FINAL
Site Inspection Report
Biak Training Center Brett Hall
Powell Butte, Oregon

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

August 2023

Prepared for:

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

UNCLASSIFIED

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
COUTES	Central Oregon Unit Training Equipment Site
CSM	conceptual site model
DA	Department of the Army
DEQ	Department of Environmental Quality
DoD	Department of Defense
DOGAMI	Department of Geology and Mineral Industries
DOT	Department of Transportation
DQO	data quality objective
DUA	data usability assessment
EDR™	Environmental Data Resources, Inc.™
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FBI	Federal Bureau of Investigation
FedEx	Federal Express
FRB	field reagent blank
FTA	Fire Training Area
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
HUC	hydrologic unit code
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
MIL-SPEC	military specification
MOUT	Military Operations on Urban Terrain
MS/MSD	matrix spike/ matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter

NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Unit
OHA	Oregon Health Authority
OMD	Oregon Military Department
ORARNG	Oregon Army National Guard
OSD	Office of the Secretary of Defense
OWRD	Oregon Water Resources Department
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Executive Summary

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

The PA identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). During the SI, an additional AOI (AOI 3) was identified. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at the Biak Training Center Brett Hall, Powell Butte, Oregon and determined no further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for each of the three AOIs at this time. Biak Training Center Brett Hall will also be referred to as the "facility" throughout this document.

Biak Training Center Brett Hall is located in Powell Butte, Oregon, approximately 4 miles southeast of the City of Redmond and approximately 14 miles northeast of the City of Bend. The facility is occupied and operated by the Oregon ARNG as a military training center. Training at the facility includes military personnel and civilian personnel, such as law enforcement, fire departments, state agencies and non-DoD federal agencies.

The PA identified two AOIs for investigation during the SI phase. A third AOI was identified after the PA. SI sampling results from the three AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, no further evaluation under CERCLA is warranted for each of the three AOIs at this time.

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

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

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

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Screening values for HFPO-DA were established after SI planning and execution and thus not included as an analyte. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Engine Academy Training Area	◐	○	○	No further action
2	Bomb Squad Training Area	◐	○	N/A	No further action
3	Range Control Infiltration Basin	◐	N/A	N/A	No further action

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

1. Introduction

1.1 Project Authorization

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

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

1.2 SI Purpose

A PA was performed at Biak Training Center Brett Hall (AECOM Technical Services, Inc. [AECOM], 2019) that identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically. A third AOI was added during the SI. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

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

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2. Facility Background

2.1 Facility Location and Description

Biak Training Center Brett Hall is located in Powell Butte, Crook County, approximately 4 miles to the southeast of the City of Redmond and approximately 14 miles to the northeast of the City of Bend. Biak Training Center Brett Hall is located approximately 2.5 miles to the south of Highway 126 (**Figure 2-1**). Biak Training Center Brett Hall is occupied and operated by the Oregon ARNG (ORARNG) as a military training center, and it encompasses 4,300 acres of which 100 acres are designated as Biak Training Center Brett Hall (Oregon Military Department [OMD], 2018a).

Biak Training Center Brett Hall includes one building used as the training center, two warehouse buildings, and an exterior training area known as the Military Operations on Urban Terrain (MOUT) range. The facility is primarily unpaved, with the exception of the main road and the parking lot surrounding the building. Numerous shipping containers at the MOUT range are used for military operations and firefighting training; access to the facility is not controlled. Biak Training Center Brett Hall draws drinking water from one well that receives no treatment and has a septic system discharging to an adjacent leach field.

The state mission of Biak Training Center Brett Hall is to provide community and training support for citizens and organizations of the state and US. The federal mission of Biak Training Center Brett Hall is to provide facilities and resources for a training center contributing readiness and military capability for the armed forces of the state and US (OMD, 2018a). Training at Biak Training Center Brett Hall includes military personnel and civilian personnel, such as law enforcement, fire departments, state agencies, and non-DoD federal agencies.

The US Forest Services (USFS) Engine Academy conducted annual fire training at the MOUT range from 2010 to 2015. The annual training included local fire departments and local law enforcement agencies (city/county/state agencies), and it was facilitated by OMD. Annual bomb squadron training occurred at the MOUT in 2016 and 2017 and included local law enforcement led by the Federal Bureau of Investigation (FBI). Aqueous film-forming foam (AFFF) has been used for training purposes at the Engine Academy fire training area (FTA) and bomb squad training area.

A dedicated Wildland Fire Program is located at the facility and has the mission of providing safety and training resources. The program provides wildland fire suppression and supports military training operations during fire seasons. The OMD collaborates with the Bureau of Land Management (BLM) Prineville District for ecosystem management (OMD, 2018b). The OMD also collaborates with the USFS and local fire departments for fire response. According to interviews conducted with the OMD Fire Officer, OMD fire rangers respond to fire emergencies in the area as necessary (if other agencies are not available).

The Biak Training Center Brett Hall property is owned by the federal government and was administered by the US Army Corps of Engineers (USACE), with licensing use to the OMD since 2002. Biak Training Center Brett Hall is within the Biak Training Center, which is comprised of 4,300 acres owned by the BLM Prineville and leased to the OMD.

Based on review of historical aerial photographs, development of the installation appears as early as 1994, with the main building, two warehouse structures, and the paved roadway; development of the MOUT range appears by 2006. The facility appears to be in similar configuration as observed during the site visit (Environmental Data Resources, Inc. ™ [EDR™], 2018a; Google Earth, 2018).

2.2 Facility Environmental Setting

Biak Training Center Brett Hall is located in the Deschutes Columbia Plateau geologic province of Oregon (Oregon Department of Environmental Quality [DEQ], 2013; US Department of Interior [USDI], 2018) and bordered by undeveloped land along all four sides. Biak Training Center Brett Hall is comprised mostly of undeveloped, vegetated land underlain by volcanic lava flow beds. Paved areas at the facility include the road to enter/exit the facility from the northwest and southwest and the parking area surrounding the main building; the paved areas at the facility are primarily flat. From west to east, elevation at the facility ranges from approximately 3,080 and increases to 3,100 feet above mean sea level (amsl). From north to south, elevation ranges from approximately 3,085 and increases to approximately 3,095 feet amsl (**Figure 2-2**). Elevation throughout the facility averages 3,100 feet amsl. Topography at the facility follows a northwest gradient (Google Earth, 2018; EDR™, 2018b).

2.2.1 Geology

Biak Training Center Brett Hall is in a geologic area characterized as basalt and basaltic andesite of the Pleistocene to Holocene ages (**Figure 2-3**). This geologic feature occurs primarily along the crest of the Cascade Range, located to the west of the facility (US Geological Survey [USGS], 2018a). These basaltic lava flows are the most widespread types of surface geology in the region, with the oldest basalt lava flows exposed west of the Deschutes River (west of the facility). Vents associated with the lava flows are dispersed throughout the region as lava and cinder cones. Known as “Lava Badlands”, basalt from fissure eruptions cover the region, generally as thin sheets of pahoehoe flows where the surface appears ropy. The lava flows were estimated to extend from the land surface to 50 to 100 feet below ground surface (bgs). The Lava Badlands consist of a lava tube system, indicative of a lateral spread of lava. The Redmond Caves is one such lava tube system, located approximately 4 miles northwest of Biak Training Center Brett Hall (Department of Geology and Mineral Industries [DOGAMI], 1976).

Biak Training Center Brett Hall is underlain by volcanic deposits of the Quaternary period of the Cenozoic era (EDR™, 2018b). These deposits constitute the second major composite stratigraphic unit in the region, which is reported as extending to depths over 2,000 feet in some areas. This composition is comprised of lava flows, domes, vent deposits, pyroclastic deposits, and volcanic sediments (USGS, 2001). The volcanic rocks consist of ash and cinders, while the sedimentary rocks consist of semi-consolidated sand and gravel eroded from volcanic rocks (USGS, 1994, 2018b).

Soils beneath Biak Training Center Brett Hall consist primarily of Stukel-Deschutes complex within most of the facility boundary and Stukel-Rock outcrop-Deschutes complex in the eastern portion of the facility (US Department of Agriculture [USDA], 1999). Both soil series consist of shallow, well-drained soils with moderately rapid permeability located in lava plains that formed in ash (USDA, 1999). The Deschutes complex is characterized as sandy loam in the top 31 inches, followed by basalt at 31 inches. The Stukel complex is characterized as sandy and cobbly sandy loam in the top 11 inches, followed by gravelly sandy loam to 18 inches bgs and basalt at 18 inches bgs. Bedrock of the Deschutes series is reported at 20 to 40 inches bgs, while bedrock of the Stukel series is reported at 10 to 20 inches bgs (USDA, 1999). Boring logs available online at the Oregon Water Resources Department (OWRD) website indicate local soil thickness is highly variable and generally greater than 2 feet thick but potentially up to 20 feet thick (OWRD, 2020).

During the SI, basalt bedrock was observed as the dominant lithology below Biak Training Center Brett Hall. The borings were completed at depths between 5 and 446.5 feet bgs. Sedimentary interbeds consisting of silty sand, poorly graded sandy, poorly graded sand, poorly graded gravel, well-graded sand, well-graded gravel, silt, siltstone, and sandstone were also observed within the bedrock at thicknesses ranging from a few inches to 24 feet. These observations are consistent

with described in other studies. Samples for grain size analyses were collected at two locations, AOI01-01-SB-[1.7]-[2.2] and BCT-02-SB-[0]-[1.0], and analyzed via American Society for Testing and Materials (ASTM) Method D-422. Grain size results are pending from the laboratory and will be included in **Appendix F**, when received, in a later version of the SI Report. Boring logs are presented in **Appendix E**.

2.2.2 Hydrogeology

Biak Training Center Brett Hall is situated above the Deschutes Formation, which is the principal aquifer within the Upper Deschutes Basin. The Deschutes Formation comprises flood deposits, alluvium, debris flows, tephra, lava flows, and ignimbrites and ranges in thickness up to 2,000 feet. The hydraulic conductivity ranges from less than 10 to approximately 1,900 feet per day (USGS, 2001). Because of the large amount of rainfall that occurs at the Upper Deschutes Basin and the highly permeable shallow rocks, the Cascade Range is the principal groundwater recharge area for the area. Groundwater from the Cascade Range flows through the permeable volcanic rock towards the east, into the Upper Deschutes Basin, where half of the volume discharges to streams, and the other half of the volume flows through the subsurface of the Deschutes Formation, eventually discharging to streams. Groundwater discharge to streams is the principal mechanism of groundwater losses in the system where stream elevation is lower than the groundwater table. Groundwater discharges to streams occurs to the west of Biak Training Center Brett Hall, surrounding the confluence of the Deschutes River (west of Bend). The Deschutes River maintains substantial flow during dry periods, and stream discharge varies by location and seasonal precipitation. Regionally, the water table fluctuates in association with recharge. Infiltration of precipitation in the region occurs from rainfall, snowmelt, canal and stream leaks, and irrigation water applied to farm fields. The USGS estimated annual recharge from infiltration of precipitation in the area surrounding the facility ranging from 3 to 4.5 inches. Recharge averages 35 to 40 percent (%) of the annual precipitation measured throughout the Upper Deschutes Basin (USGS, 2001).

Based on regional studies, groundwater flow at the facility is inferred to generally flow to the northwest (USGS, 2001). Biak Training Center Brett Hall obtains drinking water through one onsite water supply well located in the north-central portion of the facility, in the northwest corner of the building (Well #1852) (**Figure 2-3**). This well was completed in January 1985 and drilled to a depth of 492 feet bgs; depth to first water was reported at 370 feet bgs (OWRD, 2018). Shallow or perched groundwater has not been documented at or in the vicinity of the facility, but is possible in complex volcanic formations. Boring logs for nearby wells (within 2 miles of the facility) available at the OWRD website indicated first encountered groundwater ranges from approximately 230 feet bgs to over 480 feet bgs, but the geology is difficult to correlate between locations due to inconsistent lithologic characterization between drillers (OWRD, 2020).

