FINAL
Site Inspection Report
Army Aviation Support Facility #1
R W Shepherd,
Montgomery, Alabama

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

August 2023

Prepared for:

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

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
ALARNG	Alabama Army National Guard
ANGB	Air National Guard Base
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
CSMS	Combined Support Maintenance Shop
DA	Department of the Army
DoD	Department of Defense
DO	dissolved oxygen
DOT	Department of Transportation
DPT	direct push technology
DQO	data quality objective
DUA	data usability assessment
EDR™	Environmental Data Resources, Inc.™
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FTA	Fire Training Area
GPS	Global positioning system
GRPS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
HSA	hollow stem auger
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
MS/MSD	matrix spike/matrix spike duplicate
MWWSSB	Montgomery Water Works and Sanitary Sewer Board
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
ORP	oxidation-reduction potential

OSD	Office of the Secretary of Defense
OWS	oil water separator
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PRL	potential release location
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TOC	total organic carbon
TPP	Technical Project Planning
UCMR 3	Third Unregulated Contaminant Monitoring Rule
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WWTP	wastewater treatment plant

Executive Summary

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

The PA identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at the Army Aviation Support Facility (AASF) #1 in Montgomery, Alabama and determined further investigation is warranted for AOI 1: Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room and AOI 2: Flight Ramp and Wash Rack. AASF #1 will also be referred to as the "facility" throughout this document.

AASF #1 is situated on a 160-acre parcel of land owned by the Montgomery Airport Authority (Montgomery County, 2019). The facility is located in southwest Montgomery, in Montgomery County, Alabama. The facility property is within the Montgomery Regional Airport, at the southernmost portion of the airport property, off US Highway 80 (Selma Highway). According to Alabama ARNG (ALARNG) personnel, the facility was constructed in 1995. The current AASF #1 facilities include one hangar for the operation, maintenance, and repair of ALARNG rotary-winged aircraft, administrative offices, and classrooms (AECOM Technical Services, Inc. [AECOM], 2020).

The PA identified two AOIs for investigation during the SI phase. SI sampling results from the two AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation for AOI 1: Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room and AOI 2: Flight Ramp and Wash Rack.

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

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

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

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

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room	●	N/A[1]	N/A	Proceed to RI
2	Flight Ramp and Wash Rack	●	●	N/A	Proceed to RI

Legend:
1. Groundwater was not encountered within AOI 1 at the time of the SI
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

1. Introduction

1.1 Project Authorization

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

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

1.2 SI Purpose

A PA was performed at AASF #1 (AECOM Technical Services, Inc. [AECOM], 2020) that identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

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

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2. Facility Background

2.1 Facility Location and Description

AASF #1 is situated on a 160-acre parcel of land owned by the Montgomery Airport Authority (Montgomery County, 2019). The facility is located approximately 7.5 miles southwest of downtown Montgomery, in Montgomery County, Alabama. The facility property is within the Montgomery Regional Airport, at the southernmost portion of the airport property, off US Highway 80 (Selma Highway) (**Figure 2-1**). The latitude and longitude for the approximate center of the AASF are 32°17'10.84" N; 86°23'42.60" W. According to Alabama ARNG (ALARNG) personnel, the facility was constructed in 1995.

The current AASF #1 facilities include one hangar for the operation, maintenance, and repair of ALARNG rotary-winged aircraft. The facility also maintains administrative offices, classrooms, and a readiness center. An approximately 2,500-feet-long taxiway extends from the north end of the AASF #1 flight ramp, connecting it to the Montgomery Regional Airport airfield. Water, electric, and sewer utilities are provided by the City of Montgomery.

2.2 Facility Environmental Setting

AASF #1 is situated in the Black Prairie Belt district of the Coastal Plain physiographic province. The Black Prairie Belt occupies a crescent shaped area extending from northern Mississippi into central Alabama and is characterized by an undulating, deeply weathered plain of low relief. AASF #1 is situated on a generally level parcel of land at an elevation of around 230 to 240 feet above mean sea level (**Figure 2-2**). Gentle hills rise to the northwest and southeast of the facility. The facility lies in the Southeastern Plains ecoregion, which is characterized by smooth to irregular plains or flatlands separated in some places by curved bands of asymmetrical ridges and rugged hills. Streams draining this ecoregion are generally low gradient, with silty sand substrates. Forest and woodland areas are prevalent and are part of the mosaic of cropland, pasture, and urban areas that dot the landscape. Natural vegetative cover includes oak, hickory, pine, and southern mixed forests (Geological Survey of Alabama, 2002).

AASF #1 is roughly 50% covered with developed and paved surfaces. The majority of the unimproved lands are open fields located to the north and southeast of the hangar. The area immediately surrounding the facility includes the Montgomery Regional Airport to the north, rural residential properties to the east and south, and agricultural land to the west. Commercial properties exist to the north and southeast.

2.2.1 Geology

Near-surface strata in the region consist of Quaternary alluvium and Pleistocene terrace deposits. The alluvium deposits are found predominantly along the valleys of the nearby Pintlala and Catoma Creeks and their tributaries. The deposits measure 0 to 40 feet thick and are characterized by white to light-gray, silty, poorly sorted sand with yellow, gray-orange to bluish-gray, sandy clay lenses. The Pleistocene terrace deposits are remnants of the channels of the ancestral Alabama River and are found in a band approximately 6 to 8 miles wide that is parallel to the present-day river. The thicknesses of the terrace deposits range from 10 to 100 feet and are characterized by pale-yellowish-orange, cross-bedded, medium to very coarse grained, poorly-sorted sand; dark-reddish-brown sandy clay; and lenses of well-rounded gravel (Geological Survey of Alabama, 1963).

Selma Group rocks of Late Cretaceous age unconformably underlie the Pleistocene Terrace Deposits. Selma group rocks include all Upper Cretaceous strata above the Eutaw Formation.

Stratigraphic units of the Selma Group, in descending order, include Providence Sand, Prairie Bluff Chalk, Ripley Formation Sands, Demopolis Chalk, and Mooresville Chalk. Units of the Selma Group are relatively impermeable or have low groundwater permeability. The Mooresville Chalk is the primary unit mapped at the surface of the facility. This unit is prevalent across north-central Montgomery County and is characterized in the western part of the county as a gray to pale-olive silty to fine sandy, fossiliferous chalk that can be present up to 600 feet thick in some areas. The northern portion of the aforementioned Black Prairie has developed on the Mooresville Chalk, where it forms gently rolling terrain with deep black soils that grow natural grasslands (Geological Survey of Alabama, 1963).

The Eutaw Formation unconformably underlies the Mooresville Chalk. The Eutaw Formation outcrops in small areas in the region north of Montgomery but typically ranges in depth from 3 feet below ground surface (bgs) northeast of Montgomery to 405 feet bgs southwest of Montgomery. The Eutaw formation consists of light-greenish-gray, cross laminated, fine to medium-grained, well-sorted, micaceous, glauconitic, fossiliferous sand interbedded with greenish-gray micaceous glauconitic fossiliferous clay and sandy clay (Geological Survey of Alabama, 1963). Additionally, the Eutaw formation contains beds of greenish-gray micaceous, silty clay and medium-dark-gray carbonaceous clay (Geological Survey of Alabama, 1988).

The Gordo Formation unconformably underlies the Eutaw formation and is characterized by pale-yellowish-orange medium to coarse grained, poorly sorted, ferruginous-cemented sand interbedded with moderate-reddish-brown to pale-red-purple clay. The Coker Formation unconformably underlies the Gordo Formation and consists of light-greenish-gray, medium- to coarse-grained, well-sorted, fossiliferous sand that is thinly laminated with greenish-gray, lignitic, fossiliferous clay. Basement rock unconformably below the Cocker Formation is characterized by Pre-Cretaceous crystalline, biotite, mica schist (Geological Survey of Alabama, 1963).

