Final
Site Inspection Report
Army Aviation Support Facility #1
Salem, Oregon

Perfluorooctanesulfonic Acid (PFOS) and
Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

February 2021

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
Arlington, VA 22204

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
µg/kg	micrograms per kilogram
6:2 FTS	6:2 Fluorotelomer sulfonate
8:2 FTS	8:2 Fluorotelomer sulfonate
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
Cascade	Cascade Technical Services, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DL	detection limit
DO	Dissolved oxygen
DoD	Department of Defense
DOT	Department of Transportation
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	Extraction internal standards
ELAP	Environmental Laboratory Approval Program
EM	Engineers Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FRB	field reagent blank
FTA	Fire Training Area
ft/day	feet per day
GPR	ground-penetrating radar
HA	Health Advisory
HDPE	high-density polyethylene
HSA	hollow-stem auger
I-5	Interstate 5
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography tandem mass spectrometry
LCS	laboratory control sample

LCSD	laboratory control sample duplicate
LOQ	limit of quantitation
m	meters
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
ODFW	Oregon Department of Fish and Wildlife
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
PA	Preliminary Assessment
Pace	Pace Gulf Coast
PAL	Project Action Level
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFCs	perfluorinated compounds
PFDA	perfluorodecanoic acid
PFDoA	perfluoroheptanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RI	Remedial Investigation
ROD	Record of Decision

RPD	relative percent differences
SI	Site Inspection
SL	screening level
SOP	Standard Operating Procedure
SPT	standard penetration test
TCRA	Time Critical Removal Action
TOC	total organic carbon
TPP	Technical Project Planning
US	United States
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USCHPPM	United States Army Center for Health Promotion and Preventive Medicine
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
WWTP	wastewater treatment plant

Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs). A SI was performed by the Army National Guard (ARNG) at the Army Aviation Support Facility #1 (Salem AASF) in Salem, Oregon. Salem AASF will be referred to as the “Site” throughout this document.

The Site, operated by the Oregon ARNG (ORARNG), is an approximately 81.5-acre facility in Salem, Oregon, along the northeast end of Runway 16/34 of the McNary Field Salem Municipal Airport in Marion County. The Site lies approximately 3.1 miles southwest of downtown Salem. The facility consists of parcels of land that are owned by the State of Oregon for ORARNG use and are leased from the City of Salem. Originally occupied by the Salem Airport from 1930 to 1940, the property was purchased and owned by the US Navy until 1971, when the Oregon Military Department (OMD) purchased the property (OMD, 2008). Construction of the three hangars lasted from 1971 to 1973. Another parcel was purchased from the City of Salem in 1985. In 2012, ORARNG acquired a former carnival equipment production facility, previously owned and operated by Eyerly Aircraft Company, directly east of Hangar 2 and south of Hangar 1. This acquisition consisted of 4.56 acres where the previous Eyerly property was located and expanded the property boundary of the Site. From the 1980s to 2009, multiple parcels of land leased from the City of Salem and are still under term.

The PA Report identified seven potential PFAS release areas at the Site: Fire Training Area (FTA) 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area, Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad (AECOM, 2019a). The release areas were grouped into two Areas of Interest (AOIs): AOI 1, which includes FTA 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area; and AOI 2, which includes non-FTA areas Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad. The SI field activities were conducted from 12 to 15 November 2019 and included the collection of soil, groundwater, surface water, and sediment samples.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2019b), samples were collected and analyzed for a subset of 18 PFAS via liquid chromatography with tandem mass spectrometry (LC//MS/MS) compliant with Quality Systems Manual (QSM) 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.9** of this Report.

The Department of Defense (DoD) has adopted a policy to retain facilities in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, when the maximum site concentration for sampled media exceed the SLs, the site will proceed to a Remedial Investigation (RI), the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table ES-1**. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

Sample chemical analytical concentrations were compared against the project SLs as described in **Table ES-1**. A summary of the results of the SI data relative to the SLs is as follows:

- PFOA, PFOS, and PFBS were detected in groundwater in the source areas and near the upgradient and downgradient facility boundaries at AOI 1. PFOS exceeded the SL in groundwater in four of the nine temporary wells with a maximum concentration of 149 nanograms per liter (ng/L). PFOA and PFBS did not exceed the SLs. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOA, PFOS, and PFBS were detected in groundwater in the source areas and near the upgradient facility boundary at AOI 2. PFOS exceeded the SL in groundwater in all six temporary wells with a maximum concentration of 144 ng/L at AOI2-GW05. PFOA only exceeded the SL at AOI2-GW06 with a concentration of 58.9 ng/L. however, AOI2-GW06 is considered upgradient of AOI 2 based on groundwater flow. PFBS did not exceed the SL in any sample.
- PFOA and PFOS were detected in soil at both AOI 1 and 2 at low concentrations, several orders of magnitude below the SLs. The concentrations of PFOA, PFOS, and PFBS do not identify any specific historic surface release points.
- PFOA, PFOS, and PFBS were detected in groundwater upgradient of AOI 1 and AOI 2 in samples AOI1-GW01, AOI2-GW05, and AOI2-GW06, which suggests potential contributions from off-facility sources. Samples AOI2-GW05 and AOI2-GW06 exceeded the SLs and were located at the eastern and southeastern facility boundaries.

Table ES-2 summarizes the SI results for soil and groundwater. Based on the conceptual site models (CSMs) developed and revised in light of the SI findings, there is potential for exposure to residential drinking water receptors caused by DoD activities at or adjacent to the facility.

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for AOI 1 and AOI 2.

Table ES-1 Screening Levels (Soil and Groundwater)

Analyte	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b]	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	1,600	40
PFOS	1,600	40
PFBS	1,600,000	40,000

Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. HQ=0.1. 15 October 2019.

b.) If only one PFAS is present, a Hazard Quotient (HQ) of 1 applies and the values presented would increase by a factor of x10.

Table ES-2 Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	FTA 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area	◐	●	●
2	Hangar 2, Former Chrome Plating Facility, Wash Pad, Former Wash Pad	◐	●	●

Legend:

● = detected; exceedance of screening levels
◐ = detected; no exceedance of screening levels
○ = not detected

Table ES-3 Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	FTA 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area	Exceedances of the SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
2	Hangar 2, Former Chrome Plating Facility, Wash Pad, Former Wash Pad	Exceedances of the SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

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1.0 Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this Site Inspection (SI) at the Army Aviation Support Facility #1 (Salem AASF) in Salem, Oregon. The Salem AASF will be referred to as the “Site” throughout this report.

The SI project elements were performed by AECOM in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; US Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300; USEPA, 1994), and in compliance with Army Requirements and Guidance for field investigations, including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per and poly-fluoroalkyl substances (PFAS). The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS, PFOA, PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the task order.

1.2 SI Purpose

A PA was performed at the Site (AECOM, 2019a) that identified seven potential PFAS release areas, which were grouped into two Areas of Interest (AOIs). The SI was performed as the next step in the CERCLA process. The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

As stated in the *Federal Facilities Remedial Site Inspection Summary Guide* (USEPA, 2005), an SI has five goals:

1. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment;
2. Determine the potential need for a removal action;
3. Collect or develop data to evaluate potential release;
4. Collect data to better characterize the release for more effective and rapid initiation of a Remedial Investigation (RI), if determined necessary; and
5. Collect data to determine whether the release is more than likely the result of activities associated with the Department of Defense (DoD).

In addition to the USEPA identified goals of an SI, the ARNG SI effort will also identify potential off-facility sources.

2.0 Site Background

2.1 Site Location and Description

The Site is an approximately 81.5-acre facility in Marion County in Salem, Oregon, (**Figure 2-1**) along the northeast end of Runway 16/34 of the McNary Field Salem Municipal Airport. The Site lies approximately 3.1 miles southwest of downtown Salem, 48 miles southeast of Portland, and 60 miles northeast of Eugene. Interstate 5 (I-5), traveling in a north-south direction, is 0.5 miles east, and state Highway 22, traveling east-west, is 0.5 miles to the north.

The facility consists of several parcels of land that are owned either by the State of Oregon or the City of Salem. The Oregon ARNG (ORANG) operates on land parcels owned by the state or leased from the City of Salem. The current configuration and ownership of the different parcels making up the facility are shown on **Figure 2-2**. One of these parcels was originally occupied by the Salem Airport from 1930 to 1940, the property was purchased and owned by the US Navy until 1971, when the Oregon Military Department purchased the property (Oregon Military Department [OMD], 2008). Construction of the three hangars lasted from 1971 until 1973. Another parcel was purchased from the City of Salem in 1985. The last purchased parcel was bought in 2012. ORARNG acquired a former carnival equipment production facility, previously owned and operated by Eyerly Aircraft Company, directly east of Hangar 2 and south of Hangar 1. This acquisition consisted of 4.56 acres where the previous Eyerly property was located and expanded the property boundary of the Site. From the 1980s to 2009, multiple parcels of land were leased from the City of Salem and are still under term. These leases and deeds are shown in Appendix A of the PA report (AECOM, 2019a).

2.2 Facility Environmental Setting

Marion County is a predominantly urban area in the Willamette Valley physiographic province, an area that holds nearly 70 percent (%) of Oregon’s population. The region extends northward to Washington State and is bound by the Coast Range to the west, the Western Cascade Range to the east, and the Calapooya Mountains to the south. The county has an approximate total area of 1,193 square miles of which only 10 square miles are water.

The closest residence to the Site is 1 mile away, and a shopping center exists a few hundred feet to the east. Ankeny National Wildlife Refuge lies 3 miles to the southeast of the facility. Portions of the Willamette and Mount Hood National Forests are contained within Marion County, approximately 30 miles east of the Site. Wildlife in this area and in the vicinity of the Site includes black tail deer, squirrels, raccoons, and numerous species of birds (Oregon Department of Fish and Wildlife [ODFW], 2019). The terrain within the valley and flood plain is of low to moderate relief, ranging from 150 to 1000 feet of elevation. The Site topography is shown on **Figure 2-3**. The Site geology and groundwater features are presented on **Figure 2-4** and surface water features are presented on **Figure 2-5**.

2.2.1 Geology

The City of Salem and the Site lie in the Willamette Valley physiographic province, a drainage basin that is roughly 170 miles long from north to south and encompasses nearly 12,000 square miles. The Willamette River basin has considerable diversity in its landforms and may be subdivided further into three coextensive physiographic sections with respect to major surface features: (1) The Oregon Coast Range section, (2), Puget Trough Section, and (3), the Middle Cascade Mountains lowlands section.

The Middle Cascade Mountains lowlands section includes about 60% of the basin (Piper, 1942) and is where the Site is located. This area belongs to the main valley plain and is characterized by gently rolling topography traversed by steep-walled, flat-floored stream valleys. The Willamette valley has been a topographic low for at least 15 million years and was prone to frequent flooding (the Missoula Flood), due to the extensive braided channel systems of this area, which deposited Miocene and Pliocene sediments in the basin bottoms to Quaternary and late Tertiary-age sediments in the upper 0 to 328 feet that are primarily coarse-grained sediment and gravel (Woodward, Gannett & Vaccaro, 1998).

Due to this flooding, change of river flow direction, erosion, and deposition from surrounding tributaries of the mountain ranges, the thicknesses and age of these deposits can vary widely along the valley floor. The Site is an area of coalesced alluvial fans underlain by 14 meters (m) of 12.7 to 15 thousand year old unconsolidated Holocene flood deposits, 200 to 300 m of Pleistocene age sand and gravel, a 40 m thick Willamette Silt layer (fine-grained Missoula Flood Deposits and clay) which thins towards the south, and another 100 to 200 m of Pleistocene age coarse sand and gravel of roughly 28 thousand years of age (Woodward, Gannett & Vaccaro, 1998). Below this, basalt flows from the Columbia River Group, ranging from 3 to 300 m thick sloping westward, and overlies marine rocks and the Little Butte Volcanic Series (Hampton, 1972).

2.2.2 Hydrogeology

Regional and local groundwater flow follows a relatively simple drainage pattern, facilitated by the topographic and structural trough of the Willamette Valley, which lies between the Coast Range and Cascade Range. Groundwater flows from divides of high elevation to the lowland Valley and discharges into the larger streams and rivers. The direction of regional groundwater flow is generally west/northwest towards Mission Ditch and Mill Creek, tributaries of the Willamette River, and several surrounding lakes (**Figure 2-4**). Unconsolidated, highly permeable soils create a shallow groundwater subsystem with a good hydraulic connection between the aquifers and streams (Woodward, Gannett & Vaccaro, 1998). Depth to the groundwater in the vicinity surrounding the facility typically ranges from 12 to 25 feet below ground surface (bgs) (Oregon Water Resources Department [ORWRD], 2018). This provides a system of high infiltration for recharge of groundwater. Groundwater discharges to the smaller streams, which usually flow on the less permeable Willamette Silt unit. Most groundwater discharge is derived from runoff and snow melt (Hampton, 1972; Woodward, Gannett & Vaccaro, 1998). A subsurface investigation conducted at the Site in 2008 indicates that depth to groundwater on the facility occurs between 2.5 to 7 feet bgs, and that shallow groundwater flow is primarily to the west/northwest (AMEC 2008).

The geological data collected as part of the SI indicate a highly permeable and conductive environment with soils dominated by poorly graded sand, gravel, and cobbles with occasional interbedded clayey sand. These site observations are consistent with sedimentary deposition, originated from outburst flood deposits left by the Missoula and Bonneville floods, that comprise the upper Willamette Aquifer within the central Willamette Basin.

The observed depth to groundwater observed during the SI ranged from approximately 2.6 to 7.5 feet bgs. Due to the highly permeable and conductive nature of the subsurface in this area, groundwater flow velocity is fast. Data from other studies indicate a mean hydraulic conductivity of 600 feet per day (ft/day) and hydraulic gradients ranging from 20 to 40 feet per mile in the Upper Willamette Aquifer within this portion of the Willamette Basin (Woodward, Gannett & Vaccaro, 1998). Using these parameters, in conjunction with a common range of effective porosities of 10 to 25% (Sterrett, 2008) for the subsurface materials encountered during this SI, an estimated groundwater velocity range can be calculated using Darcy's Equation:

$$V=KI/n$$

where:

V = groundwater velocity
K = hydraulic conductivity
I = hydraulic gradient
n = effective porosity

Using the above parameters, groundwater velocities at the Site are estimated to range from 9 to 45 ft/day.

The majority of recharge to the aquifers occurs in the winter months, where precipitation and snowmelt are high, and evapotranspiration is low. The summer months are characterized by low precipitation, high runoff due to urbanization, and high evapotranspiration (Woodward, Gannett & Vaccaro, 1998). This recharge supplies the major aquifers of the Willamette Basin. The Willamette Valley comprises two major aquifers, and 3 confining units, created by the unique topographic and stratigraphic lowland plain resting between two mountain ranges. The City of Salem is underlain by parts of all five hydrogeological units (Hampton, 1972; Woodward, Gannett & Vaccaro, 1998). The majority of the Site lies on the Willamette aquifer, which is the principal aquifer for the Willamette Valley and lowland area (Conlon, 2005). Large diameter wells in the area, one 0.25 miles to the east-southeast and one 1.8 miles northeast of the Site, can generate upwards of 10,000 gallons of groundwater per minute.

Approximately 2 miles southwest of the Site are several aquifer storage and recovery wells located 350 feet bgs at Woodmansee Park (City of Salem, 2018). Treated drinking water from the North Santiam River, approximately 20 miles east of the Site, is injected into a fractured basalt aquifer. Treated drinking water is pumped into this aquifer during the winter months and withdrawn during summer months as needed (US Army Center for Health Promotion and Preventive Medicine [USCHPPM], 2002).

2.2.3 Hydrology

The Site is within the Middle Willamette Watershed. In general, surface water in the area surrounding the facility flows in the same west/northwest direction as groundwater, towards Mill Creek, a tributary of the Willamette River (**Figure 2-5**). Surface water within the Site flows towards a grated storm drain system, which is located on the paved western edge of the facility. Stormwater and surface water runoff are directed into two stormwater detention ponds, which discharge to Mission Ditch, outside the northwest boundary of the facility. Mission Ditch then flows west-northwest and discharges into Pringle Creek, a tributary of the Willamette River (USCHPPM, 2002).

Wastewater in and around the Site is collected through a series of sanitary sewers, which then transfer wastewater to the Willow Lake Wastewater Treatment Plant (WWTP). The WWTP, 11 miles north of the Site, treats approximately 30 million gallons of wastewater per day. Approximately one million gallons of treated water are used daily for irrigation and internal plant operations, while the remaining treated wastewater is routed to a stormwater outfall, which discharges to the Willamette River.

Drinking water at the Site is supplied by the City of Salem. The North Santiam River provides drinking water to the City of Salem as well as the nearby City of Turner. Due to the lack of development and high regulation of land within the North Santiam Watershed, water quality within this watershed is extremely high, with little treatment necessary to provide clean drinking water. Slow Sand Filtration processes are utilized at the Geren Island Water Treatment Facility, approximately 18 miles southeast of the Site (USCHPPM, 2002). Water is then transferred to the City of Salem and stored within 17 reservoirs around the City. No surface water intakes are located within 15 miles of the Site; however, several private, residential wells are located within 1 mile downgradient of the Site.

