FINAL
Site Inspection Report
Camp Santiago Joint Maneuver Center
Salinas, Puerto Rico

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

August 2023

Prepared for:

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

UNCLASSIFIED

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
°F	Degrees Fahrenheit
µg/kg	Microgram(s) 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
bgs	Below ground surface
btoc	Below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	Chain-of-custody
CSM	Conceptual site model
DoD	Department of Defense
DQO	Data quality objective
DUA	Data Usability Assessment
EA	EA Engineering, Science, and Technology, Inc., PBC
EB	Equipment blank
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EQB	Environmental Quality Board
FedEx	Federal Express
ft	Foot (feet)
FTA	Fire Training Area
gal	Gallon(s)
HDPE	High-density polyethylene
HFPO-DA	Hexafluoropropylene oxide dimer acid
ID	Identification
IDW	Investigation-derived waste
ITRC	Interstate Technology Regulatory Council
JMTC	Joint Maneuver Training Center
LC/MS/MS	Liquid chromatography tandem mass spectrometry

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

MATES	Maneuver Area Training Equipment Site
MIL-SPEC	Military Specification
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
ng/L	Nanogram(s) per liter
No.	Number
OSD	Office of the Secretary of Defense
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
ppt	Part(s) per trillion
PRARNG	Puerto Rico Army National Guard
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
QSM	Quality Systems Manual
RI	Remedial investigation
SI	Site inspection
SL	Screening level
TOC	Total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at ARNG facilities nationwide based 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) (Assistant Secretary of Defense) dated 6 July 2022. The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA).[1] 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), with an additional AOI determined during the SI planning phase, where PFAS-containing materials may have been stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and planning phase and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on a comparison of SI results to SLs for the relevant compounds. This SI was completed at the Camp Santiago Joint Maneuver Training Center (JMTC), in Salinas, Puerto Rico, and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 3. Camp Santiago will be referred to as the “Facility” throughout this document.

The Facility, operated by Puerto Rico ARNG (PRARNG), encompasses approximately 11,930 acres in Salinas, Puerto Rico. The Facility is located on the south-central coast of Puerto Rico, north of the municipality of Salinas, Puerto Rico, and is approximately 2 miles north of the Caribbean Sea. Camp Santiago was acquired from the Commonwealth of Puerto Rico in 1940 by the U.S Army for training and was originally established as the Salinas Training Area. In 1975 it was renamed Camp Santiago. Currently, the site is the largest training site licensed for ARNG training activities in the Caribbean. Camp Santiago lies on the southern slope of the Cordillera Central mountain range, which forms the east-west drainage divide in Puerto Rico (AECOM Technical Services, Inc. 2020).

The PA identified two AOIs for investigation during the SI phase. An additional AOI, for a total of three, was identified during the SI planning phase. SI sampling results from the AOIs were compared to OSD SLs. After the fieldwork was completed an additional potential PFAS release area was identified: AOI 4: Maneuver Area Training Equipment Site (MATES) Complex. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation

[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.

under CERCLA is warranted in a remedial investigation (RI) for AOI 3. No further evaluation is warranted for AOI 1 or 2 at this time. As the identification of AOI 4 did not occur until after the SI fieldwork, investigation of this AOI was not completed during the SI. AOI 4: MATES Complex will be assessed during the RI.

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

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

Notes:

1. Assistant Secretary of Defense. 2022. Risk-Based SLs in Groundwater and Soil using U.S. Environmental Protection Agency's Regional SL Calculator. Hazard Quotient=0.1. May 2022.
2. 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.

bgs = Below ground surface
ft = Foot (feet)
µg/kg = Microgram(s) per kilogram
ng/L = Nanogram(s) per liter

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

AOI	Potential Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary[1]	Future Action
1	Former Landfill	◐	◐	NA	No Further Action
2	Station Number 4 Fire Training Area	◐	◐	NA	No Further Action
3	Fire Station	●	●	NA	Proceed to RI
4	MATES Complex	TBD	TBD	NA	Proceed to RI

Legend:

● = Detected; exceedance of SLs
◐ = Detected; no exceedance of SLs
○ = Not detected

1. Facility Boundary samples were not collected at Camp Santiago

NA = Not applicable
TBD = to be determined during RI

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) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on 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 perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide-dimer acid (HFPO-DA)[2] at ARNG facilities nationwide. The ARNG performed this SI at Camp Santiago Joint Maneuver Training Center (JMTC) in Salinas, Puerto Rico. Camp Santiago JMTC is also referred to as the "Facility" throughout this report.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (U.S. 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 U.S. Army requirements and guidance for field investigations.

1.2 SITE INSPECTION PURPOSE

A PA was performed at Camp Santiago JMTC (AECOM Technical Services, Inc. [AECOM] 2020) that identified two Areas of Interest (AOIs), with a third AOI identified during the SI planning phase, where PFAS-containing materials were used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[2] 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

Camp Santiago is located on the south-central coast of Puerto Rico, north of the municipality of Salinas, Puerto Rico (**Figure 2-1**). Camp Santiago is the largest training site licensed for ARNG training activities in the Caribbean and occupies 11,930 acres. The Caribbean Sea is approximately 2 miles south from Camp Santiago (AECOM 2020).

In 1940, Camp Santiago was acquired from the Commonwealth of Puerto Rico by the U.S. Army for training and was established as the Salinas Training Area. During World War II and through the end of the Korean War, the Salinas Training Area was used for military training. The Facility was licensed for use by the PRARNG in 1967. In 1975, it was renamed Camp Santiago. Camp Santiago provides support and services to PRARNG as well as other Department of Defense (DoD) and non-DoD users, such as state and federal law enforcement agencies. Camp Santiago does not house permanent residents, although the barracks can temporarily house a large number of troops (AECOM 2020).

Camp Santiago's cantonment area is approximately 405 acres. The camp is a self-supporting Facility with finance, quartermaster, medical, and other support services normally available at military installations. Within Camp Santiago, there are approximately 12 miles of improved roads and 150 miles of unimproved roads. The improved roads (asphalt paved) are primarily comprised of Highway PR-154, streets and avenues in the cantonment area, and a stretch of road to range areas at the Camp Santiago (AECOM 2020).

2.2 FACILITY ENVIRONMENTAL SETTING

Camp Santiago lies on the southern slope of the Cordillera Central mountain range, which forms the east-west drainage divide in Puerto Rico. Topography across the facility ranges from mountains located along the northern portion of the Facility to a gently sloping outwash plain occupying the southernmost end of the Facility. Camp Santiago lies just to the east of the Salinas fan delta in an interfan or alluvial plain area. Elevations across the facility range from 40 feet (ft) above mean sea level (amsl) along the outwash plain to approximately 2,000 ft amsl in the mountains (AECOM 2020).

The following sections include information on geology, hydrogeology, hydrology, climate, and current and future land use. The topography at the Facility is shown on **Figure 2-2**. The regional geology and groundwater features are shown on **Figure 2-3**. The regional surface water features and drainage basins are shown on **Figure 2-4**. Groundwater elevations and contours are presented on **Figure 2-5**.

2.2.1 Geology

Camp Santiago is located on the southern slope of the Cordillera Central mountain range, also called the Puerto Rican anticlinorium (**Figure 2-2**). The mountains that occupy the northern portion of the Facility are composed of highly faulted and folded sedimentary and volcanic formations. The volcaniclastic and sedimentary rocks consist of massive- to thick-bedded andesitic tuff, welded tuff, porphyritic basalt, volcanic breccia, sandstone, and siltstone. A principal structural feature of the strata is a dominant southwesterly dip (AECOM 2020).

The southernmost end of the Facility is located on a gentle sloping outwash plain. This area is characterized by a low-lying, narrow fan-delta consisting of gravel, sand, and silt of Quaternary age. The alluvial and colluvial deposits that are present at the Facility have been washed down from the surrounding hills and mountains (AECOM 2020).

The Río Jueyes fault is present within the main post area and passes through the cantonment area at an angle of approximately north 60 degrees west. The Esmeralda Fault, an ancient inactive fault, may also be present in the bedrock beneath the colluvium at the southern boundary of the site (AECOM 2020).

Much of the central portion of Camp Santiago is directly underlain by the conglomerates, sandstones, siltstones, and limestones of the Cariblanco formation, which is also exposed in the mountains to the north and south as far as the Río Jueyes fault. The Río Nigua river valley drains the impact area. Relatively young alluvium has collected in the valley bottom and extends to the southeast where it coalesces with the north-northeast to south-southwest trending alluvial valley from the Río Majada. Alluvium transported from the mountains to the north of Camp Santiago has formed an alluvial fan and plain, which underlies the southeast corner of the camp and most of the region to the southeast. This feature is called the Río Nigua de Salinas alluvial fan and is part of the larger South Coastal Plain Alluvial Aquifer (AECOM 2020).

Based on the soil survey for Camp Santiago, the five most extensive soil units found within the site boundaries are the following: Aguilita stony clay loam, Callabo silty clay loam, Llano’s clay, Jacana Clay, and Cobbly alluvial land. All soil units are well drained except the Cobbly alluvial land, which is found on floodplains. The pH values for the five soil types range from 5.6 to 8.4 in the upper most 60 inches, and organic matter content is five percent (%) or less. The erodibility of these soil units is based on the susceptibility of a soil to sheer and rill erosion by water. These soil units have a slight to moderate erodibility when exposed or un-vegetated (AECOM 2020).

Soils observed during the SI field event varied widely based on AOI location within the site: northern cantonment area (AOI 1 and 2) and southern cantonment area (AOI 3). Grain size analysis included varying amounts of sand (43.4-76.9% in northern cantonment area; 35.8% in southern cantonment area), clay (6-22.3% in northern cantonment area; 4.9% in southern cantonment area), silt (13.5-22.1% in northern cantonment area; 30% in southern cantonment area), and gravel (3.6% in northern cantonment area; 29.3% in southern cantonment area), corresponding to a soil texture of “sandy clay loam” in northern cantonment area, and a “silt loam” in the southern cantonment area. Soil depths ranged between Further, pH results of soil were 7.0 to 7.5 for AOI 2 and AOI 1, respectively, and 8.2 for AOI 3, indicating a neutral to slightly basic soil composition across the Facility.

2.2.2 Hydrogeology

Camp Santiago straddles two very different hydrogeologic regions. Groundwater within the portions of the Facility directly overlying volcanic and sedimentary bedrock units primarily moves through structural features such as joints, fractures, and bedding planes. **Figure 2-3** depicts groundwater features as well as any groundwater well within 2-mile radius of the Facility. Hydrothermal springs have been identified to the northwest of the Facility, outside of the City of Coamo. The influence of hydrothermal groundwater can be seen seasonally through its impact on temperatures in wells in various parts of the facility (AECOM 2020).

Part of the central portion and most of the southeastern third of the Facility lies within the second hydrogeologic region, overlying an interfan on the edge of an alluvial plain within the eastern section of the South Coast groundwater province. This province extends along the western half of the south coast of Puerto Rico. This portion of the Facility is located on the western border of the Río Nigua de Salinas alluvial fan aquifer. The Río Nigua de Salinas alluvial fan aquifer is one of a series of alluvial fans and coastal sediments deposited during the Quaternary period that form the larger South Coastal Plain alluvial aquifer (USGS, 2014). This aquifer underlies the many watersheds that span Camp Santiago and sees recharge primarily by infiltration of precipitation (**Figures 2-4 and 2-5**).

The Río Nigua de Salinas alluvial fan aquifer is the principal source of drinking water for the residents of Salinas and the surrounding area. The hydraulic conductivity of the fan deposits in the Salinas area ranges from 26 to 100 ft per day. Based on topography, infiltration from the facility represents a very small proportion of total recharge that reaches the aquifer. The aquifer in Salinas includes three principal hydrogeologic units: (1) an upper zone typically composed of varying proportions of sand, gravel, and clay, with finer sediments increasing coastward; (2) the fan deltas and alluvial deposits, which are the principal groundwater flow zone; and (3) weathered bedrock that consists of limestones, diorite, sandstone, conglomerates, and siltstone. Groundwater within the sand and gravel beds of the upper zone is mostly unconfined; however, as the amount of fine-grained material increases coastward, this upper zone becomes a semi-confining unit to the principal groundwater flow zone within the fan delta and alluvial deposits. The upper zone, which supplies water to domestic wells varies in thickness from 75 ft along the coast to 10 to 40 ft along the northern boundary. The thickness of the fan delta is reported to be up to 350 ft, and the fan delta supplies water for municipalities and industrial water wells (AECOM 2020).

Regional groundwater flow near Camp Santiago is to the south, toward the Caribbean Sea. Localized flow may be complex due to the preferential flow paths located within the colluvium, influences of underlying bedrock that are exposed at Cerro Modesto south of the cantonment area, and the presence of the Esmeralda fault, which may be located in bedrock beneath the colluvium at the southern boundary of the facility. Pumping from wells in the Río Nigua de Salinas alluvial fan aquifer has lowered the water table sufficiently to create a cone of depression that has changed the natural north to south direction of groundwater flow (AECOM 2020). This is corroborated by groundwater elevation data collected during the SI field event. Groundwater flow in the northern cantonment area was seen to be south to slightly southwest, while the southern cantonment area saw localized flow to the west and northwest. Static groundwater level measurements obtained during the SI event in temporary wells at Camp Santiago ranged from 38.06 to 49.78 ft below ground surface (bgs) in AOI 1, 14.22 to 29.75 t bgs in AOI 2 in the northern cantonment area and 65.00 to 66.61.61 ft bgs in AOI 3 the southern cantonment area.

The groundwater contour maps, **Figure 2-5 through 2-7**, have been provided to illustrate these measurements.

Groundwater is the only source of drinking water for Camp Santiago. There are two water supply wells located near the Main Gate that supply water to the Facility that are screened in the Río Nigua de Salinas alluvial fan aquifer deposits. Camp Santiago also includes a water treatment plant, a water distribution system, and a sewer line system connected to the Salinas municipal sewage system. Based on 2010 Census data, approximately 30,000 people live in Salinas and the surrounding areas near Camp Santiago and rely on groundwater as their sole water supply source. There are more than 70 groundwater wells registered between the Puerto Rico Department of Health and the Puerto Rico Aqueduct and Sewer Authority located primarily south of Camp Santiago within the 4-mile downgradient groundwater receptor zone. The water supply wells located south of Camp Santiago are screened at various depths in the Río Nigua de Salinas alluvial fan aquifer. According to Camp Santiago personnel, municipal water infrastructure was recently established for the City of Salinas; however, it is unclear whether municipal water is primary source of drinking water (AECOM 2020).

Sampling of two domestic water sources at Camp Santiago for PFAS was conducted by the ARNG in June 2017. Concentrations of various PFAS compounds were detected, including concentrations of PFOS ranging from 1.67 to 2.90 parts per trillion (ppt) (reported as nanogram(s) per liter or ng/l) in samples collected from a water spigot inside Building 002 and a water spigot inside Building 003. Both buildings are located in the facility cantonment area. PFOA was not detected in samples (AECOM 2020). Sampling of Well no.2 was conducted again in January 2022 to determine if the water could be used to decontaminate drilling equipment. PFOS was reported as being present at 0.77 ng/l. PFOA was not detected in the sample.

2.2.3 Hydrology

Camp Santiago is situated on the southern slope of the Cordillera Central mountain range, which forms the main drainage divide of Puerto Rico. The steep topography of the southern slope of the Cordillera Central results in rapid runoff and occasional flash flooding along the intermittent streams that traverse Camp Santiago. All surface water in Camp Santiago flows south to the Caribbean Sea, roughly 2 miles from the facility boundary (**Figure 2-4**) (AECOM 2020).

There are approximately 144 miles of perennial or intermittent streams within the boundaries of Camp Santiago. Munitions use and fires have disrupted native plants, where now only grass, herbaceous plants, and shrubs grow along the stream courses. The only surface waters that flow off-facility are the Río Jueyes, Río Nigua, and Quebrada Honda. Of these waters, the Río Nigua is the principal drainage for Camp Santiago, with a watershed basin size of 112 square miles (AECOM 2020).

The Río Nigua watershed drains the eastern half of the Facility. The Río Majada, which flows along the northeastern portion of the facility boundary, is also part of the watershed and confluences with the Río Nigua downstream. The Río Jueyes watershed is much smaller, with a basin size of roughly 12 square miles, and drains the western portion of the Facility. The Quebrada Honda watershed drains the south-central part of the Facility and consists of a relatively small, intermittent creek that mainly dries out and/or infiltrates to groundwater downstream of Camp Santiago's southern boundary (AECOM 2020).

Most of the drainage features flowing through the northern and central areas of Camp Santiago are intermittent or ephemeral streams, with low gradients, sizable deposits of loose gravels and sand, and losing over significant reaches. The unconsolidated material is easily entrained and transported during high stream flow periods (AECOM 2020).

Generally, flow in streams within the Camp Santiago area are less than 35 cubic ft per second, with some sections often drying out. Intense runoff events, mostly in the mountainous area to the north and east of Camp Santiago, create flash flood conditions in the lower elevations. All low elevation areas, including the firing ranges and neighboring areas, can be flooded within hours of the onset of a storm. The local geology and drainage patterns indicate that portions of the Facility and the adjacent communities of El Coco and Salinas occupy historical floodplains (AECOM 2020).

2.2.4 Climate

Puerto Rico has a mildly tropical Caribbean climate, and seasonal variation in temperatures is very low. The average temperature in the summer in the nearby City of Ponce is 82.3 degrees Fahrenheit (°F), while the average temperature in the winter is 77.2°F (AECOM 2020).

Puerto Rico has a complex rainfall pattern that is controlled mainly by the orographic effects of the Cordillera Central mountain range. The Cordillera Central forms a barrier to the prevailing northeast trade winds and affects the distribution of rainfall throughout Puerto Rico. The trade winds persist throughout the year, producing a wind pattern varying from northeast to southeast according to the season. Much of the south coast, including Camp Santiago, lies in a rain shadow. The average annual rainfall in Ponce is about 35.48 inches (AECOM 2020).

2.2.5 Current and Future Land Use

Camp Santiago is a fully fenced facility, with restricted access via a Main Gate located on highway PR-52. Camp Santiago is currently the largest training site licensed for ARNG activities in the Caribbean, providing training and support to multiple state and federal agencies, including DoD and non-DoD entities. The future land use is not anticipated to change (AECOM 2020).

2.2.6 Sensitive Habitat and Threatened/Endangered Species

A wildlife survey has not occurred at the Facility, and the Facility does not have any significant areas of habitat. The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Salinas Municipality, Puerto Rico (U.S. Fish and Wildlife Services 2022):

- Birds: Puerto Rican Nightjar (*Caprimulgus noctitherus*) – Federally Endangered; Yellow-shouldered Blackbird (*Agelaius xanthomus*) – Federally Endangered

- Reptiles: Hawksbill Sea Turtle (*Eretmochelys imbricata*) – Federally Endangered; Leatherback Sea Turtle (*Dermochelys coriacea*) – Federally Endangered; Puerto Rican Boa (*Epicrates inornatus*) – Federally Endangered

- Flowering Plants: Erubia (*Solanum drymophilum*) – Federally Endangered; *Eugenia woodburyana* – Federally Endangered; Palo De Ramon (*Banara vanderbiltii*) – Federally Endangered; St. Thomas Prickly-ash (*Zanthoxylum thomasianum*) – Federally Endangered

2.3 HISTORY OF PFAS USE

Two potential PFAS release areas were identified at the Facility during the PA (AECOM 2020). An additional AOI was identified as the SI scoping was in progress. The AOIs include areas where aqueous film forming foam (AFFF) may have been used, stored, disposed, or released historically at Camp Santiago. Interviews and records obtained during the PA indicated that PFAS products were not present at Camp Santiago during the operational years of the Former Landfill; however, PFAS-laden materials may have been disposed in the landfill area. Additionally, fire training occurred in the Station Number 4 Fire Training Area (FTA). Though there has been no recorded usage of AFFF at this FTA by the PRARNG, the undocumented use of the FTA by other agencies may have included AFFF. Further, during the PA site visit, it was observed that the Fire Station stored two Humvee High Mobility Multipurpose Wheeled Vehicle Skid units capable of carrying 10 gallons (gal) of AFFF, one E-One Pump truck holding 50 gal of 3% AFFF, and an additional firefighting vehicle with an unknown contents and capabilities as they pertain to AFFF. An additional storage location within the Fire Station held Chemguard 3% AFFF C303 and C306 products in 5-gal buckets.

Based on interviewee recollection or knowledge, AFFF has not been released on-site at Camp Santiago; however, there is potential for incidental or residual release of AFFF on-site. The potential PFAS release areas were grouped into three AOIs based on preliminary data and presumed groundwater flow directions. During preparation of the SI Report, it was noted that firefighting vehicles were maintained at the MATES Complex. As a result, a fourth AOI, the MATES Complex, was added that will be investigated as part of the RI. A description of each AOI is presented in **Section 3**. There is no evidence that HFPO-DA (also referred to as Gen X) was used on-facility.

Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 2-1
Facility Location

Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections
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Camp Santiago, Puerto Rico

Figure 2-2
Topography

Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections
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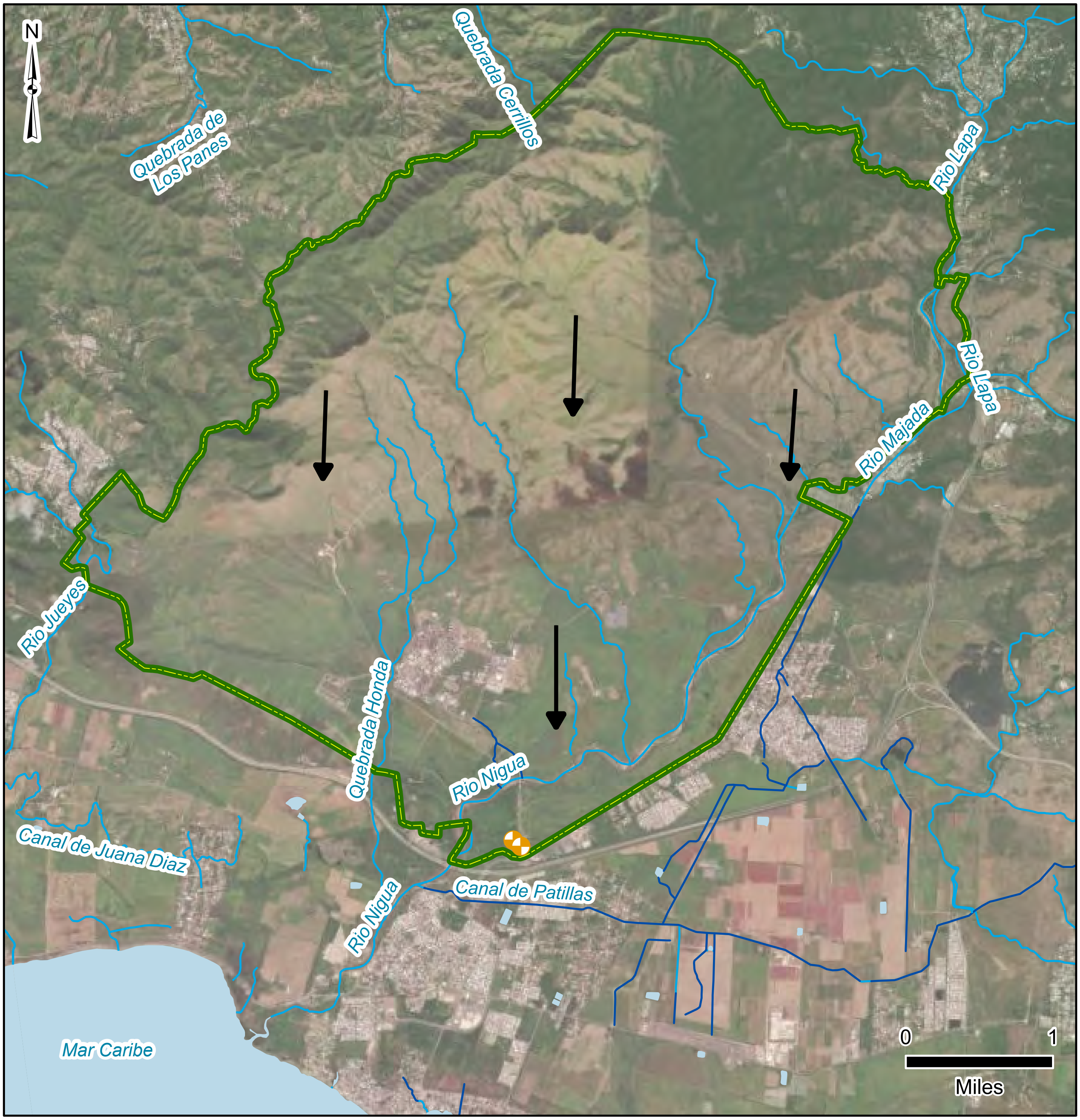
Figure 2-3
Groundwater Features



Facility Data
Facility Boundary

Well Type
Potable

Hydrology/Hydrogeology
Inferred Groundwater Flow Direction
Perennial Creek/Stream
Ditch/Drainage Swale
Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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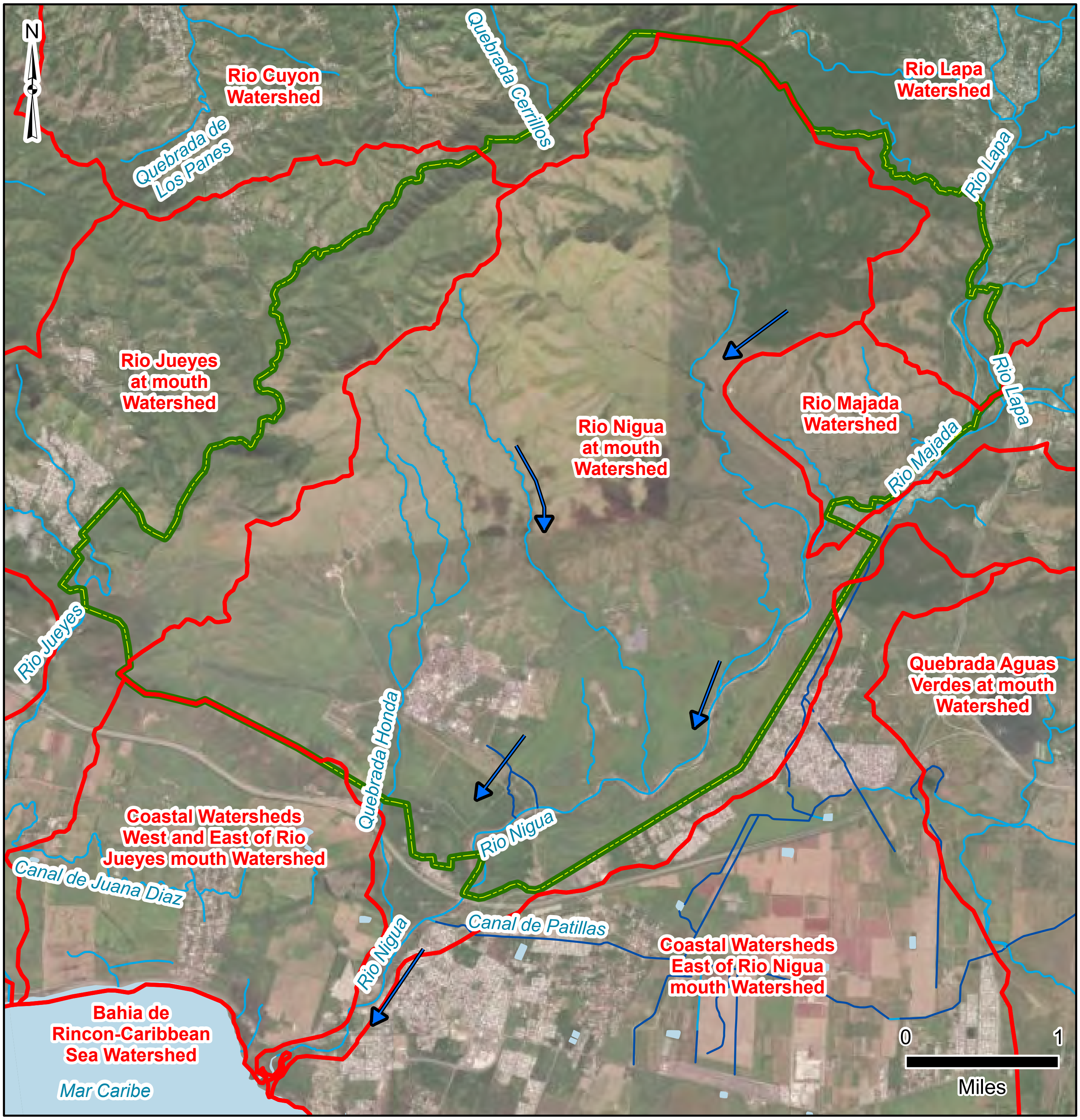
Figure 2-4
Surface Water Features



Facility Data

Facility Boundary

Hydrology

Surface Water Flow Direction

Ditch/Drainage Swale

Perennial Creek/Stream

Waterbody

Watershed Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections Site Inspection Report
Camp Santiago, Puerto Rico

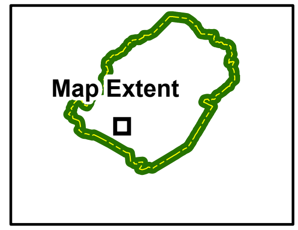
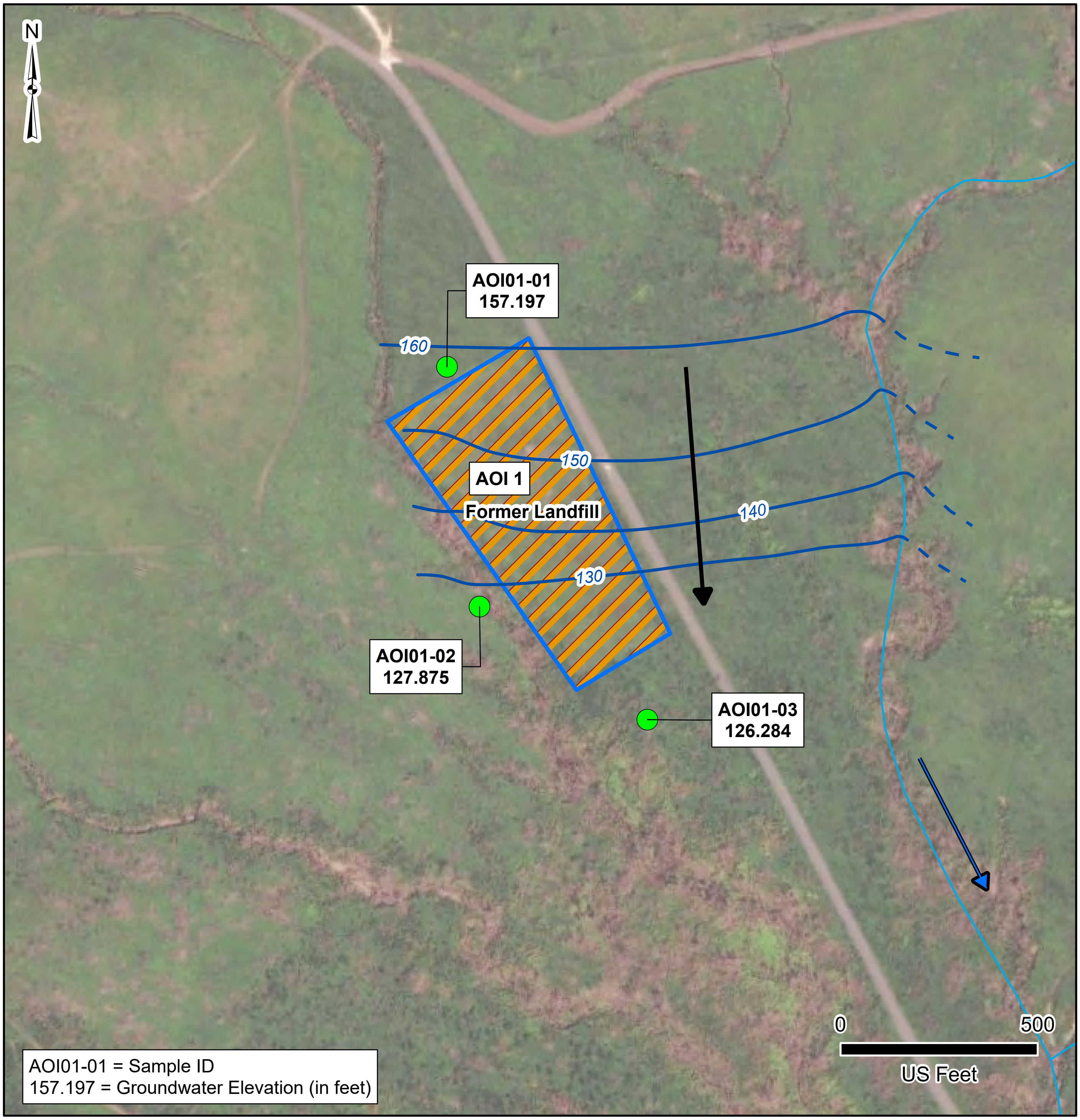


Figure 2-5
Groundwater Elevations AOI 1, May 2022



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Sample Locations
- DPT

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Surface Water Flow Direction
- Grounwater Elevation Contour (10 foot interval)
- Inferred Grounwater Elevation Contour (10 foot interval)
- Perennial Creek/ Stream

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections Site Inspection Report
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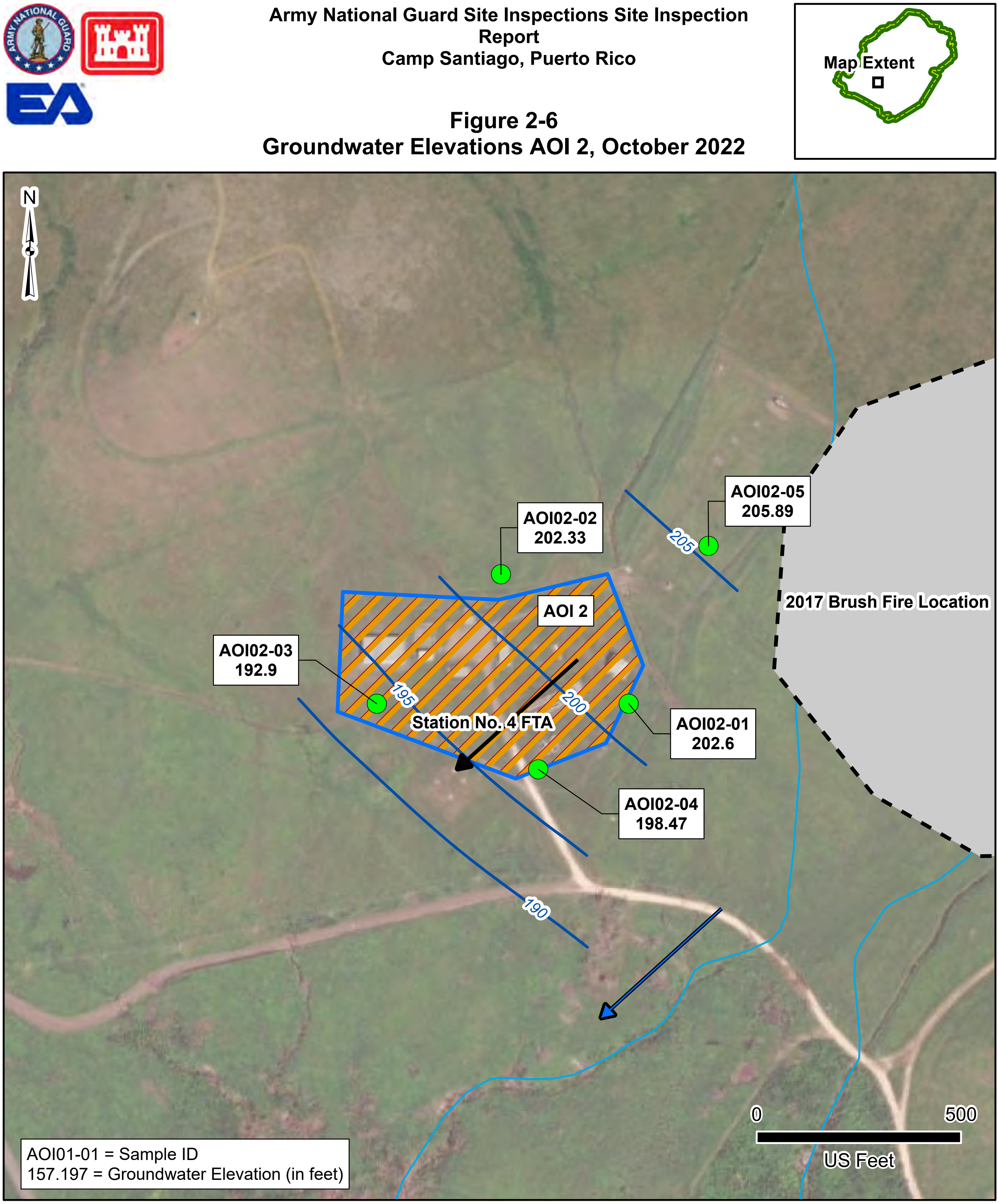
Figure 2-6
Groundwater Elevations AOI 2, October 2022



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Surface Water Flow Direction
- Grounwater Elevation Contour (5 foot interval)
- Perennial Creek/Stream

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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Camp Santiago, Puerto Rico

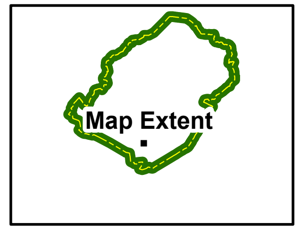
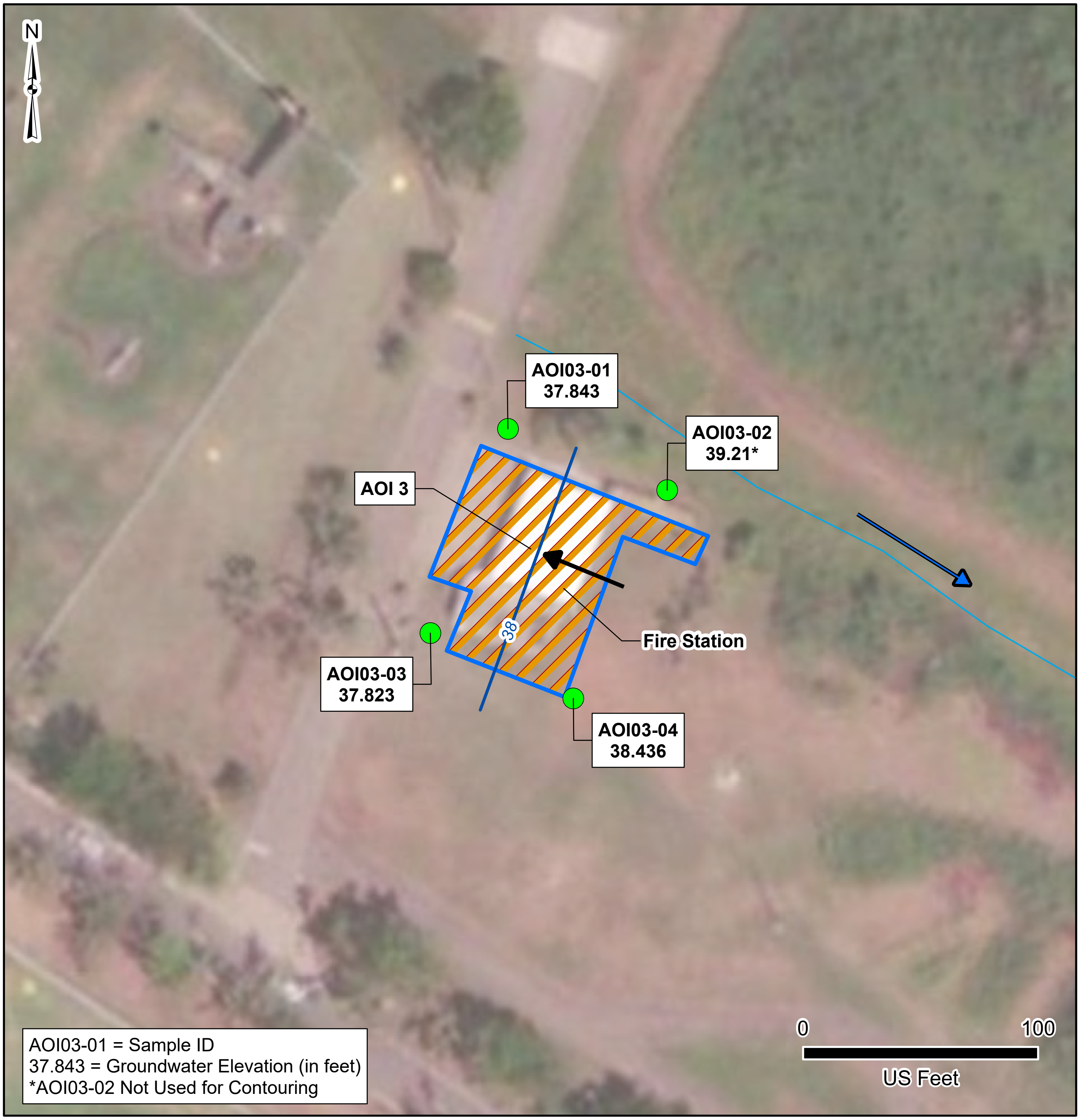


Figure 2-7
Groundwater Elevations AOI 3, May 2022



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Sample Locations
- DPT

Hydrogeology
- Groundwater Flow Direction
- Surface Water Flow Direction
- Ditch/Drainage Swale
- Groundwater Elevaton Contour (1 foot interval)

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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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 and subsequent scoping discussions, three potential release areas were identified at Camp Santiago JMTC and grouped into three AOIs identified as: AOI 1 Former Landfill, AOI 2 Station No. 4 FTA, and AOI 3 Fire Station. During preparation of the SI report, one additional potential release area was identified and will be assessed during the RI: AOI 4 MATES Complex. The AOIs are shown on **Figure 3-1**.

3.1 AOI 1 – FORMER LANDFILL

The Former Landfill at Camp Santiago is located west of the facility cantonment area. The landfill formerly operated as an approved solid waste disposal facility under a Puerto Rico Environmental Quality Board (EQB) Sanitary Landfill Permit; however, infrequent open burning of refuse occurred at the landfill without approval from the EQB. No other burn pits existed at Camp Santiago. The landfill was used primarily for the dumping of medical, household, and construction waste. According to PRARNG environmental staff, the landfill closure process began in 1993. Because AFFF products did not arrive to Camp Santiago until 2007, it is not expected that any AFFF-impacted materials have been disposed of in the landfill.

Landfills are a primary potential release area of PFAS due to the mechanical breakdown of discarded PFAS-laden materials. Such materials, to name a few, may include sludge from a wastewater treatment plant that processes PFAS-laden water or products associated with waterproofing uniforms or boots. Although AFFF was not present at Camp Santiago during the landfill's operational years, other PFAS-laden materials may have been disposed of in the landfill. Because PFAS compounds have been detected in drinking water collected from wells at the Facility, and no other PFAS release areas are known to have occurred at Camp Santiago, the former landfill is considered a potential PFAS release area. The former landfill is located approximately 1.75 miles to the northwest and generally upgradient from the two water supply wells which are located near the main facility entrance.

The former landfill was located in an area of shallow, fractured rock with a minimal amount of soil development, which would be conducive to the generation of a groundwater pollution problem with excessive rainfall. The former landfill is also located adjacent to a small stream that discharges to the Río Nigua, south of the Facility (AECOM 2020).

3.2 AOI 2 – STATION NUMBER 4 FIRE TRAINING AREA

The Station No. 4 FTA is located northwest of the cantonment area at Camp Santiago. The FTA is used for fire training by the Camp Santiago Fire Department, as well as the 215th Firefighter Engineer Department stationed at Vega Baja Readiness Center, the Fort Allen Fire Department, and other DoD and non-DoD units. The FTA compound includes several structures used for storage and training.