The majority of the SI soil borings were completed to depths ranging between 20 to 27.5 feet bgs, with the exception of AOI02-05, which was completed to 59 feet bgs. Surface and subsurface soil encountered generally consisted of low to medium plasticity lean clays which were noted to swell at most borings. Some sand was observed within these massive clay layers at several borings. A high plasticity fat clay layer was observed near the surface at AOI02-02. The clay encountered ranged in color between yellowish brown, gray, and dark greenish gray. The impermeable clays and trace amounts of silt and fine sands encountered are consistent with the Mooresville Chalk of the Selma Group. These observations are consistent with the understood marine depositional environment of the units in the region.

Water bearing units were generally not encountered during SI drilling except for very trace amounts of water in the shallow subsurface. Non-plastic silt with varying amounts of sand was encountered at several borings within AOI 2 from the surface level to depths up to 5 feet bgs. This slightly more permeable material is likely fill or reworked native soils introduced during construction.

Samples for grain size analysis was collected at AOI01-01 from 18 to 20 feet bgs and analyzed by American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil sample is mostly silt (72.51 percent [%]) and clay (26.20%). Boring logs are presented in **Appendix E**, and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

Sand beds in the Quaternary alluvium sediments yield small quantities of water in shallow wells installed in the region at depths from less than 10 to about 30 feet bgs. Some users of these wells experience water shortages during times of limited rainfall; however, some wells installed in topographically lower areas and near streams can produce water year-round. Sand and gravel beds of the Pleistocene terrace deposits are very permeable and yield moderate to large supplies

of water. Wells installed in these sand and gravel beds are used for industrial, domestic, and stock use (Geological Survey of Alabama, 1963).

The units within the Selma Group consist of relatively impermeable, fine-grained or cemented rocks that are not generally considered suitable aquifers for water production. While some wells do exist within several of these formations, they provide limited amounts of water and are not used for the municipal water supply. The Mooresville Chalk is not recognized as an aquifer in Montgomery County due to its impermeability, but rather, it is considered the confining unit above the underlying Eutaw formation (Geological Survey of Alabama, 1963).

The Eutaw and Coker formations are among the most productive aquifers in Montgomery County. Large quantities of water are pumped from these formations for municipal use by the City of Montgomery. Wells located west of Montgomery that are screened in the Eutaw are generally screened in the lower portion of the formation, where the iron content is lower. The Coker formation serves as the principal aquifer of Montgomery County, where the upper part of the formation has been developed extensively for municipal well use. The Gordo formation, which lies between the Eutaw and Coker, is not widely used as a water supply (Geological Survey of Alabama, 1963).

Based on the flow patterns of larger surface water features, general groundwater flow beneath the facility was inferred toward the northwest. An Environmental Data Resources, Inc.™ (EDR™) report conducted a well search for a 1-mile radius surrounding the facility (Appendix A of AECOM, 2020); no groundwater wells were identified within a 1-mile radius of AASF #1. Using additional online resources, such as state and local Geographic Information System databases, wells were researched to a 4-mile radius of the facility. The only wells able to be identified within the 4-mile search radius were active and inactive US Geological Survey (USGS) monitoring wells. Groundwater features in the vicinity of the facility are shown on **Figure 2-3**. There are currently no potable water wells at the facility.

Drinking water at the facility is supplied by the City of Montgomery, which receives its water from groundwater and surface water sources. Surface water from the Tallapoosa River makes up approximately two thirds of the City of Montgomery's drinking water supply, while groundwater from the city's west and southwest well fields makes up the remaining one third (Montgomery Water Works and Sanitary Sewer Board [MWWSSB] of the City of Montgomery, 2018). The Tallapoosa River is located approximately 15 miles northeast of AASF #1. The locations of the west and southwest well fields could not be ascertained from public records; however, an SI conducted at the Montgomery Air National Guard Base (ANGB), on the northern portion of the Montgomery Airport property, suggests the west well field is located approximately 4.25 miles north of AASF #1 (AECOM, 2019).

During the January 2022 SI, groundwater was only encountered in three of the six temporary monitoring wells and appeared to be present only within the upper several feet of the subsurface, where the disturbed soils were slightly more permeable. Depths to water measured at the three locations ranged from 0.40 to 19.44 feet bgs. Based on the groundwater depths and widespread clay units, the groundwater encountered appeared to be consistent with very shallow perched groundwater and not representative of actual groundwater. Water measured deeper within the clay is suspected to have filled the borehole from above.

Due to the groundwater observations showing very localized, perched conditions, groundwater measurements were not considered representative of a true potentiometric surface and the groundwater flow direction at the facility could not be properly evaluated. Groundwater flow in the deeper subsurface, beneath the observed impermeable clays, is not known but is assumed to flow toward the northwest, as inferred from the topography and flow patterns of surrounding larger surface water features.

Based on the very shallow, perched groundwater conditions and swelling clay observed during the SI, surface water runoff appears to be the primary mechanism of hydrologic transport at the facility, with infiltration being the secondary and less substantial mechanism of hydrologic transport.

2.2.3 Hydrology

AASF #1 lies within the Alabama River Basin (Geological Survey of Alabama, 2002). The facility straddles a northwest-southeast-trending watershed divide. The Middle Pintlala Creek Watershed drains the majority of the facility, including the hangar and flight ramp areas, towards Pintlala Creek to the southwest. Surface water in the northeast-most part of the facility, the area along the taxiway, drains via the Caney Branch Watershed towards Catoma Creek to the northeast. Pintlala Creek and Catoma Creek are roughly equidistant from the facility, each located approximately 2.5 miles to the southwest and northeast, respectively. Both creeks flow for over 5 miles to the northwest, into the Alabama River.

On-facility surface water generally drains via sheet flow to the west-northwest; however, surface water at the edges of the flight ramp and paved areas surrounding the hangar flow radially into unpaved areas. Two low-lying retention areas were identified to the west-southwest of the flight ramp (Retention Area 1) and southeast of the mechanical room (Retention Area 2). Retention Area 1 appears to be wet throughout most of the year and may flow off-facility during high water conditions southward via an intermittent stream. Retention Area 2 is a smaller, vegetated basin that is largely dry throughout the year except for a small area just southeast of the hangar building. Retention Area 2 does not appear to drain off-facility, as no outflow was identified, and low berms are present south of the basin. Floor and trench drains, including a drain within the wash rack (east of the flight ramp), convey to the sanitary sewer. Surface water features surrounding the facility are shown in **Figure 2-4**.

2.2.4 Climate

Alabama's climate is humid subtropical, with average annual temperatures of about 65 degrees Fahrenheit (°F) in the City of Montgomery, with an average high of 76.5 °F and an average low of 53.5 °F. Rainfall in Alabama usually is abundant and distributed throughout the year. Montgomery receives an average of 53.05 inches of rain per year (World Climate, 2022).

2.2.5 Current and Future Land Use

The ALARNG AASF #1 facility is located within the Montgomery Regional Airport. Properties surrounding the AASF #1 facility primarily consist of commercial properties to the north and southeast, rural residential properties to the east and south, and agricultural properties to the west. Reasonably anticipated future land use is not expected to change from the current land use.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, clams, insects, reptiles, snails, and flowering plants are federally endangered, threatened, proposed, and/ or are listed as candidate species in Montgomery County, Alabama (US Fish and Wildlife Service [USFWS], 2022).