Several drinking water source areas with active public and private groundwater systems were identified near Biak Training Center Brett Hall, as follows:

- Redmond Water Department (PWS ID OR4100693), approximately 2 miles to the northwest, with 9,800 connections serving approximately 30,000 people (DEQ, 2018a).
- Avion WC Red Cloud (PWS ID OR4101203), approximately 2 miles to the northeast, with 177 connections serving approximately 440 people (DEQ, 2018a).
- ORARNG Central Oregon Unit Training Equipment Site (COUTES) private water supply (PWS ID OR41-05957), approximately 3 miles to the northwest, with a single connection (the COUTES facility) serving 20 people. The groundwater well serving the COUTES facility is state regulated (Oregon Health Authority [OHA], 2019).

- Seven privately owned domestic wells located approximately 1 mile to the northwest serving multiple residential properties (OWRD, 2020). Twenty privately owned domestic wells located approximately 1 to 2 miles down gradient northeast (**Figure 2-3**). These wells have depths that range from 470 feet to 510 feet bgs and serve multiple residential properties.

Drinking water from the water well at Biak Training Center Brett Hall was sampled and analyzed by OMD for selected PFAS, including PFOS, PFOA, and PFBS, in 2017 and 2020. Drinking water samples are summarized as follows:

- June 2017 drinking water sample: The water well was sampled on 27 June 2017. The sample was analyzed by USEPA 537 Modified for 20 PFAS, included PFOS, PFOA, and PFBS. The analytical data was validated and indicates all 20 PFAS, including PFOS, PFOA, and PFBS, were not detected above limits of detection (LOD), which ranged from 0.985 nanograms per liter (ng/L) to 14.8 ng/L. PFOS was not detected above 2.83 ng/L and both PFOA and PFBS were not detected above 1.88 ng/L. All LODs were below SLs presented in the OSD memorandum "Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program," September 15, 2021 (Assistant Secretary of Defense, 2021).
- September 2020 drinking water sample: The water well was sampled on 23 September 2020. The sample was analyzed at a NELAP-approved laboratory by USEPA 537. An unvalidated laboratory analytical report for one drinking water sample indicates the 14 reported PFAS, including PFOS, PFOA, and PFBS, were not detected above LODs ranging from 2.0 ng/L to 4.0 ng/L. PFOS, PFOA, and PFBS were not detected above 4.0 ng/L. All LODs were below screening levels presented in the OSD memorandum "Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program," September 15, 2021 (Assistant Secretary of Defense, 2021).

Depths to water measured in June 2022 during the SI ranged from 394.93 to 397.64 feet bgs. Groundwater elevation elevations from the SI are presented on **Figure 2-4.** Due to limited groundwater elevation data, groundwater contours could not be determined. The inferred groundwater flow direction, based on groundwater elevations calculated for wells BTC-MW001 and AOI01-01 used in conjunction groundwater flow directions inferred in available regional studies, is to the northeast.

2.2.3 Hydrology

Biak Training Center Brett Hall is within the Town of O'Neill subwatershed (12-digit hydrologic unit code [HUC]: 170703051006), which is within the Mayfield Pond-Central Oregon Canal watershed (10-digit HUC: 1707030509) of the Lower Crooked subbasin (8-digit HUC: 17070305), of the Deschutes Basin (6-digit HUC: 170703) (**Figure 2-5**). No surface water features are located at the facility. The nearest off-site surface waterbodies are the North Unit Main Canal approximately 2 miles to the west of the facility, which flows northeast, and the Central Oregon Canal about 1.75 miles to the east, which flows northeast. The Deschutes River is located approximately 8 miles to the west of Biak Training Center Brett Hall, flows northeast, and is a major tributary to the Columbia River (located along the Oregon-Washington boarder) (DEQ, 2018b). No wetlands are located at the facility (USFS, 2018).

The facility is primarily unpaved, but existing paved areas include the roadway entering/exiting the facility from the northwest and southwest and the parking area surrounding the building. Surface stormwater runoff from paved areas flows into stormwater catch basins surrounding the building, discharging to the west of the pavement (OMD, 2018c). Stormwater runoff to unpaved areas infiltrates the soil. Surface water runoff at Biak Training Center Brett Hall would only occur during heavy precipitation events where precipitation exceeds the infiltration rate of soil.

2.2.4 Climate

Climate in the Deschutes Basin is considered semiarid: moderate with cool, wet winters and warm, dry summers. The climate is driven by air masses that develop in the Pacific Ocean (approximately 150 miles west of Biak Training Center Brett Hall) and move east over the Cascade Range (approximately 35 miles west of Biak Training Center Brett Hall), dropping up to 200 inches of precipitation (rainfall and snow) annually (mostly snow during the winter). The Deschutes Basin's climate experiences annual and long-term variability. Precipitation decreases east of the Cascade Range significantly (USDA, 1966; USGS, 2001).

Weather data recorded at the Redmond Airport weather station (Station OR USW00024230), located approximately 2 miles to the northwest of Biak Training Center Brett Hall, reported the following climatic measurements from 1990 to 2018: average annual precipitation of 8 inches, average annual snowfall of 9 inches, and average temperature of 49 degrees Fahrenheit (°F) (max of 86 °F) (National Oceanic and Atmospheric Administration [NOAA], 2018).

2.2.5 Current and Future Land Use

Biak Training Center Brett Hall lies along the western boundary of Crook County, bordering Deschutes County to the east. The nearest urban area is Redmond, approximately 4 miles to the northwest of the facility. The Redmond Airport is located approximately 2 miles to the northwest of the facility. According to the 2017 census conducted by the US Census Bureau (Census), the estimated population of Redmond at the time was 30,011. Based on the population estimates, Redmond's population has increased by nearly 3,800 since 2010 (Census, 2018). Land use surrounding the facility is primarily agricultural and zoned by Crook County as EFU3 – Exclusive Farm Use (Crook County, 2018). Land within 0.25 miles west of Biak Training Center Brett Hall is zoned by Deschutes County as EFUAL – Alfalfa Subzone (Deschutes County, 2018). Highway 126, which travels east/west from Redmond (west) to Prineville (east), is located 2 miles mile to the north of the facility. Future land use at Biak Training Center Brett Hall is not anticipated to change.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

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

- **Fishes:** Bull Trout, *Salvelinus confluentus* (threatened)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Gray wolf, *Canis lupus* (endangered)

2.3 History of PFAS Use

Three AOIs were identified where AFFF may have been used, stored, disposed, or released historically at the Biak Training Center Brett Hall (AECOM, 2019). AFFF has historically been released at the facility during fire training activities and bomb squad training activities as early as 2000. A description of each AOI is presented in **Section 3**.

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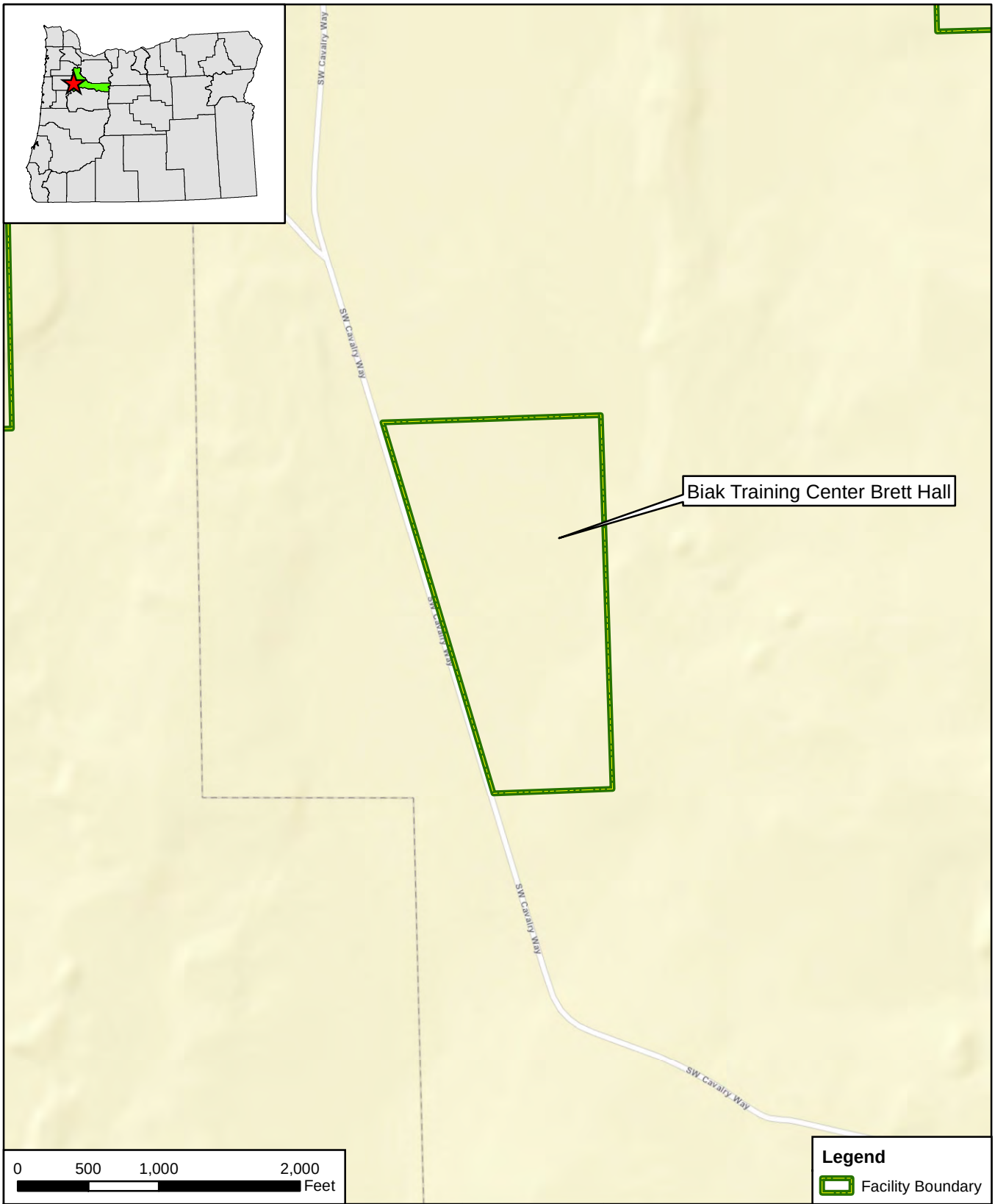

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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri		PM	CM	1/10/2023

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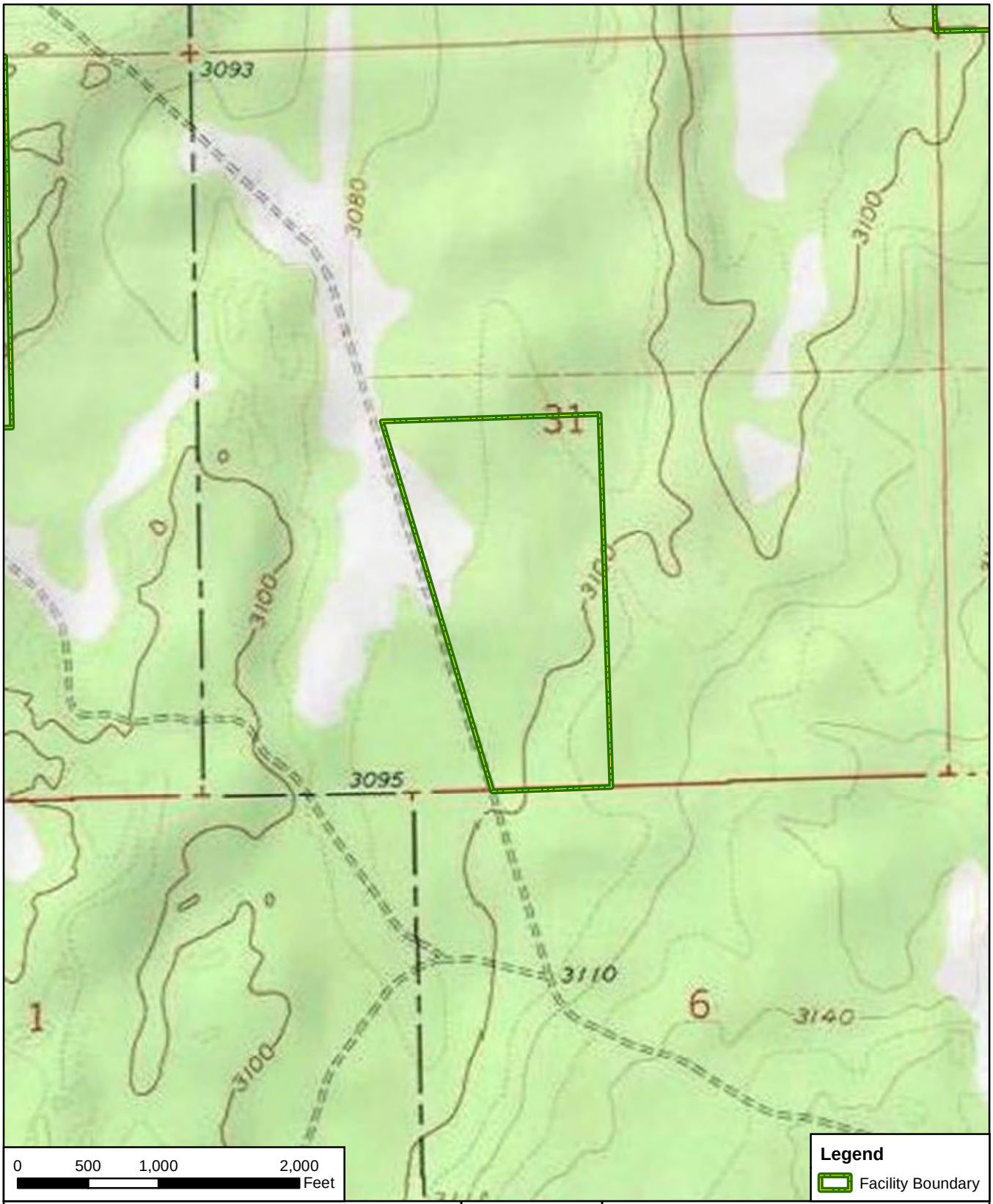
Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
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SCALE	1:12,000	CHK BY	AP	1/10/2023
Copyright:© 2013 National Geographic Society, i-cubed		PM	CM	1/10/2023