Although AFFF is stored by the Camp Santiago Fire Department at the facility fire station (AOI 3), AFFF is not used in training at Camp Santiago. According to the Camp Santiago Fire Chief, whose tenure with PRARNG firefighting companies at Camp Santiago and Vega Baja spans from 2003 to present, AFFF has never been used for training purposes at the Station No. 4 FTA, or any other location on Camp Santiago. According to PRARNG staff, the first AFFF-capable firefighting vehicle was received at Camp Santiago in 2006, and AFFF was procured in 2007. Since its arrival at Camp Santiago, AFFF has never been used or disposed of at the Facility.

The Camp Santiago Fire Department, and other units that train at the Station No. 4 FTA, only use water during training. Records of the routine fire training exercises are not kept by the PRARNG. Although there have been no known uses of AFFF at this FTA by the PRARNG, the undocumented use of the FTA by other agencies may have included AFFF. Because of this uncertainty, and the known detections of PFAS in groundwater concentrations at the Facility, the Station No. 4 FTA is considered a potential PFAS release area.

The exact timeframe and frequency of training at the Station No. 4 FTA are unknown and undocumented; however, the earliest aerial imagery showing the presence of the FTA is 2012. Two small streams exist within 0.2 miles to the east and west of the FTA and flow south towards the Caribbean Sea (AECOM 2020).

3.3 AOI 3 – FIRE STATION

The Camp Santiago Fire Station is located in the southeastern corner of the facility cantonment area. The fire station is currently operating and is used for the storage of equipment and materials associated with firefighting. As previously stated, the first AFFF-capable firefighting vehicle was received at Camp Santiago in 2006, and AFFF was procured in 2007. The fire station currently stores two Humvee High Mobility Multipurpose Wheeled Vehicle Skid Units (one capable of carrying 10 gal of AFFF, the other only capable of carrying water), one E-One Pumper Truck (carrying 50 gal of 3% AFFF), and one additional firefighting vehicle with unknown contents and capabilities as it pertains to AFFF. The AFFF tank on one of the Humvee Skid Units at the fire station was empty during the PA site visit. The Camp Santiago fire department staff stated during interviews that none of the vehicles have a history of leaking or other maintenance issues that may result in the release of AFFF. Fire department vehicles are maintained at another on-site location, the Maneuver Area Training Equipment Site (MATES) Complex. Chemguard 3% AFFF C303 and C306 products are also stored in 5-gal buckets within the firefighting material storage container at the fire station. Fewer than ten 5-gal buckets containing AFFF products were present during the PA site visit. During the SI, eleven empty 5-gal containers were observed along the northern side of the Firehouse adjacent to a storage container and hoses. In addition, a Vehicle Skid Unit was observed on the ground at the eastern end of the storage container.

The only known use of the AFFF stored at Camp Santiago was in response to a 2009 fuel fire at the Caribbean Petroleum Refinery, located on the north side of the island, in Bayamon. AFFF used by the Camp Santiago Fire Department was mixed at the scene of the emergency, not at the fire station. No other AFFF has been used or disposed of by the Camp Santiago Fire Department since it received AFFF in 2007. No fire training occurs at the Camp Santiago Fire Station. The fire department trains only with water at the Station No. 4 FTA. The fire department performs non-fire training at the Rubble Pile Training as well; however, no fires are lit during this training. The fire department also occasionally trains off-post at the U.S. Army Garrison Fort Buchanan on the northern side of the island. There are no storage records for the AFFF kept at the fire station (AECOM 2020).

3.4 AOI 4 – MATES COMPLEX

Following the SI fieldwork it was noted that fire fighting vehicles were maintained at the MATES Complex.

3.5 ADJACENT SOURCES

Two potential off-facility sources of PFAS adjacent to the Facility were identified during the PA and are not under the control of the PRARNG. These adjacent potential sources are identified for informational purposes, and potential PFAS contamination from these downgradient adjacent sources are not anticipated to migrate towards the facility. A description of each off-facility source is presented below and shown on **Figure 3-1**.

3.5.1 Salinas Fire Department

The Salinas Fire Department is located south of Camp Santiago, on the southern side of Puerto Rico Highway 52, approximately 0.4 miles southwest of the Camp Santiago entrance. According to Camp Santiago personnel, the Salinas Fire Department occasionally trains at Camp Santiago alongside the Camp Santiago Fire Department; however, AFFF has never been used in training at the Facility. It is unknown whether the Salinas Fire Department stores AFFF at the fire station, trains with AFFF, or maintains firefighting vehicles capable of using AFFF. The Salinas Fire Department is located downgradient of the Facility (AECOM 2020).

3.5.2 Puerto Rico Fire Academy Firefighters

The Puerto Rico Fire Academy of Firefighters is located south of Camp Santiago, approximately 1.5 miles southwest of the Camp Santiago entrance. According to Camp Santiago personnel, the local fire departments from the surrounding municipalities occasionally train at Camp Santiago; however, AFFF has never been used in training at the Facility. It is unknown whether the Puerto Rico Fire Academy stores AFFF at the fire station, trains with AFFF, or maintains firefighting vehicles capable of using AFFF. The Puerto Rico Fire Academy is also located downgradient of the Facility (AECOM 2020).

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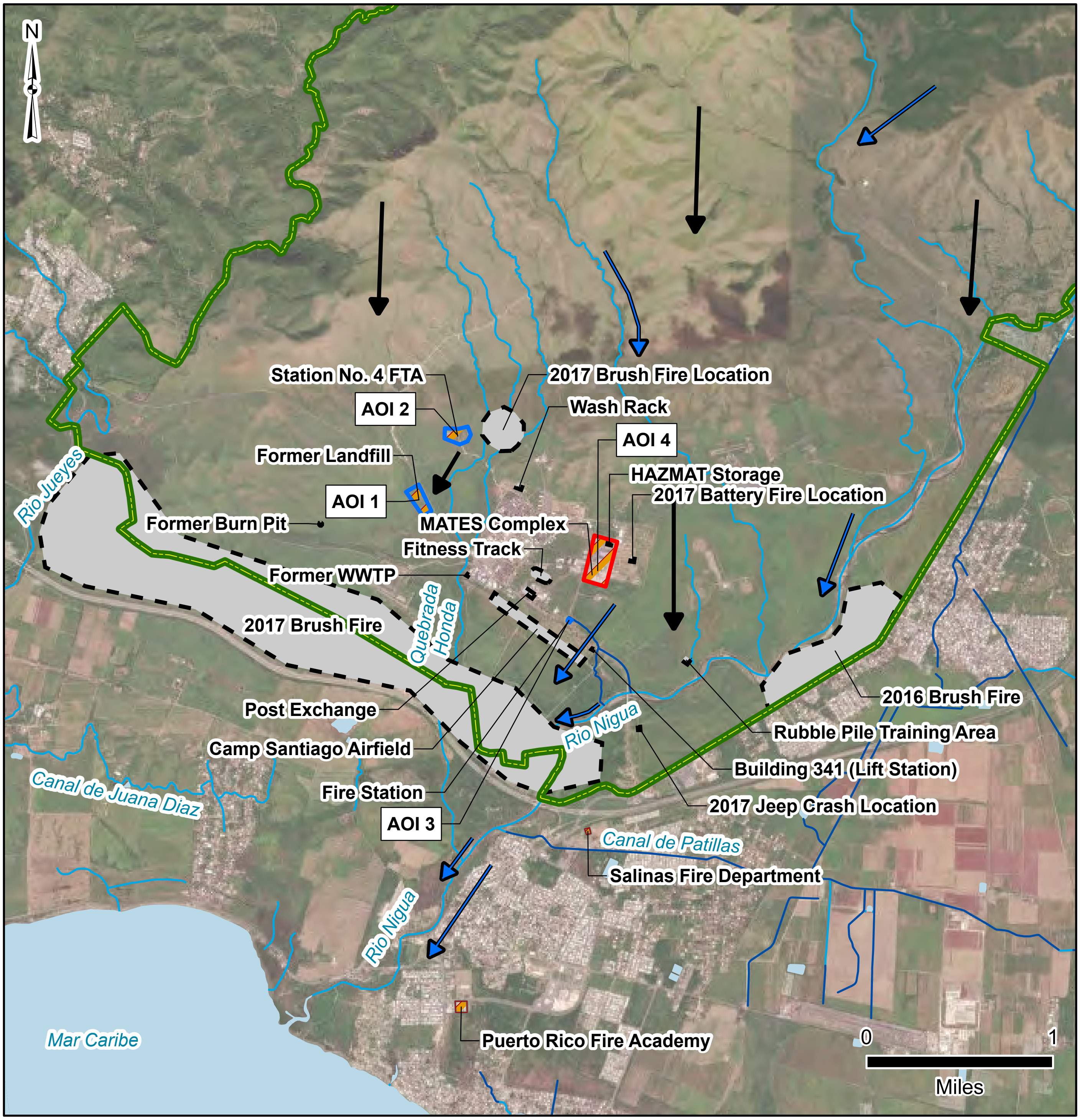
Figure 3-1
Areas of Interest



Facility Data

- Facility Boundary
- Area of Interest
- Area of Interest Identified After SI, to be Investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology

- Surface Water Flow Direction
- Groundwater Flow Direction
- Ditch/Drainage Swale
- Perennial Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:..............................June 2023
Prepared By:..............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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4. PROJECT DATA QUALITY OBJECTIVES

As identified during the data quality objective (DQO) process and outlined in the SI Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) Addendum (EA Engineering, Science, and Technology, Inc., PBC [EA] 2021a), 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 may recommend AOIs for RI if site-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 for the SI include the following:

- The PA Report for Camp Santiago (AECOM 2020)
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the UFP-QAPP Addendum (EA 2021a)
- 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 horizontally by the property limits of the Facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). Temporal boundaries were limited to the earliest available time field resources were available to complete the study.

4.4 ANALYTICAL APPROACH

Samples were analyzed by Eurofins Lancaster Laboratories Env, LLC, accredited under the DoD Environmental Laboratory Accreditation Program (ELAP); Accreditation No. 1.01. PFAS data underwent 100% Stage 2B validation in accordance with the DoD General Data Validation Guidelines (2019a) and DoD Data Validation Guidelines Module 3: Data Validation Procedure of Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual (QSM) Table B-15 (2020).

Data were compared to applicable SLs within this document and decision rules as defined in the UFP-QAPP Addendum (EA 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, 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 UFP-QAPP Addendum (EA 2021a).

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 was implemented in accordance with the following approved documents:

- *Final Preliminary Assessment Report, Camp Santiago Joint Maneuver Training Center, Salinas, Puerto Rico,* dated March 2020 (AECOM 2020)

- *Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan, Site Inspections for Per- and Polyfluoroalkyl Substances Impacted Sites, ARNG Installations, Nationwide,* dated December 2020 (EA 2020a)

- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Camp Santiago Joint Maneuver Training Center, Puerto Rico,* dated August 2021 (EA 2021a)

- *Final Programmatic Accident Prevention Plan, Revision 1,* dated November 2020 (EA 2020b)

- *Final Accident Prevention Plan/Site Safety and Health Plan Addendum, Camp Santiago Joint Maneuver Training Center, Salinas Puerto Rico,* dated March 2021 (EA 2021b).

The SI field activities were performed in two separate field mobilizations, because drilling work took longer than expected and scheduling conflicts at Station Number 4 Fire Training Area (AOI 2), which is an operational range, prevented the team from accessing AOI 2 during the original mobilization. The first event occurred between 12 to 26 May 2022 and the second event occurred between 1 to 7 October 2022. Field events consisted of hollow stem auger and hand auger borings and soil sample collection, temporary monitoring well installation and grab groundwater sample collection. Two preparatory facility visits without intrusive work were also conducted on 18 January 2022 (source water sampling) and 9, 13, and 17 May 2022 (utility location). Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021a), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 24 PFAS via liquid chromatography/tandem mass spectrometry (LC/MS/MS) compliant with QSM Version 5.3 Table B-15 to fulfill the project DQOs:

- Thirty-seven (37) soil samples from 11 primary locations and one offset locations (soil borings locations)

- Twelve (12) grab groundwater samples from 12 temporary well locations

- Thirty-four (34) quality assurance/quality control 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 medium. Field documentation is provided in **Appendix B**. A log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2,** and land survey data is provided in **Appendix B3**. Field change request forms 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 performed utility clearance and sampled decontamination source water. ARNG G-9 personnel identified and invited regulatory personnel from Puerto Rico Department of Natural and Environmental Resources (PRDNER) to participate in the technical project planning meetings (TPP) during the scoping of the SI; however, PRDNER was not available to attend." Details of these activities are presented below.

5.1.1 Technical Project Planning

The U.S. Army Corps of Engineers (USACE) TPP Process, Engineers Manual (EM) 200-1-2 (Department of the Army 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.

The stakeholders for this SI include ARNG, USACE, Puerto Rico Department of Natural and Environmental Resources (PRDNER), and PRARNG representatives familiar with the Facility, the regulations, and the community. There was no PRDNER regulatory involvement in the planning process; therefore, the initial meetings included ARNG, PRARNG, USACE, and representatives familiar with the Facility. ARNG attempted to engage PRDNER, however, PRDNER did not provide a response. A future TPP meeting, if needed, will provide an opportunity to discuss results, findings, and future actions where warranted.

5.1.2 Utility Clearance

EA contacted Puerto Rico 811 Miss Utility to notify them of intrusive work at the Facility, as well as contracted Jaca and Sierra Engineering, a private utility location service, to perform utility clearance at the Facility. Utility clearance was performed at each of the proposed boring locations on 9, 13, and 17 May 2022 with input from the EA field team. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 ft of the borings were cleared by Jaca and Sierra Engineering, using a hand auger to verify utility clearance.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was sampled prior to the start of field activities. A sample from a potable water source was collected prior to mobilization from Well No. 2 located inside Building 003, as well as a spigot located on the outside of the Firehouse building on 18 January 2022, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. The results indicated that the potable water source contained trace levels of PFAS, with all relevant compound concentrations below the SLs. HFPO-DA was not analyzed. PFBS was detected at a concentration less than one-tenth of the SL of 600 nanograms per liter (ng/L). PFOS and PFOA were detected at concentrations less than one-third of the SLs of 4 and 6 ng/L, respectively. Based on these low-level detections, the water was deemed acceptable for use in decontamination. Further discussion is provided in the DUA (**Appendix A**). Analytical results for this sample can be found in **Appendix F**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures Appendix A to the Programmatic UFP-QAPP (EA 2020a).

5.2 SOIL BORINGS AND SOIL SAMPLING

The first 5 ft of each boring were pre-cleared by EA's drilling subcontractor, Jaca and Sierra Engineering, using a hand auger to verify utility clearance in the shallow subsurface where utilities would typically be encountered. No borings were advanced exclusively by hand auger based on terminal depth. Soil samples collected from depths shallower than 5 ft bgs were collected using the hand auger. All soil sample locations are shown on **Figure 5-1** and described in the subsequent section. Non-dedicated sampling equipment (i.e., hand auger) was decontaminated between sampling locations.

Subsurface soil samples were collected via hollow stem auger drilling methods in accordance with the UFP-QAPP Addendum (EA 2021a). A CME-550 drill rig with a split spoon sampling system was used to collect continuous soil cores to the target depth.

Three discrete soil samples were collected for chemical analysis from each soil boring (except as noted in **Section 5.8**): one sample at the surface (0 to 2 ft bgs) and two subsurface soil samples. One subsurface soil sample was collected approximately 1 ft above the groundwater table, and one collected at the mid-point between the surface and the groundwater table (not to exceed 15 ft bgs). Groundwater was encountered at depths ranging from 13.62 to 64.22 ft bgs during drilling. Total boring completion depths, to accommodate temporary well installation, ranged from 28.71 to 83.60 ft bgs.

All soil sample locations are shown on **Figure 5-1**, and boring sample depths are provided in **Table 5-1**. The soil boring locations were selected based on the AOI information provided in the PA (AECOM 2020) and as agreed upon by stakeholders during the scoping and review of the UFP-QAPP Addendum (EA 2021a).

During the mobilization, the soil cores were continuously logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS). A photoionization detector (PID) was used to screen the breathing zone during boring activities as a part of personal safety requirements. Observations and measurements were recorded on sampling forms (**Appendix B2**) and in a non-treated field logbook. Depth interval, recovery thickness, PID concentrations, moisture, relative density, Munsell color, and USCS texture were recorded. The boring logs are provided in **Appendix E**.

Each sample was collected into a laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottle and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain-of-custody (CoC) procedures to the laboratory and analyzed for PFAS (LC/MS/MS compliant with QSM Version 5.3 Table B-15), total organic carbon (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM International D422) in accordance with the UFP-QAPP Addendum (EA 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/matrix spike duplicates (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, one equipment blank (EB) was collected per day 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.

Hollow stem auger borings were converted to temporary wells, which were subsequently abandoned after sampling and surveying in accordance with the UFP-QAPP Addendum (EA 2021a), except for as described in **Section 5.5**. After removal of the casings, boreholes were abandoned using bentonite chips. Borings were installed in grassy areas to avoid disturbing concrete or asphalt surfaces.

5.3 TEMPORARY WELL INSTALLATION AND GROUNDWATER GRAB SAMPLING

Temporary wells were installed using the CME-550 hollow stem auger drill rig. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 10-ft section of 1-inch Schedule 40 polyvinyl chloride (PVC) screen with sufficient casing to reach the ground surface. New PVC pipe and screen were used at each location to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected, after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well intervals, using a peristaltic or bladder pump, depending on depth to groundwater, with PFAS-free HDPE tubing. Each sample was collected in laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected in a separate container. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA 2021a).

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. Field blanks were collected in accordance with the

UFP-QAPP Addendum (EA 2021a). In instances when non-dedicated sampling equipment was used, such as a bladder pump, one EB was collected per day and analyzed for the same parameters as the groundwater samples. 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

Groundwater levels were used to monitor sitewide groundwater elevations and assess groundwater flow. Synoptic water level elevation measurements were collected from the newly installed temporary monitoring wells, taken from the survey mark on the northern side of the well casing. Due to the on-site water level probe not being PFAS-free, water level measurements were taken after all wells had been sampled and prior to the wells being pulled and abandoned. Groundwater elevation data is provided in **Table 5-3**.

5.5 SURVEYING

A well survey was performed by EA's subcontractor MForce, a Puerto Rico-licensed surveyor on 26 May 2022 for the first mobilization event, and again on 7 October 2022 for the second mobilization evet. When surveying the newly installed temporary wells, the Standard Operating Procedure is to survey the northern side of each new temporary well casing. Due to the temporary nature of the wells (lack of supporting material in the annular space) and the flexibility of the casing materials, the temporary wells were deemed not stable and were determined to be unsuitable for direct measurement. Instead, the ground elevation at each well location was surveyed, along with measuring the length of casing sticking out of the ground (top of casing). Positions were collected in Universal Transverse Mercator Zone 19Q projection with World Geodetic System 1984 datum (horizontal) and Puerto Rico Vertical Datum 2002 (vertical) as referenced on the survey report. Surveying data are provided in **Appendix B3**.

5.6 INVESTIGATION-DERIVED WASTE

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the UFP-QAPP Addendum (EA 2021a).

Soil IDW (i.e., soil cuttings) generated during the SI activities were left in place at the point of the source. The soil cuttings were replaced in the borehole and distributed on the downgradient side of the borehole. Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were discharged directly to the ground surface slightly downgradient of the source of generation (downgradient of each well location).

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

5.7 LABORATORY ANALYTICAL METHODS

Samples were analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 at Eurofins Lancaster Laboratories Environmental, LLC, in Lancaster, Pennsylvania, a DoD ELAP- and National Environmental Laboratory Accreditation Program (NELAP)-certified laboratory.

Soil samples were also analyzed for TOC using USEPA Method 9060A, pH by USEPA Method 9045D, and grain size by ASTM International D422. Due to the turbidity many of the samples were centrifuged and decanted at the laboratory prior to analysis.

Due to the turbidity groundwater samples AOI01-01-GW, AOI01-02-GW, AOI01-03-GW, AOI02-01-GW, AOI02-02-GW, AOI02-03-GW, AOI02-04-GW, AOI03-01-GW, AOI03-02-GW, AOI03-03-GW, and AOI03-04-GW were centrifuged and decanted in the laboratory prior to analysis. The leftover solid residues were not analyzed.

5.8 DEVIATIONS FROM SITE INVESTIGATION UFP-QAPP ADDENDUM

Deviations from the UFP-QAPP Addendum occurred based on field conditions. These deviations were discussed between EA, ARNG, and USACE.

- The water table was much deeper than expected at most of the temporary wells (groundwater was estimated at 13 to 18 ft bgs in the UFP-QAPP Addendum [EA 2021a] ; however, it ranged from 14 to 65 ft bgs across the different AOIs). During drilling, actual GW levels were difficult to estimate from soil observations which was due to the presence of fine-grained silts and clays encountered. The field geologists observed moist soils instead of fully saturated soils which may or may not have been indicative of the groundwater table. Due to these challenges, the temporary monitoring wells were set across the assumed water table in each location based on best professional judgement. When the well was set, and the water level was gauged it was determined that for several temporary wells, the screen was fully submerged below the water table instead of capturing the top of the phreatic surface.

- Due to the fine-grained silts and clays encountered and filling/recharge rates, true water levels were not seen during boring installation/well completion, as a result only two of the deep subsurface soil samples (AOI01-02, and AOI03-02) were collected immediately above the soil/water interface. The remaining samples were collected from soils which ended up being in the saturated zone or were several feet above the targeted soil/water interface.

- Two surface soil intervals were collected adjacent to each other for locations AOI02-01 and AOI02-01-Off. This was due to access restrictions to the location in May 2022 which postponed further drilling until the second field event mobilization in October. The shallow interval sample was collected and shipped prior to the field team realizing that the borehole could not be completed on the first mobilization. During the second mobilization, the location was re-drilled from the surface and another surface soil sample was collected in this location. This resulted in a duplicate sample name. For clarity the original location has been renamed AOI02-01-Off.