- **Birds**: Wood stork, *Mycteria americana* (threatened)
- **Clams:** Southern Clubshell, *Pleurobema* (endangered), Southern kidneyshell *Ptychobranchus jonesi* (endangered), Choctaw bean, *Obovaria choctawensis* (endangered), Southern Sandshell, *Hamiota australis* (threatened), Narrow pigtoe, *Fusconaia escambia* (threatened), Fuzzy pigtoe, *Pleurobema strodeanum* (threatened)

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Reptiles:** Gopher tortoise, *Gopherus polyphemus* (endangered), Alligator snapping turtle, *Macrochelys temminckii* (proposed threatened)
- **Snails:** Tulotoma snail, (Tulotoma magnifica) (threatened)
- **Flowering plants:** Alabama canebrake pitcher-plant, *Sarracenia rubra ssp. Alabamensis* (endangered), Georgia rockcress, *Arabis georgiana* (threatened)

2.3 History of PFAS Use

Two AOIs where AFFF may have been used, stored, disposed, or released historically at the AASF #1 were identified in the PA (AECOM, 2020). AFFF may have historically been released at the facility during the replacement of AFFF within the 800-gallon hangar fire suppression system tanks between 2006 and 2009. During the process of replacing the AFFF, an unknown quantity of AFFF was spilled outside of the south side of the mechanical room and consequently killed the grass. Additionally, a 5-gallon jug of 3% AFFF concentrate was observed in the hazardous waste storage room during the PA site visit. Facility personnel subsequently placed the 5-gallon container of AFFF into a 20-gallon overpack container to prevent an accidental release.

Mobile AFFF “Tri-Max™ 30” extinguisher units were staged along the flight ramp from 2001 to 2017. The Tri-Max™ 30 units may have also been used at the wash rack, located south of the hangar building, and are thought to have been emptied at the facility prior to their removal in 2017.

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

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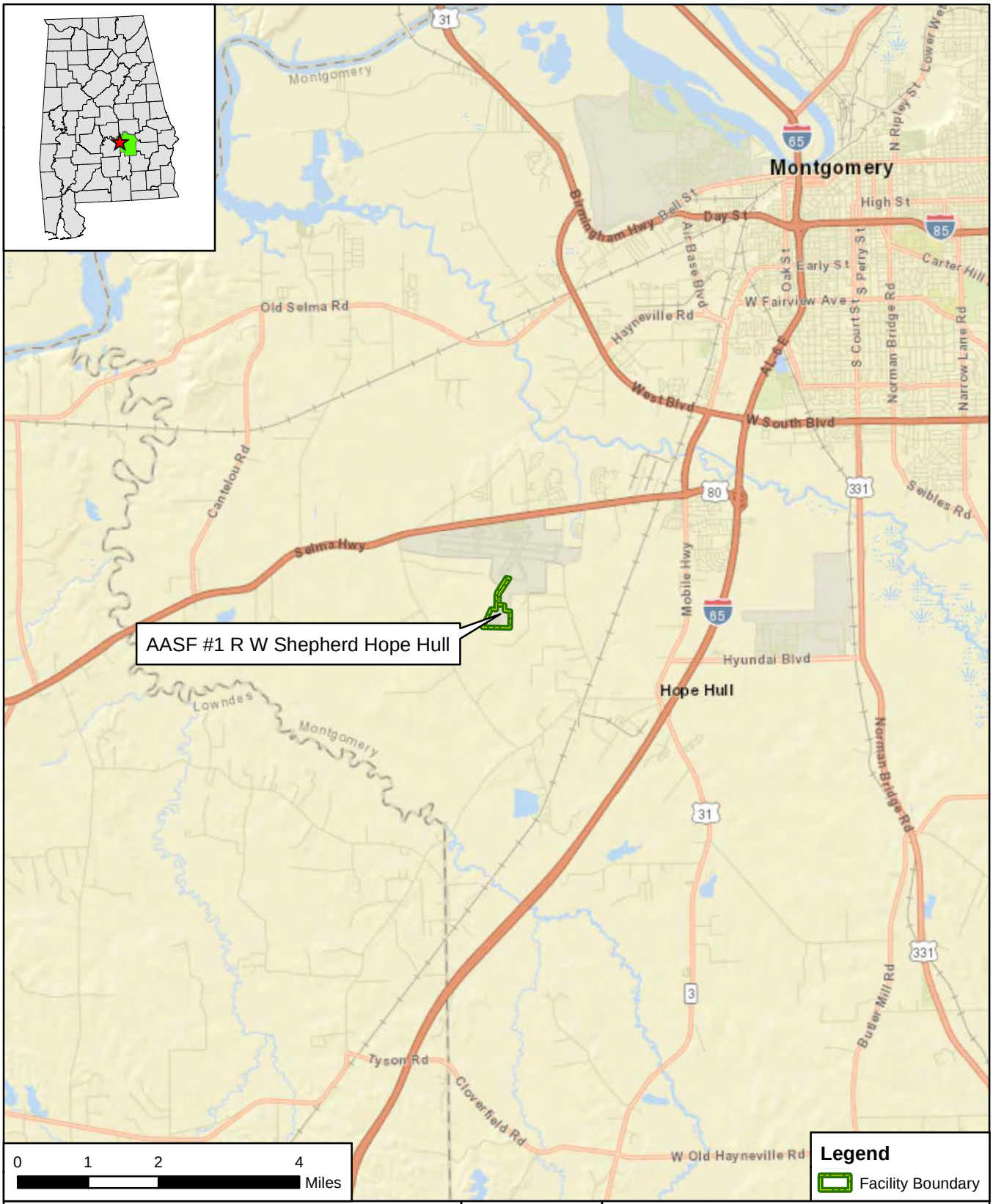

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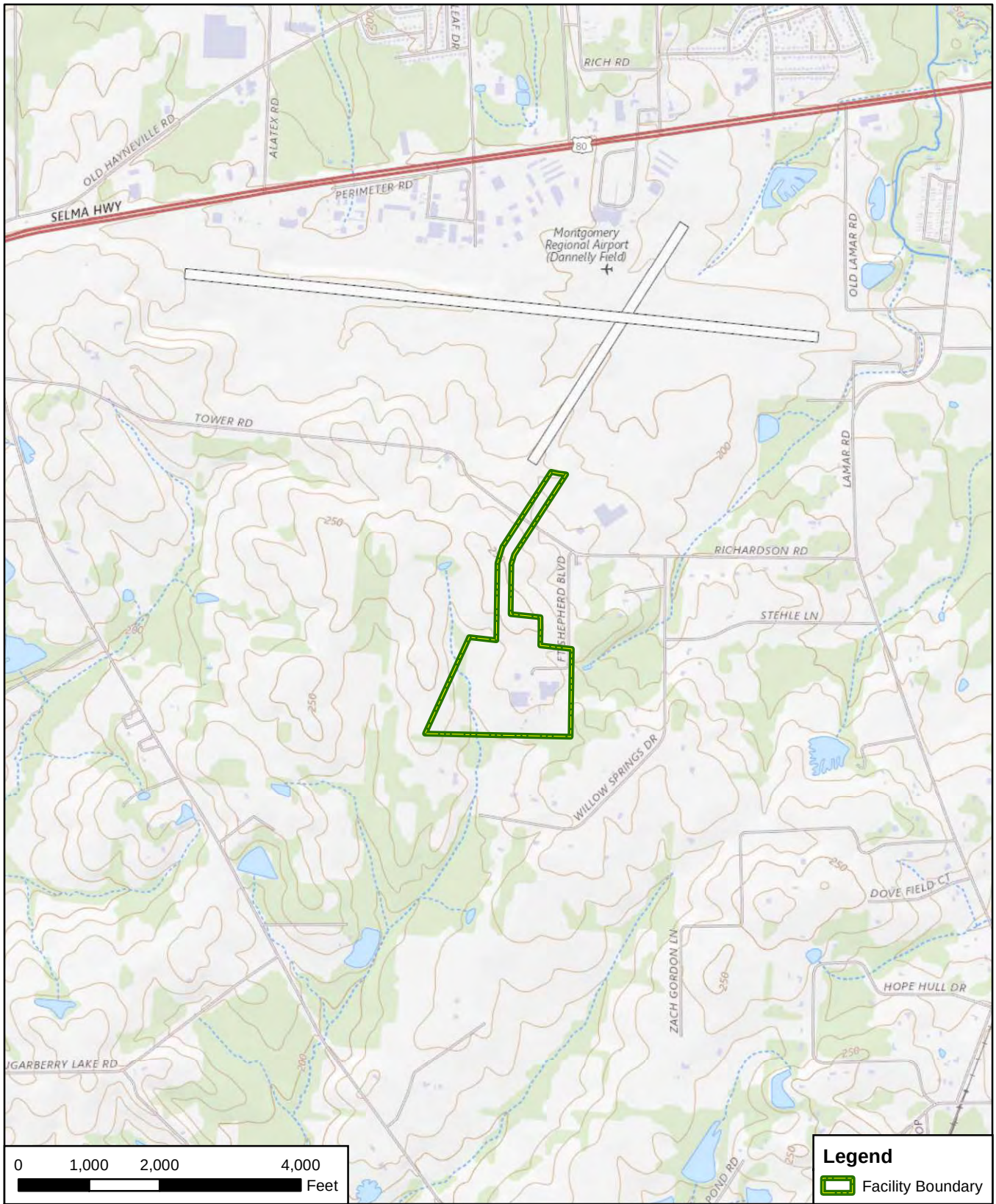
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	8/8/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	8/8/2022