2.2.4 Climate

The Site is situated in the Willamette Valley physiographic province. Temperatures are moderated year-round winds by and rains that come up and over the Coast Ranges to the east from the Pacific Ocean. Annual rainfall is high, with 80% falling from October through March and less than 5% falling in June and August, the peak growing season (Conlon et al., 2005). The average rainfall is around 40 inches near the Site, with some localized areas slightly north getting upwards of 70 inches.

2.2.5 Current and Future Land Use

Presently, the Site includes 58 acres of dedicated-use military taxiway, with the remaining 23.5 acres comprising the three active hangars, aviation fueling facilities, a hazardous material storage facility, vehicle and aircraft parking aprons, and grass-covered areas (AMEC, 2006; OMD, 2008). The Site supports the Medical Evacuation Battalion and the Theatre Aviation Battalion with associated companies, whose purpose is to provide aircraft movement to support medical evacuation; provide command, control and communications; provide organic airlift; and partake in counter drug operations and organizational support aircraft operations (OMD, 2008). Reasonably anticipated future land use is not expected to change from the current land use described above.

2.2.6 Critical Habitat and Threatened/Endangered Species

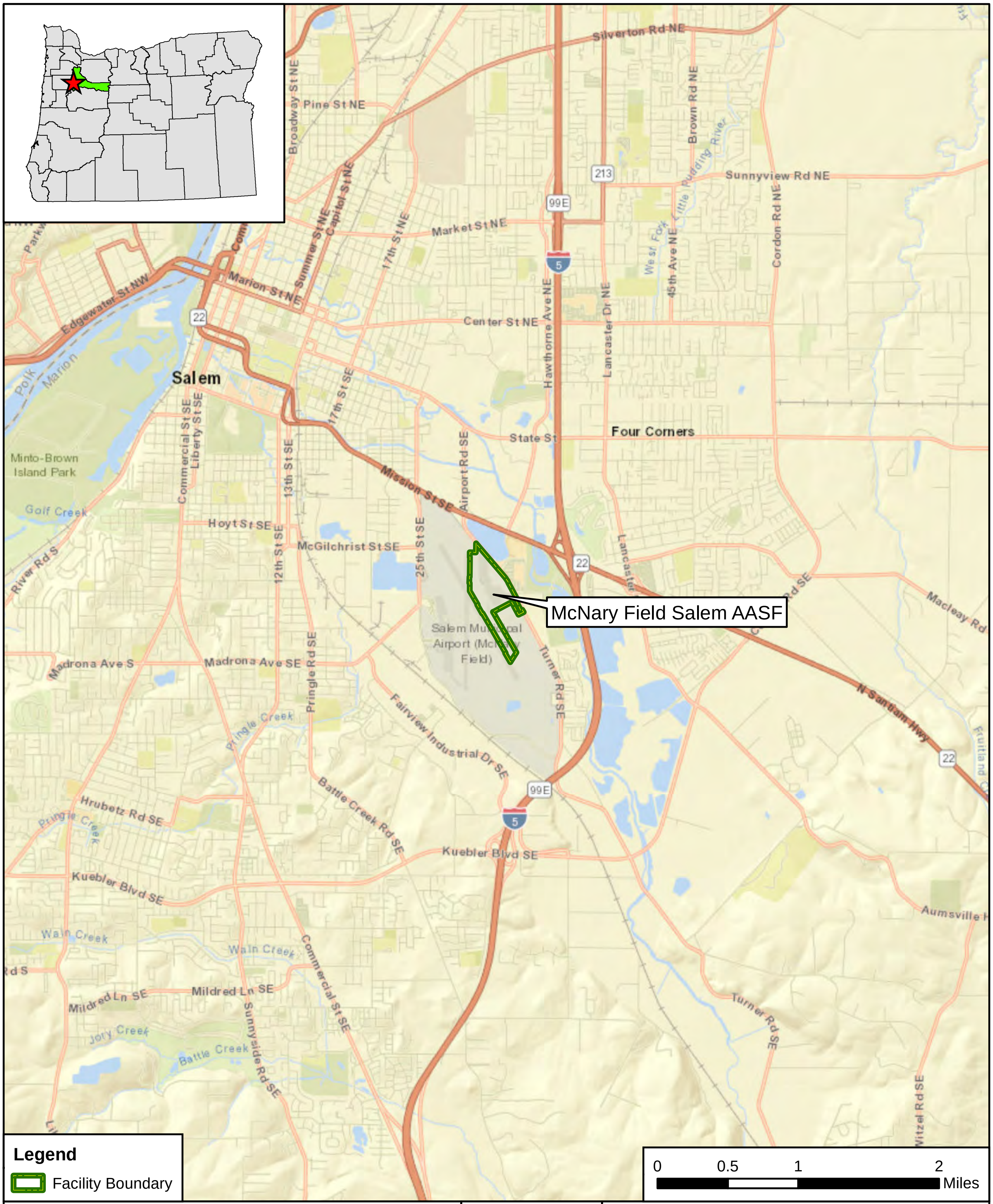
The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Marion County, Oregon (US Fish and Wildlife Service, 2020):

- **Birds**: Yellow-billed Cuckoo, *Coccyzus americanus (threatened)*, Northern spotted owl, *Strix occidentalis caurina* (threatened), Marbled murrelet *Brachyramphus marmoratus* (threatened), and Streaked Horned lark, *Eremophila alpestris strigata* (threatened)
- **Conifers and Cycads**: Whitebark pine, *Pinus albicaulis* (candidate)
- **Fishes:** Bull Trout, *Salvelinus confluentus* (threatened), and Oregon chub, *Oregonichthys crameri* (recovery)
- **Flowering Plants**: Bradshaw's desert-parsley, *Lomatium bradshawii* (endangered), Nelson's checker-mallow, *Sidalcea nelsoniana* (threatened), golden paintbrush, *Castilleja levisecta* (threatened), Water howellia, *Howellia aquatilis* (threatened), Willamette daisy, *Erigeron decumbens* (endangered), and Kincaid's Lupine, *Lupinus sulphureus ssp. kincaidii* (threatened)
- **Insects**: Fender's blue butterfly, *Icaricia icarioides fenderi* (endangered)
- **Mammal**: Fisher, *Pekania pennanti* (proposed threatened)

2.3 History of PFAS Use

Seven potential PFAS release areas were identified at the Site during the PA (AECOM, 2019a). Interviews and records (covering from 1974 to present) obtained during the PA indicate that aqueous film forming foam (AFFF) was used in numerous fire training exercises on the Site. From approximately 1997 to 2017, fire training exercises resulted in the release of AFFF to soil at one or more of the three potential release areas associated with AOI1: FTA 01 Stormwater Detention

Pond, FTA 02 Open Field, and FTA 03 Helicopter Training Area. AOI 2 encompasses four non-FTAs: Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad. Activities at AOI 2 include potential washing of firetrucks following fire training activities with AFFF, potential historic presence of PFAS-containing mist suppressants at the former chrome plating facility, known and potential washing of aircraft at two concrete wash pads, and other potential releases within the paved ramp area. A description of each AOI is presented in **Section 3**.



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Facility Location

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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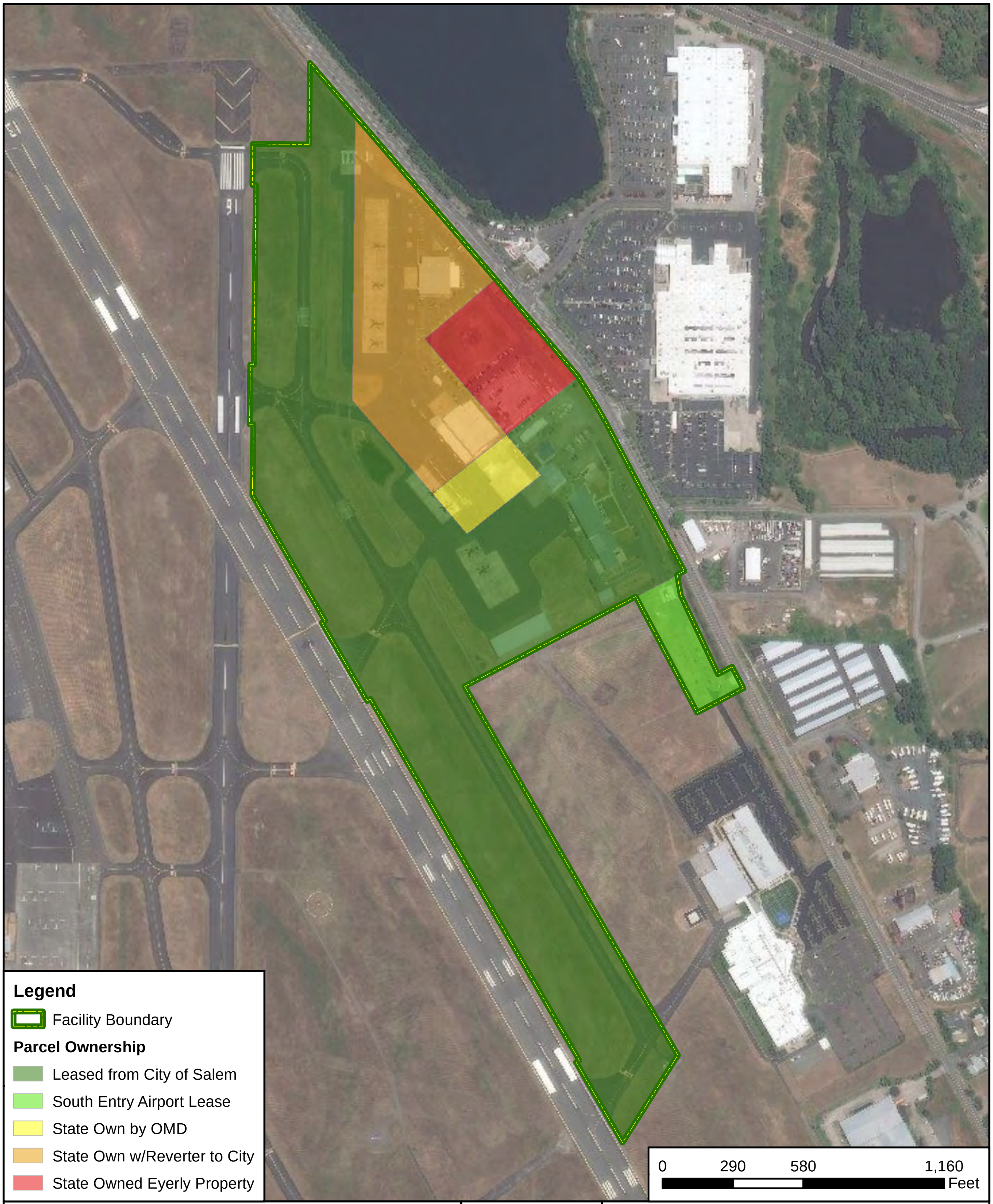

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Site Parcels

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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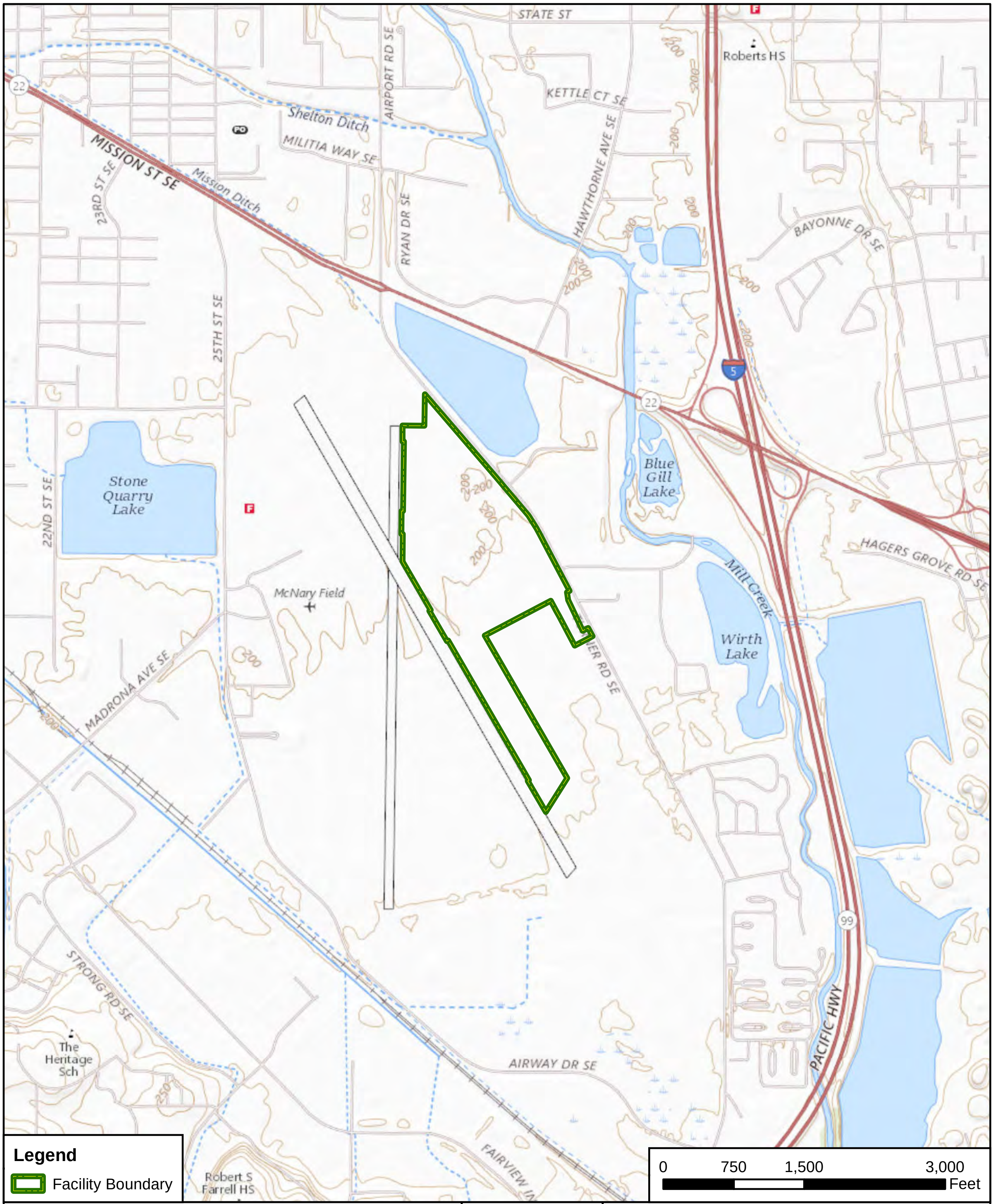

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Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	RG	9/24/2020

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Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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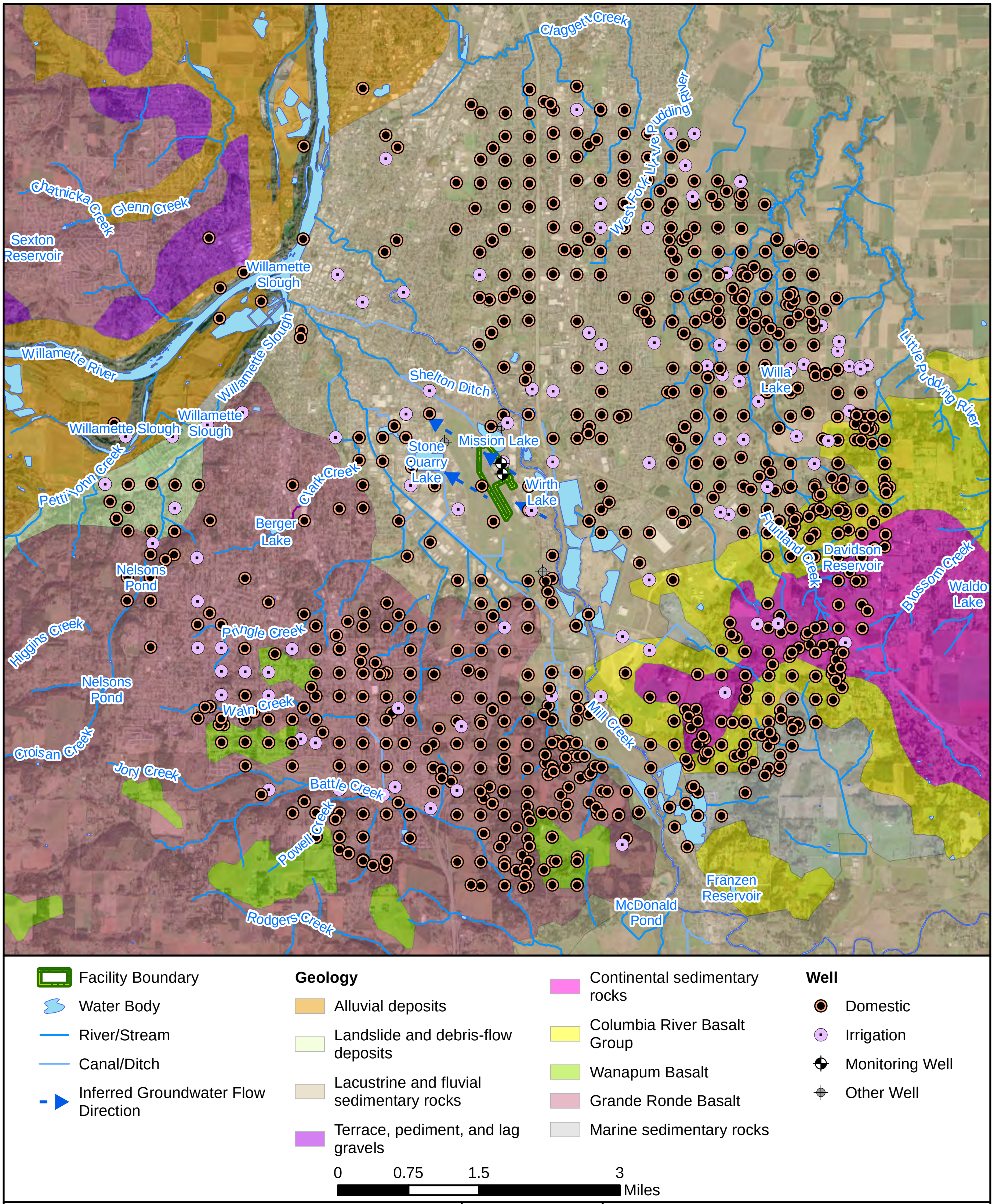

