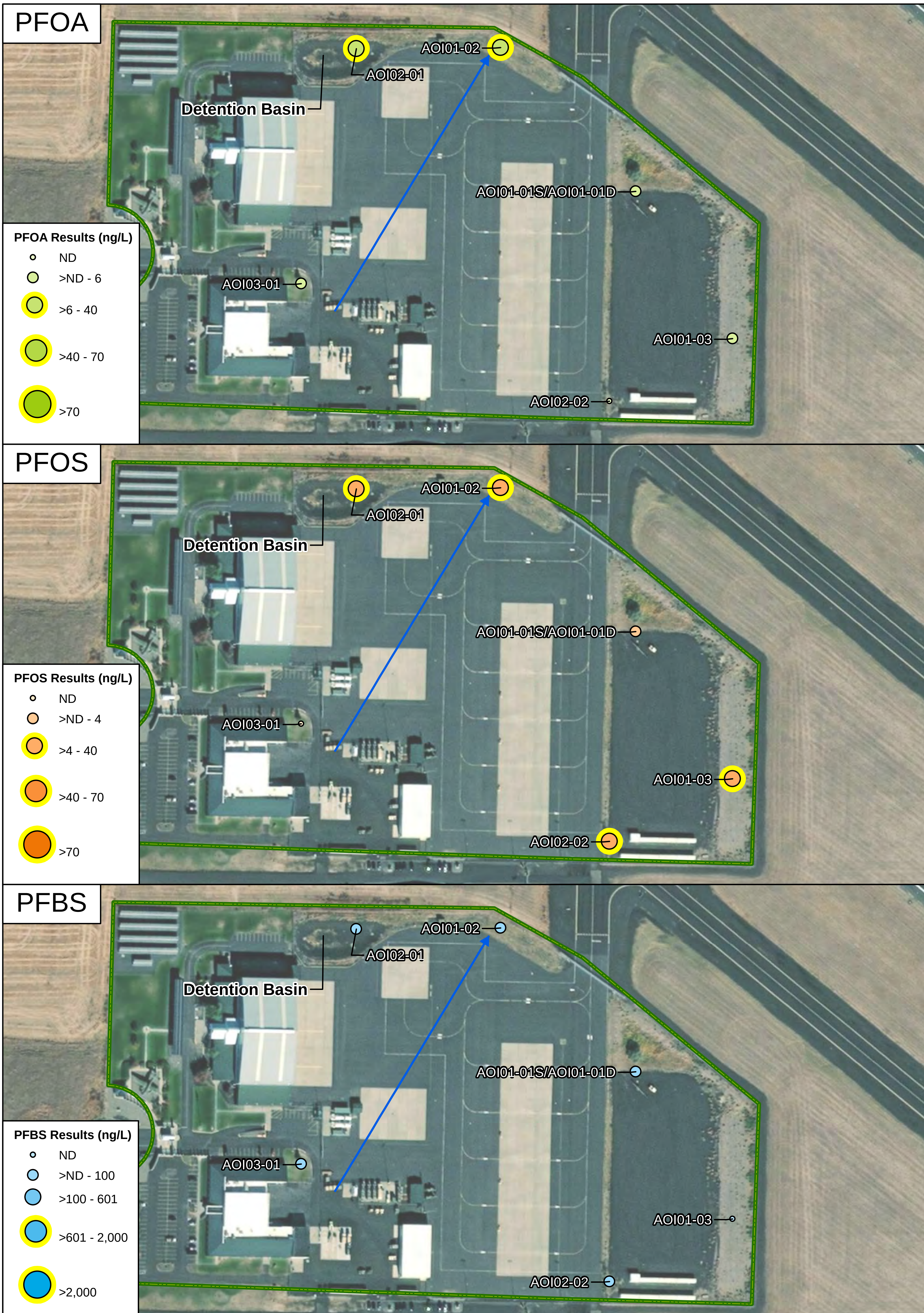
Figure 6-5



Legend

Facility Boundary

Groundwater Flow Direction

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

PFOA, PFOS, and PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	2/23/2023	GIS BY	MS	2/23/2023
SCALE	1:2,520	CHK BY	VG	2/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/23/2023

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Figure 6-6

Legend

Facility Boundary

Groundwater Flow Direction

N

0 105 210 420 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

PFHxS and PFNA Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Pendleton AASF #2, OR			
REVISED	2/23/2023	GIS BY	MS	2/23/2023
SCALE	1:2,520	CHK BY	VG	2/23/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	2/23/2023

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Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-3**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source;
2. Environmental fate and transport;
3. Exposure point;
4. Exposure route; and
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in a RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure to the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers (though unlikely due to restricted access), residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

The SI results in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1, AOI 2, and AOI 3 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 is the Eastern Detention Basin, where AFFF was historically released during familiarization training and fire training activities between approximately 1998 to 2013.