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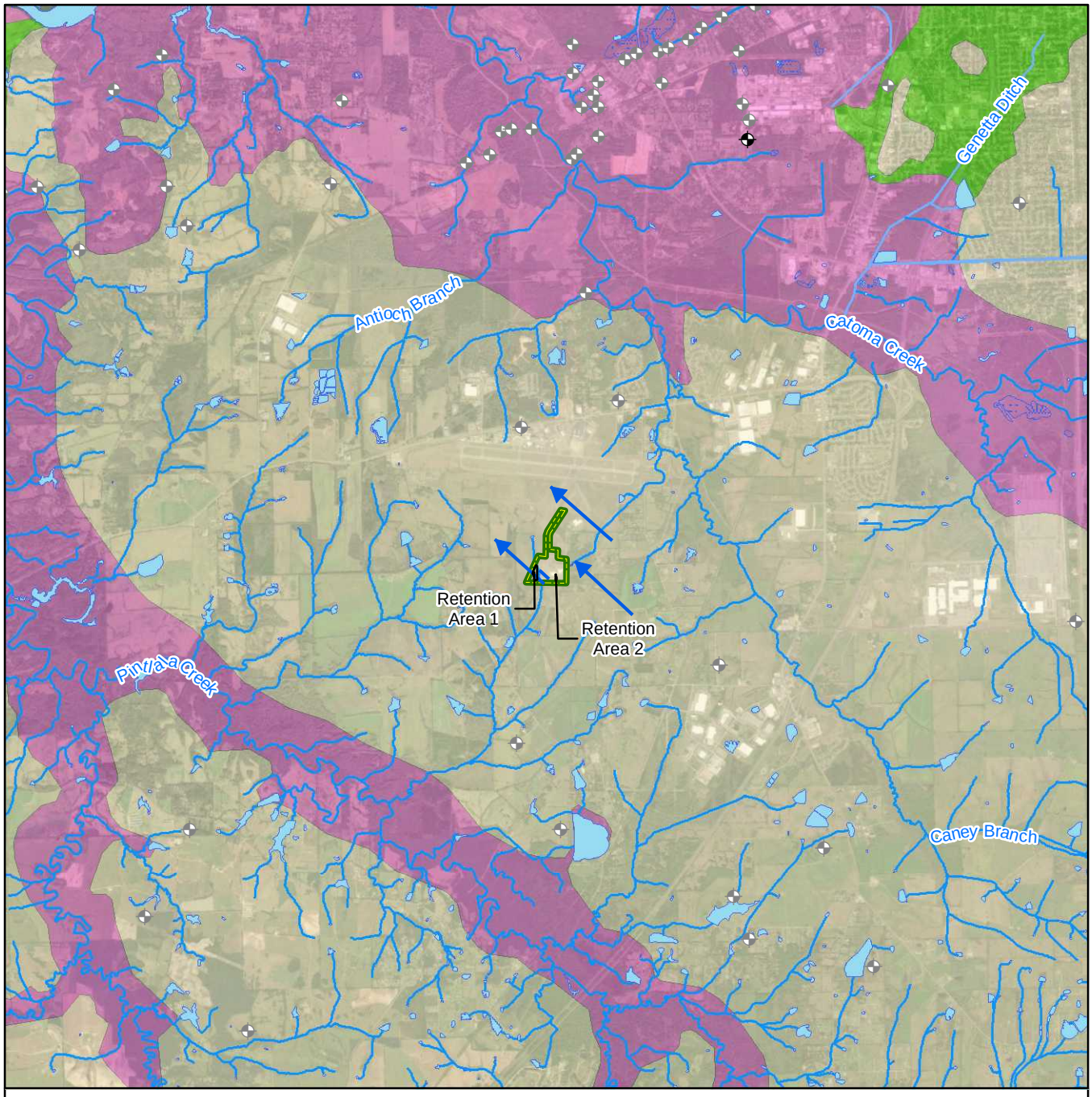
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