CLIENT ARNG

NOTES Site Inspection for PFAS at McNary Field Salem AASF, OR

REVISED	2/9/2021	GIS BY	MS	2/9/2021
SCALE	1:95,040	CHK BY	JH	2/9/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	2/9/2021

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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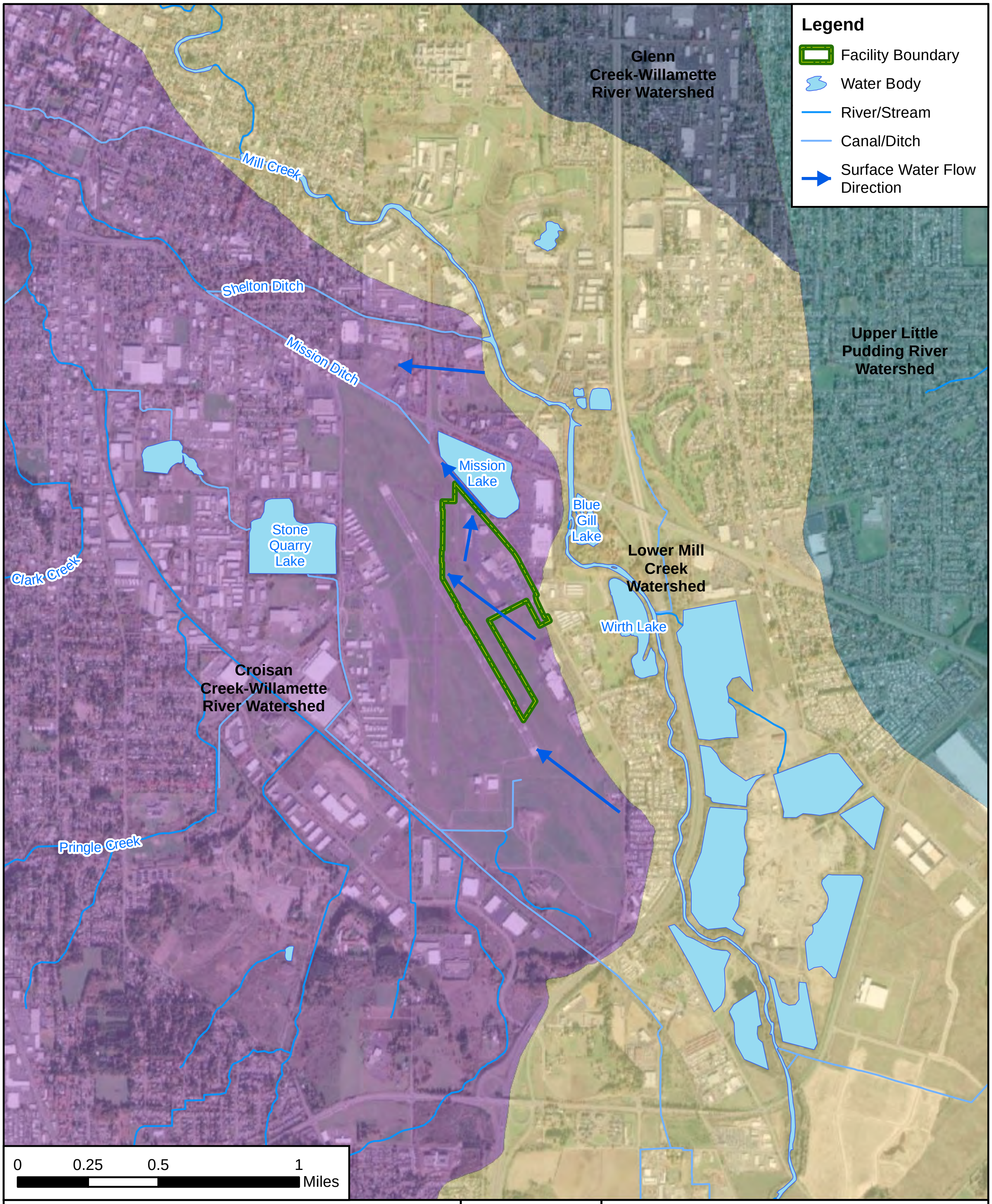

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	9/24/2020	GIS BY	MS	9/24/2020
SCALE	1:31,680	CHK BY	TK	9/24/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	9/24/2020

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Surface Water Features

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Germantown, MD 20876

Figure 2-5

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3.0 Summary of Areas of Interest

Based on the PA findings, two AOIs were identified at Site: AOI 1 Former Fire Training Areas (FTAs) and AOI 2 Non-Fire training areas. Additionally, five adjacent potential sources have been identified. (**Figure 3-1**). A summary of the AOIs and the adjacent potential sources is presented below.

3.1 AOI 1 – Former Fire Training Areas

AOI 1 encompasses three FTAs: FTA 01 Stormwater Detention Pond, FTA 02 Open Field, and FTA 03 Helicopter Training Area.

3.1.1 FTA 01 Stormwater Detention Pond

FTA 01 Stormwater Detention Pond is one of two stormwater retention ponds located west of Hangar 2, across the paved aircraft parking area. It was designated for annual fire training activities, including the release of approximately one gallon of 3% AFFF concentrate from each of the six Tri-Max™ 30 fire extinguishers. Additionally, facility personnel, along with the City of Salem Fire Department, would conduct controlled barrel burns annually from approximately 1997 to 2017. This involved burning wood and other organic debris in 55-gallon drums and extinguished using non-PFAS containing portable fire extinguishers (either Class A or Class ABC fire extinguishers).

The detention pond is unlined and contains overflow grates that route to the stormwater system, which ultimately leads to Mission Ditch. Any water that remains below the grate elevation is either evaporated or infiltrates the ground.

3.1.2 FTA 02 Open Field

FTA 02 Open Field is west of Hangar 1. From approximately 1974 until 1988, annual fire training activities, including burning of wood and other organic debris, occurred in this open field. Multiple ORARNG facilities would participate in this training by bringing their own firetrucks pre-filled with AFFF and using the open field for fire training activities. A firetruck at Salem with an AFFF concentrate tank capacity of approximately 50 gallons was used during these annual training events; however, the exact quantities and concentrations of AFFF used during each event are unknown. Following these trainings, the trucks were transported to the nearby Salem Fire Department #6 where purging of the AFFF from the trucks would occur. One firetruck was at the Salem AASF from approximately 1989 through 1994. It is unknown if there was a designated storage location for the firetruck between annual trainings.

Several stormwater catch basins are located along the east perimeter of the grassy FTA. These catch basins collect stormwater that is then discharged into Mission Ditch, just outside the northeast boundary of the facility.

3.1.3 FTA 03 Helicopter Training Area

FTA 03 is located southwest of the FTA 01 stormwater detention pond. The ORARNG conducted annual AFFF helicopter training events at several ARNG facilities throughout the State of Oregon from approximately 1998 until 2014. During training, the helicopter would take 5 to 20 flights around the AASF and the nearby Creek Falls training area, just west of Salem, and release a combination of water and AFFF for fire training purposes.

The helicopter was equipped with a 1,000-gallon water tank and a 35-gallon AFFF concentrate tank were used; however, it is estimated that only approximately 5 gallons of AFFF concentrate were used during each of the training events. The foam was added to the helicopter at the AASF and stored in 5-gallon buckets; however, the location where the helicopter was filled with AFFF or where the AFFF buckets were stored is unknown. A designated area to drop the AFFF solution was not established during training activities; however, it was estimated the AFFF solution was commonly released west of the flight line at FTA 03 Helicopter Training Area.

3.2 AOI 2 – Non-Fire Training Areas

AOI 2 encompasses four non-FTAs: Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad. Activities at AOI 2 include potential washing of firetrucks following fire training activities with AFFF, historic chrome plating with the potential presence of PFAS-containing mist suppressants, known and potential washing of aircraft at two concrete wash pads, and other potential releases within the paved ramp area.

3.2.1 Hangar 2

Hangar 2 is located directly across from FTA. Hangar 2 historically stored a firetruck with an AFFF tank within a designated bay at the Site. The truck routinely participated in fire training activities involving AFFF from approximately 1974 until 1988. A designated area for the washing of this truck following fire training activities could not be confirmed; however, washing likely occurred at the storage location within Hangar 2. The storage bay area of Hangar 2 does not have floor drains; therefore, residual AFFF rinsed from the truck during washing would have likely flowed onto the nearby paved asphalt area outside the bay door. No spills or releases were reported from this firetruck during its duration of storage and the exact storage location of the previous firetruck within the hangar does not contain any floor drains. With the exception of the area mentioned above within Hangar 2, all drains within hangars at the AASF are routed to the local sanitary sewer and then treated at Willow Lake WWTP, approximately 11 miles north of the AASF.

Additionally, Hangar 2 currently stores six empty Tri-Max™ 30 tanks inside the bay doors. These tanks were previously filled with concentrate 3% AFFF and were removed from the flight line and emptied in the stormwater detention pond across from Hangar 2 during the last fire training event in December 2017.

3.2.2 Former Chrome Plating Facility

The Former Chrome Plating Facility is located between Hangar 2 and Hangar 3. From the 1940s to 2008, a former carnival equipment ride production plant, previously owned and operated by Eyerly Aircraft Company, was located in the area directly behind Hangar 2. Previous operations at this facility included chrome and metal plating activities, which commonly involve the use of PFAS-containing mist suppressants. The ORARNG acquired this land in 2012, following extensive remedial investigations and feasibility studies for various heavy metals and hexavalent chromium. The remedial actions were completed in accordance with the Record of Decision (ROD) for the site, as documented in the No Further Action Determination Certificate of Completion issued by the Oregon Department of Environmental Quality (ORDEQ) in April 2013.The facility and associated debris were removed following demolition of the plant under ORARNG.

While there is no knowledge of any AFFF-related activities at this previous plant, given the timeframe of use, previous chrome plating activities, and historic presence of hexavalent chromium at this location, it is possible that PFAS-containing materials were used or stored at some point during the operational history of the plant. Portions of the former facility boundary now consist of paved asphalt areas and small grass patches.

3.2.3 Wash Pad

The Wash Pad was installed in 2002 and is designated for aircraft washing. Following annual helicopter training events at the Site, the AFFF tanks from the helicopter were rinsed and washed at the Wash Pad. This area contains drains that collect residual (i.e., wash water, and sediments) and control flow based on a demand valve. When the valve is not actuated, residual wash water flows to the stormwater system. The stormwater outfall discharges to Mission Ditch, which then flows into Pringle Creek, a tributary of the Willamette River. When the valve is actuated, residual flows through an oil/water separator (OWS) and eventually to an evaporator. The evaporator collects and stores any solid residual, while liquid residual is evaporated. Any remaining sludge is retained and turned in as part of the hazardous waste management program.

3.2.4 Former Wash Pad

The Former Wash Pad was located approximately 100 yards north of hangar 2 and was used for aircraft washing prior to the installation of the current wash pad; however, the date of installation of this former wash pad is unknown. The current Wash Pad was not installed until 2002; therefore, it is likely that the washing of aircraft following AFFF-related training activities occurred at the previous concrete wash pad area and the surrounding paved vicinity of the ramp area.

3.3 Adjacent Sources

Five potential off-facility sources of PFAS are adjacent to the AASF and are not under the control of the ORARNG. A description of each off-facility source is presented below and shown on **Figure 3-1**.

3.3.1 Salem Fire Department #6

Salem Fire Department #6 is located directly west of Salem AASF. As mentioned in **Section 3.1.2**, multiple training activities occurred from 1989 through 1991 at the Salem AASF involving the use of AFFF. Following these trainings, firetrucks were transported to the nearby Salem Fire Department #6 where purging of the AFFF from the trucks would occur. According to interviews, at least two fire trucks are currently located at the Salem Fire Department #6, with AFFF holding tanks on each of these trucks. A number of AFFF releases occurred from these tanks within the last several years, as well as regular nozzle testing occurring within the fire department boundary. Exact dates or timeframe of these releases and nozzle tests are unknown. Additionally, quantity and concentration of AFFF used during each release are also unknown.

3.3.2 Salem Airport Joint Training Area

ORARNG personnel would conduct joint annual off-site fire training activities with the Salem Fire Department at the nearby Salem Municipal Airport. The Salem Fire Department is believed to be the only entity other than ORARNG that would participate in these trainings.

Trainings would occur with firetrucks equipped with AFFF dispensing systems in which personnel would practice operating the nozzles. These fire training activities would occur just southwest of the facility, near the south end approach of Runway 34. While it is unsure what year these trainings began, the last time this training occurred was in approximately 2017. The type, quantity, and concentration of AFFF used during these training events are unknown.

3.3.3 Garmin AT

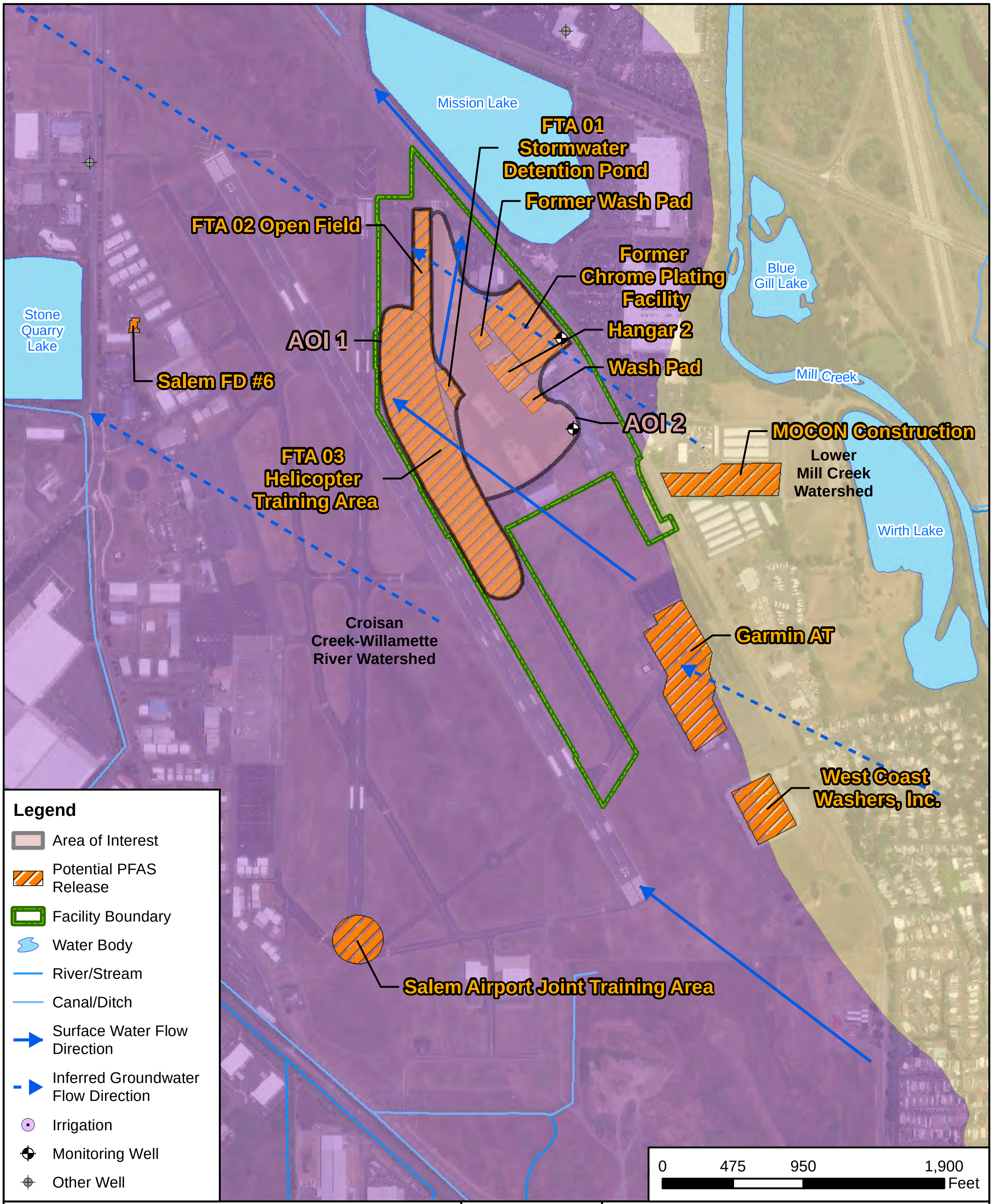
Garmin AT is located approximately 0.1 miles southeast of the facility. Garmin AT carries out product development, including mass production, for Garmin's aviation division. PFAS compounds may be used in various ways at this facility, including in electronics, semiconductors, photographic coatings, adhesives, surface coatings, Teflon-containing materials, and flame retardants.