Relevant compounds were detected in surface soil at AOI 1; PFOS exceeded the SL. No ongoing construction was observed at the facility during the SI. Site workers and future construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and construction workers are potentially complete. The facility is gated and there are no adjacent residential structures or recreational facilities; therefore, the incidental ingestion and inhalation of dust exposure pathways for the trespasser, residential, and recreational user receptors are considered incomplete.

Relevant compounds were detected in subsurface soil at AOI 1 at concentrations below the SLs. The construction worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for future construction workers is potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 is the Ramp Area, where AFFF was historically stored and released during familiarization training and fire training activities between approximately 1998 to 2013.

Relevant compounds were detected in surface soil at AOI 2, below the SLs. Site workers and future construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and construction workers are potentially complete. The incidental ingestion and inhalation of dust exposure pathways for the trespasser, residential, and recreational user receptors are considered incomplete for the same reasons established for AOI 1.

Relevant compounds were not detected in subsurface soil at AOI 2; therefore, the subsurface soil exposure pathways for all receptors are considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

AOI 3 is the Readiness Center, where a firetruck potentially containing AFFF was parked at this former hangar between approximately 1988 to 1992.

Relevant compounds were detected in surface soil at AOI 3, below the SLs. However, as AOI 3 is located upgradient of AOI 1 and AOI 2 at which exceedances of soil and groundwater were observed, further evaluation of AOI 3 is warranted. Site workers and future construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and construction workers are potentially complete. The incidental ingestion and inhalation of dust exposure pathways for the trespasser, residential, and recreational user receptors are considered incomplete for the same reasons established for AOI 1.

Relevant compounds were detected in subsurface soil at AOI 3 at concentrations below the SLs. Construction workers could contact constituents in subsurface soil via incidental ingestion, and therefore, the subsurface soil exposure pathway for future construction workers is potentially complete. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2 Groundwater Exposure Pathway

The SI results in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors based on the aforementioned criteria.

7.2.1 AOI 1

Relevant compounds were detected in groundwater at AOI 1; PFOA, PFOS, PFHxS, and PFNA exceeded the SLs. Due to the potentially variable depth to bedrock and uncertainty of groundwater flow direction in the vicinity of the facility, as well as the presence of numerous domestic wells within a 4-mile radius of the facility, the pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete. The facility receives its drinking water from offsite wells operated by the City of Pendleton. Therefore, the pathway for exposure to site workers and recreational user/tresspassers via ingestion of groundwater is considered incomplete at this time. Depths to water measured at AOI 1 in December 2022 during the SI were greater than 18 feet bgs. The construction worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

Relevant compounds were detected in groundwater at AOI 2; PFOA, PFOS, and PFHxS exceeded the SLs. The pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete for the same reasons established for AOI 1.

Depths to water measured at AOI 2 in December 2022 during the SI were greater than 18 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

Relevant compounds were detected groundwater at AOI 3 at concentrations below the SLs. However, as AOI 3 is located upgradient of AOI 1 and AOI 2 at which exceedances of soil and groundwater were observed, further evaluation of AOI 3 is warranted. The pathway for exposure to off-facility residents via ingestion of groundwater is considered potentially complete for the same reasons established for AOI 1.

Depths to water measured at AOI 3 in December 2022 during the SI were greater than 18 feet bgs. Therefore, the ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 3 is presented on **Figure 7-3**.

7.3 Surface Water and Sediment Exposure Pathway

Surface water and sediment samples were not collected; therefore, the SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors.

7.3.1 AOI 1

PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. Because relevant compounds were detected in soil and groundwater at AOI 1, it is possible that those compounds may exist in occasionally ponded surface water within the Eastern Detention Basin. Therefore, the surface water and sediment ingestion exposure pathway for site workers and future construction workers is considered potentially complete.