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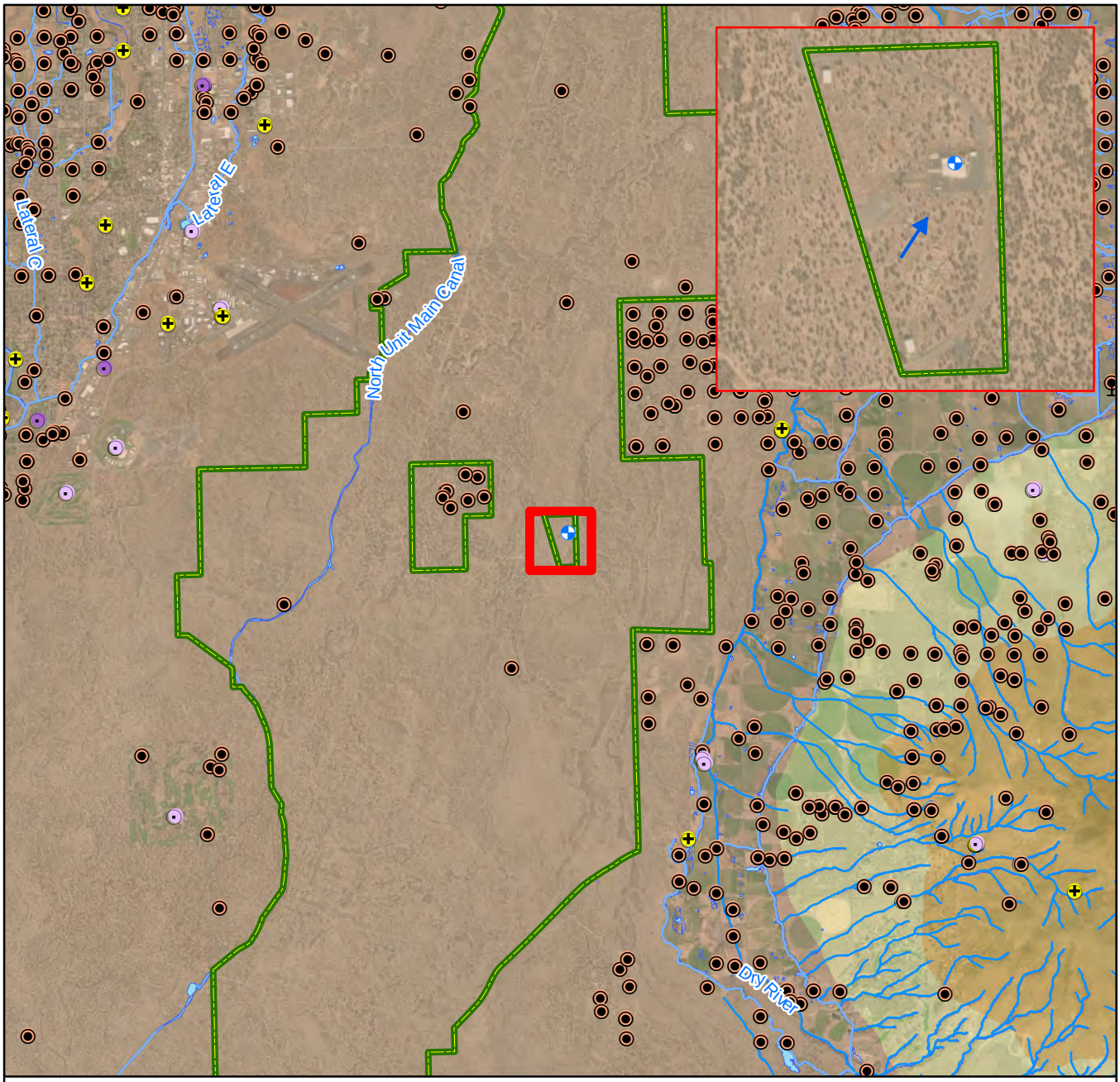
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Legend

- Facility Boundary
- Water Body
- Wetland
- River/Stream
- Canal/Ditch
- Inferred Groundwater Flow Direction

Geology

- alluvial fan
- Basalt
- rhyolite

Well

- Domestic Well
- Industrial Well
- Irrigation Well
- Community Well
- Potable Well

0 0.75 1.5 3 Miles

CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	6/15/2023	GIS BY	MS	6/15/2023
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/15/2023

N

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/5/2023	GIS BY	MS	1/5/2023
SCALE	1:4,080	CHK BY	AP	1/5/2023
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/5/2023

Groundwater Elevations, June 2022

AECOM
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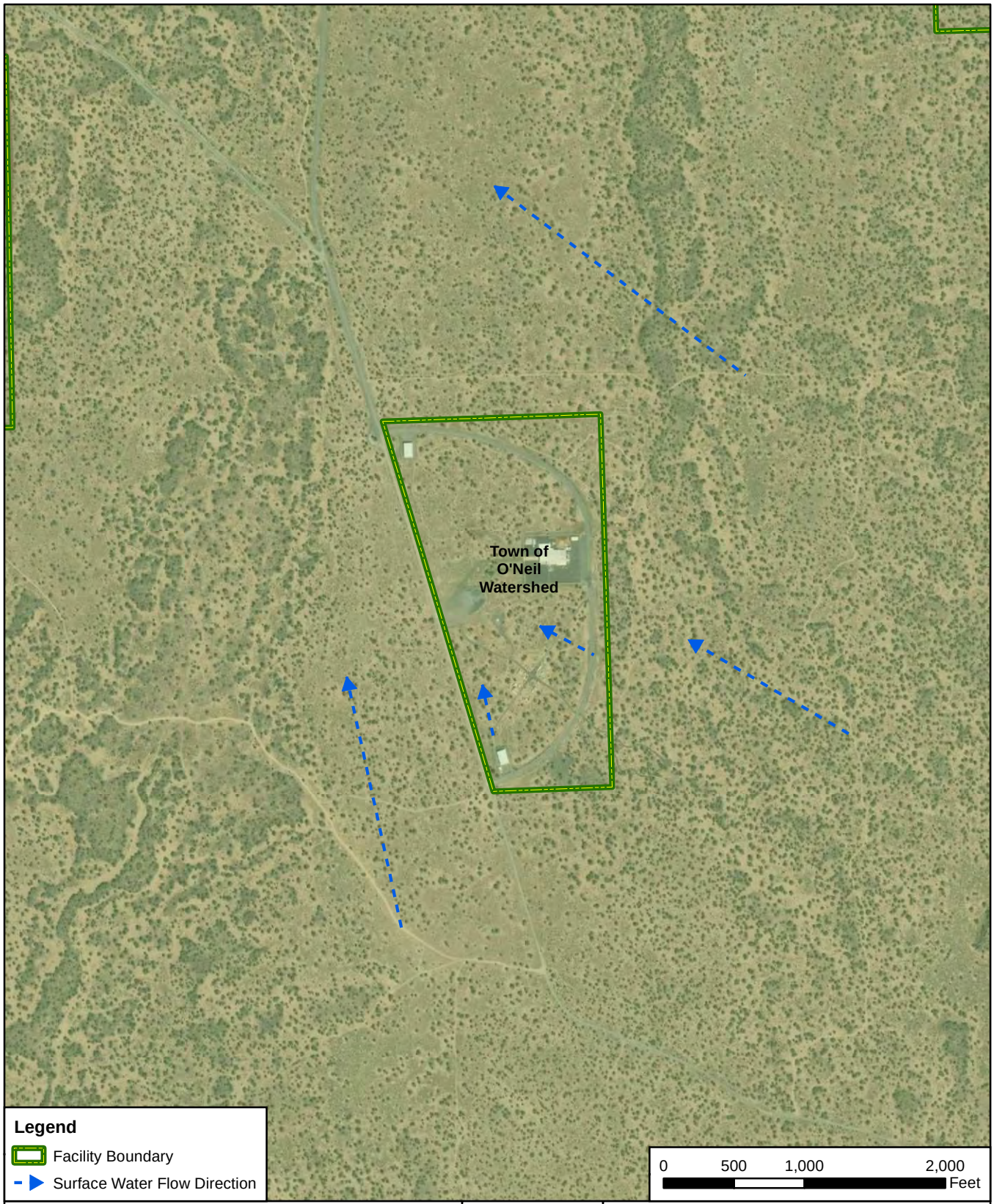
Figure 2-4



CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/10/2023	GIS BY	MS	1/10/2023
SCALE	1:12,000	CHK BY	AP	1/10/2023
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/10/2023

N

Surface Water Features

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Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, two potential release areas were identified at Biak Training Center Brett Hall and designated as two AOIs (AECOM, 2019). A third potential release area and AOI was identified during the SI. The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Engine Academy Training Area

AOI 1 is at the MOUT range approximately 660 feet southwest of the facility building. Releases of AFFF to soil by the USFS Engine Academy occurred at AOI 1 between 2000 and 2011 and between 2013 and 2015. The MOUT range (and surrounding area) is unpaved. According to interviewed facility personnel, no fires were set at this FTA, but AFFF was applied to wooden structures for training exercises to showcase applications of AFFF in fire situations. The concentration and amount of AFFF released during the training events are unknown based on interviews conducted with OMD facility personnel and USFS personnel.

3.2 AOI 2 Bomb Squad Training Area

AOI 2 is at the MOUT range located approximately 830 feet southwest of the facility building, adjacent to AOI 1. Releases of AFFF to soil occurred at AOI 2 during training events conducted by the FBI between 2016 and 2017. The MOUT range (and surrounding area) is unpaved. According to interviewed facility personnel, no fires were set at this training area, but AFFF was applied during bomb squad training exercises. The concentration and amount of AFFF released during the training events are unknown based on interviews conducted with OMD facility personnel. Interviews with FBI personnel were not conducted.

3.3 AOI 3 Range Control Infiltration Basin

During the SI, discussions with facility staff not interviewed during the PA noted that AFFF inadvertently introduced into a water tank truck was rinsed out onto the paved surface at Range Control. AFFF would have been captured by the stormwater system and discharged to a small infiltration basin west of Range Control. This area was subsequently added as an additional AOI (AOI 3).