3.3.4 MOCON Construction

MOCON Construction is directly adjacent to the facility and is across Turner Road SE to the west. According to an ORDEQ site summary report, MOCON Construction has been operating since 1981 and stores petroleum-based materials, paints, and possibly solvents. In the 1990s, ORDEQ reported more than 50 drums filled with what appeared to be unspecified hazardous material. These drums were observed to be leaking, swollen and rusted. There was evidence of vegetation kill in some areas surrounding the drums. Additionally, drums stored in trailers and storage sheds were also swollen. There was a 10,000-gallon tank without a secondary containment. In June 1991, a chemical spill of 1,000 to 5,000 gallons of glue spilled on the ground. Lastly, fires involving construction materials and chemicals have occurred (ORDEQ, 2020). It is unclear how the fires were put out and if AFFF was used.

3.3.5 West Coast Washers, Inc.

West Coast Washers, Inc. is located approximately 0.3 miles southeast of the facility. West Coast Washers, Inc. is a plant that produces washers from start to finish. PFAS is known to be used in metal plating; however, it is unclear if West Coast Washers, Inc. employ metal plating at their facility.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	10/13/2020	GIS BY	MS	10/13/2020
SCALE	1:11,400	CHK BY	TK	10/13/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	10/13/2020

Areas of Interest

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Figure 3-1

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4.0 Project Data Quality Objectives

Project Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data and define the level of certainty required to support the project decision-making process. The specific DQOs established for this Site are described below. These DQOs were developed in accordance with the USEPA's seven-step iterative process (USEPA, 2006).

4.1 Problem Statement

The presence of PFAS, which may pose a risk to human health or the environment, in environmental media at the facility is currently unknown. PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. The regulatory framework for managing PFAS at both the federal and state level continues to evolve.

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 Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). 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 site will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS. The SLs are presented in **Section 6.1** of this Report.

The following quotes from the US Department of the Army (DA) policy documents form the basis for this project (DA, 2016b; DA, 2018):

- "The Army will research and identify locations where PFOS- and/or PFOA-containing products, such as AFFF, are known or suspected to have been used. Installations shall coordinate with installation/facility fire response or training offices to identify AFFF use or storage locations. The Army will consider fire training areas, AFFF storage locations, hangars/buildings with AFFF suppression systems, fire equipment maintenance areas, and areas where emergency response operations required AFFF use as possible source areas. In addition, metal plating operations, which used certain PFOS-containing mist suppressants, shall be considered possible source areas."
- "Based on a review of site records…determine whether a CERCLA PA is appropriate for identifying PFOS/PFOA release sites. If the PA determines a PFOS/PFOA release may have occurred, a CERCLA SI shall be conducted to determine presence/absence of contamination."
- "Identify sites where perfluorinated compounds are known or suspected to have been released, with the priority being those sites within 20 miles of the public systems that tested above USEPA HA [health advisory] levels" (USEPA, 2016a; USEPA, 2016b).

4.2 Goals of the Study

The goals of this SI are to:

1. Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.
2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.

3. Determine the potential need for a Time Critical Removal Action (TCRA). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.
4. Collect data to better characterize the release areas for more effective and rapid initiation of a RI.
5. Identify within 4 miles of the installation, other potential PFAS sources (fire stations, major manufacturers, other Department of Defense facilities), and receptors including both groundwater and surface water receptors, in order to determine whether the ARNG is the likely source of PFAS or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).
6. Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.

4.3 Information Inputs

Primary information inputs for the SI include the following:

- The PA for the Site (AECOM, 2019a);
- Analytical data from groundwater, soil, surface water, and sediment samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM. 2019b); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.4 Study Boundaries

The scope of the SI was bounded horizontally by the property limits of the Site (**Figure 2-2**). Off-site sampling was not included in the scope of this SI. If future off-site sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). The scope of the SI was vertically bounded as follows: groundwater (13 feet bgs), soil from hollow stem auger borings (2 to 13 feet bgs), surface soil (0 to 2 feet bgs), surface water (midpoint of the water column), and sediment (0 to 1 foot bgs).

4.5 Analytical Approach

Samples were analyzed by Pace Gulf Coast (formerly known as Gulf Coast Analytical Laboratories) (Pace), accredited under the DoD Environmental Laboratory Accreditation Program (DoD ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs and decision rules as defined in the SI QAPP Addendum (AECOM, 2019b). Decision rules were developed for groundwater and soil, and they applied to all data collected. These rules governed response actions based on the results of the SI sampling effort.

The decision rules described in the **Worksheet #11** of the QAPP Addendum identify actions based on the following:

<u>Groundwater:</u>

- Is there a human receptor within 4-miles of the site?

- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?
- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the conceptual site model (CSM) suggest in terms of source, pathway and receptor?

Soil:

- What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0 to 2 feet bgs)?
- What is the concentration of PFOA, PFOS, and PFBS in deep soil (i.e., capillary fringe)?
- What does the CSM suggest in terms of source, pathway, and receptor?

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) 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, 2018a; DoD, 2018b; USEPA, 2017).

Data Quality Indicators (DQIs) (Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity) are important components in assessing data usability. These DQIs were evaluated in the subsequent sections and demonstrate that the data presented in this SI report are of high quality. Although the SI data are considered reliable, some degree of uncertainty can be associated with the data collected. Specific factors that may contribute to the uncertainty of the data evaluation are described below. The Data Validation Report (DVR) (**Appendix A**) presents explanations for all qualified data in greater detail.

4.6.1 Precision

Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured with the field duplicate relative percent differences (RPD); laboratory precision is measured with calibration verification, internal standard recoveries, laboratory control spike (LCS) and matrix spike (MS) duplicate RPD.

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. Several field samples displayed EIS area counts less than the lower quality control (QC) limit of 50%. The positive field sample results associated with EIS area counts less than the QC limit, but greater than 20%, were qualified “J+”, while non-detects were qualified “UJ”. The qualified results should be considered usable as estimated values with a positive bias. The field sample results associated with area counts less than 20% were qualified “X” for positive field sample results and “UX” for non-detect field sample results. The qualified field sample results associated with EIS area counts less than 20%, but greater than 10%, are recommended for use as estimated values with a positive bias and are reported with interpreted qualifiers of “J+” for the positive associated field sample results, and “UJ” for the associated non-detect field sample results. Additionally, the positive field sample results associated with EIS area counts less than 10% are recommended for use as estimated values with a positive bias and are reported with interpreted qualifiers of “J+.” The project team determined these qualified results were usable for project purposes. The non-detect field sample results associated with the remaining EIS area counts less than 10% were qualified “UX.”

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. All calibration verifications were within the project established precision limits presented in the QAPP Addendum (AECOM, 2019b), with the exception of N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) in analytical batch 673397. NEtFOSSA displayed a detection above the upper QC limit of 130%D at 137%D. Associated sample results were non-detect and no qualifying action was required.

Laboratory control spike/laboratory control spike duplicate (LCS/LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2019b) except for some RPDs for N-methylperfluorooctane sulfonamidoacetic acid (NMeFOSAA) and Perfluorotridecanoic acid (PFTrDA). NMeFOSSA displayed RPD greater than the QC limit of 30% at 31% and 36%, respectively. PFTrDA displayed RPD greater than the QC limit of 30%, at 47% and 91%, respectively. Positive field sample results associated with RPDs above QC limits were qualified as “J”.

Matrix spike/matrix spike duplicate (MS/MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD performed on parent sample AOI1-GW05 displayed RPD greater than the QC limit of 30% for PFTrDA, at 88%. The MS/MSD performed on parent sample AOI1-SB08-[2-3] displayed RPD greater than the QC limit of 30% for PFOS, at 36% and PFTrDA, at 66%. The MS/MSD performed on parent sample AOI1-SB03-3-4 displayed RPD greater than the QC limit of 30% for PFTrDA, at 52%. The positive parent sample results associated with RPDs greater than the upper QC limit were qualified “J”.

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS. The field duplicate samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2019b), with the exception of some analytes for duplicate pairs AOI2-GW03/DUP#5 and SW01/DUP#6. The difference between the parent and duplicate results for AOI2-GW03/DUP#5 was greater than twice the LOQ value of 16.7 nanograms per liter (ng/L) for PFOS and Perfluorohexanesulfonic acid (PFHxS). The RPD for SW01/DUP#6 were greater than the QC limit of 30% for PFOS, at 70.6%, and Perfluoropentanoic acid (PFPeA), at 54.2%. The difference between the parent and duplicate results for SW01/DUP#6 was greater than twice the LOQ value of 16.7 ng/L for Perfluorohexanoic acid (PFHxA). Associated results for the parent and duplicate samples were qualified as “J”.

4.6.2 Accuracy

Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its "true" or expected value, the more accurate the measurement. The more precise or reproducible the result, the more reliable or accurate the result. Accuracy is measured through percent recoveries in the LCS/LCSD, MS/MSD, and surrogates.

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis, with the following exceptions. NMeFOSSA displayed an LCSD recovery outside the QC limits of 70-130%, at 66% for batch 671749. PFTrDA displayed LCS/LCSD recoveries outside the QC limits of 70-130% at 203% (batch 674443) and 253% (batch 671749). The field sample results associated with negative biases were non-detect and qualified “UJ”. The field sample results associated with positive biases were non-detect and no data qualifying action was required.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested, with the following exceptions. The MS/MSD performed on parent sample AOI1-GW05 displayed recoveries outside the QC limits of 70-130% for PFTrDA, at 337% and NEtFOSAA, at 55%. The MS/MSD performed on parent sample AOI1-SB08-[2-3] displayed a recovery outside the QC limits of 70-130% for PFTrDA, at 204%. The MS/MSD performed on parent sample AOI1-SB03-[3-4] displayed a recovery outside the QC limits of 70-130% for PFTrDA, at 170%. The parent sample results associated with positive biases were non-detect; no data qualifying action was required. The non-detect parent sample results associated with negative biases were qualified “UJ”.

4.6.3 Representativeness

Representativeness qualitatively expresses the degree to which data accurately reflect site conditions. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences.

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.1 Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branch and linear isomers when available were used, and isotopically labeled standards were used for quantitation. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2019b) for all analyses.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory except for samples AOI1-GW05, DUP#7, and SD01, which required re-extraction outside of the 14-day holding time criteria due to internal standard failures in the initial extraction. Positive samples results were qualified as “J”, non-detect field results were qualified as “UJ”, and non-detect results exceeding holding time criteria by a factor greater than 2 were qualified as “X”. Additionally, the holding time for pH analysis is ‘immediate’ and all field samples analyzed for pH were qualified as “J.” The qualified field sample results should be considered usable as estimated values.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. All associated instrument blanks and method blanks were non-detect for all target analytes with the following exceptions. 6:2 fluorotelomer sulfonic acid (6:2 FTS), PFOS, perfluorobutyrate (PFBA) and PFHxA were above the detection limit in some method blanks. The positive associated field sample results less than five times the concentration found in the blanks were qualified as U, and where appropriate, lab limits were elevated to the detected concentrations. The results are usable as qualified but should be considered false positives and treated as non-detect.

Equipment reagent blanks (ERBs) and field reagent blanks (FRBs) were also collected for groundwater and soil samples. All equipment blanks were non-detect for target analytes. PFBA was above the detection limit in a field blank. The positive associated field sample results less than five times the concentration found in the blanks were qualified as U, and where appropriate, lab limits were elevated to detected concentrations. The results are usable as qualified but should be considered a false positive and treated as non-detect.

Overall, the data are usable for evaluating the presence or absence of PFAS at the Site. Sufficient usable data were obtained to meet the objectives of the SI and to complete the risk screening.

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. The laboratory provided data meeting system QC acceptance criteria for all samples tested. Project completeness was determined by evaluating the planned versus actual quantities of data. Percent completeness per parameter is as follows and reflects the exclusion of “X” flagged data, although the project team has retained these results in the data set:

- PFAS in groundwater by LC/MS/MS compliant with QSM 5.1 Table B-15 at 98%;
- PFAS in soil by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%;
- PFAS in surface water by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%;
- PFAS in sediment by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%;
- pH in soil by USEPA Method 9045D at 100%; and
- Total organic carbon (TOC) by USEPA Method 9060 at 100%

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a detection limit (DL) study, and calibration standards at the limit of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the QAPP Addendum (AECOM, 2019b). The laboratory provided the requested DL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the QAPP Addendum (AECOM, 2019b), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the DL were reported and qualified “J” as estimated values by the laboratory.

5.0 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 was implemented in accordance with the following approved documents:

- *Final Preliminary Assessment Report, Army Aviation Support Facility #1 Salem, Oregon,* dated August 2019 (AECOM, 2019a);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility #1 Salem, Oregon* dated November 2019 (AECOM, 2019b);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Army Aviation Support Facility #1 Salem, Oregon,* dated October 2019 (AECOM, 2019c).

The SI field activities were conducted from 12 to 15 November 2019 and consisted of hollow stem auger (HSA) boring and soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and surface water and sediment sample collection. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2019b), except as noted in **Section 5.9**.

The following samples were collected during the SI and analyzed for a subset of 18 PFAS via LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

- Thirty-three (33) soil samples from 15 locations (soil borings locations);
- Fifteen (15) grab groundwater samples from temporary well locations;
- Three (3) sediment samples; and
- Two (2) surface water samples, which were co-located with sediment samples.

Figure 5-1 provides the sample locations for all media across the Site. **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**. 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 of these activities are presented below.

5.1.1 Technical Project Planning

The USACE TPP Process, EM 200-1-2 (DA, 2016a) 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 quantitative and qualitative DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 24 September 2019, prior to SI field activities. Meeting minutes are provided in **Appendix D**. The combined TPP Meeting 1 and 2 was conducted in general accordance with Engineers Manual (EM) 200-1-2.

The stakeholders for this SI include ARNG, OMD, and ORDEQ representatives familiar with the Site, the regulations, and the community. 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, 2019b). Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM contacted the Oregon Utility Notification Center to notify them of intrusive work at the Site. AECOM contracted Utilities Down Under, a private utility location service, to perform utility clearance at the Site. Utility clearance was performed at each of the proposed boring locations on 12 November 2019 with input from the AECOM field team. General locating services and ground-penetrating radar (GPR) were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared by AECOM's drilling subcontractor, Cascade Technical Services, LLC (Cascade), 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 PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be PFAS-free prior to the start of field activities. A sample from a potable water source at Cascade's office located in Clackamas, Oregon, was collected on 4 October 2019, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15. A discussion of the results is presented in **Section 4.6.3**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the Programmatic UFP-QAPP (PQAPP) (AECOM, 2018a). Prior to the start of field work each day, a PFAS 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 hollow-stem auger drilling methods in accordance with the QAPP Addendum (AECOM, 2019b). Each boring was advanced with a CME 75 drill rig using 8-inch diameter augers. A hand auger was used to collect soil from the top five feet of the boring to be compliant with utility clearance procedures. Soil samples deeper than five feet were collected at roughly 2-foot intervals using a standard penetration test (SPT) split spoon sampler driven by a 140-pound autohammer.