- Due to access restrictions, and site-specific conditions involving greater depths to water, drilling in AOI 03 had to occur during two different mobilizations. As a result, the observed groundwater gradient for AOI 03 was based on 3 of the 4 wells (temporary well location AOI03-02 which was installed during a second mobilization was not used to create the gradient map).

- The QAPP identified a surface water sample to be collected at a small intermittent stream that discharges to the Rio Nigua (south of AOI 1). During the SI the site was visited four separate times and no surface water was observed in the intermittent stream; therefore, no surface water could be collected.

**Table 5-1. Site Inspection Samples by Medium
Camp Santiago, Salinas, Puerto Rico
Site Inspection Report**

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS	TOC	pH	Grain Size	Comments
Soil Samples							
AOI01-01-SB-[0-2]	5/13/2022	0-2	X				MS/MSD collected
AOI01-01-SB-[15-16]	5/16/2022	15-16	X				
AOI01-01-SB-[33-34]	5/16/2022	33-34	X				
AOI01-02-SB-[0-2]	5/23/2022	0-2	X				MS/MSD collected
AOI01-02-SB-[14-15]	5/23/2022	14-15	X				
AOI01-02-SB-[49-50]	5/24/2022	49-50	X				
AOI01-03-SB-[0-2]	5/24/2022	0-2	X				
AOI01-03-SB-[0-2]	5/24/2022	0-2		X	X	X	
AOI01-03-SB-[14-15]	5/24/2022	14-15	X				
AOI01-03-SB-[35-36]	5/25/2022	35-36	X				
AOI02-01-SB-[0-2]	10/4/2022	0-2	X				
AOI02-01-SB-[9-10]	10/4/2022	9-10	X				
AOI02-01-SB-[19-20]	10/4/2022	19-20	X				
AOI02-01-SB-[0-2]	5/16/2022	0-2	X				Taken during first mobilization; decision made to recollect all AOI02-01 during second mobilization
AOI02-02-SB-[0-2]	10/3/2022	0-2	X				
AOI02-02-SB-[14-15]	10/3/2022	14-15	X				
AOI02-02-SB-[40-41]	10/4/2022	40-41	X				
AOI02-03-SB-[0-2]	10/2/2022	0-2	X				
AOI02-03-SB-[0-2]	10/2/2022	0-2		X	X	X	
AOI02-03-SB-[14-15]	10/2/2022	14-15	X				
AOI02-03-SB-[34-35]	10/2/2022	34-35	X				
AOI02-04-SB-[0-2]	10/1/2022	0-2	X				
AOI02-04-SB-[14-15]	10/1/2022	14-15	X				
AOI02-04-SB-[27-28]	10/1/2022	27-28	X				
AOI02-05-SB-[0-2]	10/5/2022	0-2	X				
AOI02-05-SB-[12-13]	10/5/2022	12-13	X				
AOI02-05-SB-[20-21]	10/5/2022	20-21	X				
AOI03-01-SB-[0-2]	5/17/2022	0-2	X				MS/MSD collected
AOI03-01-SB-[13-15]	5/17/2022	13-15	X				
AOI03-01-SB-[13-15]	5/17/2022	13-15		X	X	X	
AOI03-01-SB-[70-70.5]	5/18/2022	70-70.5	X				
AOI03-02-SB-[0-2]	10/5/2022	0-2	X				
AOI03-02-SB-[14-15]	10/6/2022	14-15	X				
AOI03-02-SB-[65-66]	10/6/2022	65-66	X				
AOI03-03-SB-[0-2]	5/18/2022	0-2	X				
AOI03-03-SB-[14-15]	5/19/2022	14-15	X				
AOI03-03-SB-[62-64]	5/23/2022	62-64	X				
AOI03-04-SB-[0-2]	5/25/2022	0-2	X				
AOI03-04-SB-[14-15]	5/25/2022	14-15	X				
AOI03-04-SB-[65-66]	5/25/2022	65-66	X				
CS-FD-SB-05242022	5/24/2022	0-2	X				Field duplicate of AOI01-03-SB-[0-2]
CS-FD-SB-05182022	5/18/2022	0-2	X				Field duplicate of AOI03-03-SB-[0-2]
CS-FD-SB-05162022	5/16/2022	0-2	X				Field duplicate of AOI02-01-SB-[0-2]
CSJMTC-FD-SB-100222	10/2/2022	0-2	X				Field duplicate of AOI02-03-SB-[0-2]
CS-FD-SB-13-15	5/17/2022	13-15		X	X	X	Field duplicate of AOI03-01-SB-[13-15]

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS	TOC	pH	Grain Size	Comments
Groundwater Samples							
AOI01-01-GW	5/16/2022		X				MS/MSD collected
AOI01-02-GW	5/25/2022		X				
AOI01-03-GW	5/25/2022		X				
AOI02-01-GW	10/6/2022		X				
AOI02-02-GW	10/5/2022		X				
AOI02-03-GW	10/5/2022		X				
AOI02-04-GW	10/5/2022		X				
AOI02-05-GW	10/6/2022		X				
AOI03-01-GW	5/16/2022		X				
AOI03-02-GW	10/6/2022		X				
AOI03-03-GW	5/24/2022		X				
AOI03-04-GW	5/26/2022		X				
CSJMTC-FD-GW	10/5/2022		X				Field duplicate for AOI02-04-GW
CS-FD-GW-05192022	5/19/2022		X				Field duplicate for AOI03-01-GW
Blank Samples							
CS-FB-05192022	5/16/2022		X				Field Blank
CS-FB-05242022	5/24/2022		X				Field Blank
CS-RB-05232022	5/23/2022		X				Rinse Blank
CS-RB-05242022	5/24/2022		X				Rinse Blank
CS-FB-05252022	5/25/2022		X				Field Blank
CS-EB-05252022	5/25/2022		X				EB
CS-FB-05252022	5/25/2022		X				Field Blank
CS-FB-05262022	5/26/2022		X				Field Blank
CSJMTC-FB-05162022	5/16/2022		X				Field Blank
CSJMTC-RB-05162022	5/16/2022		X				Rinse Blank
CSJMTC-RB-05132022	5/13/2022		X				Rinse Blank
CSJMTC-RB-05172022	5/17/2022		X				Rinse Blank
CSJMTC-RB-05182022	5/18/2022		X				Rinse Blank
CSJMTC-EB-SB-100122	10/01/2022		X				EB – Soil
CSJMTC-EB-SB-100222	10/02/2022		X				EB – Soil
CSJMTC-EB-SB-100322	10/03/2022		X				EB – Soil
CSJMTC-EB-SB-100422	10/04/2022		X				EB – Soil
CSJMTC-EB-SB-100522	10/05/2022		X				EB – Soil
CSJMTC-EB-SB-100622	10/06/2022		X				EB – Soil
CSJMTC-EB-GW-100622	10/06/2022		X				EB - Groundwater
CSJMTC-FB-100522	10/05/2022		X				Field Blank
CSJMTC-EB-GW	10/05/2022		X				EB - Groundwater
CSJMTC-FB-100622	10/06/2022		X				Field Blank

**Table 5-2. Soil Boring Depths and Temporary Well Screen Intervals
Camp Santiago, Salinas, Puerto Rico
Site Inspection Report**

AOI	Boring ID	Soil Boring Depth (ft bgs)	Temporary Well Screen Interval (ft bgs)
1	AOI01-01	50	40-50
	AOI01-02	65	55-65
	AOI01-03	50	40-50
2	AOI02-01	30	20-30
	AOI02-02	50	40-50
	AOI02-03	45	35-45
	AOI02-04	40	30-40
	AOI02-05	35	25-35
3	AOI03-01	83	73-83
	AOI03-02	78	68-78
	AOI03-03	80	70-80
	AOI03-04	80	70-80

**Table 5-3. Groundwater Elevation
Camp Santiago, Salinas, Puerto Rico
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Temporary Well ID	Top of Casing Elevation (ft amsl)[1]	Depth to Water (ft btoc)	Groundwater Elevation (ft amsl)
AOI01-01	196.49	39.29	157.20
AOI01-02	177.66	49.78	127.88
AOI01-03	164.34	38.06	126.28
AOI02-01	217.35	14.75	202.6
AOI02-02	232.08	29.75	202.33
AOI02-03	219.21	26.31	192.9
AOI02-04	212.69	14.22	198.47
AOI02-05	230.23	24.34	205.89
AOI03-01	104.45	66.61	37.84
AOI03-02	104.21	65.00	39.21*
AOI03-03	104.08	66.26	37.82
AOI03-04	103.57	65.13	38.44

Notes:
btoc = Below top of casing
*AOI3-02 was gauged at a separate time period than the rest of AOI3 and although value is shown on Figure 2-7, it was not used to create contours.
1 - Due to survey issues as reported in Section 5.5, the TOC measurement height was added to the ground surface elevation to obtain TOC elevation. This number was then used in the calculation for groundwater elevation.

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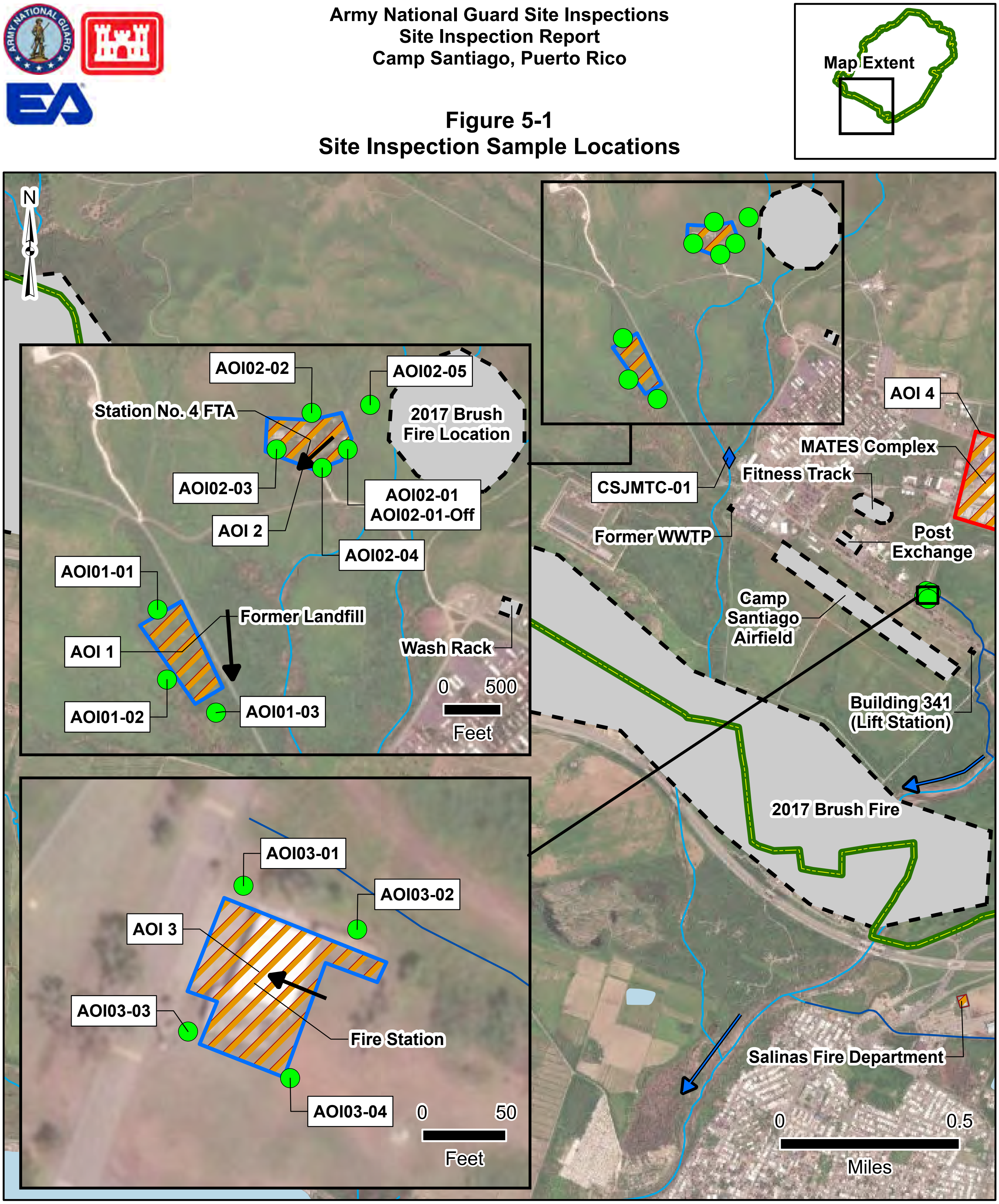
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 5-1
Site Inspection Sample Locations



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified After SI, to be Investigated in RI
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT
- Surface Water

Hydrology/Hydrogeology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Ditch/Drainage Swale
- Perennial Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:..............................June 2023
Prepared By:..............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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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** in **Table 6-1**. A discussion of the results for the AOIs is provided in **Sections 6.3 through 6.5**. **Tables 6-2 through 6-5** present results for 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 SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1**.

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

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

Notes:

1. Assistant Secretary of Defense. 2022. Risk-Based SLs in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient=0.1. May 2022.
2. Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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

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 PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions; and are therefore, relatively mobile in groundwater (Xiao et al. 2015) but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (e.g., pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC 2018).

Soil grain size, pH, and TOC was analyzed in soil samples AOI01-03-SB-[0-2], AOI02-03-SB-[0-2], and AOI03-01-SB-[0-2]. Results were similar, with pH results of 7.5, 7.0, and 8.2 respectively, and TOC results of 3,100, non-detect, and 5,400 mg/kg, respectively. The grain size analysis indicated varying amounts of sand (35.8–76.9%), clay (4.9–22.3%), silt (13.5–30%), and gravel (3.6-29.3%) This result corresponds to a soil texture of “sandy clay loam.”

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to their respective SLs for AOI 1, which includes the Former Landfill. The soil and groundwater results are summarized on **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7.**

6.3.1 AOI 1– Soil Analytical Results

Figures 6-1 through 6-5 present the ranges of detections in soil. **Tables 6-2 through 6-4** summarize the soil results.

Soil was sampled at three boring locations associated with the potential release area at AOI 1. Soil was sampled from three intervals at each of the boring location. Samples were generally collected from surface (0 to 2 ft bgs), shallow subsurface (14 to 16 ft bgs), and deep subsurface (33 to 36 ft; AOI01-02 was taken from 49 to 50 ft bgs).

Soil was sampled from surface soil from boring locations AOI01-01 through AOI01-03. PFBS, PFHxS, PFNA, and PFOA were not detected at any location in AOI01. PFOS were detected below the SL of 13 µg/kg in two samples, AOI03-03 and its’ associated duplicate, with concentrations of 2.3 µg/kg and 1.8 µg/kg, respectively.

Soil was sampled from shallow subsurface soil from boring locations AOI1-01 through AOI01-03. None of the relevant compounds were detected in any of the shallow subsurface samples.

Soil was sampled from deep subsurface (33 to 36 ft bgs in AOI01-01 and AOI01-03; and 49 to 50 ft bgs in AOI01-02). No relevant compounds were detected in AOI01-1 and AOI01-02. PFOS was detected in AOI01-03 at an estimated concentration of 0.32 J µg/kg.

6.3.2 AOI 1 – Groundwater Analytical Results

Table 6-5 summarizes the groundwater results. **Figures 6-6 and 6-7** present the ranges of detections in groundwater.

Groundwater samples were collected from three temporary wells associated with the potential release area of AOI 1. No relevant compounds were detected in AOI01-01 or AOI01-02. PFOA was detected below the SL (6 ng/L) in AOI01-03 at a concentration of 1.8 ng/L.

6.3.3 AOI 1 – Conclusions

Based on the results of the SI, no relevant compounds were detected in soil or groundwater above their respective SLs. Therefore, further evaluation at AOI 1 is not warranted at this time.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes the Station No. 4 FTA. The soil and groundwater results are summarized on **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7.**

6.4.1 AOI 2 – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-1 through 6-5** present the ranges of detections in soil.

Soil was sampled in five boring locations associated with the potential release areas at AOI 2. Soil was sampled from three intervals at all locations. Two surface soils samples were collected at location AOI02-01 as discussed in Section 5.8. Samples were collected from surface (0 to 2 ft bgs), shallow subsurface (9 to 15 ft bgs), and deep subsurface (19 to 41 ft bgs).

There were no detections of relevant compounds in soil at AOI 2 for any sampling interval.

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 samples were collected from five temporary wells at AOI 2 during the SI. PFBS was detected below the SL (601 ng/L) at AOI02-03 and in the duplicate sample associated with AOI02-04 at estimated concentrations of 0.85 J ng/L and 0.77 J ng/L, respectively. PFOA was detected in AOI02-03 at an estimated concentration of 0.55 J ng/L, below the 6 ng/L SL. No other relevant compounds were detected in any location from AOI02.

6.4.3 AOI 2 – Conclusions

Based on the results of the SI, none of the relevant compounds were detected in soil. Although detections of PFOA and PFBS occurred in groundwater, concentrations were below their respective SLs. Based on these results, further evaluation at AOI 2 is not warranted at this time.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for samples collected at the Fire Station. The detected compounds are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-8 through 6-14**.

6.5.1 AOI 3 – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-8 through 6-12** present the ranges of detections in soil.

Soil was sampled in four boring locations associated with the AOI 3. Soil was sampled from three intervals at all boring locations. Samples were taken from surface (0 to 2 ft bgs), shallow subsurface (13 to 15 ft bgs), and deep subsurface (62 to 70.5 ft bgs).

Surface soil samples were collected for AOI03-01 through AOI03-04. PFOS was detected above the SL (13 µg/kg) for AOI03-01, and below the SL for AOI03-03, its' associated duplicate, and AOI03-04. Results ranged from an estimated concentration of 0.44 J µg/kg for AOI03-04, to an exceedance of 42 µg/kg for AOI03-01. PFOA was detected below the SL (19 µg/kg) for AOI03-01 (2 µg/kg), AOI03-03 (estimated 0.26 J µg/kg), and AOI03-04 (1.3 µg/kg). PFNA was detected below the SL (19 µg/kg) in AOI03-01 and AOI03-04 at concentrations of 1.4 µg/kg and estimated 0.34 J µg/kg, respectively. PFHxS was detected in AOI03-01 with an estimated concentration of 0.56 J µg/kg, below the SL of 130 µg/kg. PFBS was detected in AOI03-04 with an estimated concentration of 0.58 J µg/kg, also below the SL of 1,900 µg/kg.

Shallow subsurface samples were collected for AOI03-01 through AOI03-04. No relevant compounds were detected in AOI03-02 through AOI03-04. AOI03-01 had detections of PFHxS, PFOS, and PFOA with concentrations of 0.98 µg/kg, 6.1 µg/kg, and an estimated concentration of 0.44 J µg/kg, respectively, each detection was below their respective SLs of 1,600 µg/kg, 160 µg/kg, and 250 µg/kg, respectively.

Deep subsurface samples were collected for AOI03-01 through AOI3-04. No relevant compounds were detected in deep subsurface samples.

6.5.2 AOI 3 – Groundwater Analytical Results

Figures 6-13 and 6-14 present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

Groundwater samples were collected from four temporary wells associated with AOI 3 during the SI. Relevant compounds were detected in groundwater at concentrations below the SLs, with the exception of a single exceedance of PFOA.

PFBS, PFHxS, and PFOA were found in all four temporary well locations below their respective SLs of 601 ng/L, 39 ng/L, and 6 ng/L, with one exceedance of PFOA at AOI03-02. PFBS concentrations ranged from 2 ng/L in AOI3-02 to 4.1 ng/L in AOI03-04. PFHxS concentrations ranged from an estimated 0.73 J ng/L in AOI03-03 to 2 ng/L in AOI03-04. PFOA concentrations ranged from an estimated 0.62 J ng/L in AOI03-03, to an exceedance of 10 ng/L in AOI03-02. PFNA was detected below the SL of 6 ng/L in one well location, AOI3-02, with an estimated concentration of 0.82 J ng/L. PFOS was not detected at any of the AOI03 temporary well locations.

6.5.3 AOI 3 – Conclusions

Based on the results of the SI, PFOS was the only relevant compound detected in soil above the respective SLs. PFOA, PFNA, PFOS, PFHxS, and PFBS were all detected in soil at detections below their respective SLs. PFBS, PFHxS, and PFNA were detected in groundwater at concentrations below their respective SLs, and PFOA was detected in groundwater at concentrations above the SL. Based on the exceedances of the SLs in groundwater and soil, further evaluation is warranted at AOI 3.

6.6 AOI 4

Following the SI fieldwork, it was noted that fire fighting vehicles were maintained at the MATES Complex. AOI 4 will be investigated as part of the RI.