Legend

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

Geology

- Alluvial and Low Terrace Deposits
- Mooreville Chalk
- Eutaw Formation

Well

- USGS Active Monitoring Well
- USGS Inactive Monitoring Well

0 0.75 1.5 3 Miles

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
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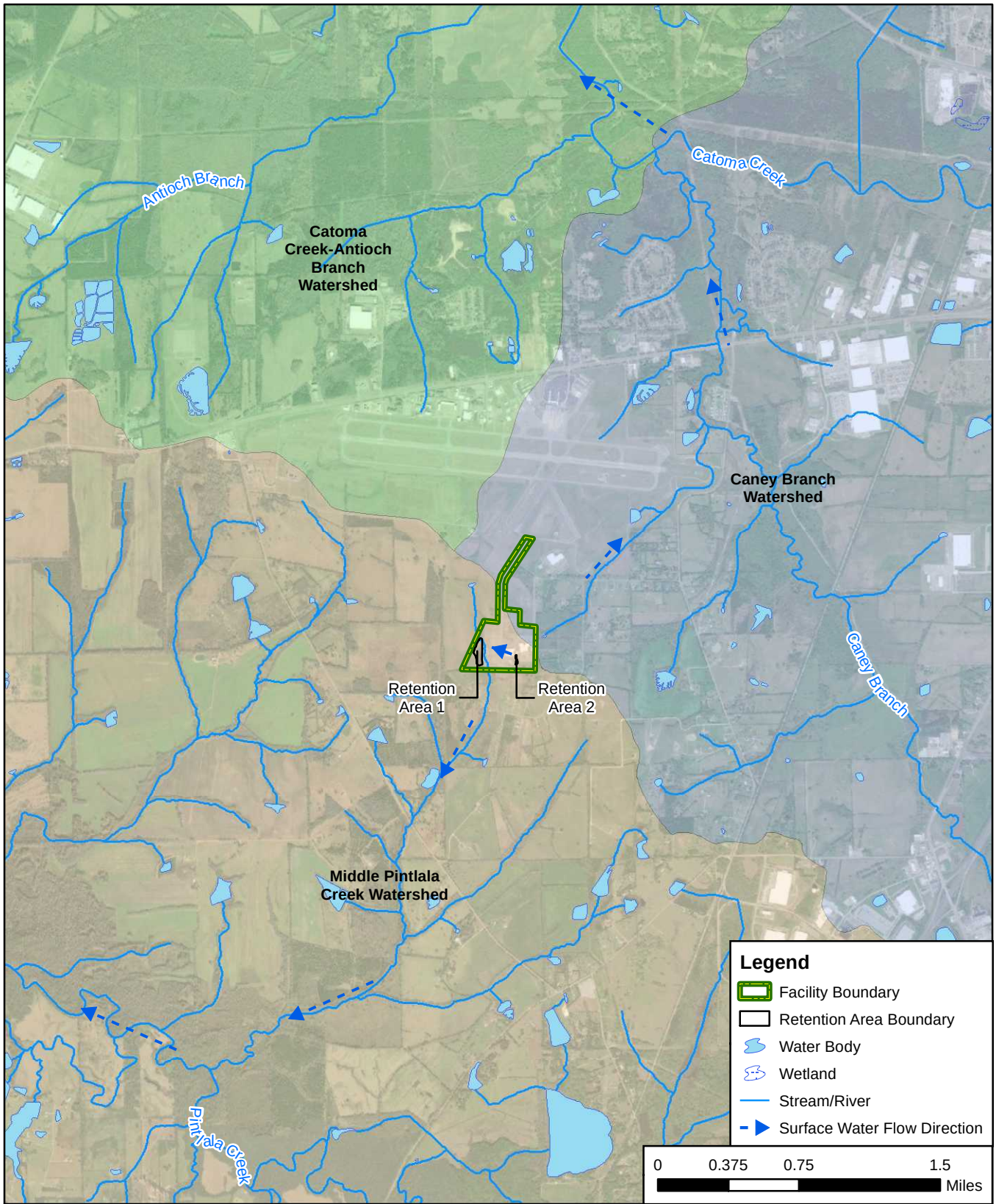
Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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, four potential release areas were identified at AASF #1 and grouped into two AOIs (AECOM, 2020). A fifth potential release area (the hazardous waste storage room) was added to AOI 1, after the submittal of the 2020 PA, in order to be consistent with the programmatic practice that any AFFF storage be considered a potential release area. The potential release areas are shown on **Figure 3-1**.

3.1 AOI 1 Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room

AOI 1 consists of three potential release areas: the hangar fire suppression system, mechanical room, and hazardous waste storage room. The AASF #1 hangar contains an overhead fire suppression system supplied by two 800-gallon tanks filled with AFFF concentrate. Both tanks are located in the mechanical room at the southeast corner of the hangar. In addition to the overhead system, the hangar building is equipped with smaller stationary floor tanks, also filled with AFFF, located on the hangar floor. The current AFFF suppression system was installed in 1995 and was part of the original hangar construction. According to interviews with ALARNG personnel with knowledge of the property dating back to 2000, a full-scale test of the system was not conducted, and the system has not been triggered; however, information regarding any earlier testing from 1995 to 2000 could not be ascertained. It is reasonable to assume that an acceptance test was conducted prior to ALARNG accepting the system installation.

According to ALARNG personnel, the AFFF concentrate in the 800-gallon tanks was replaced with AFFF of the same concentration between 2006 and 2009. During the process of replacing the AFFF, an unknown quantity of AFFF was spilled outside of the south side of the mechanical room and consequently killed the grass. The manufacturer of the historical and current AFFF is unknown. Additionally, information regarding where the original AFFF was disposed of was not known by ALARNG personnel and could not be ascertained.

During the visual inspection, metal corrosion and rust staining were observed on both 800-gallon AFFF concentrate tanks in the mechanical room as well as the floor tanks within the hangar building. Corrosion was not evident when observing the overhead suppression system in the hangar building. Trench drains are located at the north and south ends of the hangar building, and additional floor drains were noted within the hangar and mechanical room.

The hazardous waste storage room is located on the west side of the hangar building. A 5-gallon jug of 3% AFFF concentrate was observed in the hazardous waste storage room during the PA site visit. ALARNG personnel noted that the jug was left over when AFFF in the hangar fire suppression system was replaced between 2006 and 2009. The AFFF jug was presumably left in the mechanical room to top off the 800-gallon concentrate tanks. Prior to the PA visit, ALARNG personnel had relocated the AFFF jug to the hazardous waste storage room. While AFFF is not classified as a hazardous waste, the jug was relocated to the hazardous waste storage room until proper disposal could be determined. Visual inspection of the jug indicated corrosion and leakage from the cap; however, it was noted that the jug was stored in secondary containment.

Any releases at AOI 1 could have occurred on the hangar floor or mechanical room, both of which drain to floor and trench drains. These drains would convey any AFFF to the oil water separator (OWS) and then to the sanitary sewer. According to ALARNG personnel, wastewater from the AASF #1 facility goes to the Catoma Wastewater Treatment Plant (WWTP) located approximately 6 miles northwest of the facility. Biosolids generated from wastewater treatment at the Catoma WWTP are spread at two sites near the WWTP (MWWSSB, 2021). Other releases may have

occurred directly to the building floor slab, including at the hazardous waste storage area. It is possible AFFF may have infiltrated into the subsurface soil via joints in the slab or could have traveled outside onto the flight ramp and surrounding grassy areas. AFFF is known to have been released to the unpaved, grassy area south of the mechanical room during the replacement of the AFFF from the 800-gallon concentrate tanks.