Two or three discrete soil samples were collected, depending on the depth that groundwater was encountered and drilling conditions, for chemical analysis from each soil boring. Groundwater was encountered at depths ranging from 2.6 to 7.5 feet bgs during drilling. Total boring completion depths, to accommodate temporary well installation, ranged from 8 to 13 feet bgs. One surface soil sample (0 to 1 feet bgs) was collected at each boring location. Best efforts were made to collect subsurface soil samples at the depths (e.g. one approximately 1 foot above the groundwater table and one at the mid-point between the surface and the groundwater table) prescribed by the QAPP Addendum. However, due to shallow occurrence of groundwater and split spoon samples not being collected continuously through the entire boring, augers were inadvertently advanced below groundwater at some boring locations without the collection of samples that conform to the specifications prescribed in the QAPP Addendum. Refer to **Section 5.7** for details on soil sampling deviations from the QAPP Addendum. The soil boring locations are shown on **Figure 5-1**, and boring and sample depths are provided **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and QAPP Addendum review.

The split spoon soil samples were logged for lithological descriptions by a 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 sampling forms (**Appendix B2**) 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. Clay layers with a thickness in excess of 3 feet were not observed at any of the boring locations. The boring logs are provided in **Appendix E**.

Each 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 for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15, TOC (USEPA Method 9060A), and pH (USEPA Method 9045D) in accordance with the QAPP Addendum (AECOM, 2019b).

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. In instances when non-dedicated sampling equipment was used, such as a hand auger for the 0 to 1 feet bgs soil samples, ERBs 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 4 degrees Celsius (°C) during shipment.

HSA borings were converted to temporary wells, which were subsequently abandoned in accordance with the QAPP Addendum (AECOM, 2019b) using bentonite chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells, which were constructed inside the augers, were installed at fifteen boring locations (**Figure 5.1**). Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-foot section of 2-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. The screen intervals for the temporary wells are provided on **Table 5-2**. New PVC pipe and screen were used at each location to avoid cross contamination between locations.

Groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. 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, 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**) after each grab sample was collected. 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 on 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 for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 in accordance with the QAPP Addendum (AECOM, 2019b).

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 FRB 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 4°C during shipment.

Temporary wells were abandoned in accordance with the QAPP Addendum (AECOM, 2019b) by removing the PVC and backfilling the hole with bentonite chips. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Surface Water and Sediment Sampling

Two co-located surface water and sediment samples (SD/SW01 and SD/SW02) were collected from a stormwater detention associated with AOI 1 (FTA 01 Stormwater Detention Pond). One stand-alone sediment sample was collected from a secondary stormwater detention pond, which was observed to be dry during the field investigation, located downgradient of the FTA 01 Stormwater Detention Pond. SD/SW04, which is a catch basin that discharges off-facility to Mission Ditch, was observed to be dry and free of sediment during the field investigation. A suitable replacement for this sample location was not identified. Refer to **Section 5.7** for details on surface water and sediment sampling deviations from the QAPP Addendum.

Surface water samples were collected from a single point in the waterbody by dipping the laboratory-supplied bottle into the water, approximately two-thirds up from the bottom of the water body. For the co-located surface water and sediment samples, the surface water sample was collected before the co-located sediment sample. Sampling was performed deliberately and methodically to minimize disturbance of bottom sediments and as quickly as possible to ensure a representative sample was collected. Additionally, a subsample of each surface water sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted on any of the surface water samples.

After collection of the surface water sample, the sediment sample was collected from the first 1 foot of sediment using a hand auger or stainless-steel spoon. The sediment was transferred to a Ziploc bag, where the sample was homogenized and stones in excess of 1 centimeter were removed. An ERB was collected from the Ziploc bag to ensure the material was PFAS-free. After collection of the surface water and sediment samples from each location, general water quality parameters (i.e., temperature, pH, conductivity, DO, and ORP) were collected with a water quality meter and recorded on the field sampling form (**Appendix B2**). The surface water and sediment sample locations are shown on **Figure 5-1**, and sample depths are provided **Table 5-1**.

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 for analysis of PFAS (LC/MS/MS compliant with QSM 5.1 Table B-15). Sediment samples were also analyzed for TOC (USEPA Method 9060A) and pH (USEPA Method 9045D), in accordance with the QAPP Addendum (AECOM, 2019b).

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. In instances when non-dedicated sampling equipment was used, ERB samples 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 4 degrees Celsius (°C) during shipment.

5.5 Investigation-Derived Waste

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the QAPP Addendum (AECOM, 2019b).

Soil IDW (i.e., soil cuttings) and liquid IDW (i.e., purge water, development water, and decontamination fluids) generated during the SI activities were containerized in Department of Transportation (DOT)-approved 55-gallon steel drums, per ORDEQ instruction. Soil and liquid IDW was not sampled and assumes the PFAS characteristics of the associated soil/groundwater/surface water samples collected from that source location. A total of eight soil and six aqueous (water/slurry) drums were generated during the SI field event. Each drum was labelled with its contents (e.g. investigation location, media, depth, and date) and staged in a located designated by OMD.

Other solids such as spent PPE, 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.

5.6 Laboratory Analytical Methods

Samples were analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 at Pace in Baton Rouge, Louisiana, a DoD ELAP and NELAP-certified laboratory. The 18 PFAS compounds analyzed as part of the ARNG SI program include the following:

- 6:2 fluorotelomer sulfonate (6:2 FTS)
- 8:2 fluorotelomer sulfonate (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.7 Deviations from QAPP Addendum

Deviations from the QAPP Addendum occurred based on field conditions and discussion between AECOM, ARNG, USACE, and ORDEQ. Two deviations from the QAPP Addendum are noted below:

- A co-located surface water and sediment sample was proposed in the SI QAPP at location SD/SW04, a catch basin located on the northeast portion of the Site, which ultimately drains off-facility into Mission Ditch. However, the catch basin was observed to be dry and free of sediment during the SI sampling event. A suitable replacement for this sample location was not able to be identified during the SI field event. The potential for this deviation was discussed during 24 September 2019 TPP meeting.
- Only two soil samples, rather than the three prescribed in the QAPP Addendum, were collected at the following boring locations: AOI1-SB01, AOI1-SB02 , AOI1-SB03, AOI1-SB04 , AOI1-SB05, AOI1-SB06, AOI1-SB09, AOI2-SB01, AOI2-SB02, AOI2-SB03, AOI2-SB05, and AOI2-SB06. Due to shallow occurrence of groundwater and split spoon samples not being collected continuously through the entire boring, augers were inadvertently advanced below groundwater at some boring locations without the collection of all three samples. The potential for this deviation was discussed during 24 September 2019 TPP meeting.

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

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Comments
Soil Samples						
AOI1-SB01-[0.5-1]	11/14/2019	0.5 - 1	x			
AOI1-SB01-[2-3]	11/14/2019	2 - 3	x			
AOI1-SB02-[0.5-1]	11/14/2019	0.5 - 1	x			
AOI1-SB02-[3-4]	11/14/2019	3 - 4	x			
DUP#3	11/14/2019	3 - 4	x			Field Duplicate
AOI1-SB03-[0.5-1]	11/14/2019	0.5 - 1	x			
AOI1-SB03-[3-4]	11/14/2019	3 - 4	x	x	x	
AOI1-SB04-[0.5-1]	11/14/2019	0.5 - 1	x			
AOI1-SB04-[3-4]	11/14/2019	3 - 4	x			
AOI1-SB05-[0.5-1]	11/14/2019	0.5 - 1	x			
AOI1-SB05-[3-3.5]	11/14/2019	3 - 3.5	x			
AOI1-SB06-[0.5-1]	11/13/2019	0.5 - 1	x			
DUP#2	11/13/2019	0.5 - 1	x			Field Duplicate
AOI1-SB06-[4-4.5]	11/13/2019	4 - 4.5	x			
AOI1-SB07-[0.5-1]	11/13/2019	0.5 - 1	x			
AOI1-SB07-[2.5-3]	11/13/2019	2.5 - 3	x			
AOI1-SB07-[5-5.5]	11/13/2019	5 - 5.5	x			
AOI1-SB08-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI1-SB08-[2-3]	11/15/2019	2 - 3	x			
AOI1-SB08-[4-4.5]	11/15/2019	4 - 4.5	x			
AOI1-SB09-[0.5-1]	11/13/2019	0.5 - 1	x			
AOI1-SB09-[5-5.5]	11/13/2019	5 - 5.5	x			
AOI2-SB01-[0.5-1]	11/12/2019	0.5 - 1	x			
AOI2-SB01-[2-2.5]	11/12/2019	2 - 2.5	x	x	x	
AOI2-SB02-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI2-SB02-[2-3]	11/15/2019	2 - 3	x			
AOI2-SB03-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI2-SB03-[2.5-3]	11/15/2019	2.5 - 3	x			
DUP#4	11/15/2019	2.5 - 3	x			Field Duplicate
AOI2-SB04-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI2-SB04-[2.5-3]	11/15/2019	2.5 - 3	x	x	x	
AOI2-SB04-[4-5]	11/15/2019	4 - 5	x	x	x	
AOI2-SB05-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI2-SB05-[3]	11/15/2019	3	x			
DUP#7	11/15/2019	3	x			Field Duplicate
AOI2-SB06-[0.5-1]	11/15/2019	0.5 - 1	x			
AOI2-SB06-[2.5-3.5]	11/15/2019	2.5 - 3.5	x			

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

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Comments
Groundwater Samples						
AOI1-GW01	11/14/2019	5.5	x			
AOI1-GW02	11/14/2019	5.5	x			
AOI1-GW03	11/14/2019	5.5	x			
AOI1-GW04	11/14/2019	5.5	x			
AOI1-GW05	11/14/2019	5.5	x			
AOI1-GW06	11/14/2019	5.5	x			
AOI1-GW07	11/14/2019	5.5	x			
DUP#1	11/14/2019	5.5	x			Field Duplicate
AOI1-GW08	11/15/2019	7.5	x			
AOI1-GW09	11/13/2019	5.5	x			
AOI2-GW01	11/12/2019	5.5	x			
AOI2-GW02	11/15/2019	5.5	x			
AOI2-GW03	11/15/2019	5.5	x			
DUP#1	11/15/2019	5.5	x			Field Duplicate
AOI2-GW04	11/15/2019	7.5	x			
AOI2-GW05	11/15/2019	10.5	x			
AOI2-GW06	11/15/2019	7.5	x			
Sediment Samples						
SD01	11/15/2019	0 - 1	x			
SD02	11/15/2019	0 - 1	x			
SD03	11/15/2019	0 - 1	x			
Surface Water Samples						
SW01	11/15/2019	0.5	x			
DUP#6	11/15/2019	0.5	x			Field Duplicate
SW03	11/15/2019	0.5	x			
Blank Samples						
CASCADE OR-WATER	10/4/2019	na	x			Drillers Water
Equipment Blank#1	11/15/2019	na	x			Rinsate Blank
Equipment Blank#2	11/15/2019	na	x			Rinsate Blank

Notes:
ft = feet
MS/MSD = matrix spike/ matrix spike duplicate
na = not applicable
PFAS = per- and polyfluoroalkyl substances
TOC =total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals
Salem AASF #1, Salem, Oregon
Site Inspection Report

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)
1	AOI1-SB01	8	3-8
	AOI1-SB02	8	3-8
	AOI1-SB03	8	3-8
	AOI1-SB04	8	3-8
	AOI1-SB05	8	3-8
	AOI1-SB06	10	5-10
	AOI1-SB07	8	3-8
	AOI1-SB08	10	5-10
	AOI1-SB09	11.5	4.5-9.5
2	AOI2-SB01	8	3-8
	AOI2-SB02	8	3-8
	AOI2-SB03	8	3-8
	AOI2-SB04	10	5-10
	AOI2-SB05	13	8-13
	AOI2-SB06	8	3-8

Notes:
bgs = below ground surface

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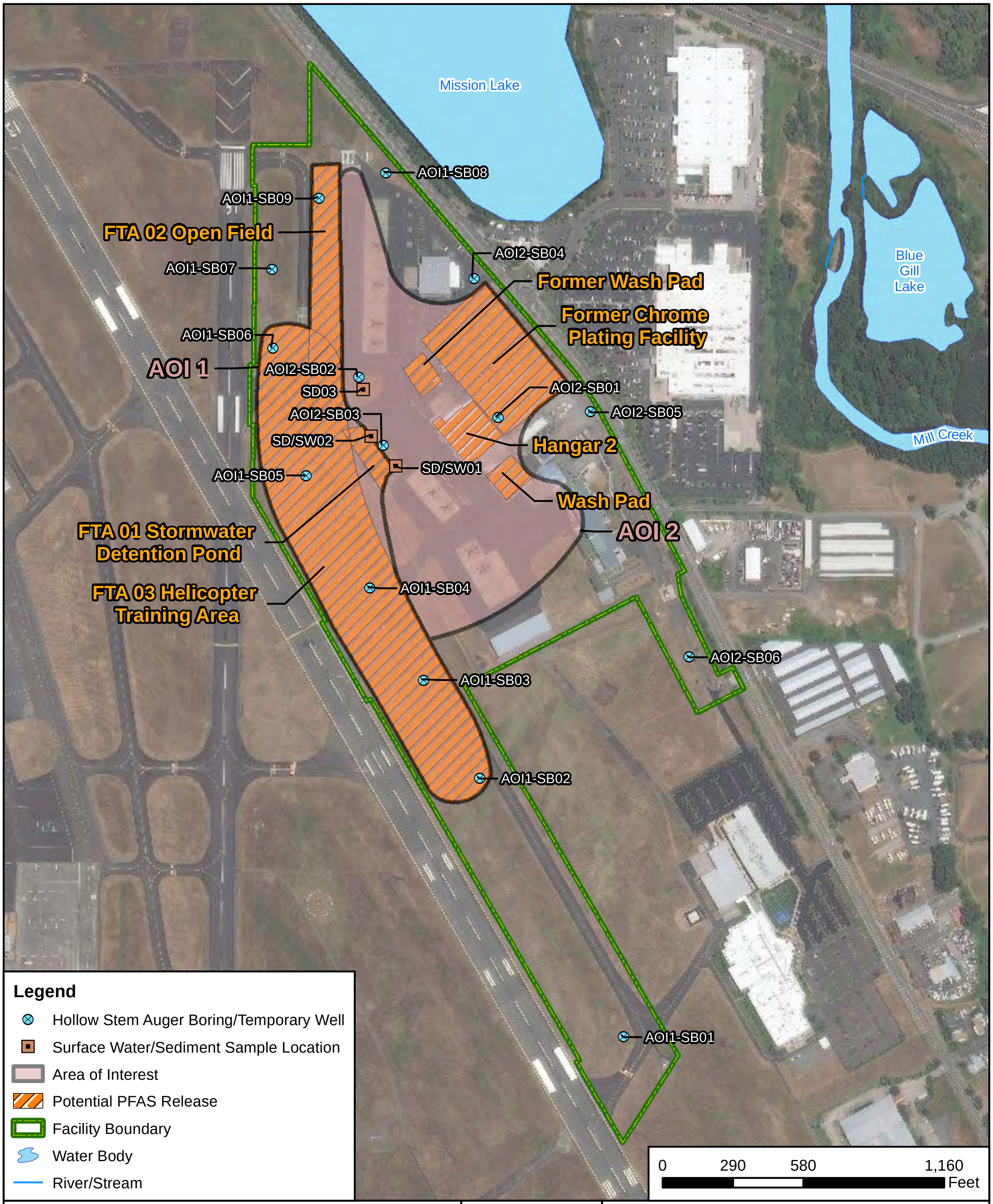

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	8/14/2020	GIS BY	MS	8/14/2020
SCALE	1:6,960	CHK BY	SI	8/14/2020
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	8/14/2020

N

Site Inspection Sample Locations

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6.0 Site Inspection Results

This section presents the analytical results of the SI for each AOI. The analytical results are reported and evaluated in the subsequent sections. 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** and **Section 6.4**. **Table 6-2** through **Table 6-6** present PFAS results for samples with detections in soil, sediment, surface water, or groundwater; only constituents detected in one or more samples are included. 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 15 October 2019 (Assistant Secretary of Defense, 2019). 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 site will proceed to a RI, the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table 6-1**.

All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain PFAS within the boundaries of the facility.

Table 6-1 Screening Levels (Soil and Groundwater)

Analyte	Residential (Soil) (µg/kg)a,b	Industrial/ Commercial Composite Worker (Soil) (µg/kg)^{a,b}	Tap Water (Groundwater) (ng/L)^{a,b}
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. HQ=0.1. 15 October 2019.

b.) If only one PFAS is present, a Hazard Quotient (HQ) of 1 applies and the values presented would increase by a factor of x10.

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 of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS 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 – Former Fire Training Areas

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1, which includes three potential PFAS release areas: FTA 01 Stormwater Detention Pond, FTA 02 Open Field, and FTA 03 Helicopter Training Area, and the results for surface water and sediment. There are no established SLs for surface water and sediment; therefore, these results are presented for informational purposes only. The detected compounds are summarized in **Table 6-2** through **Table 6-6** and on **Figure 6-1** through **Figure 6-5**.

6.3.1 Soil Analytical Results

PFOA, PFOS, and PFBS in soil, when detected, did not exceed the SLs at AOI 1. **Tables 6-2 and Table 6-3** summarize the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present the ranges of detections for PFOS and PFOA in soil.