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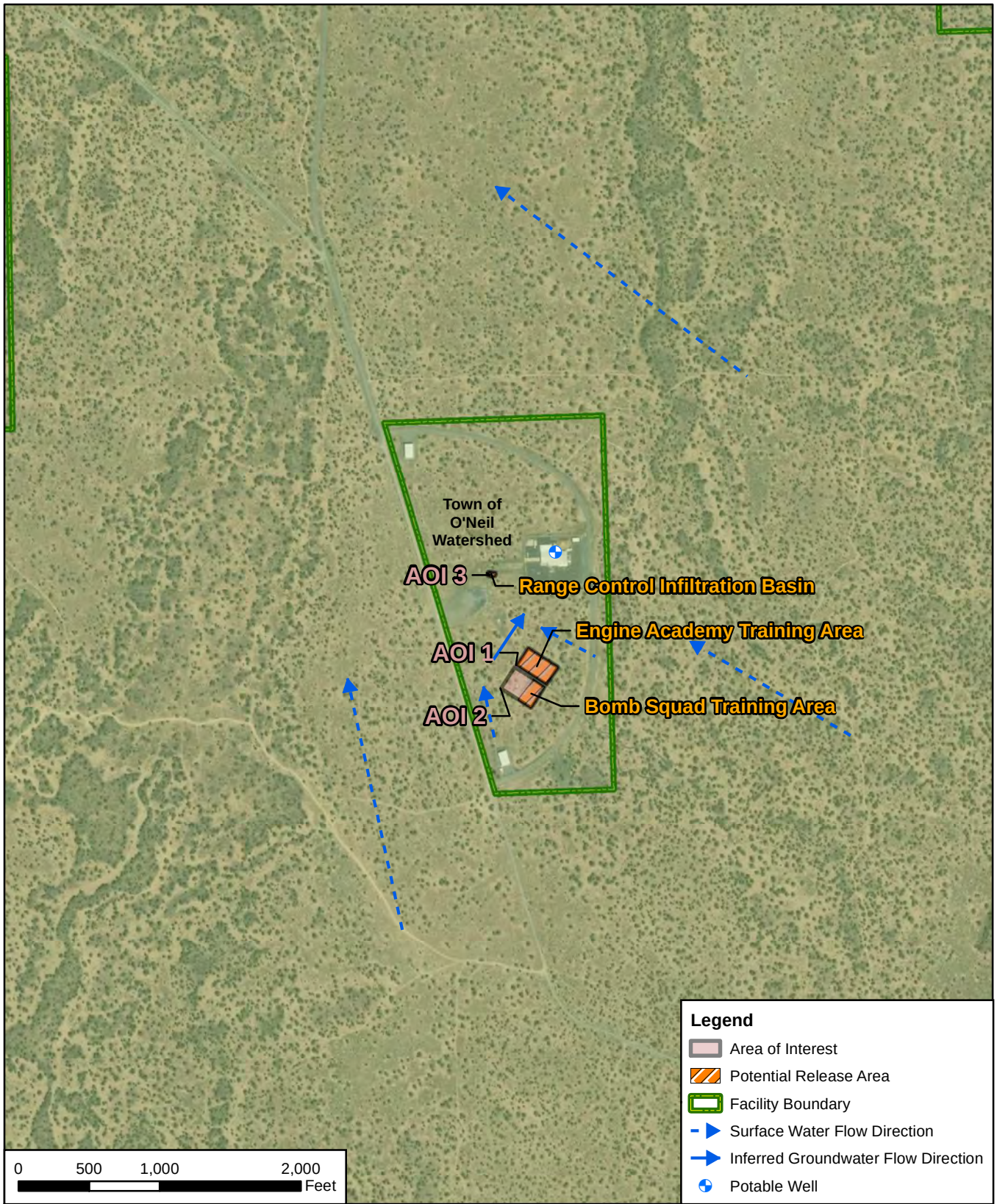

CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/25/2023	GIS BY	MS	1/25/2023
SCALE	1:12,000	CHK BY	AP	1/25/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/25/2023

Areas of Interest

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Figure 3-1

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4. Project Data Quality Objectives

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

4.1 Problem Statement

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

4.2 Information Inputs

Primary information inputs included:

- The PA for Biak Training Center Brett Hall (AECOM, 2019);
- Analytical data collected from the onsite drinking water well at Biak Training Center Brett Hall in 2017 and 2020;
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2022b); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). The scope of the SI was vertically bounded as follows: soil from sonic borings, surface soil (0 to 2 feet bgs), shallow subsurface soil (2 to 5 feet bgs), sedimentary interbeds (47 to 211 feet bgs), and groundwater (446 feet bgs).Temporal boundaries were limited to the spring season, which was the earliest available time field resources were available to complete the study.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2021a).

4.5 Data Usability Assessment

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation

in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2019a; DoD, 2019b; USEPA, 2017).

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

5. Site Inspection Activities

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

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Biak Training Center, Brett Hall, Oregon* dated December 2019 (AECOM, 2019);
- *Final Site Safety and Health Plan, Biak Training Center Brett Hall, Powell Butte, Oregon* dated February 2022 (AECOM, 2022a); and
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Biak Training Center Brett Hall, Powell Butte, Oregon* dated March 2022 (AECOM, 2022b).

The SI field activities were conducted from 14 March 2022 to 22 June 2022 and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation, groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022b), except as noted in **Section 5.8**.

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

- Thirty-one (31) soil samples from 12 boring locations;
- Two groundwater samples from two newly installed monitoring wells;
- Nineteen (19) quality assurance (QA)/quality control (QC) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, a Field Change Request Form is provided in **Appendix B3**, land survey data are provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 25 January 2022, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, ORARNG, USACE, Oregon DEQ, and OHA. 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, 2022b).

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

5.1.2 Utility Clearance

AECOM placed a ticket with the Oregon One Call, the local utility clearance provider, to notify them of intrusive work on 1 March 2022. Additionally, AECOM contracted Ground Penetrating Radar Systems (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 14 March 2022 with input from the AECOM field team and Biak Training Center Brett Hall facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

A potable water source at Biak Training Center Brett Hall was sampled on 4 February 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected at the onsite production well spigot (BTC-DECON-01) confirmed this source to be acceptable (detections less than 1/5 of the SLs) for use in this investigation; therefore, it was used throughout the field activities. Due to slow flow rates from the spigot and a need for significant amount of water for drilling, OMD filled a 10,000-gallon non-potable water tank that is piped directly from the onsite production well for use during drilling activities. A separate sample (BTC-DECON-02) was collected from the non-potable tank on 14 March 2022 and results of this sample confirmed the tank to be acceptable for use in this investigation. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water samples associated with the onsite production well spigot and non-potable water tanks used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

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

5.2 Soil Borings and Soil Sampling

Samples associated with AOI 3 were designated as surface soil samples only (0 to 2 feet bgs) which were collected via hand auger. Soil samples associated with AOI 1 and AOI 2 were collected via sonic drilling methods, in accordance with the SI QAPP Addendum (AECOM, 2022b). A Terra Sonic 150CC drill rig was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and depths are provided **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample at the mid-point between the surface and the bedrock interface, and one subsurface soil sample at bedrock interface. If refusal was encountered at 6 feet bgs or shallower, only two samples were required to be collected per boring: one surface soil sample and one sample approximately 1-foot above refusal.

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

Soil borings completed during the SI found basalt bedrock as the dominant lithology below the Biak Training Center Brett Hall. The borings were completed at depths between 5 and 446.5 feet bgs. Sedimentary interbeds consisting of silty sand, poorly graded sand, poorly graded gravel, well-graded sand, well-graded gravel, silt, siltstone, and sandstone were also observed within the bedrock at thicknesses ranging from a few inches to 24 feet. These observations are consistent with the understood depositional environment of the region.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2022b).

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

Two borings (BTC-MW001 and BTC-02) were converted to permanent monitoring wells (BTC-MW001 and BTC-MW002) as discussed in **Section 5.3** below. All other borings were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2022b) using bentonite chips at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Permanent Well Installation and Groundwater Sampling

During the SI, two permanent monitoring wells were installed within or downgradient of potential source areas. The locations of the wells are shown on **Figure 5-2**.

A Terra Sonic 150CC drill rig was used to install two 4-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 80 polyvinyl chloride (PVC), flush threaded 20-foot sections of riser, 0.010-inch slotted well screen, and a threaded bottom cap. A filter pack of 8/12 silica sand was installed in the annulus around the well screen to a minimum of 2-foot above the well screen.
A 2-foot-thick layer of 20/40 silica sand was placed above the filter pack. Bentonite grout was placed in the well annulus from the top of the 20/40 sand to 3 feet bgs, and concrete was placed

from 3 feet bgs to the ground surface. The bentonite grout was allowed to set for 24 hours prior to well completion in accordance with the SI QAPP Addendum (AECOM, 2022b). The monitoring wells were constructed with a stick-up completion. The screen interval of each of the groundwater monitoring wells is provided in **Table 5-2**.

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

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

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

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 22 June 2022. Groundwater elevation measurements were collected from the two new monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater elevation map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Oregon-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2022b). Survey data from the newly installed wells on the facility were collected on 22 June 2022 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 1984 (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

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

Soil IDW (i.e., soil cuttings) generated during the SI activities were contained in labeled, 55-gallon Department of Transportation (DOT)-approved steel drums and left onsite in a designated waste storage area. Rock core was stored on and covered with thick mil plastic sheeting. The soil and rock IDW was not sampled and assumes the characteristics of the associated soil and sedimentary interbed samples collected from that source location. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were contained in labeled, 55-gallon DOT-approved steel drums or 275-gallon poly totes, and left onsite in a designated waste storage area. The liquid IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location. Containerized liquid IDW will be managed and disposed of by ARNG (either by offsite disposal or onsite disposal with treatment, as appropriate) under a separate contract in accordance with SOP No. 042A (EA, 2021).

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

5.7 Laboratory Analytical Methods

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

5.8 Deviations from SI QAPP Addendum

One deviation from the SI QAPP Addendum was identified during review of the field documentation. The deviation is noted below and is documented in a Field Change Request Form (**Appendix B3**):

- During the start of field activities in March 2022, discussion with facility staff not interviewed during the PA concluded AOI 2 was more frequently used for training utilizing AFFF over a wider area. It was suggested to add additional soil borings and adjust the proposed location of BTC-MW002. Additionally, AFFF inadvertently introduced into a water tank truck was rinsed out onto the paved surface at Range Control. AFFF would have been captured by the stormwater system and discharged to a small infiltration basin west of Range Control. As a result of this discussion, the following changes occurred:
    - Boring location AOI01-04 was added to increase the soil boring density and distribution within AOI 1.
    - The installation of monitoring well BTC-MW002 was removed from location AOI01-01 and moved to a new location within AOI 2.
    - Boring location AOI02-03 was moved further south to increase soil boring density and distribution withing AOI 2.
    - A new AOI (AOI 3) was added to capture the potential release area near Range Control. AOI 3 included two surface soil sampling locations (AOI03-01, AOI03-02) and one sediment sampling location (AOI03-03, sediment from inside the stormwater pipe discharging into the infiltration basin).