Drainage swales and wetlands leading to Pendleton River are located 0.25 miles to the south and topographically downgradient of the facility. However, the facility is located at a topographic high with local surface runoff flowing toward the on-facility, unlined detention basins. Additionally, Pendleton AASF #2 is located in the Upper Stage Gulch Watershed, and the southern drainages are located within the Upper Stage Gulch Watershed. Recreational and drinking source surface water bodies that may potentially receive runoff from the facility are greater than 15 miles from the facility boundary. Therefore, the surface water and sediment ingestion exposure pathway for off-facility residents and recreational users are considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

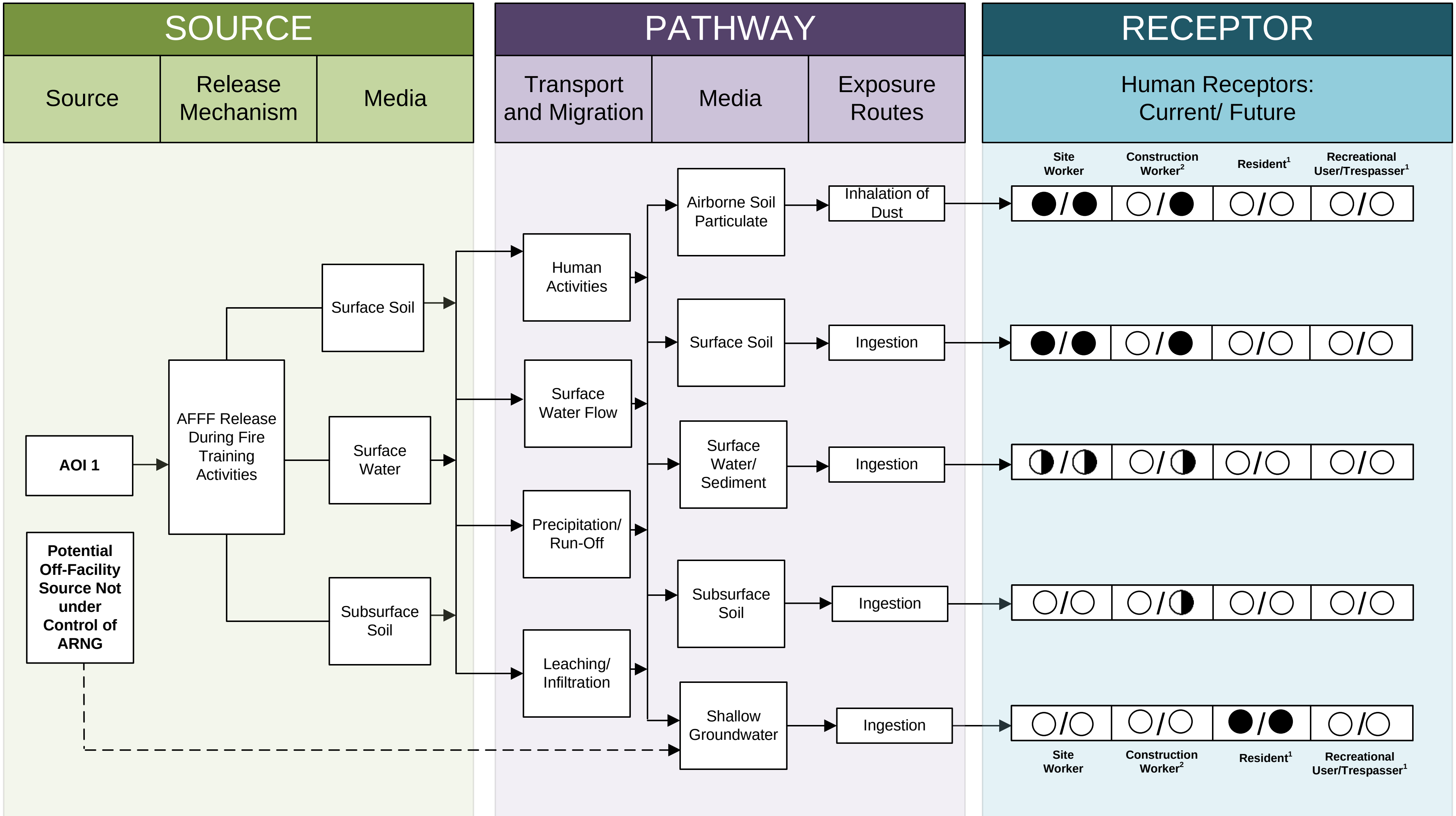
Because relevant compounds were detected in soil and groundwater at AOI 2, it is possible that those compounds may exist in occasionally ponded surface water within the northwestern detention basin. Therefore, the surface water and sediment ingestion exposure pathway for site workers and future construction workers is considered potentially complete.