3.2 AOI 2 Flight Ramp and Wash Rack

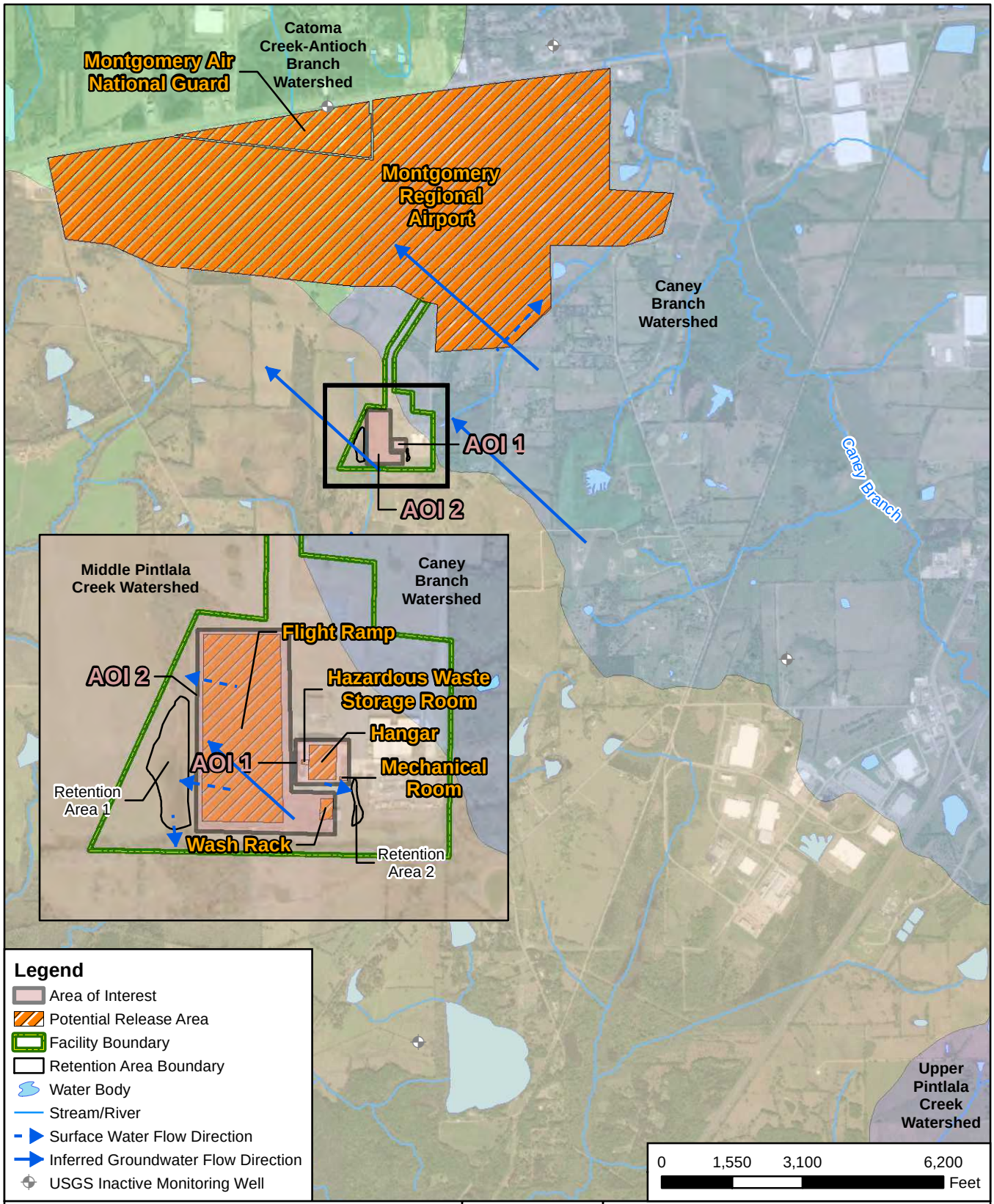
AOI 2 consists of two potential release areas: Flight Ramp and Wash Rack. The AOI encompasses the flight ramp located west of the hangar building. According to ALARNG personnel with knowledge of the facility dating back to 2000, approximately 10 mobile AFFF Tri-Max™ 30 extinguisher units were staged along the flight ramp from 2001 to 2017. These units were reportedly transported off-facility in 2017 and replaced with the mobile Purple K units currently used at the facility. The Tri-Max™ 30 units were transported to the combined maintenance shop (CSMS) at the Alabama National Guard office in Montgomery, Alabama. According to CSMS personnel, the Tri-Max™ 30 units were received empty; however, information regarding how the Tri-Max™ 30 units were emptied could not be ascertained by ALARNG personnel at AASF #1. Based on this discrepancy, it may be assumed that the Tri-Max™ 30 units were discharged on the facility prior to transportation to CSMS.

The wash rack is located south of the hangar building and is used to wash aircrafts. The wash rack is sloped on all sides towards one drain in the center of the wash rack that empties to the OWS, where it would combine with drainage from the hangar and mechanical room and then convey to the sanitary sewer system. ALARNG personnel with knowledge of the facility dating back to 2000 stated that ALARNG used aircraft soap at the wash rack area to simulate firefighting techniques and did not use fire or AFFF for these simulations. It is reasonable to assume that the Tri-Max™ 30 units staged along the Flight Ramp could have been used at the wash rack, or that the Tri-Max™ 30 units may have been emptied at this location prior to being transported to the CSMS. Any releases at AOI 2 would have occurred on both pavement and grassy surfaces. AFFF may have infiltrated into the subsurface soil via cracks or joints in the pavement or runoff to the surrounding grassy areas.

3.3 Adjacent Sources

The Montgomery ANGB is located adjacent to the Montgomery Regional Airport and approximately 1.25 miles northwest of the facility. Aircraft support operations at Montgomery ANGB include aircraft fueling and maintenance, aircraft deicing, fire protection and support, ground vehicle fueling and maintenance, and equipment and facilities maintenance (AECOM, 2019). Previous PA documentation for the Montgomery ANGB indicates that fire training was not performed within the facility boundary. However, a fire training area (FTA) was identified approximately 0.5 miles southeast of the Montgomery ANGB facility and across the East-West Runway on Airport property. According to this PA, fire training took place circa 1989 and 1991 and was conducted jointly with airport authority. During each exercise, an unknown quantity of spent fuel was ignited and extinguished using AFFF (BB&E, Inc., 2016).

An SI was performed at the Montgomery ANGB from December 2017 to March 2018, in areas deemed as potential release locations (PRLs). A total of six PRLs were investigated during the SI. Results of the SI indicated that PFAS were present in all media sampled at each PRL. Additionally, PFAS detected in base boundary wells indicate that off-base migration of PFAS is possible (AECOM, 2019). Based on the findings of the SI report, the Montgomery ANGB is considered an off-facility source of PFAS. The location of the Montgomery ANGB and Montgomery Regional Airport are shown on **Figure 3-1** for informational purposes but will not be evaluated as part of this SI.



CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	10/24/2022	GIS BY	MS	10/24/2022
SCALE	1:37,200	CHK BY	VG	10/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/24/2022

N

Areas of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2021), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

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

4.2 Information Inputs

Primary information inputs included:

- The PA for AASF #1 (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2021);
- Analytical data collected from surface water samples added during field work in response to the evolved understanding of the conceptual site model (CSM) that suggests surface runoff may be the primary mechanism for hydrologic transport at the facility (**Section 5.9**); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). The SI scope was bounded vertically by the massive clay unit observed beneath the entire facility, and the resulting decision to not penetrate this potentially confining unit. Temporal boundaries of the study were limited by seasonal conditions present during the Winter 2022 field work.

4.4 Analytical Approach

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

4.5 Data Usability Assessment

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

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2021).

5. Site Inspection Activities

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

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, AASF #1 RW Shepherd, Montgomery, Alabama* dated September 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, AASF #1 R W Shepherd Hope Hull, Montgomery, Alabama* dated November 2021 (AECOM, 2021);
- *Final Site Safety and Health Plan, AASF #1 R W Shepherd Hope Hull, Montgomery, Alabama* dated January 2022 (AECOM, 2022).

The SI field activities were conducted from 18 to 21 January 2022 and consisted of utility clearance, direct push boring, hollow stem augering, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and grab surface water sample collection. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021), except as noted in **Section 5.9**.

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

- Twenty-seven (27) soil samples from 13 locations;
- Three grab groundwater samples from six temporary wells;
- Two surface water samples from two surface water bodies; and
- Twenty (20) quality assurance (QA)/quality control (QC) samples.

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

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

The US Army Corps of Engineers (USACE) TPP Process, Engineer Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.)

determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 22 September 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG G-9, ALARNG, and USACE. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2021).

A TPP Meeting 3 was held on 26 July 2023 to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

Both AECOM and their drilling contractor, Walker-Hill Environmental, contacted Alabama 811 one-call utility clearance contractor prior to mobilization to notify them of intrusive work. Because Alabama 811 locators do not locate private utilities, such as those belonging to AASF #1, AECOM contracted Ground Penetrating Radar Systems, LLC. (GPRS) to perform utility clearance for private utilities at all boring locations. GPRS performed the utility clearance under the oversight of the AECOM field team on 18 January 2022 using industry standard methods in addition to ground-penetrating radar. Additionally, the first 5 feet of the direct-push borings were advanced using hand augering methods to visually verify utility clearance in the shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be acceptable for decontamination of drilling equipment. Samples from two potable water sources at the facility were collected on 16 November 2021 (MGM-DECON-01 and MGM-DECON-02), prior to mobilization, and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15. An additional sample was collected on 21 January 2022 (MGM-DECON-03), during SI field activities, from the same water after it passed through the driller's decontamination water tank and hose. The results of the decontamination water samples are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2021). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via DPT, in accordance with the SI QAPP Addendum (AECOM, 2021). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. At one location (AOI02-05), 3.25-inch diameter hollow stem augers (HSAs) were used from 20 feet bgs to 59 feet bgs to drill into the swelling clays where refusal was encountered during DPT drilling. As discussed in **Section 5.9**, the clay layer was not penetrated, and subsequent borings were advanced using only the dual-tube sampling system to refusal. A

hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and depths are provided **Table 5-2**.