Soil was sampled in nine boring locations associated with three potential release areas at AOI 1. Soil was sampled from three intervals at locations AOI1-SB07 and AOI1-SB08; two intervals at AOI1-SB01, AOI1-SB02, AOI1-SB03, AOI1-SB04, AOI1-SB05, AOI1-SB06, and AOI1-SB09. PFOS was detected in two borings (AOI1-SB05 and AOI1-SB08), with a maximum concentration of 1.13 µg/kg at AOI1-SB08 from 0.5 to 1 feet bgs. PFOA was detected in one sample at boring AOI1-SB08 from 0.5 to 1 feet bgs with a concentration of 0.212 J µg/kg. PFBS was not detected in any samples within the nine borings. All detections were several orders of magnitude below the applicable soil SLs. AOI1-SB08 is the only boring where PFOS and PFOA were detected. AOI1-SB08 is located northwest of FTA 02 Open Field at the facility boundary near Mission Lake. Soil samples collected from borings AOI1-01, AOI1-02, AOI1-03, AOI1-04 and AOI1-SB06 at FTA 03 Helicopter Training Area had no detections of PFOA, PFOS, or PFBS above the laboratory reporting limits, indicating that the release of AFFF to surface soil may have occurred within the middle of the potential release area, near AOI1-SB05. Additionally, soil samples collected from boring AOI1-07, located north of FTA 03 Helicopter Training Area, also did not detect PFOA, PFOS, or PFBS above the laboratory reporting limits. No soil samples were collected within FTA 01 Stormwater Detention Pond.

6.3.2 Groundwater Analytical Results

Groundwater samples were collected from nine temporary wells at AOI 1 during the SI (AOI1-GW01 through AOI1-GW09). PFOS was detected in groundwater at concentrations exceeding the SLs at four of the temporary wells: AOI1-GW06, AOI1-GW07, AOI1-GW08, and AOI1-GW09, all of which are adjacent to the facility boundaries. PFOA and PFBS did not exceed the SLs in any sample location. **Table 6-4** summarizes the detected compounds in groundwater. **Figure 6-3** presents the ranges of detections for PFOS and PFOA.

PFOS was detected in six of temporary wells, ranging in concentration from 1.99 J ng/L at AOI1-GW04 to 149 ng/L at AOI1-GW08. PFOA was detected in seven locations, ranging in concentration from 1.66 J ng/L at AOI1-GW04 to 17.7 ng/L at AOI1-GW08. PFBS was detected at five locations, ranging in concentration from 1.60 J ng/L at AOI1-GW01 to 6.05 J ng/L at AOI1-GW08. AOI1-GW08 is located northeast of FTA 02 Open Field at the facility boundary near Mission Lake. No PFOA, PFOS, or PFBS were detected at AOI1-GW03, which is located at FTA 03 Helicopter Training Area. PFOA and PFBS were detected upgradient of AOI 1 at AOI1-GW01 at concentrations of 8.58 ng/L and 1.60 ng/L, respectively.

6.3.3 Sediment Analytical Results

Three sediment samples were collected from two stormwater detention ponds within AOI 1. PFOS was detected in all three samples with a maximum detection of 35.1 µg/kg at SD02, which is located on the effluent end of FTA 01 Stormwater Detention Pond. The only detection of PFOA, at a concentration of 0.295 J µg/kg, was observed at location SD03, which is located in the secondary stormwater detention pond downgradient of FTA 01 Stormwater Detention Pond. PFBS was not detected in any of the samples. **Table 6-5** summarizes the detected compounds in sediment. **Figure 6-4** presents the ranges of detections for PFOS and PFOA in sediment.

6.3.4 Surface Water Analytical Results

Surface water samples co-located with sediment samples were collected from the two locations associated with FTA 01 Stormwater Detention Pond. PFOA, PFOS, and PFBS were detected in both surface water samples collected at AOI 1. The maximum concentrations of PFOA, PFOS, and PFBS were 15.9 ng/L, 91.4 ng/L, and 2.99 ng/L, respectively. **Table 6-6** summarizes the detected compounds in surface water. **Figure 6-5** presents the ranges of detections for PFOS and PFOA in surface water.

6.3.5 Conclusions

Based on the results of the SI, PFOA and PFOS were detected in soil at AOI 1; however, the detected concentrations were two orders of magnitude lower than the applicable soil SLs. PFBS was not detected in any of the soil samples. PFOS was detected in groundwater at concentrations above the SLs at four locations, including AOI1-GW06, AOI1-GW07, AOI1-GW08 and AOI1-GW09, all of which are adjacent to an inferred downgradient facility boundary. PFOA and PFBS were detected at concentrations below the groundwater SLs. PFOA and PFOS were detected in sediment, whereas PFOA, PFOS, and PFBS were detected in surface water. There are no established SLs for sediment and surface water; therefore, these results are presented for informational purposes only.

6.4 AOI 2 – Non-Fire Training Areas

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes four potential PFAS release areas: Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad. The detected compounds are summarized in **Table 6-2** through **Table 6-4** and on **Figure 6-1** through **Figure 6-3**.

6.4.1 Soil Analytical Results

PFOS and PFOA in soil did not exceed the SLs at AOI 2. PFBS was not detected in any samples above the laboratory reporting limits. **Table 6-2** and **Table 6-3** summarizes the detected compounds in soil. **Figure 6-1** and **Figure 6-2** present the ranges of detections for PFOS and PFOA in soil.

Soil was sampled in six boring locations associated with the four potential release areas at AOI 2. Soil was sampled from three intervals at locations AOI2-SB04 and two intervals at AOI2-SB01, AOI2-SB02, AOI2-SB03, AOI1-SB05, and AOI1-SB06. PFOS was detected in four borings, including locations AOI2-SB03, AOI2-SB04, AOI2-SB05, and AOI2-SB06, with a maximum concentration of 7.64 J µg/kg at location AOI2-SB05 from 3 feet bgs. PFOA was detected in three borings, including locations AOI2-SB03, AOI2-SB05, and AOI2-SB06, with a maximum concentration of 0.599 J µg/kg at location AOI2-SB05 from 3 feet bgs. Concentrations of PFOA and PFOS were many orders of magnitude below the SLs for soil. PFBS was not detected in any samples.

The highest detections of PFOA and PFOS were both at AOI2-SB05, which is located east of the Former Chrome Plating Facility, adjacent to the Site boundary. PFOA, PFOS, and PFBS were not detected at AOI2-SB01 and AOI2-SB02. AOI2-SB01 is located at the southern corner of the Former Chrome Plating Facility, whereas AOI2-SB02 is located at the secondary stormwater detention pond. No borings were collected directly at the Former Wash Pad, the Wash Rack, and Hangar 2. PFOA and PFOS were detected at AOI2-SB05 and AOI2-SB06, which are located near the facility boundary and are interpreted to be upgradient of AOI 2 and AOI 1.

6.4.2 Groundwater Analytical Results

Groundwater samples were collected from six temporary wells at AOI 2 during the SI (AOI2-GW01 through AOI2-GW06). PFOS exceeded the SLs at every location, whereas PFOA only exceeded at AOI2-GW06. PFBS was detected at each location, but at estimated concentrations well below the SL. **Table 6-4** summarizes the detected compounds in groundwater. **Figure 6-3** presents the ranges of detections for PFOS and PFOA.

PFOA was detected in all six temporary wells, ranging in concentration from 2.42 J ng/L at AOI2-GW01 to 58.9 ng/L at AOI2-GW06. PFOS ranged in concentration from 40.1 J ng/L at AOI2-GW03 to 144 ng/L at AOI2-GW05. PFBS was detected in all six temporary wells, ranging in concentration from 3.20 J ng/L at AOI2-GW04 to 12.4 ng/L at AOI2-GW02. Therefore, groundwater samples from every temporary well exceeded at least one of the SLs. Samples AOI2-GW05 and AOI2-GW06, which are located at the eastern and southeastern property boundaries and are interpreted to be upgradient from AOI 2, both exceeded the SLs.

6.4.3 Conclusions

Based on the results of the SI, PFOA and PFOS were detected in soil at AOI 2; however, the detected concentrations were well below the soil SLs. PFBS was not detected in any of the soil samples. PFOA and PFOS were detected in groundwater at concentrations above the SLs. PFBS was detected at concentrations below the groundwater SL.

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Salem AASF #1

Area of Interest		AOI1																			
Sample ID		AOI1-SB01-[0.5-1]		AOI1-SB02-[0.5-1]		AOI1-SB03-[0.5-1]		AOI1-SB04-[0.5-1]		AOI1-SB05-[0.5-1]		AOI1-SB06-[0.5-1]		DUP#2		AOI1-SB07-[0.5-1]		AOI1-SB08-[0.5-1]		AOI1-SB09-[0.5-1]	
Sample Date		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/13/2019		11/13/2019		11/13/2019		11/15/2019		11/13/2019	
Depth		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 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, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)																					
6:2 FTS	-	ND		ND		ND		ND		0.457	J	ND		ND		ND		ND		ND	
PFBA	-	0.152	J	0.192	J	0.212	J	0.150	J	0.228	J	0.167	J	0.269	J	0.172	J	0.291	J	0.225	J
PFDA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHxA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHxS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFNA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOA	130	ND		ND		ND		ND		ND		ND		ND		ND		0.212	J	ND	
PFOS	130	ND		ND		ND		ND		0.287	J	ND		ND		ND		1.13		ND	
PFPeA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

▨ Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFDA	perfluorodecanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography 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
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Salem AASF #1

	Area of Interest	AOI2											
	Sample ID	AOI2-SB01-[0.5-1]		AOI2-SB02-[0.5-1]		AOI2-SB03-[0.5-1]		AOI2-SB04-[0.5-1]		AOI2-SB05-[0.5-1]		AOI2-SB06-[0.5-1]	
	Sample Date	11/12/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019	
	Depth	0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft		0.5 - 1 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)													
6:2 FTS	-	ND		ND		ND		ND		ND		ND	
PFBA	-	0.272	J	0.267	J	0.267	J	ND		0.174	J	0.273	J
PFDA	-	ND		ND		ND		ND		ND		0.347	J
PFHxA	-	ND		ND		0.233	J	ND		ND		ND	
PFHxS	-	ND		ND		0.180	J	ND		ND		ND	
PFNA	-	ND		ND		0.191	J	ND		ND		0.098	J
PFOA	130	ND		ND		0.254	J	ND		ND		0.276	J
PFOS	130	ND		ND		2.71		ND		ND		2.87	
PFPeA	-	ND		ND		0.219	J	ND		ND		ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFDA	perfluorodecanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography 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
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Salem AASF #1

Area of Interest		AOI1																			
Sample ID		AOI1-SB01-[2-3]		AOI1-SB02-[3-4]		DUP#3		AOI1-SB03-3-4		AOI1-SB04-[3-4]		AOI1-SB05-[3-3.5]		AOI1-SB06-[4-4.5]		AOI1-SB07-[2.5-3]		AOI1-SB07-[5-5.5]		AOI1-SB08-[2-3]	
Sample Date		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/13/2019		11/13/2019		11/13/2019		11/15/2019	
Depth		2 - 3 ft		3 - 4 ft		3 - 4 ft		3 - 4 ft		3 - 4 ft		3 - 3.5 ft		4 - 4.5 ft		2.5 - 3 ft		5 - 5.5 ft		2 - 3 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, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)																					
PFBA	-	ND		0.358	J	0.628	J	ND		0.159	J	0.158	J	ND		ND		ND		0.281	J
PFHpA	-	ND		0.377	J	0.600	J	ND		ND		ND		ND		ND		ND		ND	
PFHxA	-	ND		1.28		1.61		ND		ND		ND		0.216	J	ND		ND		0.181	J
PFHxS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOA	1600	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFOS	1600	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.249	J
PFPeA	-	ND		1.95		2.39		ND		ND		ND		ND		ND		ND		ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography 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
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Salem AASF #1

Area of Interest		AOI1				AOI2															
Sample ID		AOI1-SB08-[4-4.5]		AOI1-SB09-[5-5.5]		AOI2-SB01-[2-2.5]		AOI2-SB02-[2-3]		AOI2-SB03-[2.5-3]		DUP#4		AOI2-SB04-2.5-3		AOI2-SB04-4-5		AOI2-SB05-[3]		DUP#7	
Sample Date		11/15/2019		11/13/2019		11/12/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019	
Depth		4 - 4.5 ft		5 - 5.5 ft		2 - 2.5 ft		2 - 3 ft		2.5 - 3 ft		2.5 - 3 ft		2.5 - 3 ft		4 - 5 ft		3 - 3 ft		3 - 3 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, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)																					
PFBA	-	0.238	J	0.163	J	ND		ND		ND		ND		ND		ND		0.515	J	0.605	J
PFHpA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.180	J
PFHxA	-	0.202	J	0.176	J	ND		ND		ND		ND		ND		ND		0.718	J	1.02	J
PFHxS	-	ND		ND		ND		ND		0.322	J	ND		ND		0.541	J	0.517	J	0.643	J
PFOA	1600	ND		ND		ND		ND		ND		ND		ND		ND		0.430	J	0.599	J
PFOS	1600	0.299	J	ND		ND		ND		ND		0.567	J	ND		1.63		5.60		7.64	J
PFPeA	-	ND		0.250	J	ND		ND		ND		ND		ND		ND		0.455	J	0.674	J

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography 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
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Salem AASF #1

	Area of Interest	AOI2	
	Sample ID	AOI2-SB06-[2.5-3.5]	
	Sample Date	11/15/2019	
	Depth	2.5 - 3.5 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)			
PFBA	-	0.165	J
PFHpA	-	ND	
PFHxA	-	ND	
PFHxS	-	ND	
PFOA	1600	ND	
PFOS	1600	0.212	J
PFPeA	-	ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
ft	feet
HQ	Hazard quotient
LCMSMS	Liquid Chromatography 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
ug/Kg	micrograms per Kilogram
-	Not applicable

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Salem AASF #1

	Area of Interest	AOI1																	
	Sample ID	AOI1-GW01		AOI1-GW02		AOI1-GW03		AOI1-GW04		AOI1-GW05		AOI1-GW06		AOI1-GW07		DUP#1		AOI1-GW08	
	Sample Date	11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/14/2019		11/13/2019		11/13/2019		11/13/2019		11/15/2019	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																			
6:2 FTS	-	ND		3.17	J	ND		ND		ND	UX	ND		ND		ND		2.88	J
PFBA	-	ND		22.9		ND		ND		ND	UX	11.4		ND		ND		10.6	
PFBS	40000	1.60	J	ND		ND		ND		ND	UX	3.63	J	2.36	J	2.65	J	6.05	J
PFDA	-	ND		ND		ND		ND		ND	UX	ND		ND		ND		ND	
PFHpA	-	12.6		22.0		ND		3.01	J	ND	UX	4.22	J	6.94	J	4.54	J	10.6	
PFHxA	-	36.7		64.7		ND		7.27	J	ND	UX	11.9		18.2		11.1		32.6	
PFHxS	-	19.8		ND		ND		ND		7.42	J	42.6		22.1		22.7		76.4	
PFNA	-	1.52	J	ND		ND		ND		ND	UX	ND		1.58	J	ND		2.69	J
PFOA	40	8.58		5.17	J	ND		1.66	J	ND	UX	4.49	J	6.37	J	4.13	J	17.7	
PFOS	40	ND		ND		ND		1.99	J	22.1	J	101		77.8		59.0		149	
PFPeA	-	61.1		122		ND		9.72		ND	UX	8.05	J	23.3		12.3		20.4	
PFTrDA	-	ND		ND		ND	UJ	ND	UJ	ND	UX	ND	UJ	ND	UJ	ND		ND	UJ
PFUnDA	-	ND		ND		ND		ND		ND	UX	ND		ND		ND		ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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.

UX/X = The presence or absence of the analyte cannot be substantiated. Acceptance or rejection of the data should be decided by the project team, but exclusion of the data is recommended.

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
GW	Groundwater
HQ	Hazard quotient
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
Qual	Interpreted Qualifier
USEPA	United States Environmental Protection Agency
ng/L	nanogram per liter
-	Not applicable

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Salem AASF #1

	Area of Interest	AOI1		AOI2													
	Sample ID	AOI1-GW09		AOI2-GW01		AOI2-GW02		AOI2-GW03		DUP#5		AOI2-GW04		AOI2-GW05		AOI2-GW06	
	Sample Date	11/13/2019		11/12/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019		11/15/2019	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																	
6:2 FTS	-	ND		ND		ND		ND		2.28	J	ND		ND		ND	
PFBA	-	10.7		ND		18.3		16.9		12.9		ND		ND		31.3	
PFBS	40000	5.03	J	3.33	J	12.4		5.21	J	9.64		3.20	J	6.30	J	3.40	J
PFDA	-	ND		ND	UJ	1.51	J	ND		ND		ND		ND		1.78	J
PFHpA	-	5.06	J	ND		19.1		4.41	J	7.30	J	3.00	J	1.80	J	27.2	
PFHxA	-	12.5		5.21	J	37.1		12.0		18.9		10.2		13.6		106	
PFHxS	-	35.8		40.1		97.8		39.7	J	67.2	J	72.4		95.5		27.1	
PFNA	-	1.58	J	ND		3.20	J	ND		ND		ND		ND		5.79	J
PFOA	40	7.34	J	2.42	J	13.5		5.66	J	7.53	J	4.47	J	4.04	J	58.9	
PFOS	40	128		76.8		103		40.1	J	91.9	J	140		144		82.8	
PFPeA	-	12.5		ND		35.1		10.8		20.4		5.54	J	3.71	J	101	
PFTrDA	-	ND	UJ	31.6	J+	ND		ND		ND		8.75	J+	ND		ND	
PFUnDA	-	ND		1.96	J+	ND		ND		ND		ND		ND		ND	

▨ Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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.