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Biak Training Center Brett Hall, Oregon

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0.5-1.0	3/15/2022 9:30	0.5 - 1.0	x				
AOI01-01-SB-1.7-2.2	3/15/2022 14:00	1.7 - 2.2	x				
AOI01-01-SB-1.7-2.2	3/16/2022 9:15	1.7 - 2.2		x	x	x	
AOI01-01-SB-2.5-3.0	3/15/2022 14:45	2.5 - 3.0	x				
AOI01-02-SB-0.5-1.0	3/15/2022 9:45	0.5 - 1.0	x				
AOI01-02-SB-1.5-2.0	3/15/2022 15:15	1.5 - 2.0	x				
AOI01-02-SB-2.5-3.0	3/15/2022 10:30	2.5 - 3.0	x				
AOI01-03-SB-0.5-1.0	3/15/2022 10:00	0.5 - 1.0	x				
AOI01-03-SB-1.5-2.0	3/15/2022 12:15	1.5 - 2.0	x				
AOI01-03-SB-4.5-5.0	3/16/2022 11:00	4.5 - 5.0	x				
AOI01-04-SB-0.5-1.0	3/15/2022 10:45	0.5 - 1.0	x				
AOI01-04-SB-1.5-2.0	3/15/2022 11:00	1.5 - 2.0	x				
AOI01-04-SB-1.5-2.0-D	3/15/2022 12:00	1.5 - 2.0	x				FD
AOI01-04-SB-4.5-5.0	3/15/2022 13:30	4.5 - 5.0	x				
AOI02-01-SB-0.5-1.0	3/15/2022 16:25	0.5 - 1.0	x				
AOI02-01-SB-2.5-3.0	3/16/2022 11:30	2.5 - 3.0	x				
AOI02-02-SB-0.5-1.0	3/15/2022 16:35	0.5 - 1.0	x				
AOI02-02-SB-0.5-2.0	3/16/2022 11:45	0.5 - 2.0	x				
AOI02-02-SB-2.5-3.0	3/16/2022 12:00	2.5 - 3.0	x				
AOI02-03-SB-0.5-1.0	3/16/2022 7:50	0.5 - 1.0	x				
AOI02-03-SB-0.5-1.0-MS	3/16/2022 7:50	0.5 - 1.0	x				MS
AOI02-03-SB-0.5-1.0-MSD	3/16/2022 7:50	0.5 - 1.0	x				MSD
AOI02-03-SB-1.0-1.5	3/18/2022 14:40	1.0 - 1.5	x				
AOI02-03-SB-2.0-2.5	3/18/2022 14:45	2.0 - 2.5	x				
AOI03-01-SB-0.0-1.0	3/18/2022 11:45	0 - 1.0	x				
AOI03-01-SB-0.0-1.0-D	3/18/2022 11:45	0 - 1.0	x				FD
AOI03-02-SB-0.0-0.7	3/18/2022 12:00	0 - 0.7	x				
AOI03-02-SB-0.0-0.7-MS	3/18/2022 12:00	0 - 0.7	x				MS
AOI03-02-SB-0.0-0.7-MSD	3/18/2022 12:00	0 - 0.7	x				MSD
AOI03-03-SB-0.0-0.5	3/18/2022 11:30	0 - 0.5	x				
BTC-02-SB-0.0-1.0[2]	3/16/2022 8:30	0 - 1.0	x	x	x		
BTC-02-SB-0.0-1.0-D[2]	3/16/2022 8:30	0 - 1.0	x			x	FD
BTC-02-SB-4.5-5.0[2]	5/18/2022 8:30	4.5 - 5.0	x				
BTC-02-SB-35-36[2]	5/18/2022 16:30	35 - 36	x				
BTC-02-SB-94-96[2]	5/23/2022 10:00	94 - 96	x				
BTC-02-SB-210-211[2]	5/25/2022 16:00	210 - 211	x				
BTC-02-SB-210-211-MS[2]	5/25/2022 16:00	210 - 211	x				MS
BTC-02-SB-210-211-MSD[2]	5/25/2022 16:00	210 - 211	x				MSD
BTC-MW001-SB-47-49	3/18/2022 16:00	47 - 49	x				
BTC-MW001-SB-124-126	3/30/2022 14:00	124 - 126	x				
BTC-MW001-SB-224-226	4/1/2022 16:00	224 - 226	x				
Groundwater Samples							
AOI01-01-GW[1]	6/21/2022 11:35	NA	x				
AOI01-01-GW-D[1]	6/21/2022 13:00	NA	x				FD
AOI01-01-GW-MS[1]	6/21/2022 13:00	NA	x				MS
AOI01-01-GW-MSD[1]	6/21/2022 13:00	NA	x				MSD
BTC-MW001-GW	6/21/2022 10:45	NA	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Biak Training Center Brett Hall, Oregon

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
BTC-DECON-01	2/4/2022 11:23	NA	x				production well spigot
BTC-DECON-02	3/14/2022 14:30	NA	x				non-potable tank
BTC-ERB-01	3/16/2022 16:20	NA	x				hand auger
BTC-ERB-02	3/16/2022 16:30	NA	x				trowel
BTC-ERB-03	6/10/2022 8:00	NA	x				drill bit
BTC-ERB-04	6/21/2022 11:35	NA	x				pump

Notes:

1. Groundwater sample AOI01-01-GW and associated FD, MS, MSD samples were collected from monitoring well BTC-MW002.
2. Soil boring BTC-02 associated with monitoring well BTC-MW002.

AOI = area of interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
BTC = Biak Training Center
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
QSM = Quality Systems Manual
SB = soil boring
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths
Site Inspection Report, Biak Training Center Brett Hall, Oregon

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)
1	AOI01-01	5
	AOI01-02	6
	AOI01-03	5
	AOI01-04	6
	BTC-MW001	446.5
2	AOI02-01	5
	AOI02-02	5
	AOI02-03	5
	BTC-02[1]	446
3	AOI03-01	1
	AOI03-02	0.7
	AOI03-03	0.5

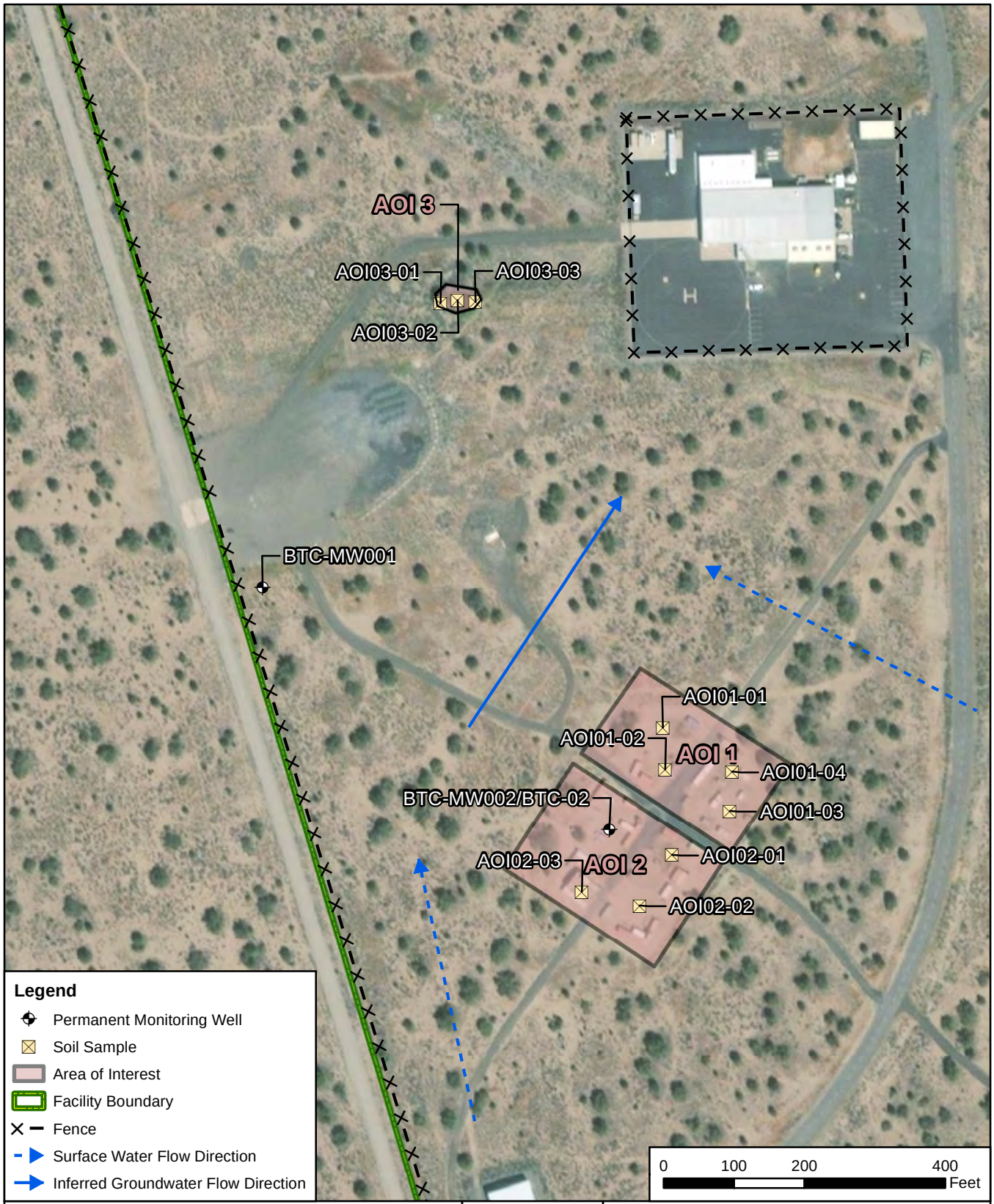
Notes:
1. Soil boring BTC-02 associated with monitoring well BTC-MW002.

AOI = area of interest
bgs = below ground surface
BTC = Biak Training Center
btoc = below top of casing
MW = monitoring well
NA = not applicable
NAVD88 = North American Vertical Datum 1988

Table 5-3
Permanent Monitoring Well Screen Intervals and Groundwater Elevations
Site Inspection Report, Biak Training Center Brett Hall, Oregon

Area of Interest	Boring Location	Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	BTC-MW001	426 - 446	3097.47	3095.05	397.35	394.93	2700.12
2	BTC-MW002	426 - 446	3099.90	3097.67	399.87	397.64	2700.03

Notes:
bgs = below ground surface
BTC = Biak Training Center
btoc = below top of casing
MW = monitoring well
NA = not applicable
NAVD88 = North American Vertical Datum 1988



CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/25/2023	GIS BY	MS	1/25/2023
SCALE	1:2,400	CHK BY	AP	1/25/2023
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/25/2023

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.5**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Screening values for HFPO-DA were established after SI planning and execution and thus not included as an analyte. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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

6.2 Soil Physicochemical Analyses

To provide basic soil parameter information, soil samples were analyzed for TOC, pH, and grain size, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC, pH, and grain size sampling. Grain size results are pending from the laboratory and will be included, when received, in a later version of the SI Report.

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

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Engine Academy Training Area. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled from surface soil (between 0.5 to 2.2 feet bgs) and shallow subsurface soil (between 2.5 to 5 feet bgs) from boring locations AOI01-01 through AOI01-04. Soil was also sampled from deep subsurface soil intervals (between 47 to 226 feet bgs) from boring location BTC-MW001. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA and PFNA were detected below their SLs in surface soil at AOI01-03 (0.5 to 1 feet bgs), with concentrations of 0.148 J micrograms per kilogram (µg/kg) and 0.168 J µg/kg, respectively. PFOS, PFHxS, and PFBS were not detected in surface soil. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in shallow subsurface soil or deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Figure 6-6 and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results. Groundwater was sampled from permanent monitoring well BTC-MW001. PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in groundwater.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA and PFNA were detected in soil below their SLs. PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in groundwater. Therefore, no further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2: Bomb Squad Training Area. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Soil was sampled from surface soil (between 0.5 to 2 feet bgs) and shallow subsurface soil (between 2 to 5 feet bgs) from boring locations AOI02-01 through AOI02-03 and BTC-02. Soil was also sampled from deep subsurface soil intervals (between 35 to 211 feet bgs) from boring location BTC-02. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOS and PFHxS were detected below their SLs in surface soil at BTC-02, with concentrations of 0.219 J µg/kg and 0.088 J µg/kg, respectively. PFOA, PFNA, and PFBS were not detected in surface soil. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in shallow subsurface soil. PFOS was detected in deep subsurface soil at BTC-02, with a concentration of 0.144 J µg/kg. This low level detection, which was collected from within a coarse sand interbed, may be attributed to drilling mud circulation or matrix interference during laboratory analysis. PFOA, PFHxS, PFNA, and PFBS were not detected in deep subsurface soil.

6.4.2 AOI 2 Groundwater Analytical Results

Figure 6-6 and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results. Groundwater was sampled from permanent monitoring well BTC-MW002 (sample inadvertently labeled AOI01-01-GW). PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in groundwater.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOS and PFHxS were detected in soil, at concentrations below their SLs. PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in groundwater. Therefore, no further evaluation at AOI 2 is warranted.

6.5 AOI 3

This section presents the analytical results for soil in comparison to SLs for AOI 3: Range Control Infiltration Basin. The results in soil and groundwater are presented in **Table 6-2** and **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.5.1 AOI 3 Soil Analytical Results

Soil was sampled from surface soil (between 0 to 1 feet bgs) from boring locations AOI03-01 through AOI03-03. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** summarizes the soil results.

PFOA, PFOS, PFHxS, and PFNA were detected below their SLs in at least one surface soil sample, with the following maximum concentrations: PFOA at 0.474 J µg/kg, PFOS at 0.674 J µg/kg, PFHxS at 0.334 J µg/kg, and PFNA at 5.19 µg/kg. PFBS was not detected in surface soil.