In general, three discrete soil samples were collected for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample from approximately 13 to 15 feet bgs, and one subsurface soil sample at a point between the surface and 15 feet bgs. However, at AOI01-01, a total of four soil samples were collected to add vertical data density at the potential release area near the mechanical room. Additionally, a total of two soil samples were collected from AOI02-05. The soil sample deviations are discussed further in **Section 5.9**.

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

The majority of the SI soil borings were completed to depths ranging between 20 to 27.5 feet bgs, with the exception of AOI02-05, which was completed to 59 feet bgs to assess the vertical extent of the clay unit. Soil borings completed during the SI generally found low to medium plasticity lean clay. Non-plastic silt with varying quantities of sand was encountered at three DPT borings within AOI 2 from the surface level to depths up to 5 feet bgs. The silt and sand encountered in the shallow subsurface is considered reworked native material or introduced fill from construction of the facility.

A high plasticity fat clay layer was observed within AOI02-02. DPT drilling and sampling refusal was observed in boring AOI02-05 at a depth of 20 feet bgs due to stiff, swelling clays encountered at 10 feet bgs and below. The clays expanded within the sampling cores to two times the length of the actual advanced interval (i.e., 5-foot core recovery over a 2.5-foot DPT run). DPT refusal was encountered at approximately 20 feet bgs. Since groundwater was not observed at 20 feet bgs, HSAs were used to advance the borehole incrementally until HSA refusal was encountered at 59 feet bgs. A continuous clay unit was observed to the terminal depth of the boring. Soil cuttings showed no signs of groundwater bearing zones, and the borehole remained dry after a day. Subsequent borings showed that the swelling clay encountered at AOI02-05 was present across the facility. Water-bearing units were generally not encountered during drilling. The clay encountered ranged in color between yellowish brown, gray, and dark greenish gray. These thick, impermeable clay layers with varying degree of silt and very fine sand were encountered to some degree in all borings during the SI and are consistent with the clay and sandy clay of the Mooresville Chalk of the Selma Group.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2021).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/MS duplicate (MSD) samples were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same

parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2021) using bentonite-cement grout at completion of sampling activities. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

During the SI, six temporary monitoring wells were installed within potential source areas. The locations of the wells are shown on **Figure 5-1**. Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system.

Once the borehole was advanced to the desired depth, wherever conditions allowed, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Sufficient time was allowed for groundwater accumulation in the temporary wells before proceeding with collection of groundwater samples. Three of the temporary wells (AOI01-01, AOI02-02, and MGM-02) did not produce groundwater over the duration of the SI, so the wells were not sampled. A sufficient supply of groundwater for grab sampling was encountered at three of the six temporary well locations (AOI02-01, AOI02-03, and AOI02-04). After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. The temporary wells were attempted to be purged at a rate to reduce turbidity and draw down prior to sampling; however, this could not be achieved due to the limited availability and very slow recharge of groundwater. Based on the groundwater depths and widespread clay layer, the groundwater encountered appeared to be consistent with very shallow perched groundwater and not representative of deeper formational groundwater.

Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2021).

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

Temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2021) by removing the PVC and backfilling the hole with bentonite-cement grout. Upon completion of well abandonment, the ground surface at each location was patched to match existing surrounding conditions. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Surface Water

In response to the evolved understanding of the CSM that suggests surface runoff may be the primary mechanism for hydrologic transport at the facility, surface water samples were collected from both AOIs. One sample was collected from Retention Area 2 located southeast of AOI 1, in the vicinity of soil boring location AOI01-04. The second sample was collected from Retention Area 1 at AOI 2, in the vicinity of soil boring location MGM-02. Surface water samples were collected as specified in Field Change Request Form FCR002, dated 21 January 2022 (**Appendix B3**). Sediment samples were not collected.

Surface water samples were collected at the top of the water column from a single point in the waterbody by using a peristaltic pump with PFAS-free HDPE tubing. Sampling was performed deliberately and methodically to minimize disturbance of bottom sediments and as quickly as possible to ensure a representative sample was collected. Additionally, a subsample of each surface water sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the surface water samples.

After collection of the surface water samples from each location, general water quality parameters (i.e., temperature, pH, conductivity, DO, and ORP) were collected with a water quality meter and recorded on the field sampling form (**Appendix B2**). The surface water sample locations are shown on **Figure 5-1** and listed in **Table 5-1**.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory for analysis by LC/MS/MS compliant with QSM 5.1 Table B-15.

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

5.5 Synoptic Water Level Measurements

Due to the very limited and shallow perched groundwater conditions noted during the SI, a synoptic groundwater gauging event was not performed. Groundwater was only noted in three of the six temporary monitoring wells installed. Depths to water measured at these three locations ranged from 0.40 to 19.44 feet bgs; however, the groundwater measured deeper in the boring, within the clay, is suspected to have filled the borehole from above. Since the perched groundwater was not representative of actual potentiometric groundwater conditions, a groundwater flow contour map was not generated. Perched groundwater level data are provided in **Table 5-2**.

5.6 Surveying

As stated in the Field Change Request Form FCR002, dated 21 January 2022 (**Appendix B3**), and in **Section 5.9**, surveying of the temporary monitoring wells not completed due to the absence of representative groundwater conditions encountered.

5.7 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in

accordance with the SI QAPP Addendum (AECOM, 2021) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during the SI activities were contained in three labeled, 55-gallon Department of Transportation (DOT)-approved steel drums and stored south of the helicopter wash pad. Based on laboratory results, containerized soil cuttings will be managed and disposed of off-facility by ARNG, under a separate contract held by EA Engineering, Science, and Technology, Inc. (EA). Specifics on the disposal of solid IDW will be addressed in an IDW Treatment Memorandum submitted by EA.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were contained in one labeled, 55-gallon DOT-approved steel drum, and stored south of the helicopter wash pad, next to the soil IDW drums. Based on laboratory results, ARNG will manage and dispose of the liquid IDW off-facility under a separate contract held by EA. Specifics on the disposal of liquid IDW will be addressed in an IDW Treatment Memorandum submitted by EA.

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

5.8 Laboratory Analytical Methods

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

5.9 Deviations from SI QAPP Addendum

Several deviations from the SI QAPP Addendum were identified during review of the field documentation. The deviations are noted below and documented in Field Change Request Forms (**Appendix B3**):

- DPT drilling and sampling refusal was observed in boring AOI02-05 at a depth of 20 feet bgs due to stiff, swelling clays encountered at 10 feet bgs and below. The clays expanded within the sampling cores to two times the length of the actual advanced interval (i.e., 5 feet core recovery over a 2.5 feet DPT run). Additionally, the expanding clays ruptured the acetate core liner in several instances, jamming the liner within the core barrel. DPT refusal was encountered at approximately 20 feet bgs.