UX/X = The presence or absence of the analyte cannot be substantiated. Acceptance or rejection of the data should be decided by the project team, but exclusion of the data is recommended.

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
GW	Groundwater
HQ	Hazard quotient
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
Qual	Interpreted Qualifier
USEPA	United States Environmental Protection Agency
ng/L	nanogram per liter
-	Not applicable

Table 6-5
PFAS Detections in Sediment
Site Inspection Report, Salem AASF #1

Area of Interest	AOI 1					
Sample ID	SD01		SD02		SD03	
Sample Date	11/15/2019		11/15/2019		11/15/2019	
Depth	0 - 1 ft		0 - 1 ft		0 - 1 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Sediment, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ug/Kg)						
PFBA	0.212	J	1.75	J	0.498	J
PFHxA	ND	UJ	ND		0.263	J
PFHxS	ND	UJ	3.00	J	0.741	J
PFNA	ND	UJ	ND		0.157	J
PFOA	ND	UJ	ND		0.295	J
PFOS	0.771	J	35.1		5.90	
PFPeA	ND	UJ	ND		0.280	J

Interpreted Qualifiers

J = Estimated concentration

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.

Chemical Abbreviations

PFBA	perfluorobutyrate
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	feet
LOD	Limit of Detection
ND	Analyte not detected above the LOD
Qual	Interpreted Qualifier
SD	Sediment
μg/Kg	micrograms per Kilogram

Table 6-6
PFAS Detections in Surface Water
Site Inspection Report, Salem AASF #1

Area of Interest	AOI 1					
Sample ID	SW01		DUP#6		SW02	
Sample Date	11/15/2019		11/15/2019		11/15/2019	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, PFAS via PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)						
PFBA	13.7		20.8		ND	
PFBS	1.52	J	2.99	J	2.41	J
PFDA	2.23	J	2.16	J	ND	
PFHpA	16.1		25.3		2.12	J
PFHxA	32.9	J	51.7	J	6.88	J
PFHxS	13.1		22.0		21.0	
PFNA	3.14	J	5.90	J	ND	
PFOA	10.2		15.9		3.39	J
PFOS	43.7	J	91.4	J	43.1	
PFPeA	46.8	J	81.6	J	6.41	J
PFUnDA	ND		7.46	J	ND	

Interpreted Qualifiers

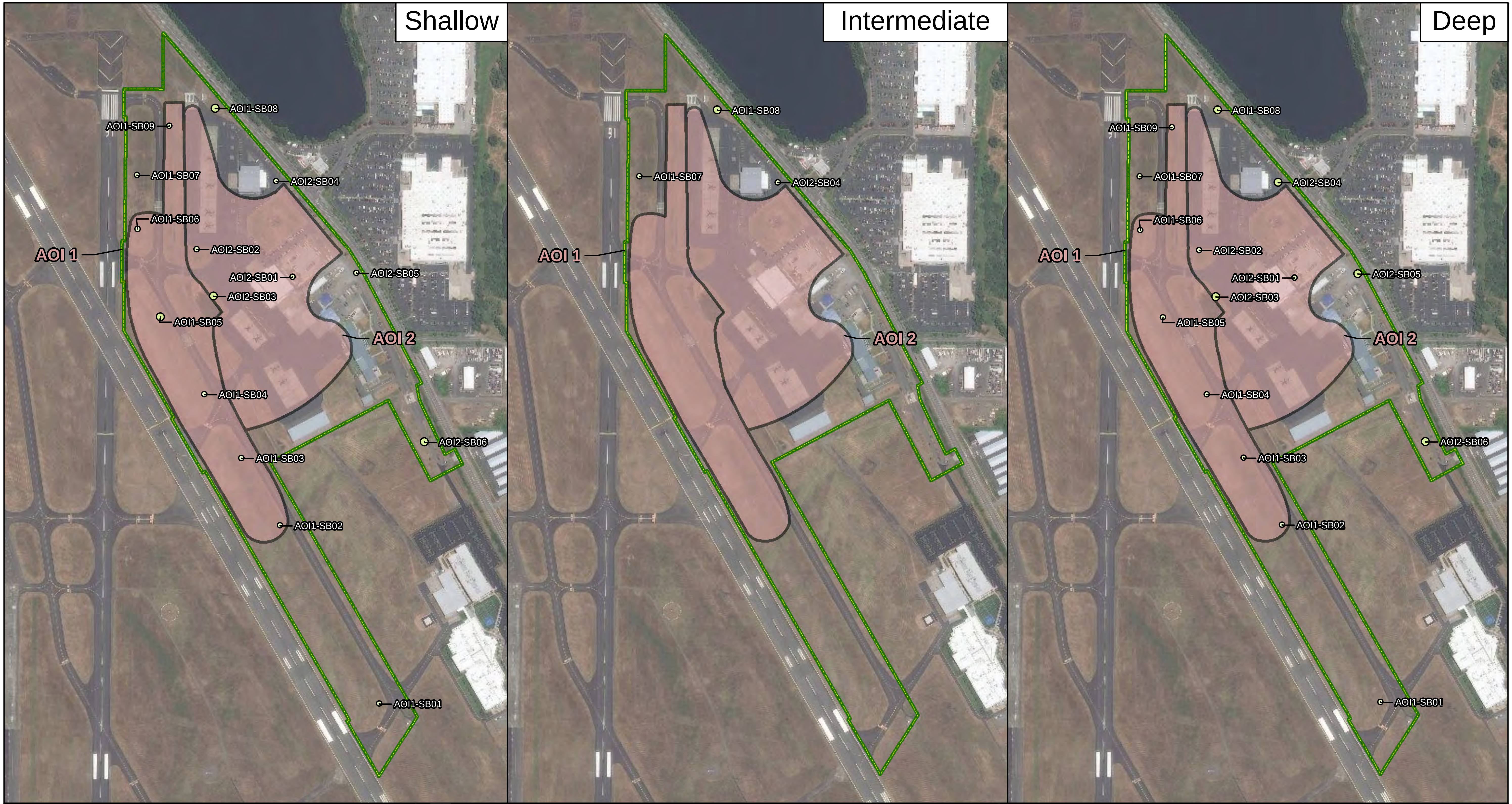
J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DUP	Duplicate
LOD	Limit of Detection
ND	Analyte not detected above the LOD
Qual	Interpreted Qualifier
SW	Surface water
ng/L	nanogram per liter



▨ Area of Interest
🟩 Facility Boundary

PFOS Results (µg/Kg)
- ○ ND
- ● >ND - 10
- ● >10 - 130
- ● >130 - 1,600
- ● >1,600

0 290 580 1,160 Feet

N

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	4/10/2020	GIS BY	MS	4/10/2020
SCALE	1:6,960	CHK BY	AP	4/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	4/10/2020

PFOS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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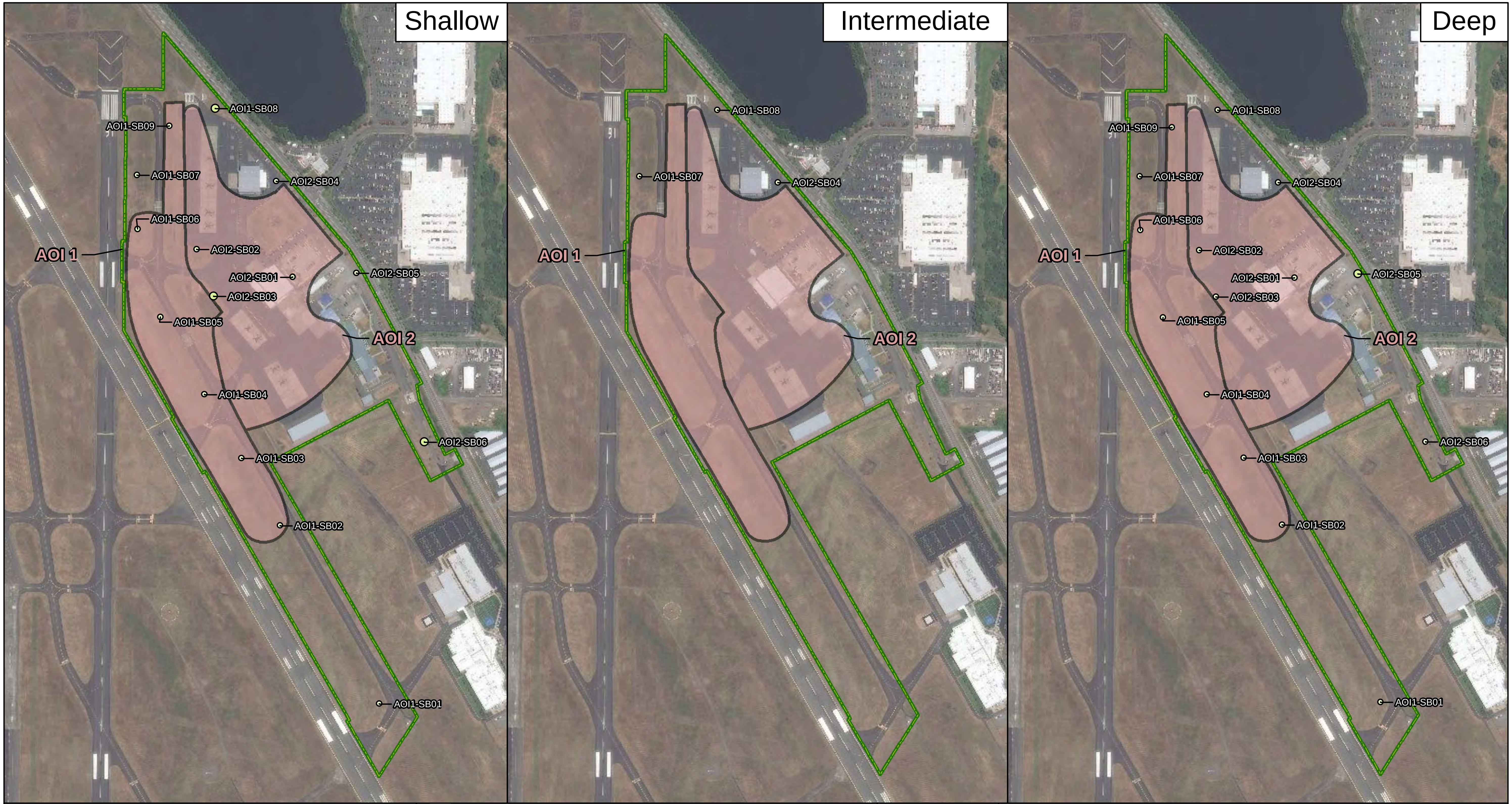

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	4/10/2020	GIS BY	MS	4/10/2020
SCALE	1:6,960	CHK BY	AP	4/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	4/10/2020

🟥 Area of Interest

🟩 Facility Boundary

PFOA Results (µg/Kg)

- ○ ND
- ● >ND - 10
- ● >10 - 130
- ● >130 - 1,600
- ● >1,600

0 290 580 1,160
Feet

N

PFOA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2

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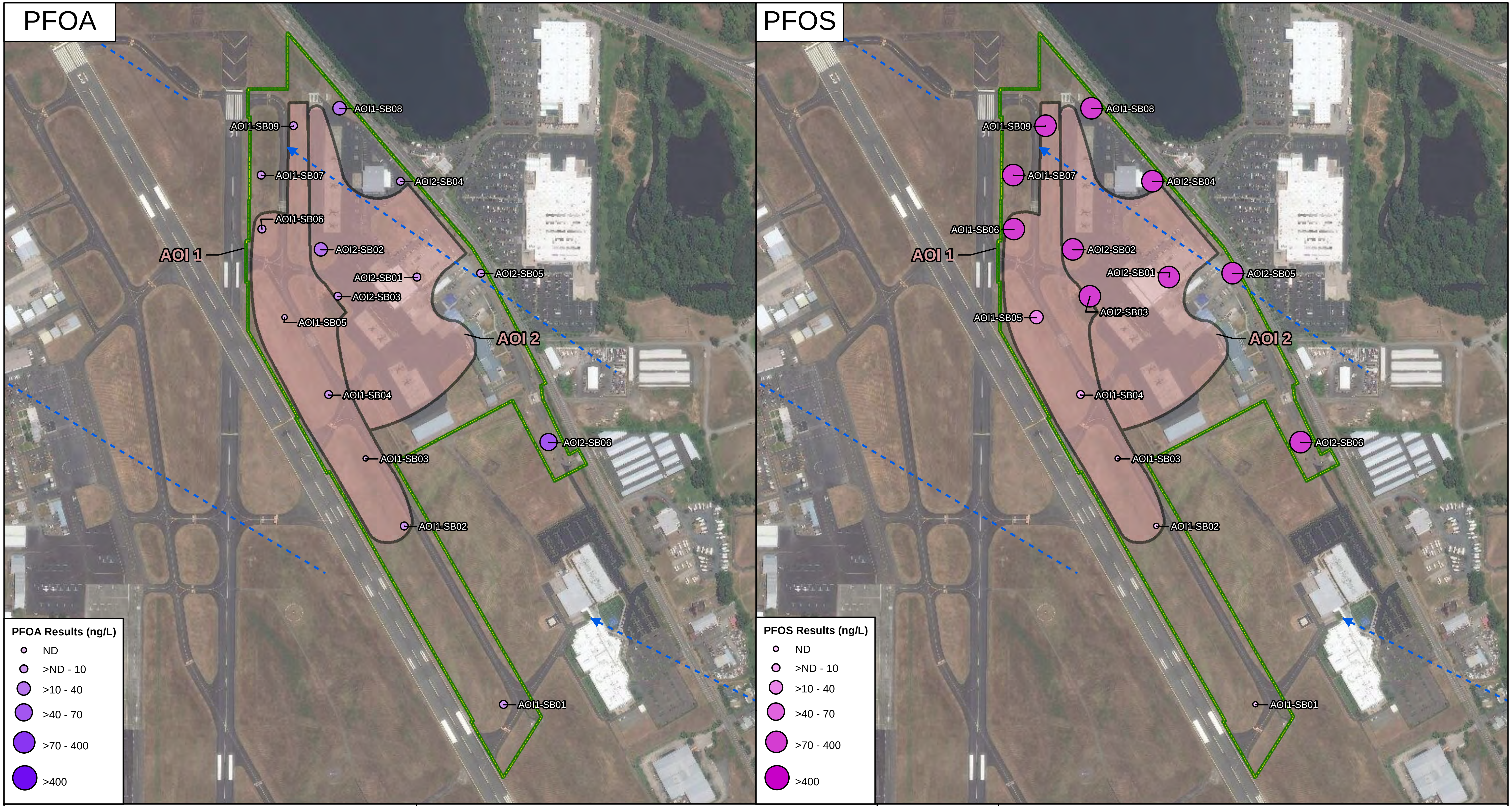

CLIENT	ARNG				
PROJECT	Site Inspection for PFAS at McNary Field Salem AASF, OR				
REVISED	8/14/2020	GIS BY	MS	8/14/2020	
SCALE	1:6,960	CHK BY	AP	8/14/2020	
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	8/14/2020	

Legend

▨ Area of Interest

🟩 Facility Boundary

- ▶ Inferred Groundwater Flow Direction

0 290 580 1,160
Feet

N

PFOA & PFOS Detections in Groundwater

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	4/10/2020	GIS BY	MS	4/10/2020
SCALE	1:6,960	CHK BY	AP	4/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	4/10/2020

▨ Area of Interest
🟩 Facility Boundary

PFOA Results (µg/Kg)
- ○ ND
- ● >ND - 10
- ● >10 - 100
- ● >100 - 1,000
- ● >1,000

PFOS Results (µg/Kg)
- ○ ND
- ○ >ND - 10
- ● >10 - 100
- ● >100 - 1,000
- ● >1,000

N

PFOA and PFOS Detections in Sediment

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-4

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at McNary Field Salem AASF, OR			
REVISED	4/10/2020	GIS BY	MS	4/10/2020
SCALE	1:6,960	CHK BY	AP	4/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	RG	4/10/2020

▭ Area of Interest
▭ Facility Boundary

PFOA Results (ng/L)
- ○ ND
- ● >ND - 10
- ● >10 - 100
- ● >100 - 1,000
- ● >1,000

PFOS Results (ng/L)
- ○ ND
- ● >ND - 10
- ● >10 - 100
- ● >100 - 1,000
- ● >1,000

N

PFOA and PFOS Detections in Surface Water

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-5

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7.0 Exposure Pathways

The CSMs for each AOI, revised based on the SI findings are presented on **Figure 7-1**. 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 no identified complete pathway generally warrant no further action. However, the pathway is considered potentially complete if PFOA, PFOS, or PFBS 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 PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway may warrant further investigation.