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Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, CSJMTC

	Location ID	AOI01-01		AOI01-02		AOI01-03		AOI01-03		AOI02-01-Off		AOI02-01-Off		AOI02-01		AOI02-02	
	Sample Name	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		CS-FD-SB		AOI02-01-SB-0-2		CS-FD-SB		AOI02-01-SB-0-2		AOI02-02-SB-0-2	
	Parent Sample ID							AOI01-03-SB-0-2				AOI02-01-SB-0-2					
	Sample Date	5/13/2022		5/23/2022		5/24/2022		5/24/2022		5/16/2022		5/16/2022		10/4/2022		10/3/2022	
	Depth (ft bgs)	0-2		0-2		0-2		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)																	
Perfluorobutanesulfonic acid (PFBS)	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	13	ND	U	ND	U	2.3		1.8		ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on a residential scenario for direct ingestion of contaminated soil.
Values exceeding the Screening Level are shaded gray.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, CSJMTC

Location ID		AOI02-03		AOI02-03		AOI02-04		AOI02-05		AOI03-01		AOI03-02		AOI03-03		AOI03-03		AOI03-04	
Sample Name		AOI02-03-SB-0-2		CSJMTC-FD-SB		AOI02-04-SB-0-2		AOI02-05-SB-0-2		AOI03-01-SB-0-2		AOI03-02-SB-0-2		AOI03-03-SB-0-2		CS-FD-SB		AOI03-04-SB-0-2	
Parent Sample ID				AOI02-03-SB-0-2												AOI03-03-SB-0-2			
Sample Date		10/2/2022		10/2/2022		10/1/2022		10/5/2022		5/17/2022		10/5/2022		5/18/2022		5/18/2022		5/25/2022	
Depth (ft bgs)		0-2		0-2		0-2		0-2		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)																			
Perfluorobutanesulfonic acid (PFBS)	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.58	J
Perfluorohexanesulfonic acid (PFHxS)	130	ND	U	ND	U	ND	U	ND	U	0.56	J	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	19	ND	U	ND	U	ND	U	ND	U	1.4		ND	U	ND	U	ND	U	0.34	J
Perfluorooctanesulfonic acid (PFOS)	13	ND	U	ND	U	ND	U	ND	U	42		ND	U	0.81		0.52	J	0.44	J
Perfluorooctanoic acid (PFOA)	19	ND	U	ND	U	ND	U	ND	U	2		ND	U	0.26	J	ND	U	1.3	

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on a residential scenario for direct ingestion of contaminated soil.
Values exceeding the Screening Level are shaded gray.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-3. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, CSJMTC

	Location ID	AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02		AOI02-03	
	Sample Name	AOI01-01-SB-15-16		AOI01-02-SB-14-15		AOI01-03-SB-14-15		AOI02-01-SB-9-10		AOI02-02-SB-14-15		AOI02-03-SB-14-15	
	Parent Sample ID												
	Sample Date	5/16/2022		5/23/2022		5/24/2022		10/4/2022		10/3/2022		10/2/2022	
	Depth (ft bgs)	15-16		14-15		14-15		9-10		14-15		14-15	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)													
Perfluorobutanesulfonic acid (PFBS)	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.
Values exceeding the Screening Level are shaded gray.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-3. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, CSJMTC

	Location ID	AOI02-04		AOI02-05		AOI03-01		AOI03-02		AOI03-03		AOI03-04	
	Sample Name	AOI02-04-SB-14-15		AOI02-05-SB-12-13		AOI03-01-SB-13-15		AOI03-02-SB-14-15		AOI03-03-SB-14-15		AOI03-04-SB-14-15	
	Parent Sample ID												
	Sample Date	10/1/2022		10/5/2022		5/17/2022		10/6/2022		5/19/2022		5/25/2022	
	Depth (ft bgs)	14-15		12-13		13-15		14-15		14-15		14-15	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)													
Perfluorobutanesulfonic acid (PFBS)	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1600	ND	U	ND	U	0.98		ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	ND	U	ND	U	6.1		ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	ND	U	ND	U	0.44	J	ND	U	ND	U	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA’s Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.
Values exceeding the Screening Level are shaded gray.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-4. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, CSJMTC

Location ID	AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02		AOI02-03	
Sample Name	AOI01-01-SB-33-34		AOI01-02-SB-49-50		AOI01-03-SB-35-36		AOI02-01-SB-19-20		AOI02-02-SB-40-41		AOI02-03-SB-34-35	
Parent Sample ID												
Sample Date	5/16/2022		5/24/2022		5/25/2022		10/4/2022		10/4/2022		10/2/2022	
Depth (ft bgs)	33-34		49-50		35-36		19-20		40-41		34-35	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)												
Perfluorobutanesulfonic acid (PFBS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	ND	U	ND	U	0.32	J	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-4. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, CSJMTC

Location ID	AOI02-04		AOI02-05		AOI03-01		AOI03-02		AOI03-03		AOI03-04	
Sample Name	AOI02-04-SB-27-28		AOI02-05-SB-20-21		AOI03-01-SB-70-70.5		AOI03-02-SB-65-66		AOI03-03-SB-62-64		AOI03-04-SB-65-66	
Parent Sample ID												
Sample Date	10/1/2022		10/5/2022		5/18/2022		10/6/2022		5/23/2022		5/25/2022	
Depth (ft bgs)	27-28		20-21		70-70.5		65-66		62-64		65-66	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)												
Perfluorobutanesulfonic acid (PFBS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-5. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, CSJMTC

	Location ID	AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02		AOI02-03		AOI02-04	
	Sample Name	AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI02-01-GW		AOI02-02-GW		AOI02-03-GW		AOI02-04-GW	
	Parent Sample ID														
	Sample Date	5/16/2022		5/25/2022		5/25/2022		10/6/2022		10/5/2022		10/5/2022		10/5/2022	
Analyte	**Screening Level[1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (ng/L)															
Perfluorobutanesulfonic acid (PFBS)	601	ND	U	ND	U	ND	U	ND	U	ND	U	0.85	J	ND	U
Perfluorohexanesulfonic acid (PFHxS)	39	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	6	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	4	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	6	ND	U	ND	U	1.8		ND	U	ND	U	0.55	J	ND	U

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA’s Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
Values exceeding the Screening Level are shaded gray.
ng/L = Nanogram(s) per liter.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

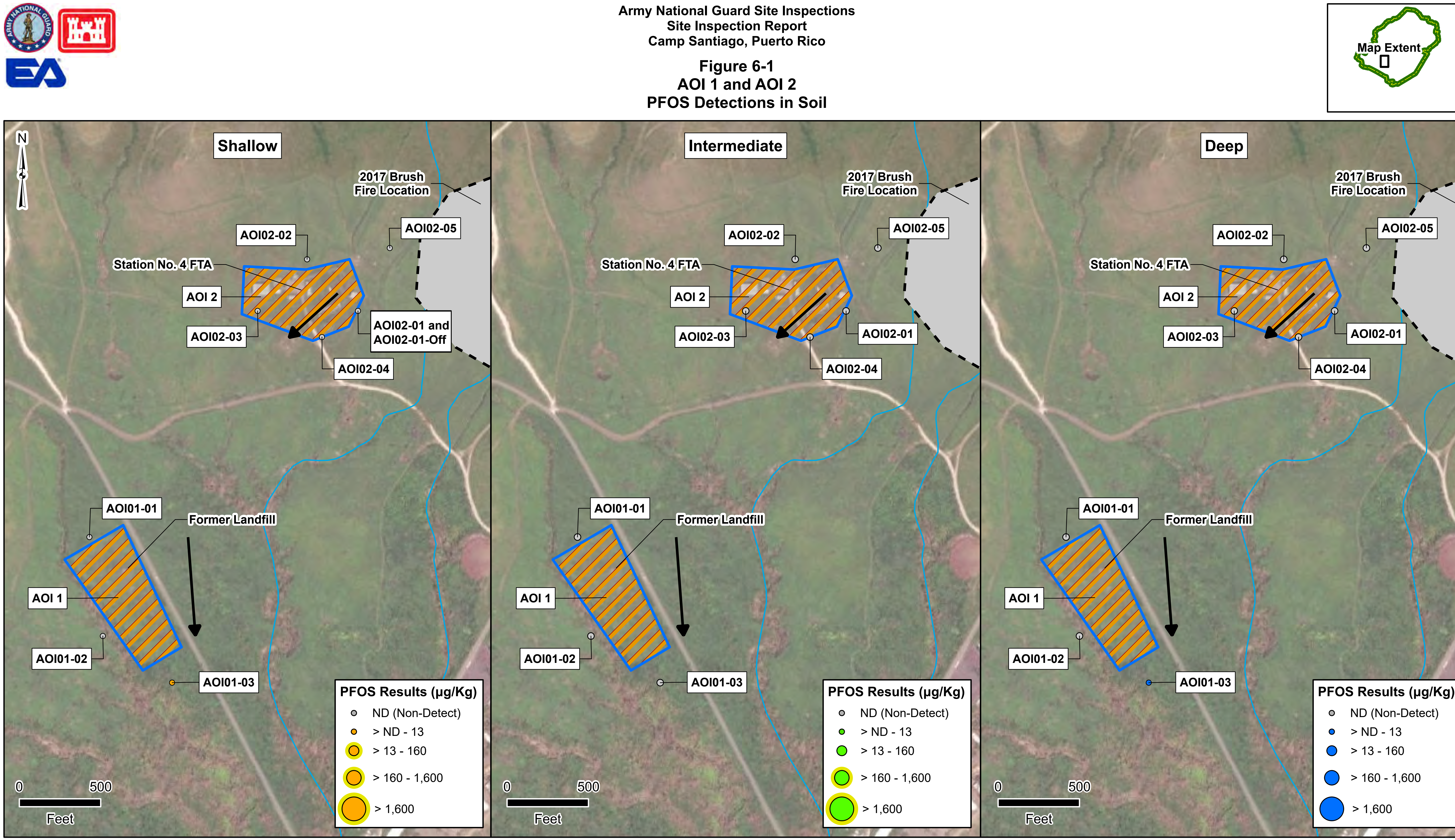
Table 6-5. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, CSJMTC

	Location ID	AOI02-04		AOI02-05		AOI03-01		AOI03-01		AOI03-02		AOI03-03		AOI03-04	
	Sample Name	CSJMTC-FD-GW		AOI02-05-GW		AOI03-01-GW		CS-FD-GW		AOI03-02-GW		AOI03-03-GW		AOI03-04-GW	
	Parent Sample ID	AOI02-04-GW						AOI03-01-GW							
	Sample Date	10/5/2022		10/6/2022		5/19/2022		5/19/2022		10/6/2022		5/24/2022		5/26/2022	
Analyte	**Screening Level[1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (ng/L)															
Perfluorobutanesulfonic acid (PFBS)	601	0.77	J	ND	U	2.7		2.3		2		2		4.1	
Perfluorohexanesulfonic acid (PFHxS)	39	ND	U	ND	U	1.6	J	1.6	J	1	J	0.73	J	2	
Perfluorononanoic acid (PFNA)	6	ND	U	ND	U	ND	U	ND	U	0.82	J	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	4	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	6	ND	U	ND	U	2.2		2.4		10		0.62	J	2.5	

Notes:
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
Values exceeding the Screening Level are shaded gray.
ng/L = Nanogram(s) per liter.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-1
AOI 1 and AOI 2
PFOS Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Perennial Creek/Stream

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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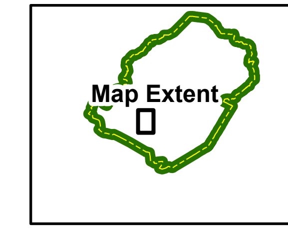
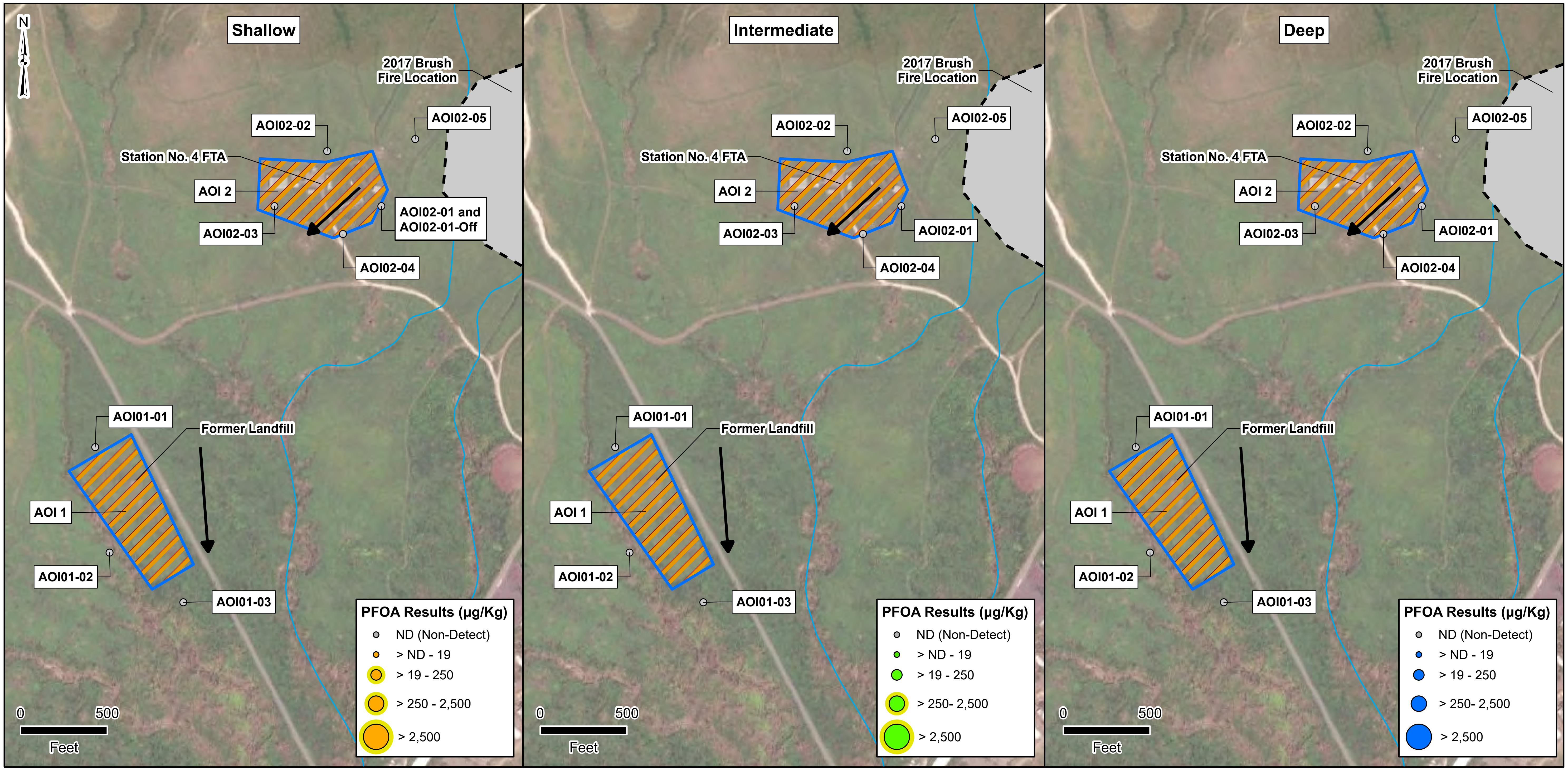
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-2
AOI 1 and AOI 2
PFOA Detections in Soil





Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Perennial Creek/Stream

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:..............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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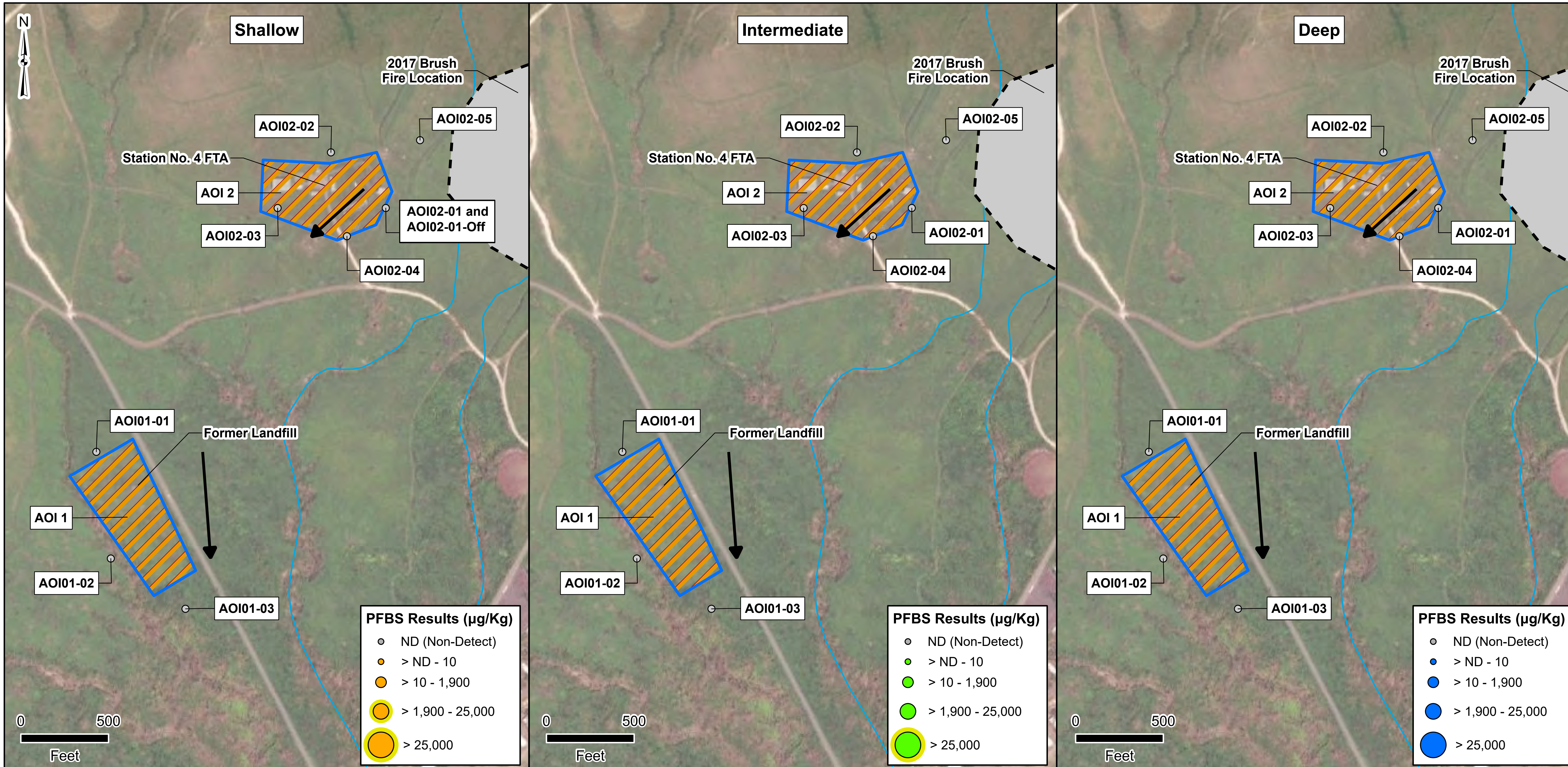
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-3
AOI 1 and AOI 2
PFBS Detections in Soil

Map Extent



Facility Data

Facility Boundary

Area of Interest

Potential PFAS Release

No Suspected Release

Hydrology/Hydrogeology

Groundwater Flow Direction

Perennial Creek/Stream

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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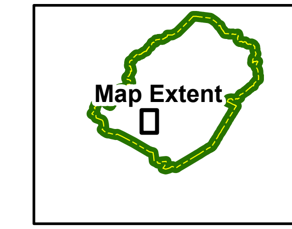
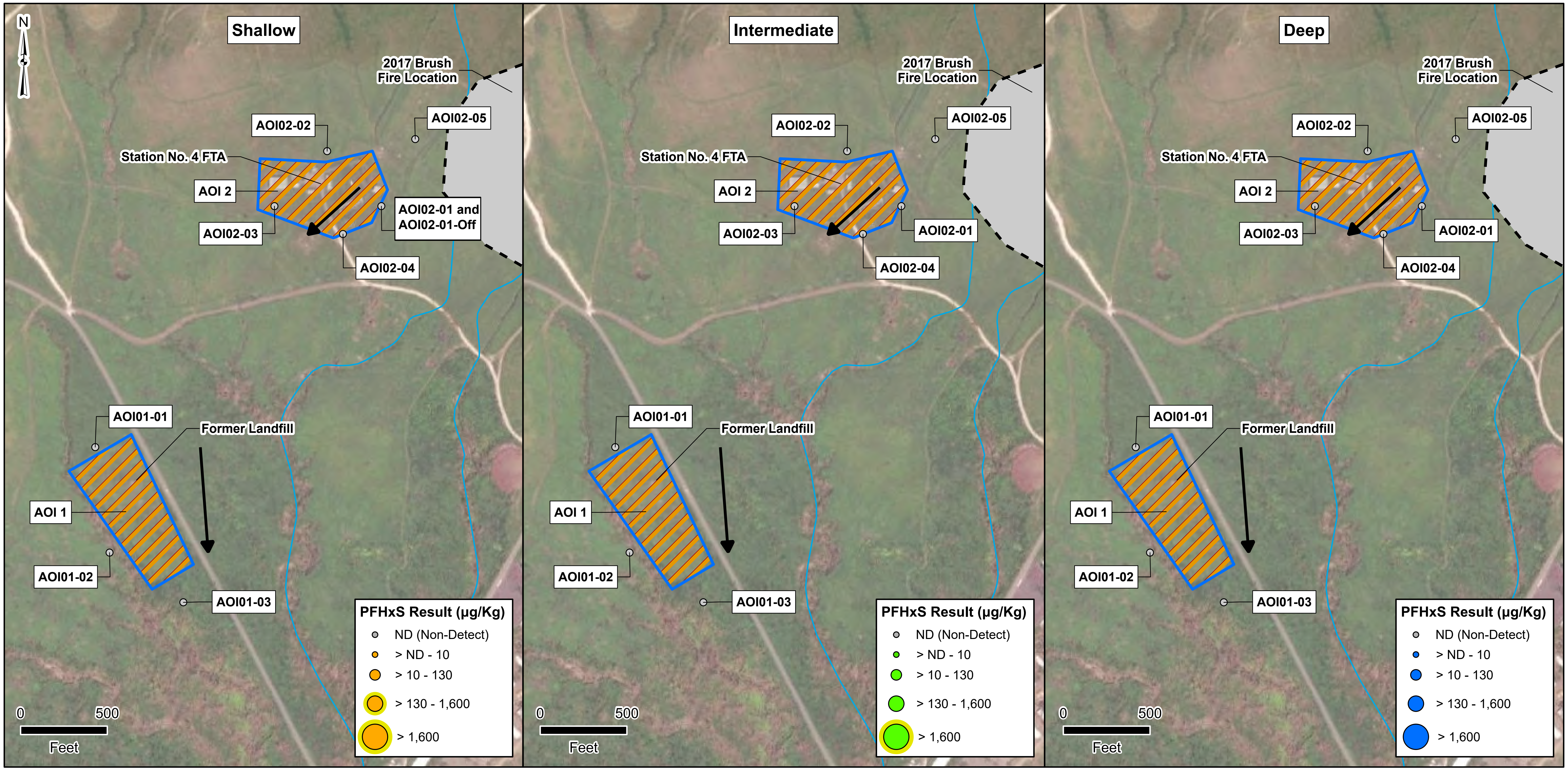
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-4
AOI 1 and AOI 2
PFHxS Detections in Soil