The surface water and sediment ingestion exposure pathway for off-facility residents and recreational users are considered incomplete for the same reasons established for AOI 1. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3.3 AOI 3

Surface water bodies are not located in the vicinity of AOI 3. Therefore, the surface water and sediment ingestion exposure pathway for site workers and construction workers is considered incomplete.

The surface water and sediment ingestion exposure pathway for off-facility residents and recreational users are considered incomplete for the same reasons established for AOI 2. The CSM for AOI 3 is presented on **Figure 7-3**.



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial/ Possible Flow

Incomplete Pathway

Potentially Complete Pathway

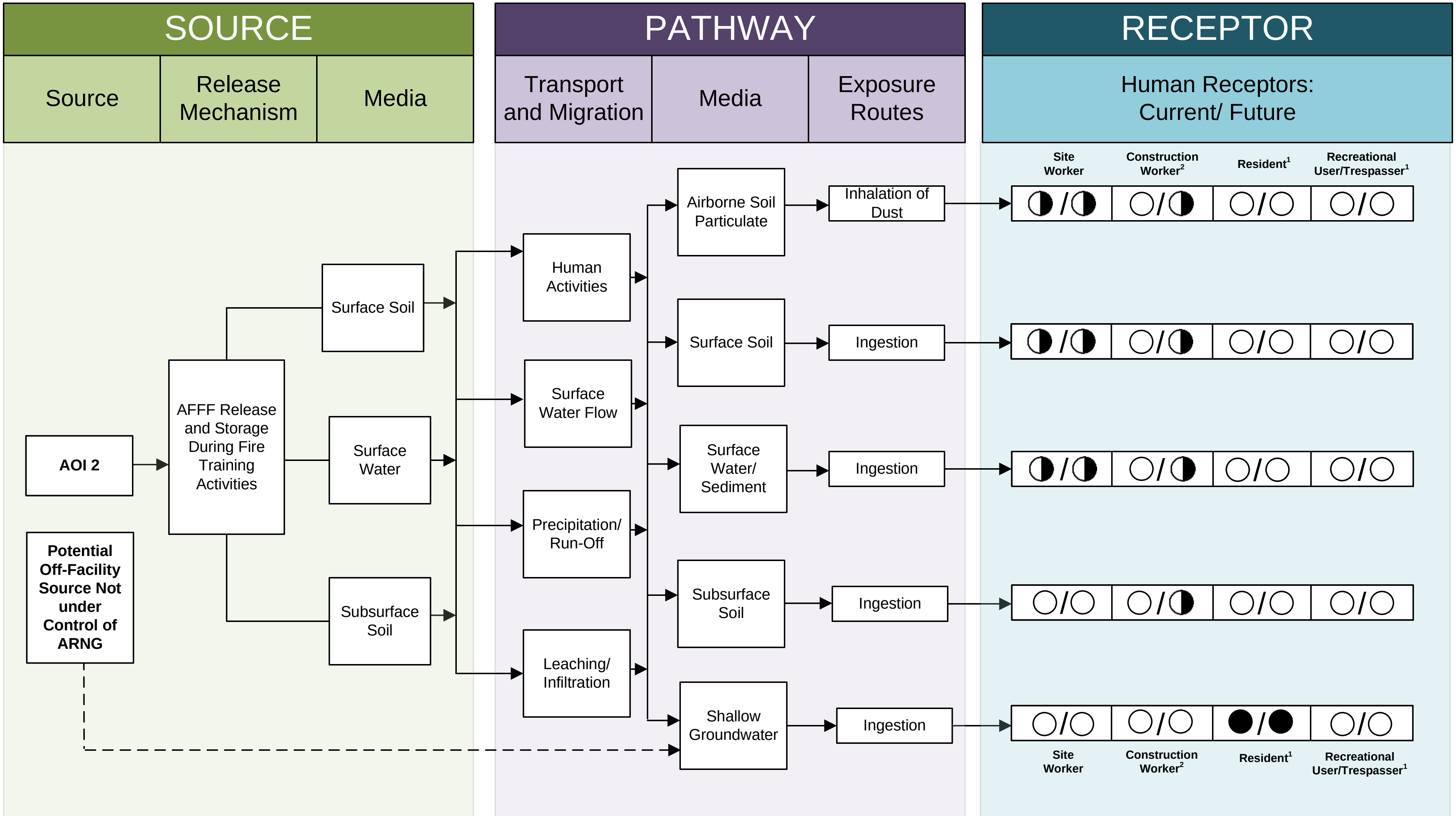
Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