6.5.2 AOI 3 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, and PFNA were detected in soil, at concentrations below their SLs. Therefore, no further evaluation at AOI 3 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Biak Training Center Brett Hall

Area of Interest		AOI01																		AOI02	
Sample ID		AOI01-01-SB-0.5-1.0		AOI01-01-SB-1.7-2.2-20220315		AOI01-02-SB-0.5-1.0		AOI01-02-SB-1.5-2.0		AOI01-03-SB-0.5-1.0		AOI01-03-SB-1.5-2.0		AOI01-04-SB-0.5-1.0		AOI01-04-SB-1.5-2.0		AOI01-04-SB-1.5-2.0-D		AOI02-01-SB-0.5-1.0	
Sample Date		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022		03/15/2022	
Depth		0.5-1 ft		1.7-2.2 ft		0.5-1 ft		1.5-2 ft		0.5-1 ft		1.5-2 ft		0.5-1 ft		1.5-2 ft		1.5-2 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, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	19	ND	U	ND	U	ND	U	ND	U	0.168	J	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	19	ND	U	ND	U	ND	U	ND	U	0.148	J	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	13	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Biak Training Center Brett Hall

Area of Interest		AOI02												AOI03							
Sample ID		AOI02-02-SB-0.5-1.0		AOI02-02-SB-0.5-2.0		AOI02-03-SB-0.0-1.0		AOI02-03-SB-1.0-1.5		BTC-02-SB-0.0-1.0		BTC-02-SB-0.0-1.0-D		AOI03-01-SB-0.0-1.0		AOI03-01-SB-0.0-1.0-D		AOI03-02-SB-0.0-0.7		AOI03-03-SB-0.0-0.5	
Sample Date		03/15/2022		03/16/2022		03/16/2022		03/18/2022		03/16/2022		03/16/2022		03/18/2022		03/18/2022		03/18/2022		03/18/2022	
Depth		0.5-1 ft		0.5-2 ft		0.5-1 ft		1-1.5 ft		0-1 ft		0-1 ft		0-1 ft		0-1 ft		0-0.7 ft		0-0.5 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	ND	UJ	0.088	J	ND	U	ND	U	ND	U	0.334	J
PFNA	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.154	J	0.164	J	0.639	J	5.19	
PFOA	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.474	J
PFOS	13	ND	U	ND	U	ND	U	ND	U	ND	UJ	0.219	J	0.146	J	0.143	J	0.154	J	0.674	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Biak Training Center Brett Hall

Area of Interest		AOI01								AOI02							
Sample ID		AOI01-01-SB-2.5-3.0		AOI01-02-SB-2.5-3.0		AOI01-03-SB-4.5-5.0		AOI01-04-SB-4.5-5.0		AOI02-01-SB-2.5-3.0		AOI02-02-SB-2.5-3.0		AOI02-03-SB-2.0-2.5		BTC-02-SB-4.5-5.0	
Sample Date		03/15/2022		03/15/2022		03/16/2022		03/15/2022		03/16/2022		03/16/2022		03/18/2022		05/18/2022	
Depth		2.5-3 ft		2.5-3 ft		4.5-5 ft		4.5-5 ft		2.5-3 ft		2.5-3 ft		2-2.5 ft		4.5-5 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																	
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Biak Training Center Brett Hall

Area of Interest	AOI01						AOI02					
Sample ID	BTC-MW001-SB-47-49		BTC-MW001-SB-124-126		BTC-MW001-SB-224-226		BTC-02-SB-35-36		BTC-02-SB-94-96		BTC-02-SB-210-211	
Sample Date	03/18/2022		03/30/2022		04/01/2022		05/18/2022		05/23/2022		05/25/2022	
Depth	47-49 ft		124-126 ft		224-226 ft		35-36 ft		94-96 ft		210-211 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)												
PFBS	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	ND	U	ND	U	ND	U	ND	UJ	ND	U	ND	U
PFNA	ND	U	ND	U	ND	U	ND	UJ	ND	U	ND	U
PFOA	ND	U	ND	U	ND	U	ND	UJ	ND	U	ND	U
PFOS	ND	U	ND	U	ND	U	ND	UJ	0.144	J	ND	U

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

AOI	Area of Interest
BTC	Biak Training Center
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Biak Training Center Brett Hall

Area of Interest		AOI01		AOI02			
Sample ID		BTC-MW001-GW		AOI01-01-GW[1]		AOI01-01-GW-D[1]	
Sample Date		06/21/2022		06/21/2022		06/21/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)							
PFBS	601	ND	U	ND	U	ND	U
PFHxS	39	ND	U	ND	U	ND	U
PFNA	6	ND	U	ND	U	ND	U
PFOA	6	ND	U	ND	U	ND	U
PFOS	4	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

1. Sample AOI01-01-GW and the associated duplicate were collected from monitoring well BTC-MW002.
2. ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

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

Acronyms and Abbreviations

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

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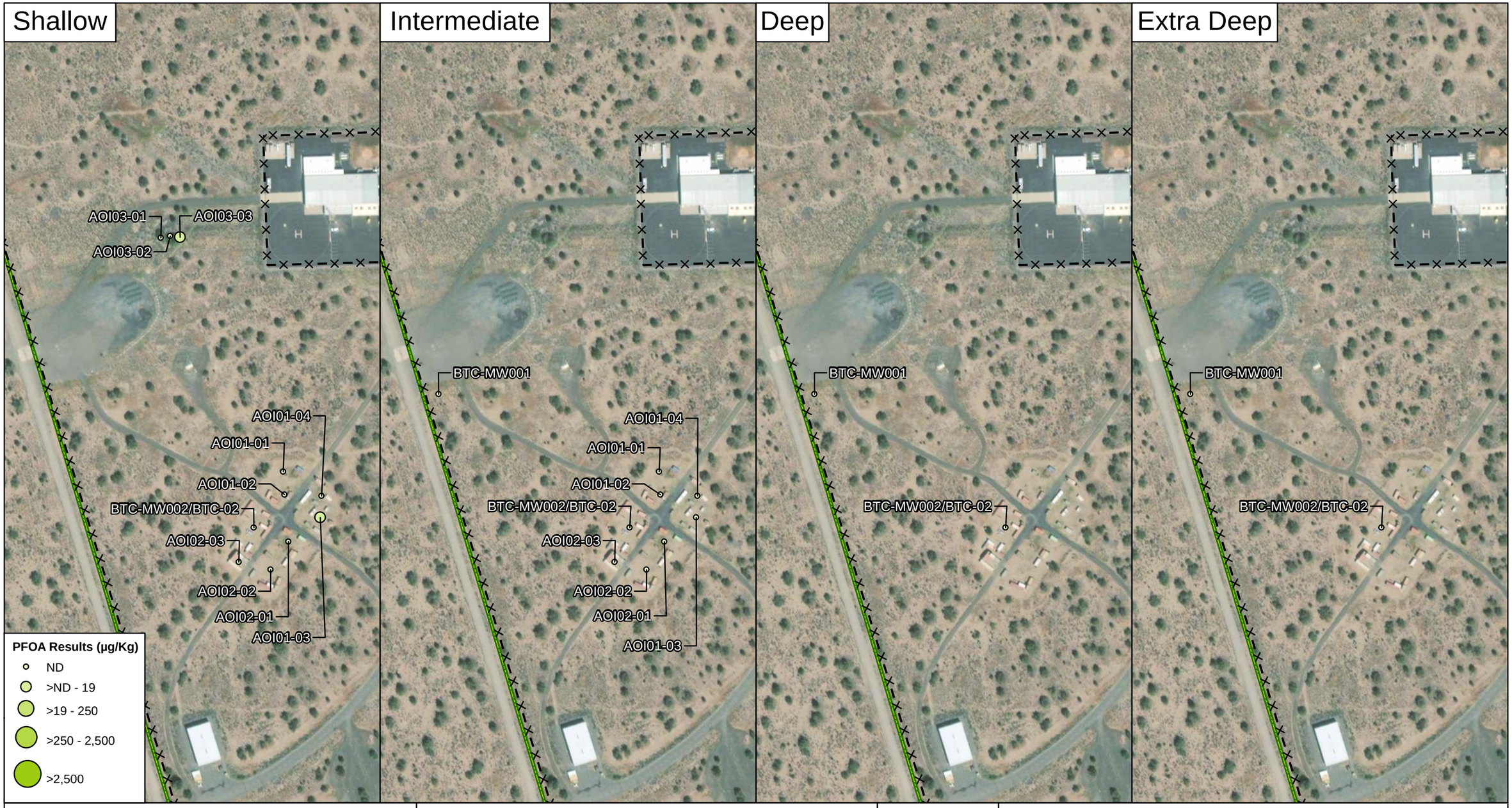


CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/12/2023	GIS BY	MS	1/12/2023
SCALE	1:3,000	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

Fence

Facility Boundary

0 125 250 500 Feet

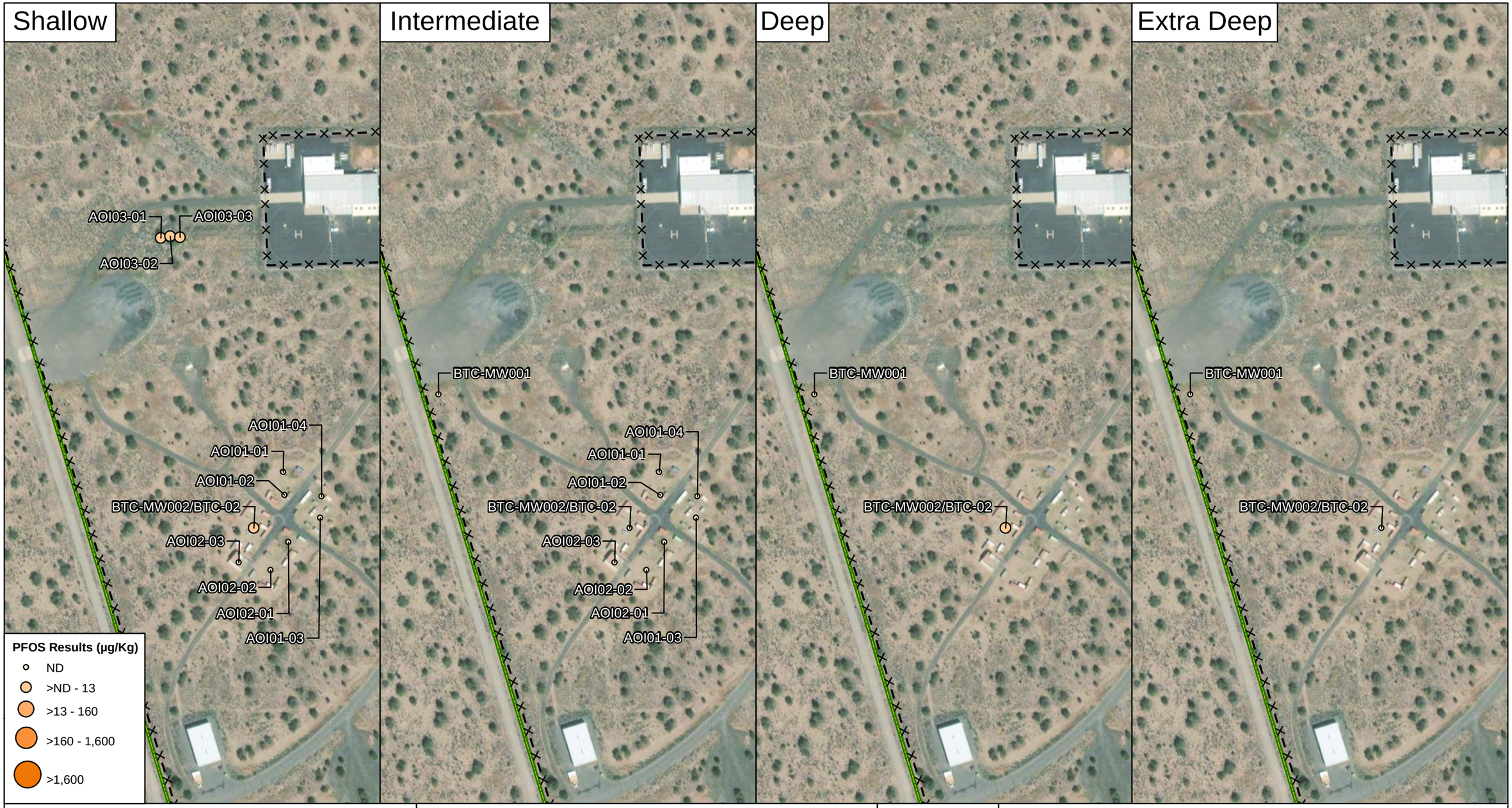
Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1



CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/12/2023	GIS BY	MS	1/12/2023
SCALE	1:3,000	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

Fence

Facility Boundary

0 125 250 500 Feet

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

N

PFOS Detections in Soil

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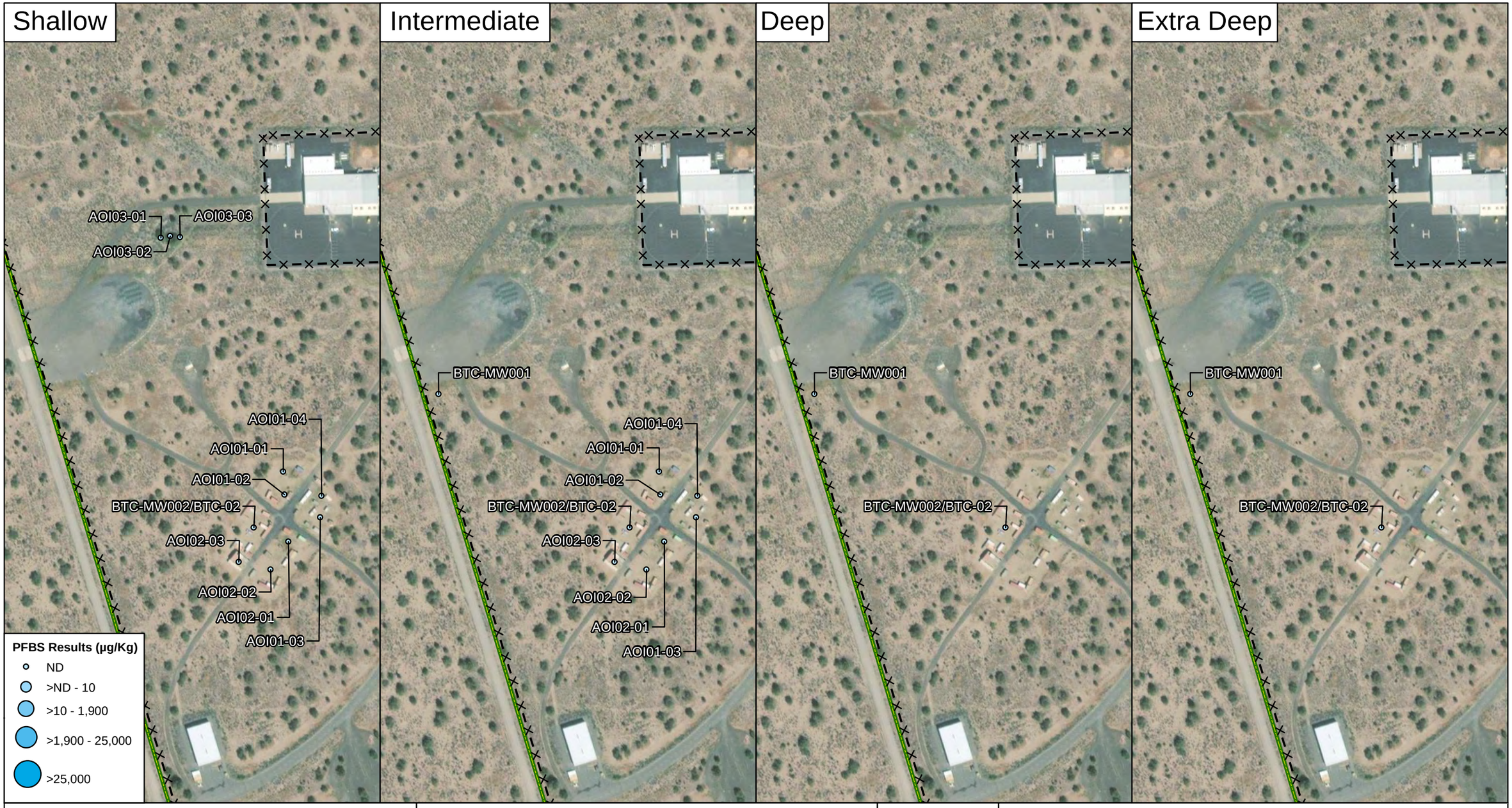
Figure 6-2



CLIENT	ARNG			
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Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

Fence

Facility Boundary

0 125 250 500 Feet

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

N

PFBS Detections in Soil

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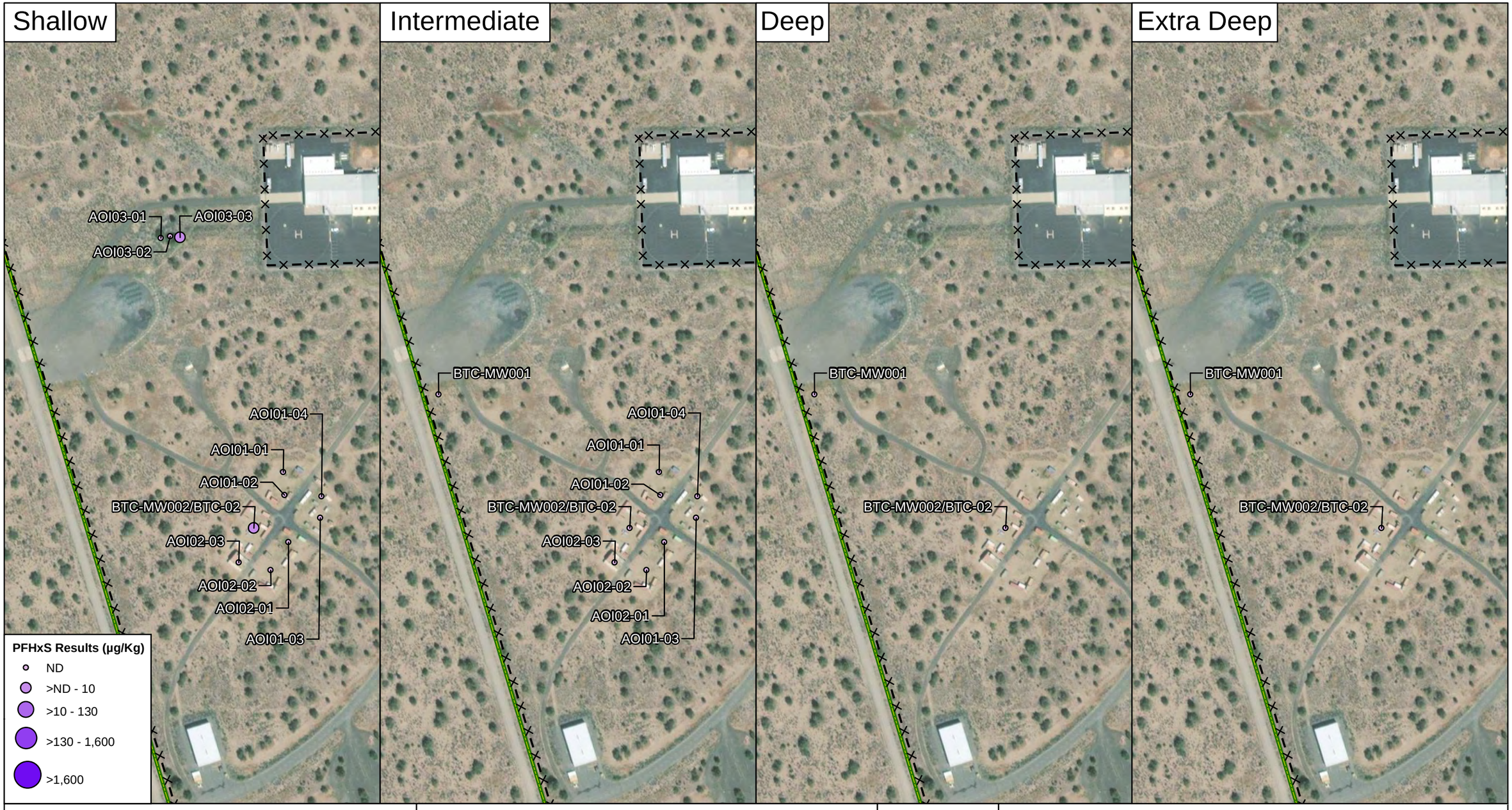
Figure 6-3



CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
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SCALE	1:3,000	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

Fence

Facility Boundary

0 125 250 500 Feet

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

N

PFHxS Detections in Soil

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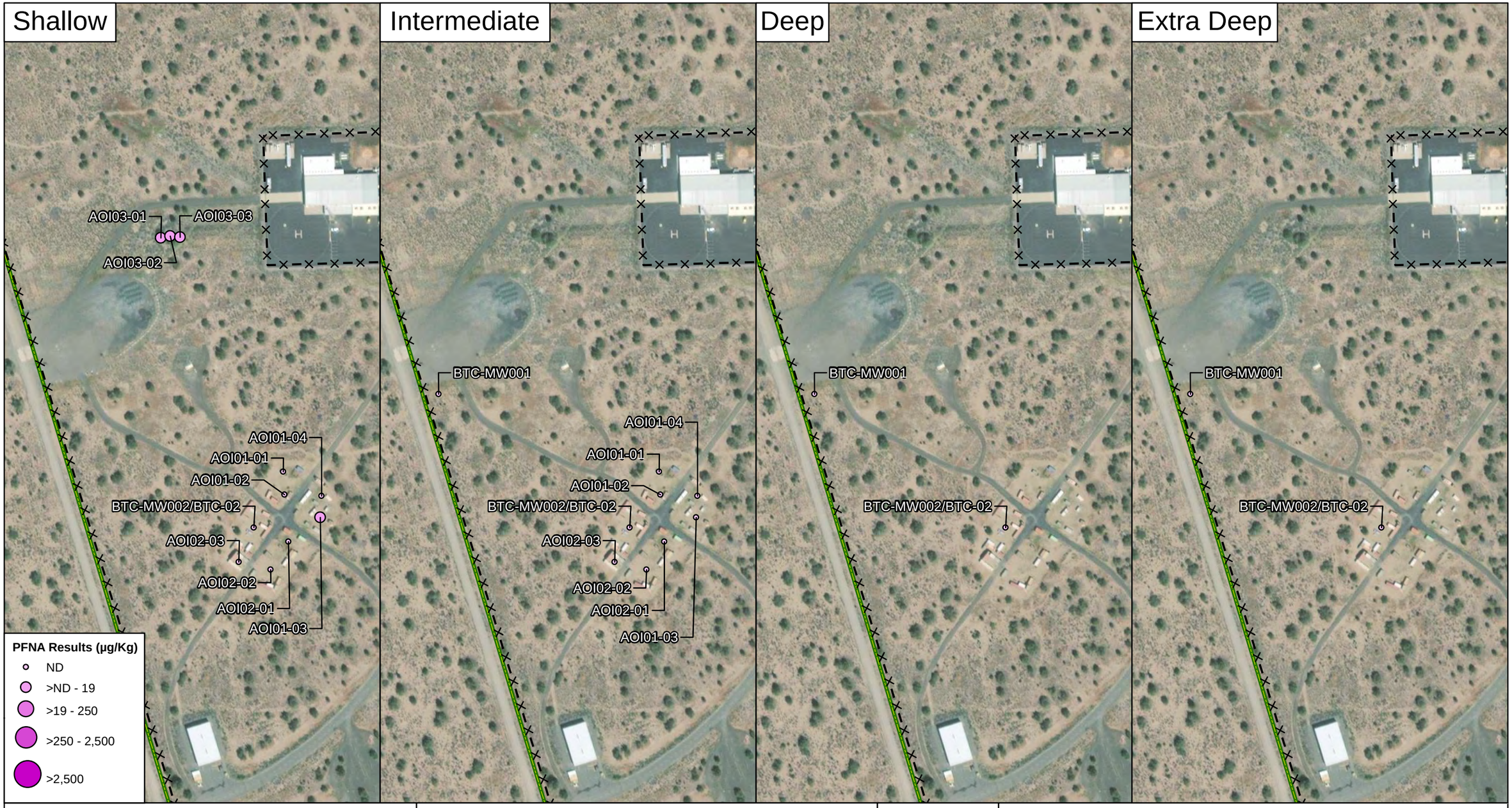
Figure 6-4



CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/12/2023	GIS BY	MS	1/12/2023
SCALE	1:3,000	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

Fence

Facility Boundary

0 125 250 500 Feet

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

N

PFNA Detections in Soil

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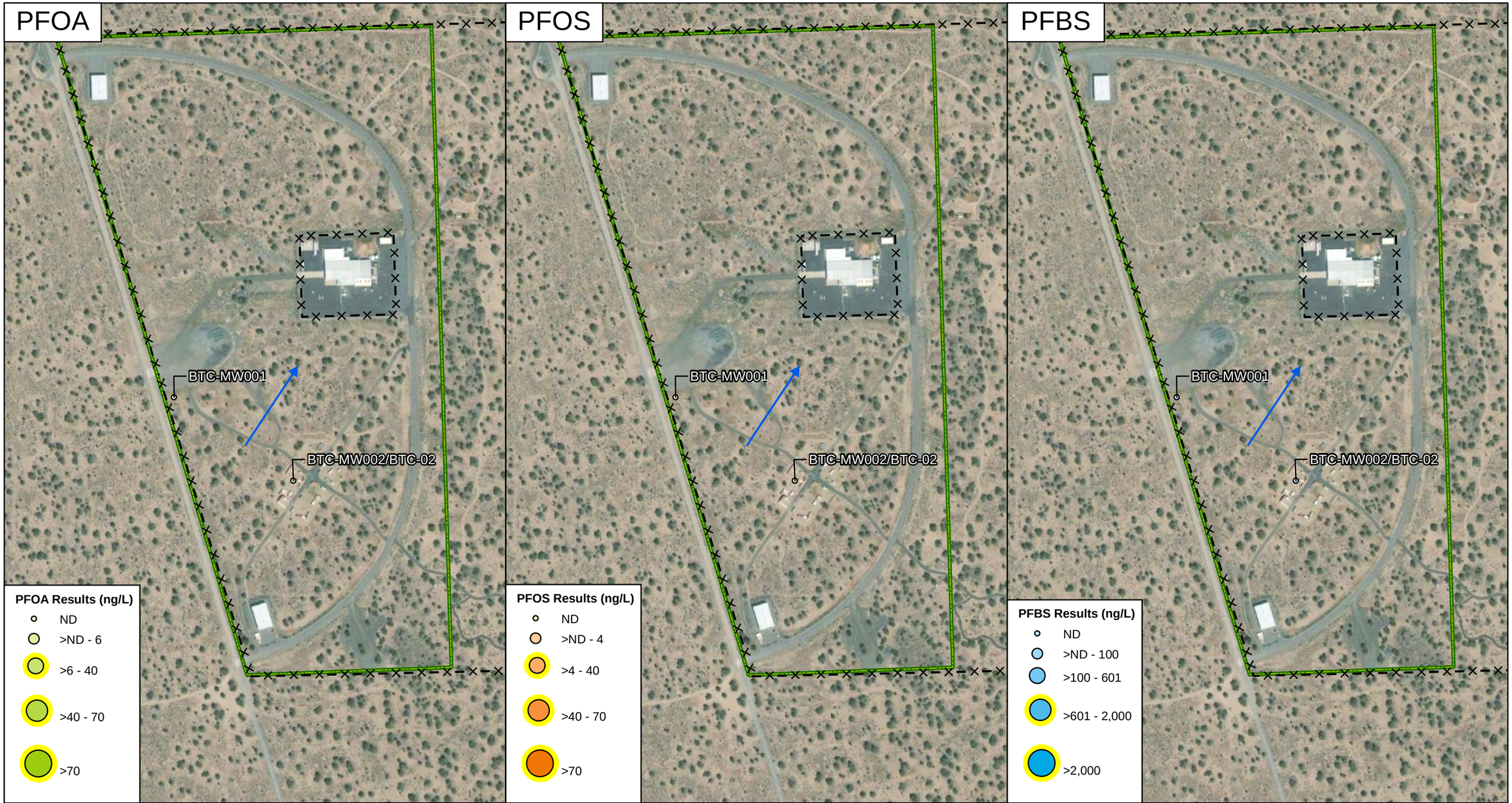
Figure 6-5



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SCALE	1:4,800	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

- Fence
- Facility Boundary
- Inferred Groundwater Flow Direction

0 200 400 800 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Groundwater sample ID AOI01-01-GW is associated with monitoring well BTC-MW002.

N

PFOA, PFOS, and PFBS Detections in Groundwater

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Figure 6-6

PFHxS

PFNA

BTC-MW001

BTC-MW002/BTC-02

PFHxS Results (ng/L)

- ND
- >ND - 39
- >39 - 100
- >100 - 1,000
- >1,000

PFNA Results (ng/L)

- ND
- >ND - 6
- >6 - 100
- >100 - 1,000
- >1,000

CLIENT	ARNG			
PROJECT	Site Inspection at Biak Training Center Brett Hall in Powell Butte, OR			
REVISED	1/12/2023	GIS BY	MS	1/12/2023
SCALE	1:3,960	CHK BY	AP	1/12/2023
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	1/12/2023

Legend

- Fence
- Facility Boundary
- Inferred Groundwater Flow Direction

0 165 330 660 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Groundwater sample ID AOI01-01-GW is associated with monitoring well BTC-MW002.

N

PFHxS and PFNA Detections in Groundwater

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Figure 6-7

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7. Exposure Pathways

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

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

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

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

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1, AOI 2, and AOI 3

AOI 1 and AOI 2 are training areas where AFFF was applied during training exercises. AOI 3 is the infiltration basin where water would have discharged from rinsing a water tank truck impacted with AFFF.

Relevant compounds were detected in surface soil at AOI 1, AOI 2, and AOI 3. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and construction workers are potentially complete. Since facility access is not controlled, trespassers could also contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for trespassers is potentially complete. The nearest residence is approximately 1-mile away; therefore, residents are unlikely to encounter soil via inhalation of dust and the exposure pathway is considered incomplete. PFOS was detected in deep subsurface soil (94 to 96 feet bgs) at AOI 1. Construction workers are not anticipated to come in contact with soil greater than 15 feet bgs; therefore, the subsurface soil exposure pathway for construction workers is considered incomplete. The CSM for AOI 1, AOI 2, and AOI 3 is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

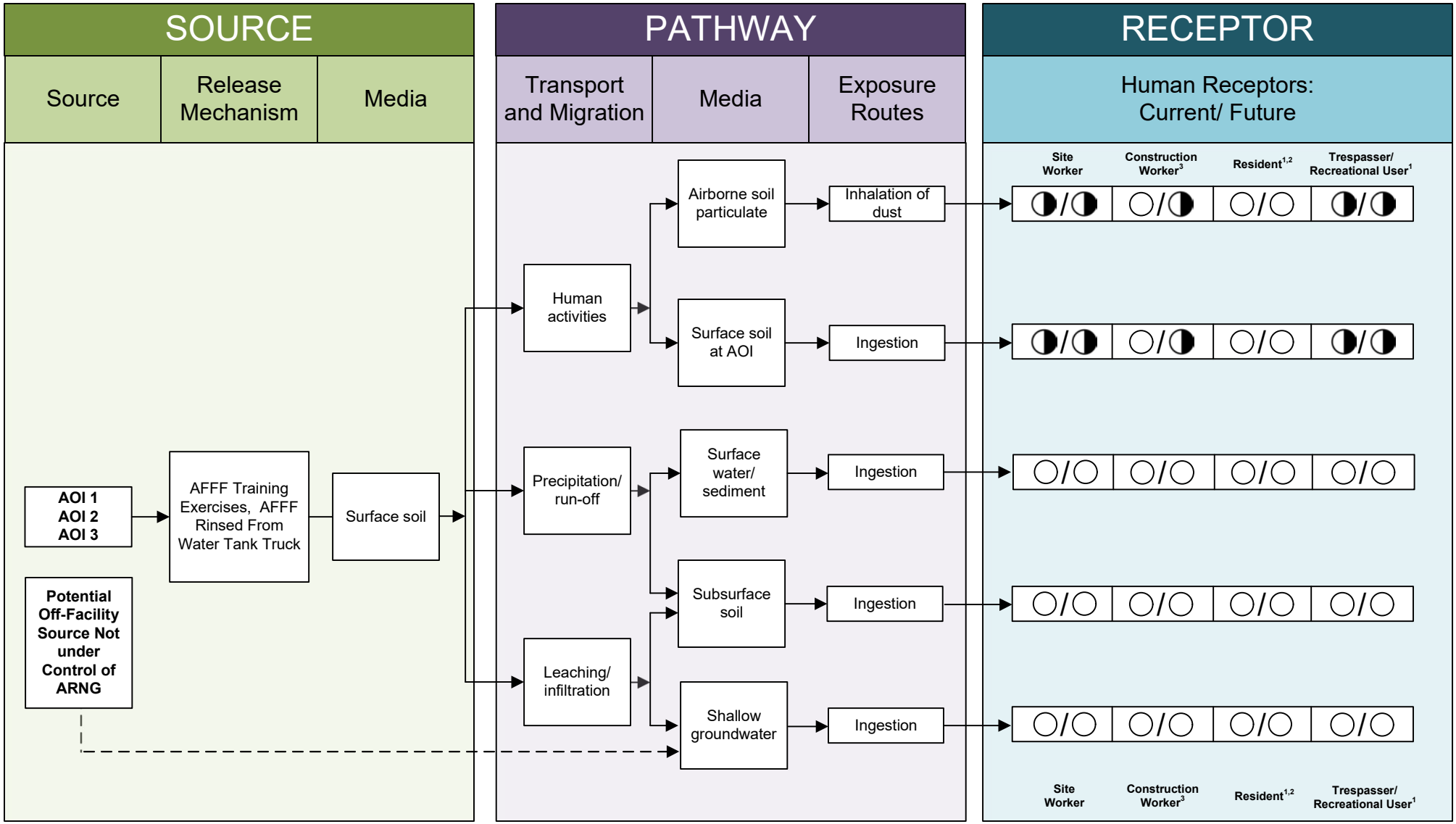
The SI results in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors based on the aforementioned criteria.

7.2.1 AOI 1 and AOI 2

The relevant compounds were not detected in groundwater samples collected at AOI 1 and AOI 2. Therefore, the groundwater ingestion exposure pathway for all receptors is considered incomplete. The CSM for AOI 1 and AOI 2 is presented on **Figure 7-1**.

7.3 Surface Water and Sediment Exposure Pathway

No surface water features are present at the facility or immediately downgradient of the facility; therefore, the surface water and sediment exposure pathways are considered incomplete for all receptors.



LEGEND

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

Notes:

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. No current active construction at the facility.

Figure 7-1
Conceptual Site Model, AOI 1, AOI 2, and AOI 3
Biak Training Center Brett Hall

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8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 14 March 2022 to 22 June 2022 and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation, groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2022b), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

- Thirty-one (31) soil samples from 12 boring locations;
- Two groundwater samples from two newly installed monitoring wells;
- Nineteen (19) quality assurance QA/QC samples.

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

8.2 Outcome

Based on the results of this SI, no further evaluation under CERCLA is warranted for each of the three AOIs at this time (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, there is no potential for exposure to drinking water receptors from AOI 1, AOI 2, and AOI 3 from sources on the facility resulting from historical DoD activities. Sample analytical concentrations collected during the SI were compared to the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - The detected concentrations of relevant compounds in soil at AOI 1 were below their SLs.
    - The relevant compounds were not detected in groundwater at AOI 1.
    - Based on the results of the SI, further evaluation of AOI 1 is not warranted.
- At AOI 2:
    - The detected concentrations of relevant compounds in soil at AOI 2 were below their SLs.

- The relevant compounds were not detected in groundwater at AOI 2.
- Based on the results of the SI, further evaluation of AOI 2 is not warranted.

- At AOI 3:
  - The detected concentrations of relevant compounds in soil at AOI 3 were below their SLs.
  - Based on the results of the SI, further evaluation of AOI 3 is not warranted.

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Engine Academy Training Area	◐	○	○	No further action
2	Bomb Squad Training Area	◐	○	N/A	No further action
3	Range Control Infiltration Basin	◐	N/A	N/A	No further action

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

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