Facility Data

Facility Boundary

Area of Interest

Potential PFAS Release

No Suspected Release

Hydrology/Hydrgeology

Groundwater Flow Direction

Perennial Creek/Stream

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections
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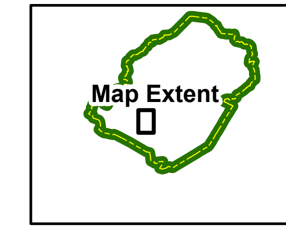
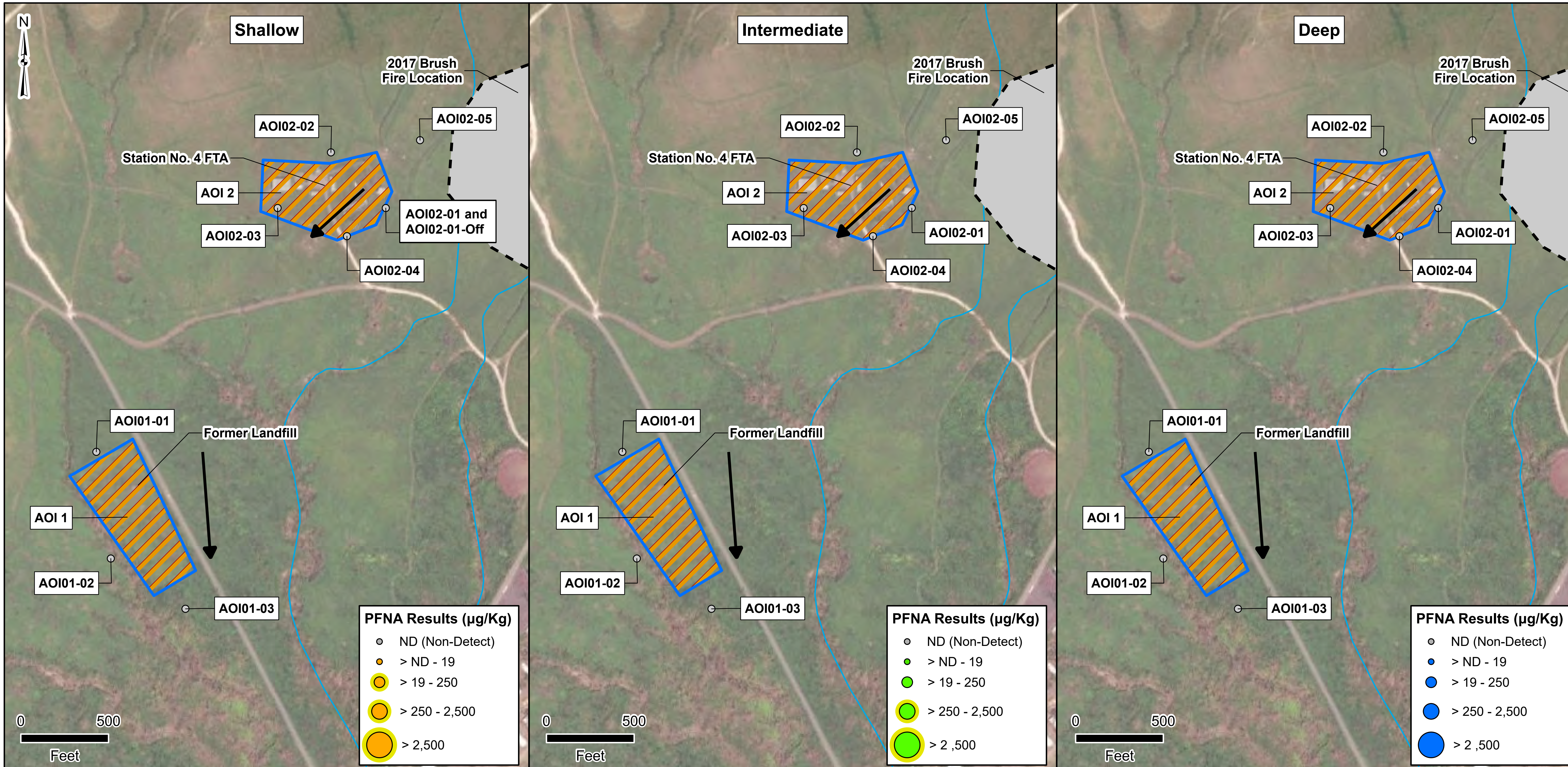
Camp Santiago, Puerto Rico

Figure 6-5
AOI 1 and AOI 2
PFNA Detections in Soil





Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Perennial Creek/Stream

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:..............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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Site Inspection Report
Camp Santiago, Puerto Rico

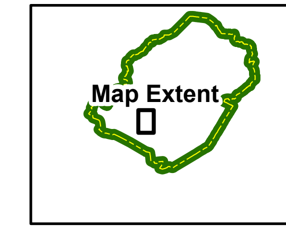
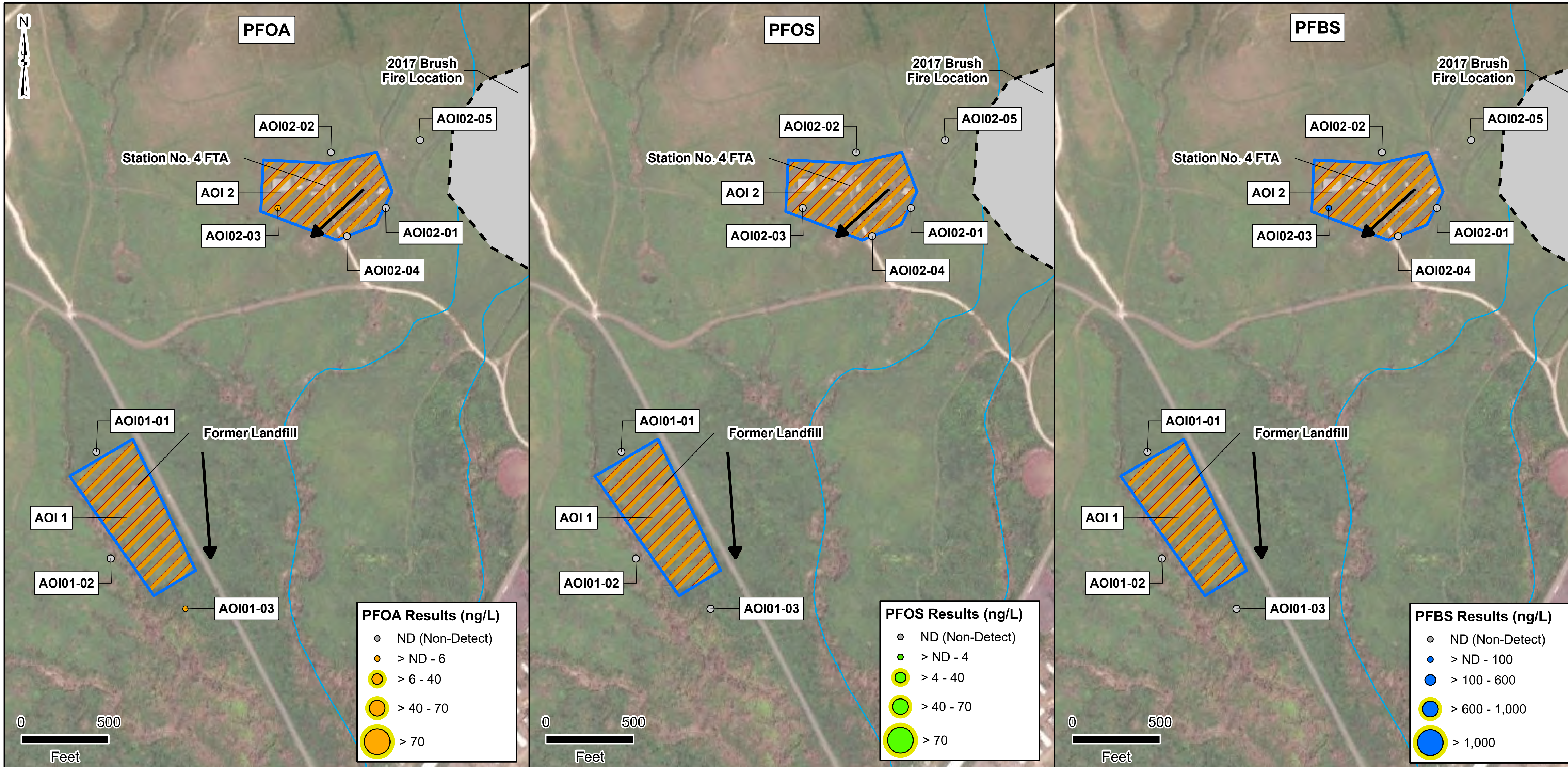


Figure 6-6
PFOA, PFOS and PFBS Detections in Groundwater (AOI 1 and AOI 2)



Facility Data

- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology

- Groundwater Flow Direction
- Perennial Creek/Stream

Note:
PFOA = Perfluorooctanesulfonic acid
PFOS = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:.............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

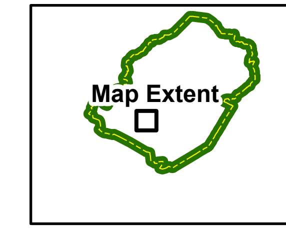
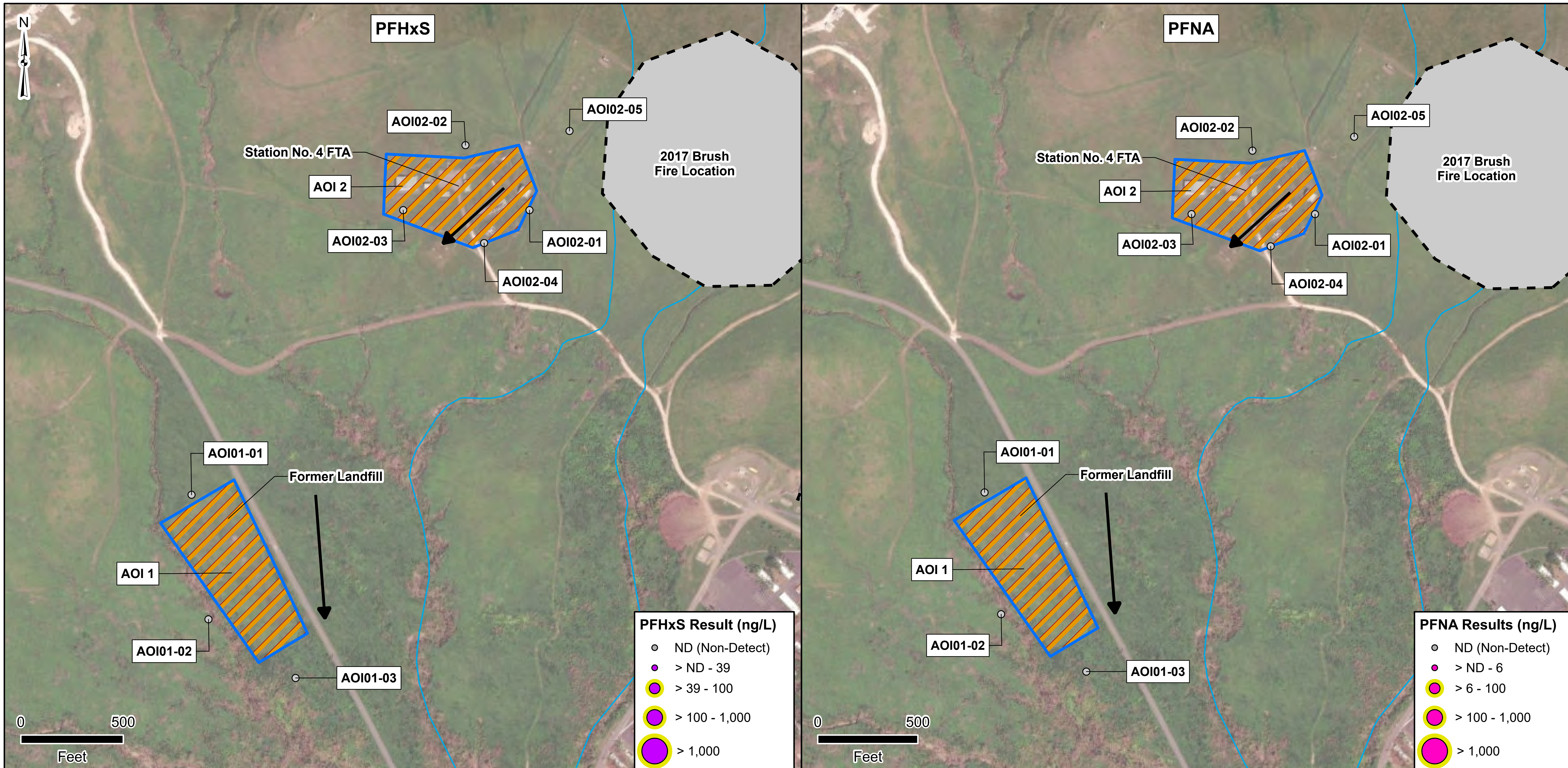


Figure 6-7
PFHxS and PFNA Detections in Groundwater (AOI 1 and AOI 2)



Path: G:\Federal\Nationwide\PFAS\MAES_634250383\PROJECTS\Santiago\SIReport\SantiagoSI.aprx

Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:..............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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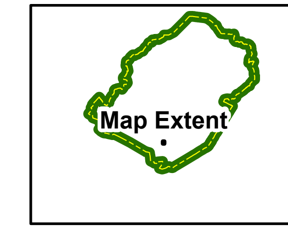
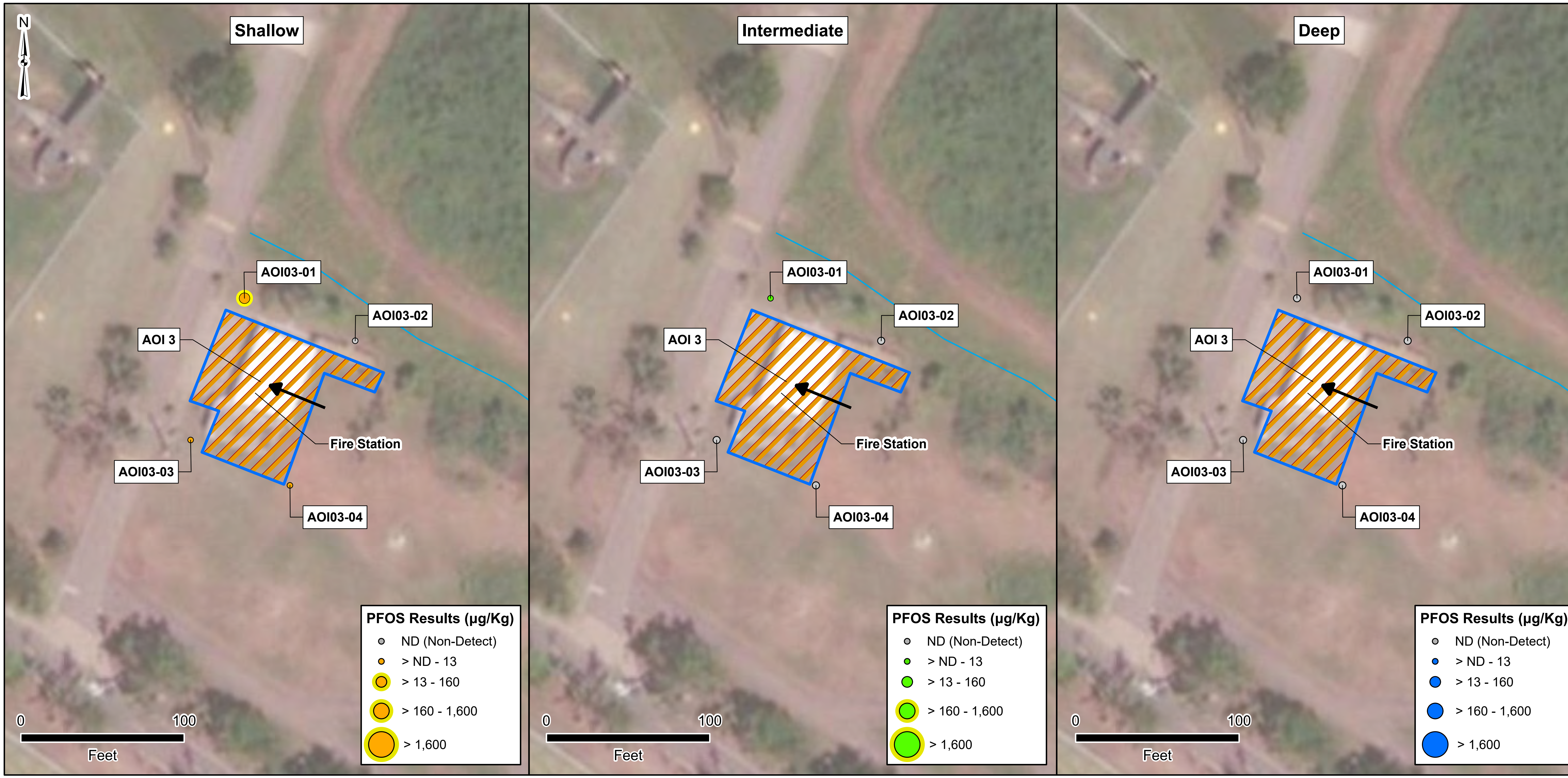
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-8
AOI 3
PFOS Detections in Soil





Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Hydrogeology
- Groundwater Flow Direction
- Ditch/Drainage Swale

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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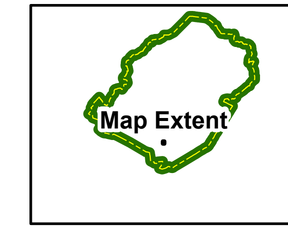
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-9
AOI 3
PFOA Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Hydrogeology
- Groundwater Flow Direction
- Ditch/Drainage Swale

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:.............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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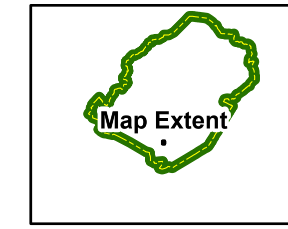
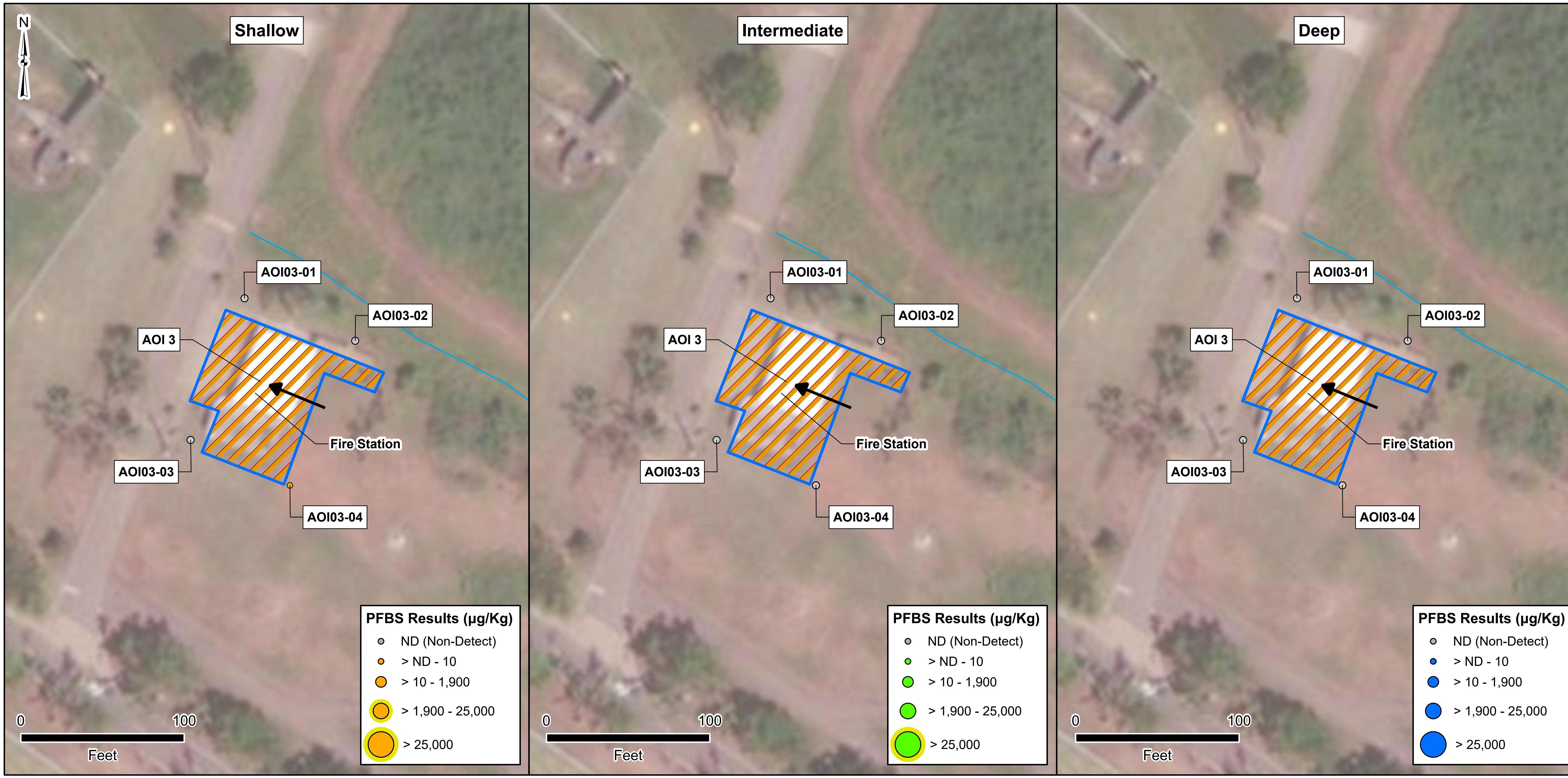
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-10
AOI 3
PFBS Detections in Soil





Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Hydrogeology
- Groundwater Flow Direction
- Ditch/Drainage Swale

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:....................USACE
Projection:........WGS 84 UTM 20N

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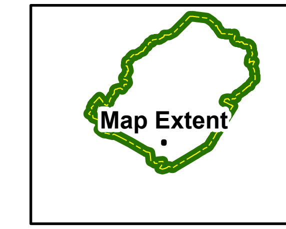
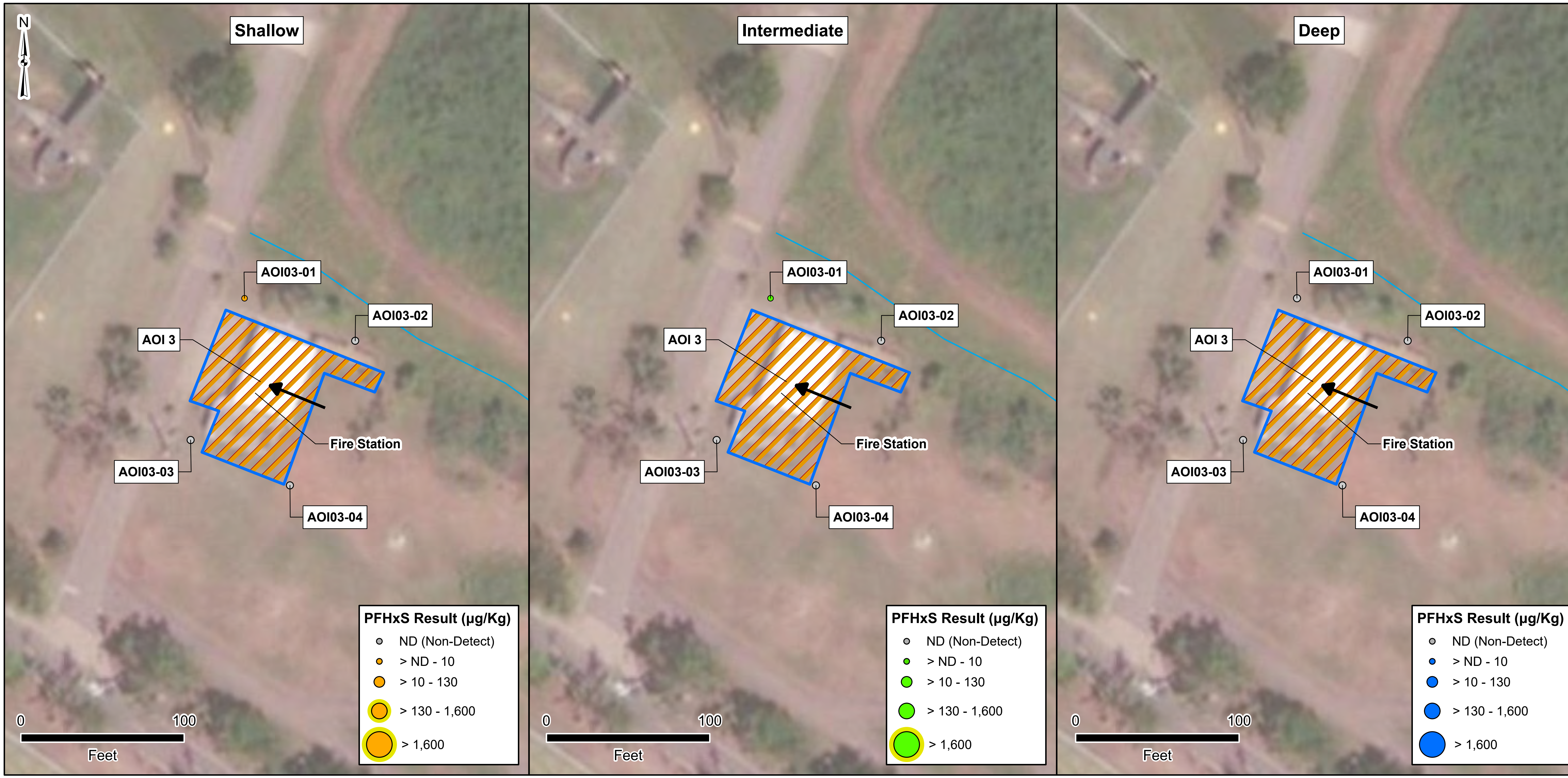
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-11
AOI 3
PFHxS Detections in Soil





Facility Data
Facility Boundary
Area of Interest
Potential PFAS Release

Hydrogeology
Groundwater Flow Direction
Ditch/Drainage Swale

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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Army National Guard Site Inspections
Site Inspection Report
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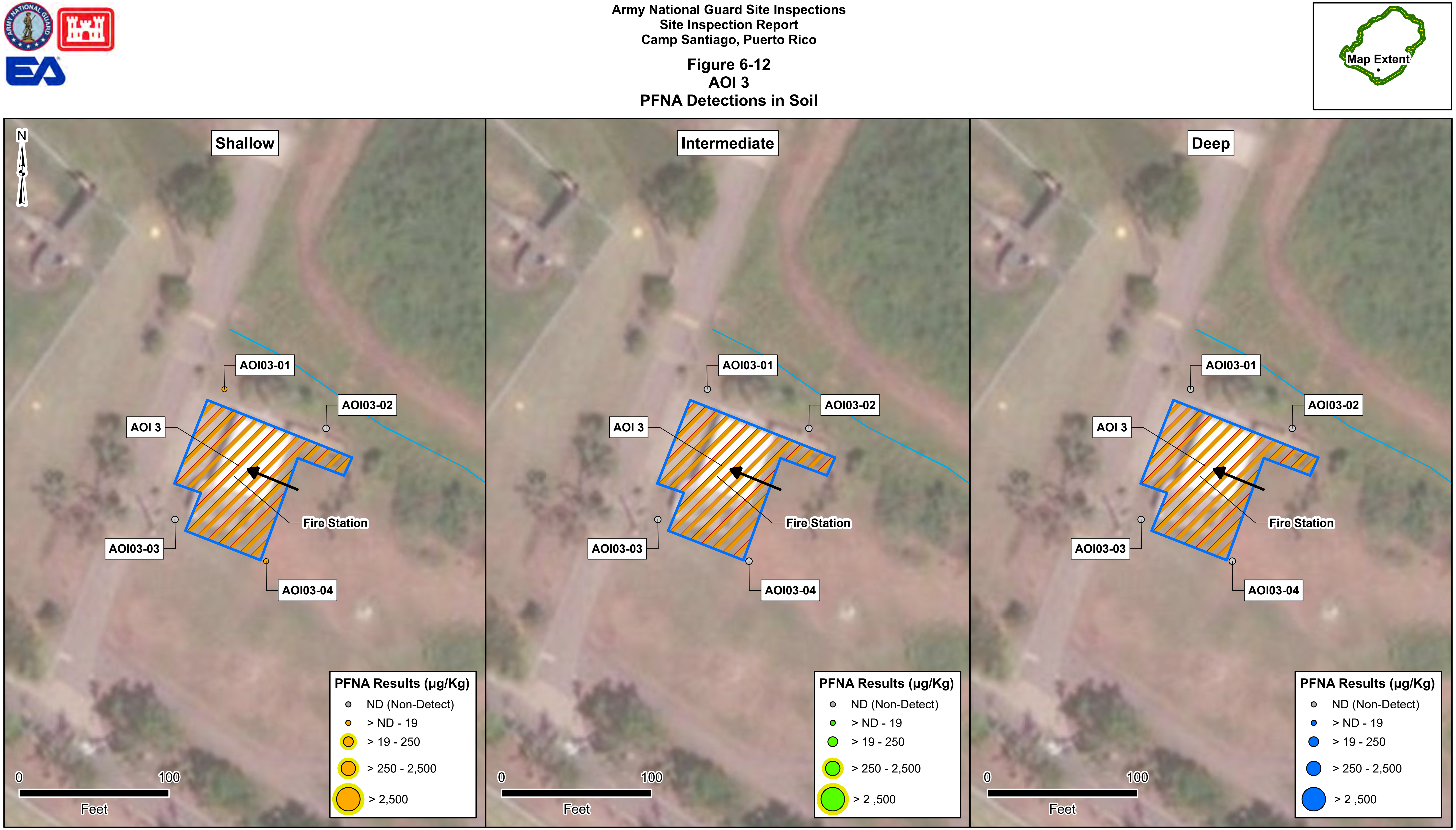
Figure 6-12
AOI 3
PFNA Detections in Soil



Facility Data
Facility Boundary
Area of Interest
Potential PFAS Release

Hydrogeology
Groundwater Flow Direction
Ditch/Drainage Swale

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

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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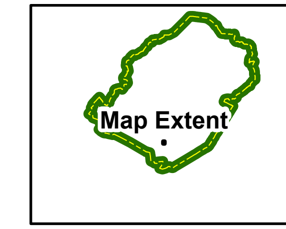
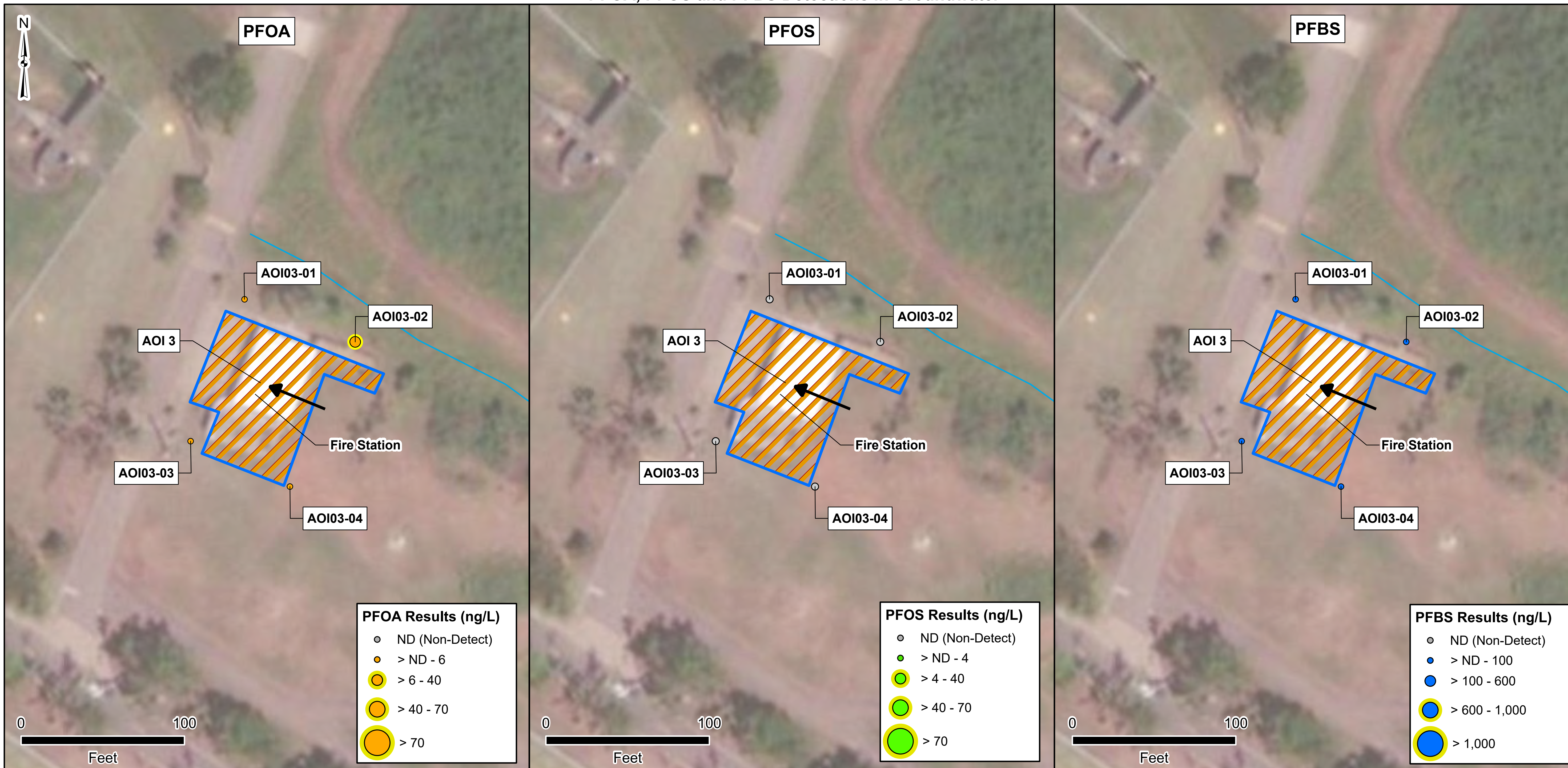
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Figure 6-13
AOI 3
PFOA, PFOS and PFBS Detections in Groundwater





Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Hydrogeology
- Groundwater Flow Direction
- Ditch/Drainage Swale

Note:
PFOA = Perfluorooctanesulfonic acid
PFOS = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo

Data Sources:
ESRI 2022
AECOM 2019

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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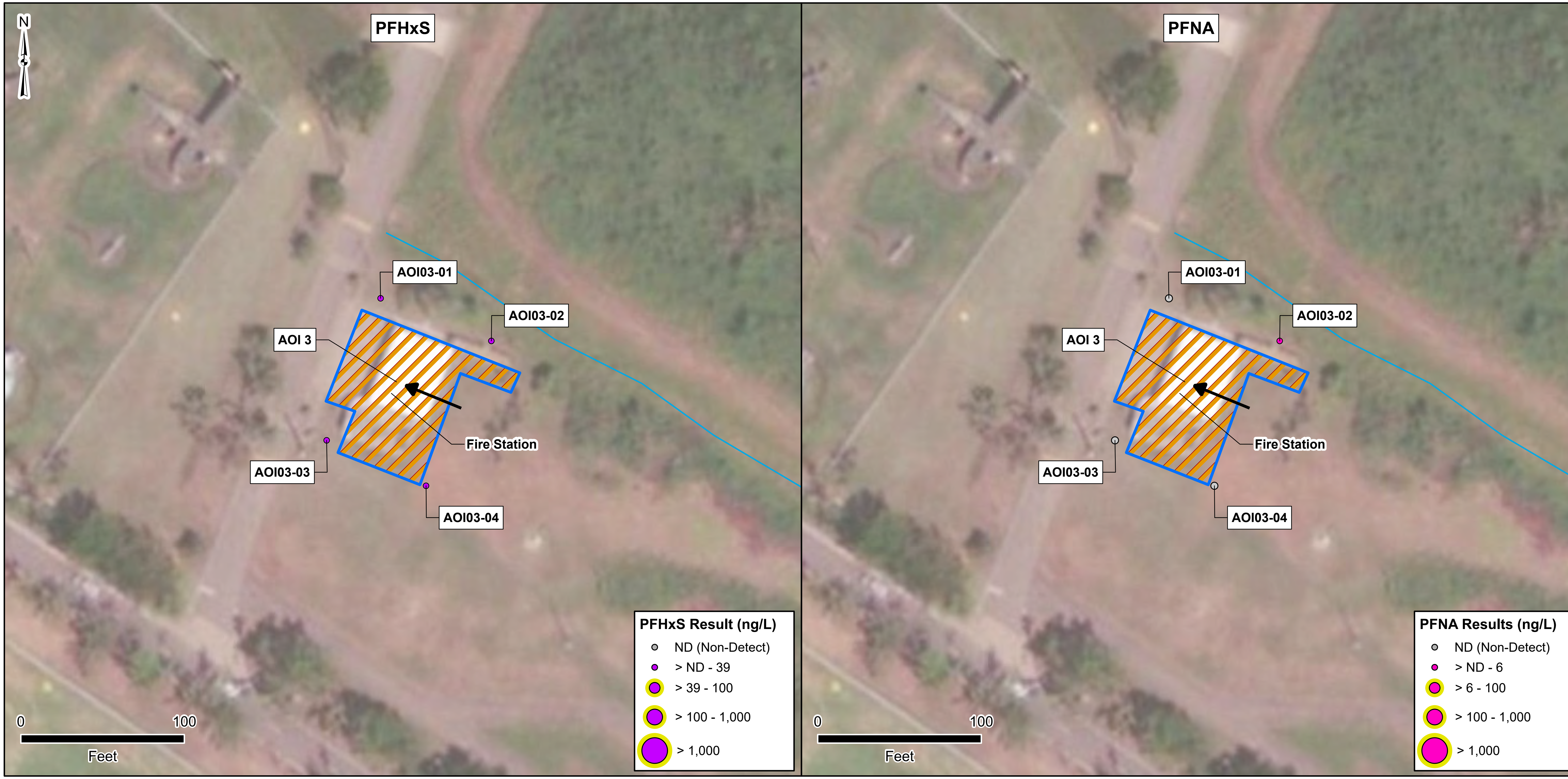
Army National Guard Site Inspections
Site Inspection Report
Camp Santiago, Puerto Rico

Map Extent

Figure 6-14
AOI 3
PFHxS and PFNA Detections in Groundwater



Facility Data
- Facility Boundary
- Area of Interest
- Potential PFAS Release

Hydrogeology
- Groundwater Flow Direction
- Ditch/Drainage Swale

Notes:
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:........................January 2023
Prepared By:............................EA
Prepared For:...................USACE
Projection:........WGS 84 UTM 20N

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7. EXPOSURE PATHWAYS

The conceptual site model (CSM) for the AOIs, revised based on the SI findings, is presented on **Figures 7-1 through 7-3**. Additionally, a preliminary CSM for AOI 4 is included as **Figure 7-4**. Following the SI fieldwork, it was noted that fire fighting vehicles were maintained at the AOI 4. AOI 4 will be investigated as part of the RI.

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
5. Potentially exposed populations.

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

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

7.1 SOIL EXPOSURE PATHWAY

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

7.1.1 AOI 1

During interviews with Camp Santiago personnel, the Former Landfill area was identified as a location where AFFF was not known to have been stored, used, or disposed of, but an area where PFAS laden materials may have potentially been discarded. The Former Landfill is located west of the facility cantonment area adjacent to a small intermittent stream that discharges to the Rio Nigua. The landfill is vegetated and maintained, and the underlying area reportedly consists of shallow fractured rock with minimal soil cover.

PFOS was detected in surface soil at one location on the downgradient side of AOI 1 at concentrations below the SL. Site workers, construction workers, trespasser/recreational users could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathways for these receptors are considered potentially complete. PFOS was detected in deep subsurface soil at one location on the downgradient side of AOI 1 at concentrations below the SL. The sample was collected below 15 ft bgs so it is unlikely anyone will be in contact with soils greater than 15 ft bgs; therefore, the exposure pathway for subsurface soil is incomplete for the receptors. The CSM Is presented in **Figure 7-1**.

7.1.2 AOI 2

PRARNG have indicated that there has been no known or recorded use of AFFF at the Station No.4 FTA; however, it is possible that AFFF has been used at the FTA by non-DOD units and agencies without the knowledge of the PRARNG personnel interviewed. .

No relevant compounds were detected in surface soil at AOI 2. Therefore, the surface soil exposure pathways for site workers and construction workers and trespasser/recreational users are incomplete. There were no detections of the relevant compounds in subsurface soil at AOI 2. Therefore, the exposure pathways for subsurface soil is incomplete for the construction worker. The CSM is presented in **Figure 7-2**.

7.1.3 AOI 3

The Camp Santiago Fire Station is used for the storage of equipment and materials associated with firefighting, and currently stores several vehicles for firefighting including an E-One Pumper truck carrying 50 gal of 3% AFFF. Five-gal buckets storing Chemguard 3% AFFF C303 and C306 were also stored within the Fire Station and empty containers were observed adjacent to a storage container next to the fire house. No record or documentation exists concerning leakage or AFFF use.

All five relevant compounds were detected within surface soil at AOI 3, with PFOS exceeding the SL at one location. Construction was observed to be ongoing near AOI 3 during the SI. Site workers, construction workers, and trespasser/recreational users could contact constituents in surface soil via incidental ingestion and inhalation of dust. Due to the exceedance, surface soil exposure pathways for site workers and construction workers are considered complete. Further, PFHxS, PFOS, and PFOA were detected in subsurface soil below their respective SLs. Therefore, the subsurface soil exposure pathways for construction workers is considered potentially complete. The CSM is presented on **Figure 7-3**.

7.1.4 AOI 4

AOI 4 is the MATES Complex (**Figure 3-1**). The MATES Complex is used for the maintenance and service of vehicles from Fort Allen and Camp Santiago, including firefighting vehicles. According to the MATES Shop Chief, no AFFF is stored or used at the MATES Complex, and no emergencies have occurred at the MATES Complex requiring AFFF in response. There are no documented releases of PFAS to the ground surface. Potential releases may have occurred on paved and unpaved surfaces. PFAS releases to the paved surfaces could have impacted soil through cracks or joints between concrete slabs. Direct contact with surface soil could result in site worker, construction worker, and/or trespasser exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. Direct contact with subsurface soil (during excavation activities) could result in construction worker exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-4**.

7.2 GROUNDWATER EXPOSURE PATHWAY

The SI results for 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

PFOA was detected below the SL at one location within AOI 1.

The Facility receives drinking water from two water supply wells located near the main gate, which are screened in the Rio Nigua de Salinas alluvial fan deposits, downgradient from AOI 1. Sampling of the on-site wells showed PFAS relevant compounds below their respective SLs. Municipal water infrastructure was recently established for the City of Salinas; however, it is unclear whether municipal water is the primary source for drinking water. There are over 70 registered groundwater wells located downgradient from the Facility as well. Further, due to the potential for unidentified residential wells downgradient of the Facility, and the potential discharge to downgradient off-site surface water bodies used for drinking and recreation, the ingestion exposure pathway for groundwater is potentially complete for off-facility residents and recreational users that are located downgradient of AOI 1. Additionally, the depth to groundwater at AOI 1 was around 50 ft bgs, suggesting it is highly unlikely that construction worker exposure via incidental ingestion would occur; therefore, this pathway is considered incomplete. Although the pathway for construction and site workers via ground disturbing/construction activities is incomplete, the potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site wells that supply water to the Facility. Thus, the CSM shows a potentially complete pathway for these receptors. The CSM is presented in **Figure 7-1**.