In general, the potential PFAS exposure pathways 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 PFAS toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the Site include site workers (e.g., facility staff and visiting soldiers), construction workers, recreational users, and nearby off-facility residents. The CSM for AOIs 1 and 2, revised based on the SI findings, is presented on **Figure 7-1**.

7.1 Soil Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

7.1.1 AOI 1 – Former Fire Training Areas

From approximately 1997 to 2017, fire training exercises resulted in the release of AFFF to soil at one or more of the three potential release areas associated with AOI 1: FTA 01 Stormwater Detention Pond, FTA 02 Open Field, and FTA 03 Helicopter Training Area. PFOA and PFOS were detected in soil at low levels at two boring locations completed at AOI 1. Based on the results of the SI in AOI 1, ground-disturbing activities to surface soil could result in site worker and construction worker exposure to PFOA and PFOS via inhalation of dust. Ground-disturbing activities to subsurface soil could result in construction worker exposure to PFOS via ingestion. Therefore, the exposure pathways for inhalation and ingestion are potentially complete for these receptors. The CSM is presented in **Figure 7-1**.

7.1.2 AOI 2 – Non-Fire Training Areas

AOI 2 encompasses four non-FTAs: Hangar 2, Former Chrome Plating Facility, Wash Pad, and Former Wash Pad. Activities at AOI 2, documented as having occurred as early as 1974, include potential washing of firetrucks following fire training activities with AFFF, potential historic presence of PFAS-containing mist suppressants used in chrome plating, and known and potential washing of aircraft at two concrete wash pads, and other potential AFFF releases within the paved ramp area. PFOA and PFOS were detected in four boring locations at AOI 2 at low levels within the surface and shallow subsurface soil. Based on the results of the SI in AOI 2, ground-disturbing activities to surface soil could result in site worker and construction worker exposure to PFOA and PFOS via inhalation of dust. Ground-disturbing activities to subsurface soil could result in construction worker exposure to PFOA and PFOS via ingestion. Therefore, the exposure pathways for inhalation and ingestion are potentially complete for these receptors. The CSM is presented in **Figure 7-1**.

7.2 Groundwater Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

7.2.1 AOI 1 – Former Fire Training Areas

PFOA, PFOS, and PFBS were detected in groundwater from temporary wells at the AOI 1 source areas and facility boundary with PFOS exceeding the SLs for groundwater. While the surface water intakes for the City of Salem drinking water are all located upgradient of the Site, private drinking water wells, ranging from approximately 30 to 100 feet deep, are located less than a mile downgradient from the Site. Based on the SI results, the drinking water pathway via ingestion is potentially complete for nearby off-site residents. Additionally, the ingestion exposure pathway is also considered potentially complete for construction workers during trenching activities deep enough to encounter shallow groundwater.

Based on groundwater flow directions and the analytical results reported for sample AOI1-GW01, potential upgradient, off-facility sources may be impacting the Site. Although the groundwater sampled at AOI1-GW01 was below the SLs (**Section 6.3.1**), the presence of PFOA and PFBS indicate a potential off-facility source. The CSM is presented in **Figure 7-1**.

7.2.2 AOI 2 – Non-Fire Training Areas

PFOA, PFOS, and PFBS were detected in groundwater at the AOI 2 source areas and facility boundary at concentrations exceeding the SLs for PFOA and PFOS in groundwater. The pathways and receptors for AOI 2 are the same as described in **Section 7.2.1**. The CSM is presented in **Figure 7-1**. Based on groundwater flow directions, two temporary wells identified as being upgradient of AOI 2 at the facility boundary exceeded SLs. Groundwater sample AOI2-GW05 exceeded the SL for PFOS and sample AOI2-GW06 exceeded the SLs for PFOA and PFOS. Consequently, potential off-facility sources may be impacting the Site.

7.3 Surface Water and Sediment Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in surface water and sediment were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

7.3.1 AOI 1 – Fire Training Areas

Surface water within the Site flows towards a grated storm drain system, which is located on the paved western edge of the facility. Stormwater and surface water runoff are directed into two stormwater detention ponds, which discharge to Mission Ditch, outside the northwest boundary of the facility. Mission Ditch then flows west-northwest and discharges into Pringle Creek, a tributary of the Willamette River. Two co-located surface water/sediment samples were collected from within the FTA 01 Stormwater Detention Pond, and one sediment sample was collected from a secondary stormwater detention pond located downgradient of the FTA 01 Stormwater Detention Pond.

PFOA, PFOS, and PFBS were detected in surface water at AOI 1, whereas PFOA and PFOS were detected in sediment. Therefore, the incidental ingestion exposure pathways in surface water and sediment are considered potentially complete for receptors at the site (workers, construction workers) and recreational users. The CSM is presented in **Figure 7-1**.

7.3.2 AOI 2 – Non-Fire Training Areas

Surface water and sediment sampling was planned for AOI 2 during this SI, but the proposed sampling location (SD/SW04) was observed to be dry and free of sediment, and a suitable replacement location was unable to be identified. This resulted in the surface water and sediment exposure pathway not being fully evaluated for AOI 2. However, given that surface water collected within AOI 2 discharges to Mission ditch, as it does for AOI 1, the receptors are the same for both AOIs. Therefore, the incidental ingestion exposure pathways in surface water and sediment are considered potentially complete at AOI 2 for receptors at the site (workers, construction workers), and recreational users. The CSM is presented in **Figure 7-1**.

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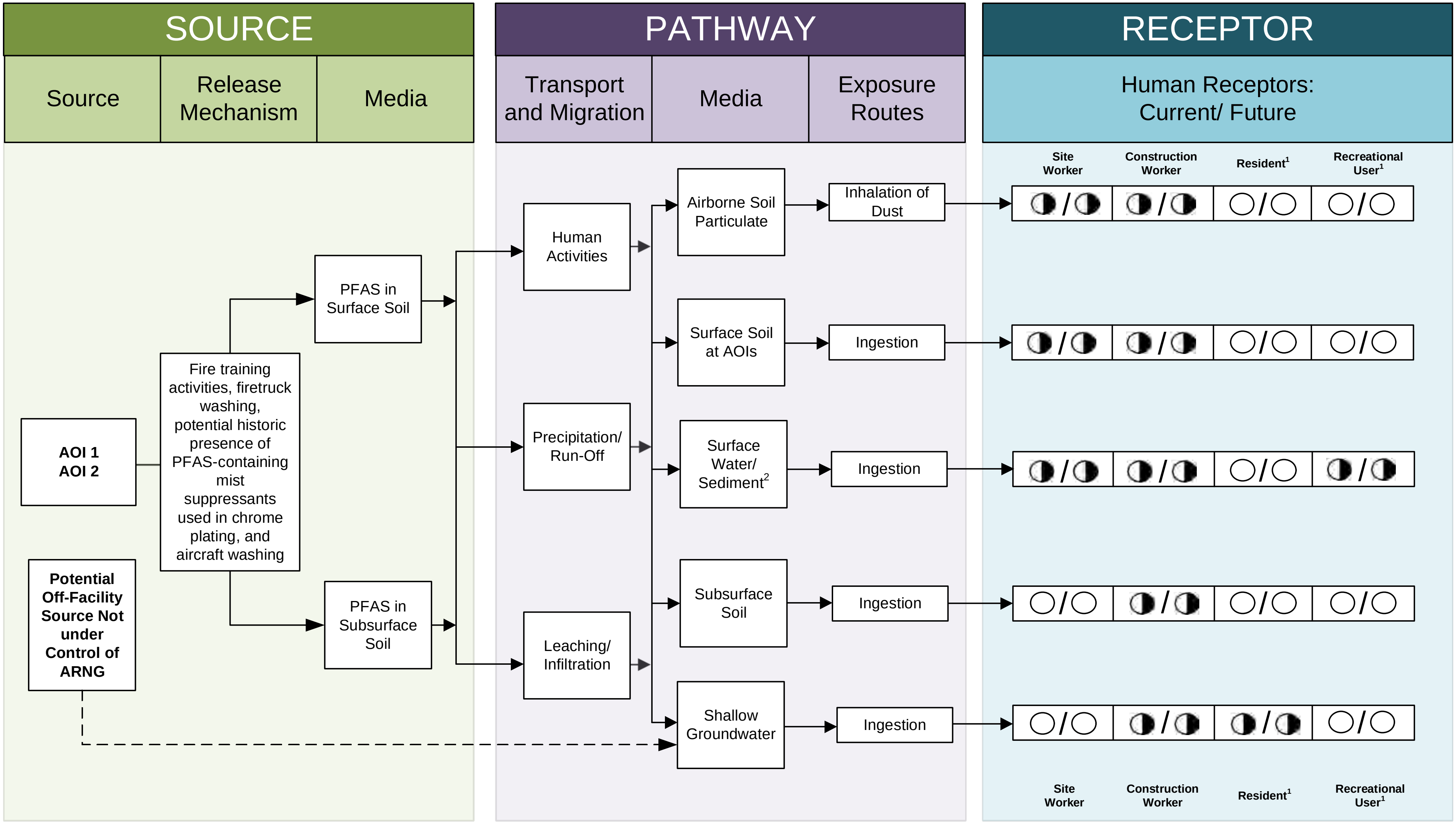

SOURCE			PATHWAY			RECEPTOR
Source	Release Mechanism	Media	Transport and Migration	Media	Exposure Routes	Human Receptors: Current/ Future

AOI 1
AOI 2

Potential Off-Facility Source Not under Control of ARNG

Fire training activities, firetruck washing, potential historic presence of PFAS-containing mist suppressants used in chrome plating, and aircraft washing

PFAS in Surface Soil

PFAS in Subsurface Soil

Human Activities

Precipitation/ Run-Off

Leaching/ Infiltration

Media	Exposure Routes	Site Worker	Construction Worker	Resident[1]	Recreational User[1]
Airborne Soil Particulate	Inhalation of Dust	◐/◐	◐/◐	○/○	○/○
Surface Soil at AOIs	Ingestion	◐/◐	◐/◐	○/○	○/○
Surface Water/ Sediment[2]	Ingestion	◐/◐	◐/◐	○/○	◐/◐
Subsurface Soil	Ingestion	○/○	◐/◐	○/○	○/○
Shallow Groundwater	Ingestion	○/○	◐/◐	◐/◐	○/○

LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

○ Incomplete Pathway

◐ Potentially Complete Pathway

● Complete Pathway

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

2. Surface water/sediment exposure routes fully evaluated for AOI 1 only. However, given that surface water collected within AOI 2 discharges to Mission Ditch, as it does for AOI 1, the receptors are the same for both AOIs.

3. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-1
Conceptual Site Model
AOI 1 Fire Training Areas and AOI 2 Non-Fire Training Areas.

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8.0 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 Summary

The SI field activities at the Site were conducted from 12 to 15 November 2019. The SI field activities included soil, groundwater, surface water, and sediment sampling. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2019b), except as previously noted in **Section 5.7**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2019b), samples were collected and analyzed for a subset of PFAS by LC/MS/MS complaint with QSM 5.1 Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.6** of this Report

- 33 soil grab samples from 15 boring locations;
- 15 grab groundwater samples from 15 temporary well locations;
- 3 sediment samples; and
- 2 surface water samples, which were co-located with sediment samples.

The information gathered during this investigation was used to determine PFOA, PFOS, and PFBS were present at or above SLs. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure to PFOA, PFOS, and PFBS at the AOIs, which are described in **Section 7**.

8.2 SI Goals Evaluation

As described in **Section 4.2**, the SI activities were designed to achieve six main goals or DQOs. This section describes the SI goals and the conclusions that can be made for each based on the data collected during this investigation.

1. *Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.*

   PFOA, PFOS, and PFBS were detected at the Site in groundwater and surface water, whereas PFOA and PFOS were detected in soil and sediment. PFOA, PFOS, and PFBS were detected both at source areas as well as near the facility boundary between source areas and potential drinking water receptors. Detections in groundwater exceeded the SLs for PFOA and PFOS.

2. *Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.*

   All potential release areas were soil samples were collected detected PFOA or PFOS at concentrations several orders of magnitude below the SLs. Additionally, PFOA, PFOS, and PFBS were detected in groundwater samples associated with both AOIs, with detections in 14 out of 15 temporary wells. The only groundwater sample that did not have any detections of PFOA, PFOS, or PFBS was AOI1-GW03, which is located at the FTA 03 Helicopter Training Area; however, other samples in the release area had detections. Ten of the 15 groundwater samples collected during the SI exceeded the SLs. Therefore, none of the release areas have been eliminated from further consideration.

3. *Determine the potential need for a removal action.*

   Based on the data collected during this SI, no need for a removal action was identified.

4. *Collect data to better characterize the release areas for more effective and rapid initiation of a RI, if determined necessary.*

   The collected geological data indicate a highly permeable and conductive environment with soils dominated by poorly graded sand, gravel, and cobbles with occasional interbedded clayey sand. The observed depth to groundwater observed during the SI ranged from approximately 2.6 to 7.5 feet bgs. Groundwater velocities calculated in **Section 2.2.3** range from 9 to 45 ft/day. These geologic and hydrogeologic observations can be used in development of technical approach for the RI.

   Out of the five soil borings collected across FTA 03 Helicopter Training Area, only AOI1-SB05 had detections of PFOS. Though these detections were low, this may indicate that fire training activities occurred mostly toward the middle of this area. Similarly, AOI2-SB01 did not have any PFOA, PFOS, or PFBS in soil but AOI2-SB04 did at 4-5 feet bgs. This may suggest that PFAS was used to the northern areas of the Former Chrome Plating Facility.

5. *Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).*

   Based upon the qualitative evaluation of soil results in combination with quantitative groundwater results and groundwater flow direction analysis, the source of detected PFOA, PFOS, and PFBS at the Site is likely the result of historical DoD activities; however, PFOA, PFOS, and PFBS were detected in temporary wells installed upgradient of AOIs 1 and 2, including two temporary wells that exceeded the SLs in groundwater, suggesting an off-facility source may be impacting the facility.

6. *Determine whether a potentially complete pathway exists between the source and potential receptors and whether the contamination is attributable to ARNG activities.*

   Detections of PFOA, PFOS, and PFBS in soil and groundwater at source areas and near the facility boundary indicate there are potentially complete pathways between source and on and off-facility receptors.

8.3 Outcome

Based on the CSMs developed and revised based on the SI findings, there is potential for exposure to residential drinking water receptors from releases during historical DoD activities at the Site, and potentially from off-facility sources.

Sample chemical analytical concentrations collected during this SI were compared against the project SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOA, PFOS, and PFBS were detected in groundwater in the source areas and near the facility boundary at AOI 1. PFOS exceeded the SL in groundwater in four of the nine temporary wells with a maximum concentration of 149 ng/L. PFOA and PFBS did not exceed the SLs. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

- PFOA, PFOS, and PFBS were detected in groundwater in the source areas and near the facility boundary at AOI 2. PFOS exceeded the SL in groundwater in all six temporary wells with a maximum concentration of 144 ng/L at AOI2-GW05. PFOA only exceeded the SL at AOI2-GW06 with a concentration of 58.9 ng/L; however, AOI2-GW06 is considered upgradient of AOI 2 based on groundwater flow. PFBS did not exceed the SL in any sample.
- PFOA and PFOS was detected in soil at both AOI 1 and 2 at low concentrations, several orders of magnitude below the SLs.
- PFOA, PFOS, and PFBS were detected in groundwater upgradient of AOI 1 and AOI 2 in samples AOI1-GW01, AOI2-GW05, and AOI2-GW06, which suggests potential contributions from off-facility sources. Samples AOI2-GW05 and AOI2-GW06 exceeded the SLs and were located at the eastern and southeastern facility boundaries.

Table 8-1 summarizes the SI results for soil and groundwater. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to residential drinking water receptors caused by DoD activities at or adjacent to the facility.

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for AOI 1: Former Fire Training Areas and AOI 2: Non-Fire Training Areas.

Table 8-1 Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	FTA 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area	◐	●	●
2	Hangar 2, Former Chrome Plating Facility, Wash Pad, Former Wash Pad	◐	●	●

Legend:

● = detected; exceedance of screening levels
◐ = detected; no exceedance of screening levels
○ = not detected

Table 8-2 Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	FTA 01 Stormwater Detention Pond, FTA 02 Open Field, FTA 03 Helicopter Training Area	Exceedances of the SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
2	Hangar 2, Former Chrome Plating Facility, Wash Pad, Former Wash Pad	Exceedances of the SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

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