2. Construction was not observed during SI field activities.

Figure 7-1
Conceptual Site Model, AOI 1
Pendleton AASF #2, Pendleton, Oregon



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial/ Possible Flow

Incomplete Pathway

Potentially Complete Pathway

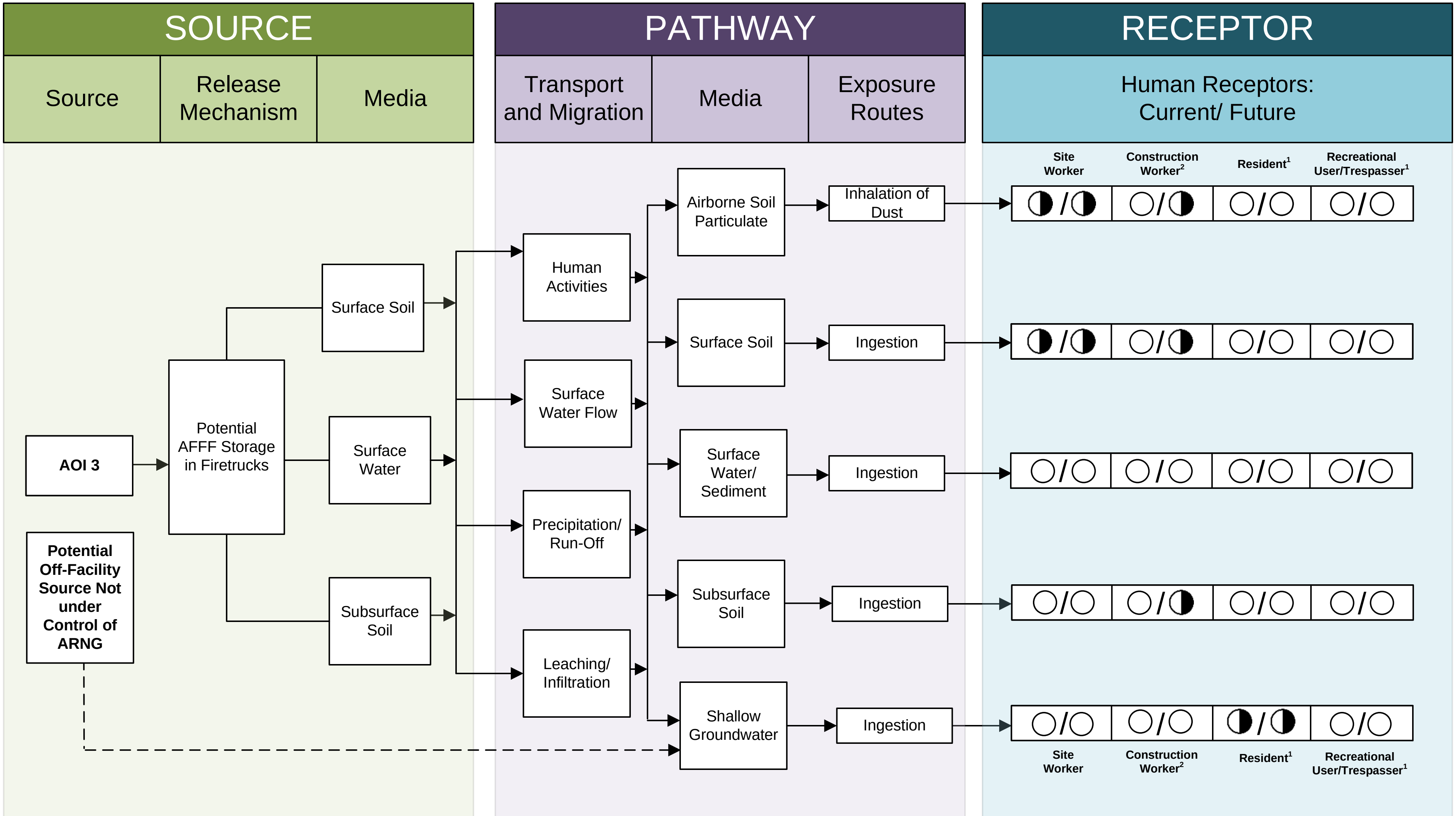
Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

2. Construction was not observed during SI field activities.

Figure 7-2
Conceptual Site Model, AOI 2
Pendleton AASF #2, Pendleton, Oregon



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.