7.2.2 AOI 2

PFBS and PFOA were detected in groundwater at AOI 2 at concentrations below their respective SLs.

The Facility receives drinking water from two water supply wells located near the main gate, which are screened in the Rio Nigua de Salinas alluvial fan deposits, downgradient from AOI 2. Water supply wells were sampled and showed concentrations of relevant compounds under their respective SLs. There are over 70 registered groundwater wells located downgradient from the Facility. Further, due to the potential for unidentified residential wells downgradient of the Facility, and the potential discharge to downgradient off-site surface water bodies used for drinking and recreation, the ingestion exposure pathway for groundwater is potentially complete for off-facility residents and recreational users that are located downgradient of AOI 2. Additionally, the depth to groundwater observed in the temporary wells in AOI 2 was between 14 and 30 ft bgs and trenching activities could result in construction worker exposure via incidental ingestion; therefore, this pathway is considered potentially complete. The CSM is presented in **Figure 7-2**.

7.2.3 AOI 3

PFBS, PFHxS, and PFNA were detected in groundwater at AOI 3 at concentrations below their respective SLs. PFOA was detected in groundwater in exceedance of the SL.

The Facility receives drinking water from two water supply wells located near the main gate which are screened in the Rio Nigua de Salinas alluvial fan deposits. These wells are located downgradient from AOI 3. Sampling results for these wells contained PFAS relevant compounds that did not exceed SL. There are over 70 registered groundwater wells located further downgradient to the Facility water supply wells. Due to the potential for unidentified residential wells downgradient of the Facility, and the potential discharge to downgradient off-site surface water bodies used for drinking and recreation, the ingestion exposure pathway for groundwater is potentially complete for off-facility residents that are located downgradient of AOI 3. The depth to groundwater observed in the temporary wells in AOI 3 was nearly 65 ft bgs. Therefore, it is highly unlikely that construction workers or site workers could result in accidental ingestion; therefore, this pathway is considered incomplete. Although the pathway for construction and site workers via ground disturbing/construction activities is incomplete, the potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site wells that supply water to the Facility and the fact that PFAS above SLs is present in upgradient wells. Thus, the CSM shows a potentially complete pathway for the construction and site workers. The CSM is presented in **Figure 7-3**.

7.2.4 AOI 4

AOI 4 is the MATES Complex (**Figure 3-1**). The MATES Complex is used for the maintenance and service of vehicles from Fort Allen and Camp Santiago, including firefighting vehicles. According to the MATES Shop Chief, no AFFF is stored or used at the MATES Complex, and no emergencies have occurred at the MATES Complex requiring AFFF in response. There are no documented releases of PFAS to the ground surface. Potential releases may have occurred on paved and unpaved surfaces. PFAS releases to the paved surfaces could have impacted soil through cracks or joints between concrete slabs. PFAS releases to the soil can migrate to groundwater, as such, ground disturbing activities that extend to the water table (approximately 15 ft bgs) could result in construction worker exposure to PFAS via incidental ingestion. Potential resident receptors downgradient of the AOI 3 could also be exposed by ingestion of groundwater. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-4**.

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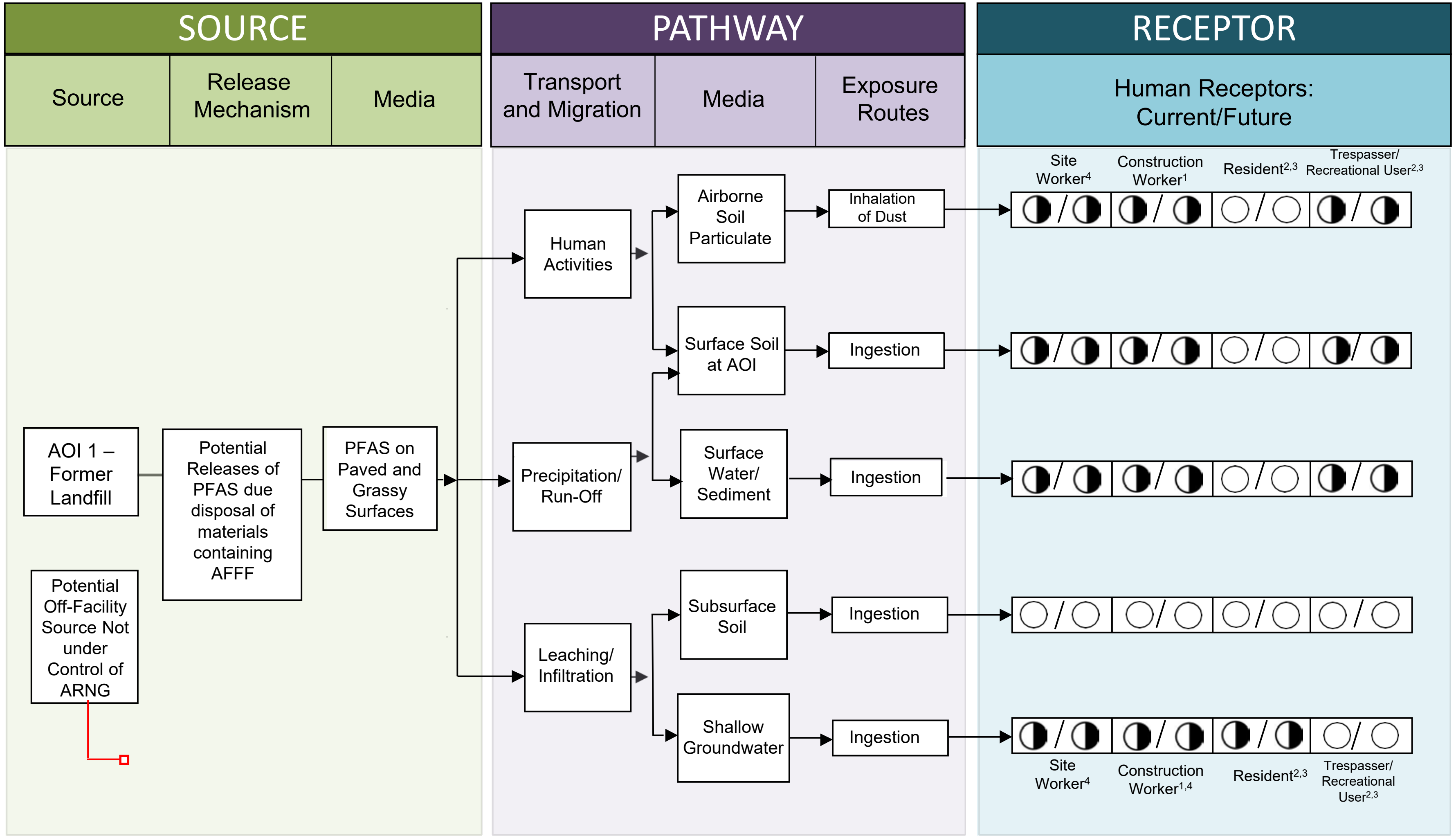

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. No current active construction at the AOI.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site downgradient wells that supply water to the facility.

Figure 7-1
Conceptual Site Model
AOI 1 Camp Santiago, Puerto Rico

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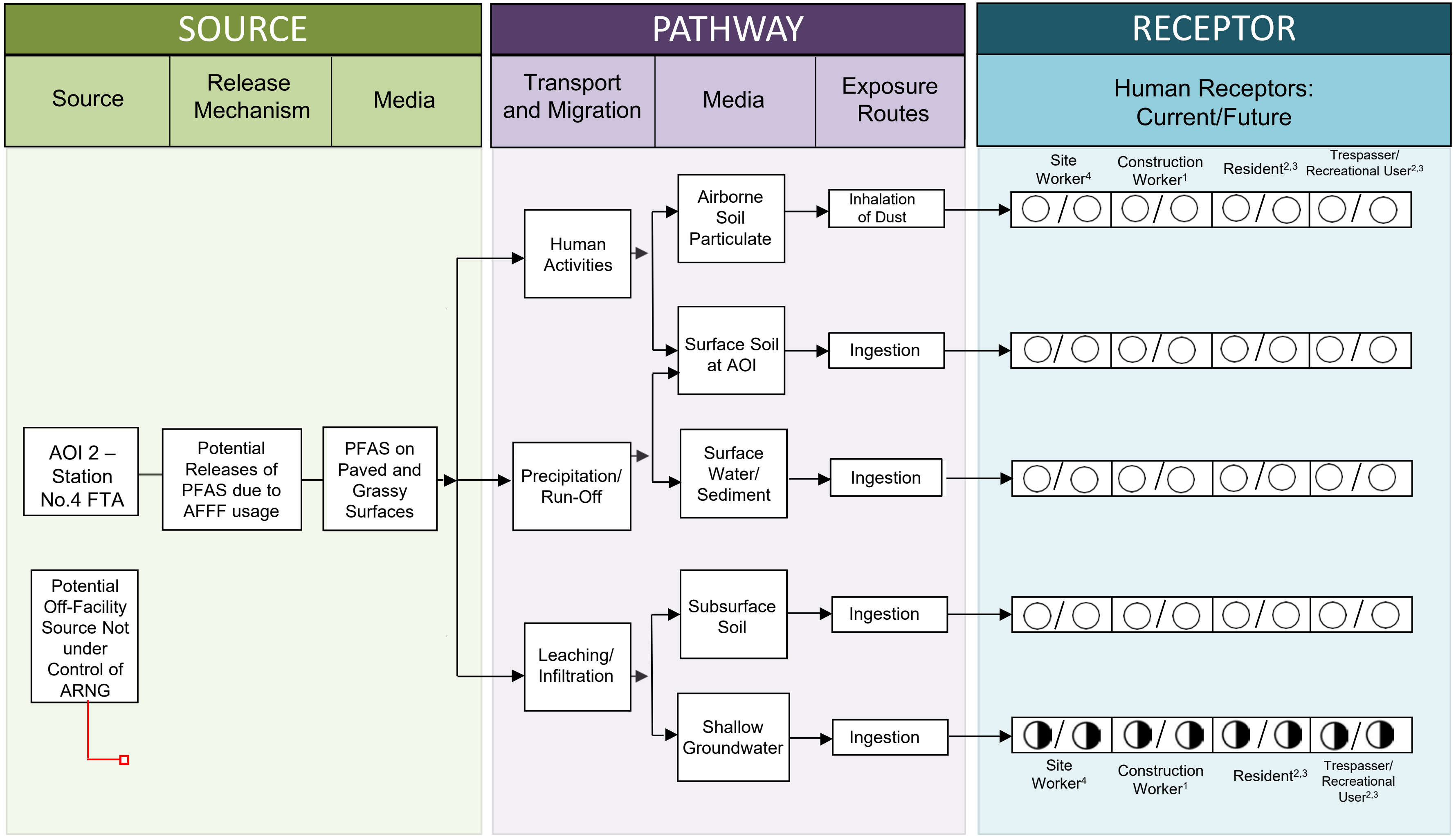

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. No current active construction at the AOI.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site downgradient wells that supply water to the facility.

Figure 7-2
Conceptual Site Model
AOI 2 Camp Santiago, Puerto Rico

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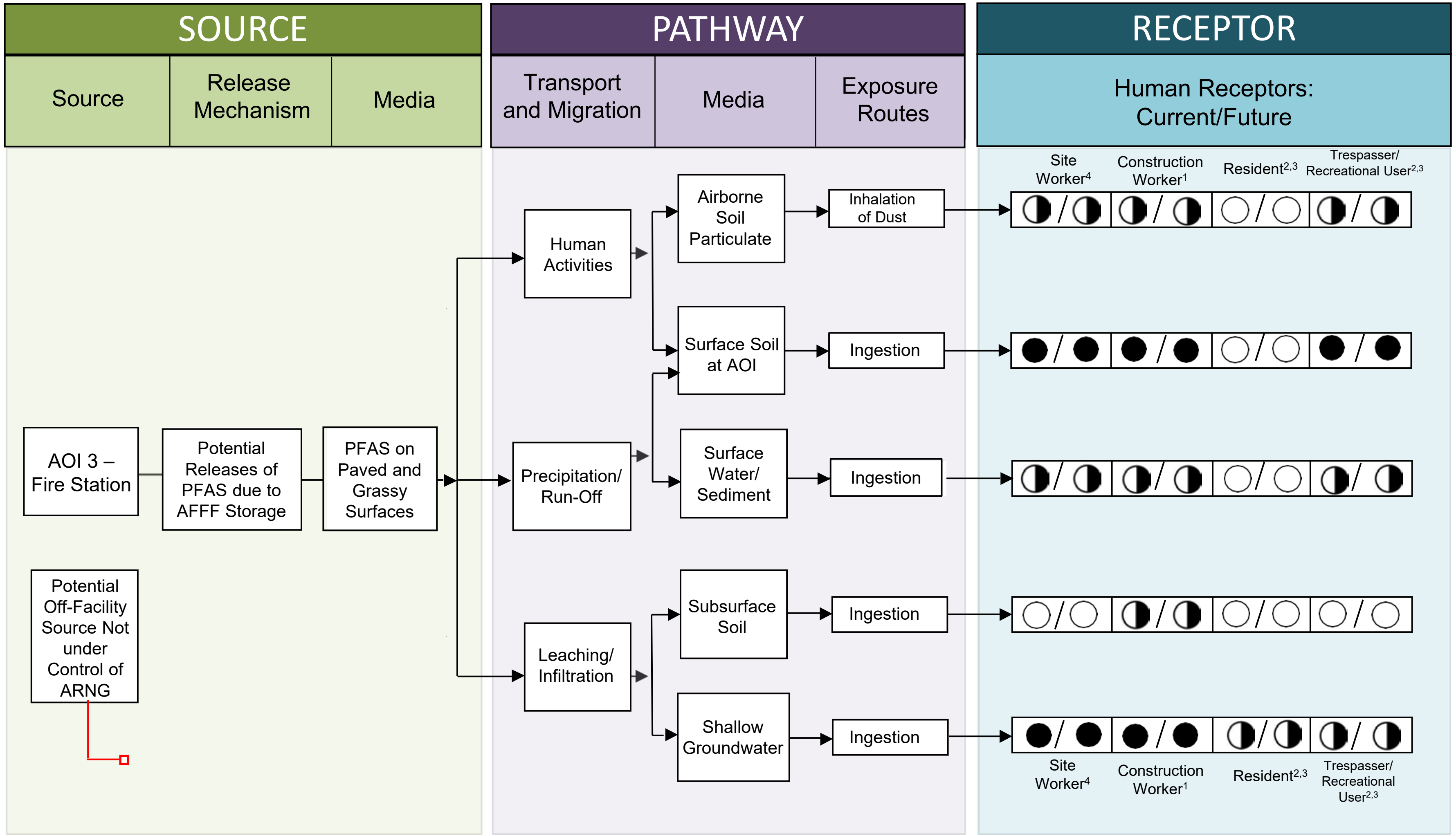

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. Construction observed near the AOI, but depth to water beyond 15 ft.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site wells that supply water to the facility.

Figure 7-3
Conceptual Site Model
AOI 3 Camp Santiago, Puerto Rico

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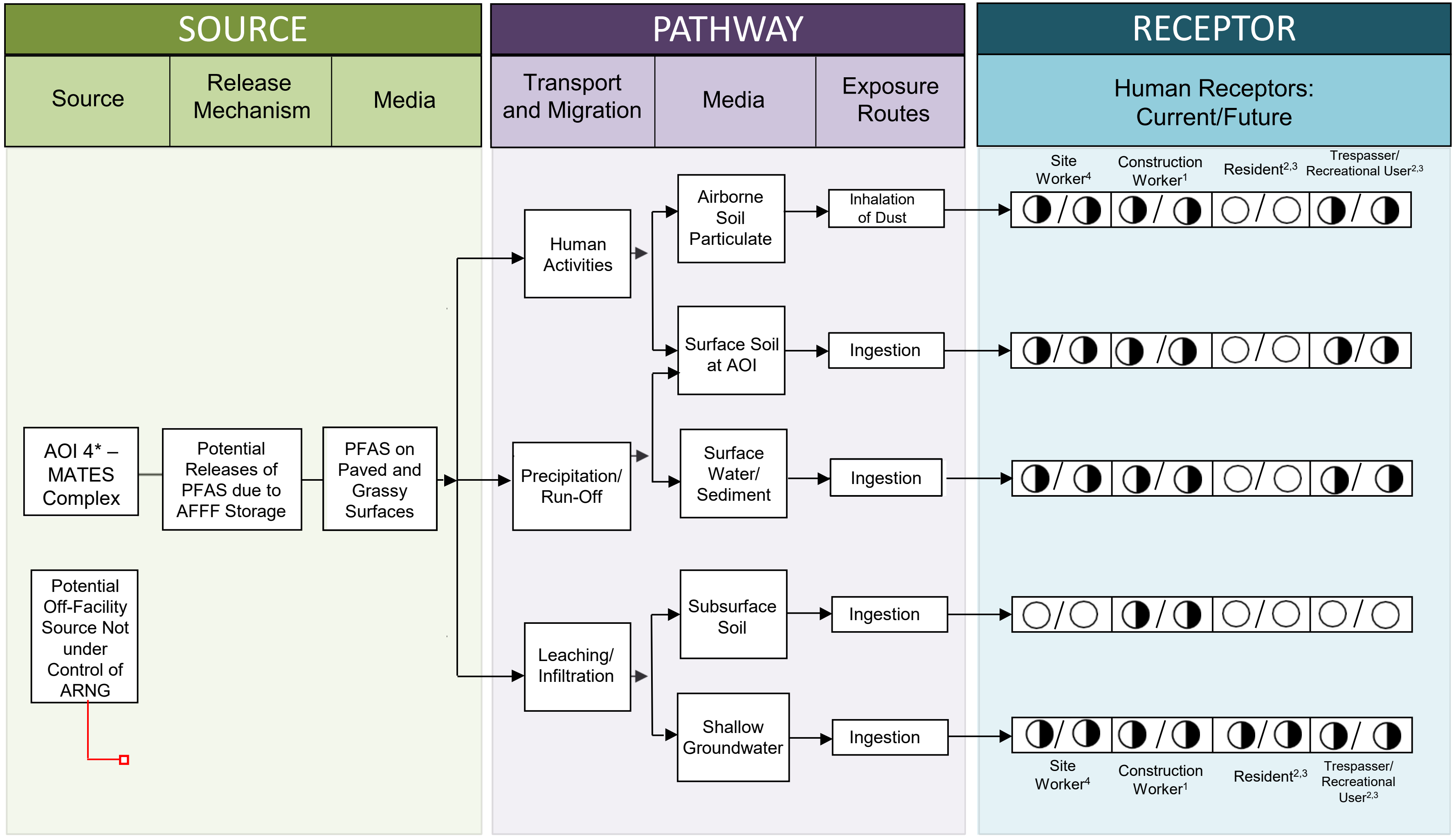

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

* Assessment of pathways will be conducted during the RI

1. Construction observed near the AOI, but depth to water beyond 15 ft.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected below SLs in the on-site wells that supply water to the facility.

Figure 7-4
Conceptual Site Model
AOI 4 Camp Santiago, Puerto Rico

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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 SITE INSPECTION ACTIVITIES

The SI field activities were performed in two separate field mobilizations. The first event was held between 12 to 26 May 2022 and the second event occurred between 1 to 7 October 2022. The SI field activities included soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021a), except as previously noted in **Section 5.8**.

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

- Thirty-Seven (37) soil samples from 11 primary locations and one offset location (soil borings locations)

- Twelve (12) grab groundwater samples from 12 temporary well locations

- Thirty-Four (34) quality assurance/quality control samples

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

8.2 OUTCOME

Based on the results of this SI, further evaluation under CERCLA is warranted under an RI for AOI 3. Based on the CSMs developed and revised based on the SI findings, there is potential for exposure to site workers, residential drinking water receptors, recreational user of surface water, trespassers and construction workers from potential releases during historical DoD activities at the Facility. Sample analytical concentrations collected during this SI were compared against the project SLs in soil and groundwater, as described in **Table 6-1**.

A summary of the results of the SI data relative to SLs is as follows:

- AOI 1:
  - PFOS was detected in surface soil at AOI 1 under the SL. PFOA, PFBS, PFHxS, and PFNA were not detected in soil at any location in AOI 1.
  - PFOA was detected in groundwater at AOI 1 at concentrations below the SLs. Based on the results of this SI, no further evaluation at AOI 1 is warranted at this time.
- AOI 2:
  - There were no detections of relevant compounds in soil at AOI 2.
  - PFBS and PFOA were detected in groundwater well locations in AOI 2 below their respective SLs. Based on the results of this SI, no further evaluation is warranted for AOI 2 at this time.
- AOI 3:
  - PFOA, PFBS, PFNA, and PFHxS were detected in surface and shallow subsurface soil at AOI 3 below their respective SLs. PFOS exceeded the SL in surface soil with a concentration of 42 µg/kg.
  - PFBS, PFHxS, and PFNA were detected in groundwater at AOI 3 below their respective SLs. PFOA was detected at AOI 3 above the SL with a concentration of 10 ng/L. Two potable wells are downgradient of AOI 3 that supply water to the Facility. These wells had detections of PFAS relevant compounds when sampled. Based on the results of this SI, further evaluation is warranted for AOI 3, and an RI is recommended.
- AOI 4:
  - Following the SI fieldwork it was noted that fire fighting vehicles were maintained at the MATES Complex. Based on this information, the MATES Complex was designated as AOI 4 and will be evaluated during the RI.

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 PFAS Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary[1]	Future Action
1	Former Landfill	◐	◐	NA	No Further Action
2	Station Number 4 Fire Training Area	◐	◐	NA	No Further Action
3	Fire Station	●	●	NA	Proceed to RI
4	MATES Complex	TBD	TBD	NA	Proceed to RI

Legend:

● = Detected; exceedance of SLs

◐ = Detected; no exceedance of SLs

○ = Not detected

1. Facility Boundary samples were not collected at Camp Santiago.

RI = remedial investigation

TBD = to be determined during RI

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