2. Construction was not observed during SI field activities.

Figure 7-3
Conceptual Site Model, AOI 3
Pendleton AASF #2, Pendleton, Oregon

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8. Summary and Outcome

This section summarizes SI activities and findings. The most significant findings are summarized in this section and are reproduced directly or abstracted from information contained in this report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SI Activities

The SI field activities were conducted from 29 August to 31 August, 1 September to 15 September 2022 and consisted of utility clearance, sonic drilling, soil sample collection, temporary and permanent monitoring well installation, well development, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022a).

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2022a), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Thirty-six (36) soil samples from seven (7) sonic borings and nineteen (19) hand auger locations;
- Four (4) grab groundwater samples from three (3) temporary well locations;
- Four (4) groundwater samples from four (4) permanent well locations; and
- Twenty (20) QA/QC samples.

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, which are described in **Section 7**.

8.2 Outcome

Based on the results of this SI, further evaluation under CERCLA is warranted in an RI for AOI 1, AOI 2, and AOI 3 (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors from sources on the facility resulting from historical DoD activities and/or nearby adjacent sources. Sample analytical concentrations collected during the SI were compared against the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - PFOS was detected above the 13 µg/kg SL, with a maximum concentration of 31.0 µg/kg in surface soil at location AOI01-06. All other relevant compounds in surface soil were below their SLs. All relevant compounds were below SLs or not detected in subsurface soil.

    - PFOA, PFOS, PFHxS, and PFNA in groundwater exceeded their SLs. PFOA exceeded the 6 ng/L SL, with a maximum concentration of 7.84 J ng/L at AOI01-02; PFOS exceeded the 4 ng/L SL, with a maximum concentration of 31.0 J ng/L at AOI01-02; PFHxS exceeded the 39 ng/L SL, with a maximum concentration of 124 J ng/L at AOI01-02; PFNA exceeded the 6 ng/L SL, with a maximum concentration of 12.1 ng/L at AOI01-02. PFBS was below the SL in groundwater.
    - Based on the results of the SI, further evaluation of AOI 1 is warranted.
- At AOI 2:
    - PFOA, PFOS, PFHxS, and PFNA were detected in surface soil, at concentrations below their SLs. PFBS was not detected. Relevant compounds were not detected in shallow subsurface soil.
    - PFOA, PFOS, and PFHxS in groundwater exceeded their SLs. PFOA exceeded the 6 ng/L SL, with a maximum concentration of 18.1 ng/L at AOI02-01; PFOS exceeded the 4 ng/L SL, with a maximum concentration of 6.67 ng/L at AOI02-02; PFHxS exceeded the 39 ng/L SL, with a maximum concentration of 519 ng/L at AOI02-01. PFBS and PFNA were below their SLs in groundwater.
    - Well AOI02-02 is located along the facility boundary and is in the upgradient portion of the facility based on the groundwater elevations measured during the SI, indicating that there may be an adjacent, offsite source.
    - Based on the results of the SI, further evaluation of AOI 2 is warranted.
- At AOI 3:
    - PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface and shallow subsurface soil, at concentrations below their SLs.
    - PFOA, PFBS, and PFHxS were detected in groundwater, at concentrations below their SLs. The maximum concentration of the three compounds was PFBS at 22.5 ng/L at AOI03-01. PFOS and PFNA were not detected in groundwater.
    - While relevant compounds in soil and groundwater were detected below SLs at AOI 3, this AOI is located upgradient of AOI 1 and AOI 2, at which there were observed exceedances. Due to this information, AOI 3 cannot be ruled out as a possible contributing source to AOI 1 and AOI 2; therefore, further evaluation of AOI 3 is warranted.

Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

Table 8-1: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Eastern Detention Basin	●	●	●	Proceed to RI
2	Ramp Area	◐	●	●	Proceed to RI
3	Readiness Center	◐	◐	N/A	Proceed to RI

Legend:
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

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