  Groundwater was not observed prior to refusal; therefore, a decision was made to continue the borehole using the rig's HSA capabilities; however, because discrete soil sampling is not possible without the use of the DPT tooling, soil samples for laboratory analysis could not be collected when using HSA. DPT sampling refusal at AOI02-05 was encountered below the maximum depth at which a screening level is established, 15 feet bgs for the industrial/commercial worker. Therefore, the surface soil sample and subsurface soil sample from the 13-15 feet bgs interval were successfully collected. The deep subsurface soil sample was not collected at AOI02-05 because groundwater was not encountered before refusal was met at 59 feet bgs. However, the results for the two sampled intervals (0-2 feet bgs and 13-15 feet bgs) are considered adequate in order to meet the data quality objectives for the SI. The Field Change Request Form noted similar changes may be necessary at subsequent boring locations if these conditions persisted.

- At AOI02-05, soil cuttings showed no signs of groundwater bearing zones, and the borehole remained dry after a day; therefore, a groundwater sample could not be collected. Subsequent borings showed that the swelling clay encountered at AOI02-05 was present across the facility. At several locations, very shallow perched groundwater was available in enough volume that a grab sample was collected. The ability to collect these grab groundwater samples appeared to be dependent on the transmissivity of the first several feet of the subsurface. Groundwater samples were able to be collected at just three of the six planned locations: AOI02-01, AOI02-03, and AOI02-04. All DPT borings were advanced to refusal or at least 5 to 10 feet into the swelling clays to confirm the clay was present facility-wide.

  Additional deep boreholes were not attempted after AOI02-05 because of the homogeneity of the clay, concern of perforating the thick confining unit, and indications that groundwater was available only within the shallow subsurface. Infiltration appears to be limited, and transportation is likely controlled by topography, either by runoff or in the narrow transmissive zone. As a result of these findings and to account for possible data gaps, the following measures were taken after discussion with ARNG.

  1) An additional DPT boring was completed at location MGM-02; this was considered the location most likely to provide an additional groundwater sample. Groundwater was not encountered, but two additional subsurface soil samples were collected.

  2) An additional subsurface soil sample was collected at DPT boring AOI01-01 to add vertical data density at the potential release area.

  3) Two additional surface soil samples were collected at AOI 1 to add data density at the potential release area.

  4) Two surface water samples were collected to characterize runoff west and east of the AOIs.

  5) Temporary wells were not surveyed. Near-surface, perched groundwater elevations were not considered adequate to generate a representative flow direction that would satisfy the data quality objectives.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, AASF #1 RW Shepherd, Montgomery, Alabama

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-00-02	1/20/2022 12:20	00-02	x	x	x		
AOI01-01-SB-00-02-MS	1/20/2022 12:20	00-02	x				MS/MSD
AOI01-01-SB-00-02-MSD	1/20/2022 12:20	00-02	x				MS/MSD
AOI01-01-SB-05-07	1/21/2022 9:10	05-07	x				
AOI01-01-SB-10-12	1/21/2022 9:20	10-12	x				
AOI01-01-SB-13-15	1/21/2022 9:30	13-15	x				
AOI01-01-SB-18-20	1/21/2022 9:40	18-20				x	
AOI01-02-SB-00-02	1/18/2022 15:50	00-02	x				
AOI01-02-SB-00-02-D	1/18/2022 15:50	00-02	x				Duplicate
AOI01-03-SB-00-01	1/21/2022 9:05	00-01	x				
AOI01-04-SB-00-01	1/21/2022 9:10	00-01	x				
AOI02-01-SB-00-02	1/19/2022 16:20	00-02	x				
AOI02-01-SB-00-02-D	1/19/2022 16:20	00-02	x				Duplicate
AOI02-01-SB-08-10	1/20/2022 15:00	08-10	x				
AOI02-01-SB-13-15	1/20/2022 15:15	13-15	x				
AOI02-02-SB-00-02	1/19/2022 15:48	00-02	x				
AOI02-02-SB-10-12	1/20/2022 16:20	10-12	x				
AOI02-02-SB-13-15	1/20/2022 16:30	13-15	x				
AOI02-03-SB-00-02	1/19/2022 13:45	00-02	x	x	x		
AOI02-03-SB-00-02-D	1/19/2022 13:45	00-02	x	x	x		Duplicate
AOI02-03-SB-00-02-MS	1/19/2022 13:45	00-02		x	x		MS/MSD
AOI02-03-SB-00-02-MSD	1/19/2022 13:45	00-02		x	x		MS/MSD
AOI02-03-SB-08-10	1/19/2022 14:45	08-10	x				
AOI02-03-SB-13-15	1/19/2022 14:50	13-15	x				
AOI02-04-SB-00-02	1/19/2022 15:00	00-02	x				
AOI02-04-SB-08-10	1/19/2022 16:30	08-10	x				
AOI02-04-SB-13-15	1/19/2022 17:00	13-15	x				
AOI02-05-SB-00-02	1/18/2022 13:50	00-02	x				
AOI02-05-SB-13-15	1/18/2022 14:32	13-15	x			x	
AOI02-06-SB-00-01	1/19/2022 9:50	00-01	x				
AOI02-06-SB-00-01-MS	1/19/2022 9:50	00-01	x				MS/MSD
AOI02-06-SB-00-01-MSD	1/19/2022 9:50	00-01	x				MS/MSD
AOI02-07-SB-00-02	1/19/2022 8:50	00-02	x				
MGM-01-SB-00-02	1/19/2022 11:15	00-02	x				
MGM-02-SB-00-02	1/19/2022 10:30	00-02	x				
MGM-02-SB-10-12	1/21/2022 12:49	10-12	x				
MGM-02-SB-13-15	1/21/2022 12:50	13-15	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, AASF #1 RW Shepherd, Montgomery, Alabama

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Groundwater Samples							
AOI02-01-GW	1/21/2022 11:52	NA	x				
AOI02-03-GW	1/20/2022 10:52	NA	x				
AOI02-03-GW-D	1/20/2022 10:52	NA	x				Duplicate
AOI02-03-GW-MS	1/20/2022 10:52	NA	x				MS/MSD
AOI02-03-GW-MSD	1/20/2022 10:52	NA	x				MS/MSD
AOI02-04-GW	1/21/2022 12:30	NA	x				
Surface Water Samples							
MGM-03-SW	1/21/2022 15:03	NA	x				
MGM-04-SW	1/21/2022 15:05	NA	x				
MGM-04-SW-D	1/21/2022 15:05	NA	x				Duplicate
MGM-04-SW-MS	1/21/2022 15:05	NA	x				MS/MSD
MGM-04-SW-MSD	1/21/2022 15:05	NA	x				MS/MSD
Quality Control Samples							
MGM-FRB-01	1/20/2022 10:00	NA	x				FRB
MGM-ERB-01	1/19/2022 9:15	NA	x				ERB
MGM-ERB-02	1/20/2022 9:20	NA	x				ERB
MGM-ERB-03	1/20/2022 9:30	NA	x				ERB
MGM-DECON-01	11/16/2021 14:55	NA	x				DECON
MGM-DECON-02	11/16/2021 14:45	NA	x				DECON
MGM-DECON-03	1/21/2022 11:00	NA	x				DECON

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

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Levels
Site Inspection Report, AASF #1 RW Shepherd, Montgomery, Alabama

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Depth to Water (feet btoc)	Depth to Water (feet bgs)
2	AOI02-01	20	15-20	11.25	10.85
	AOI02-03	27.5	22-27	1.00	0.40
	AOI02-04	25	20-25	19.94	19.44

Notes:

bgs = below ground surface

btoc = below top of casing

Groundwater levels appeared indicative of perched groundwater and were not considered adequate to generate a representative flow direction that would satisfy the data quality objectives. Therefore, the temporary well locations were not surveyed. Depth to Water (bgs) is calculated from field-measured well casing stick up height

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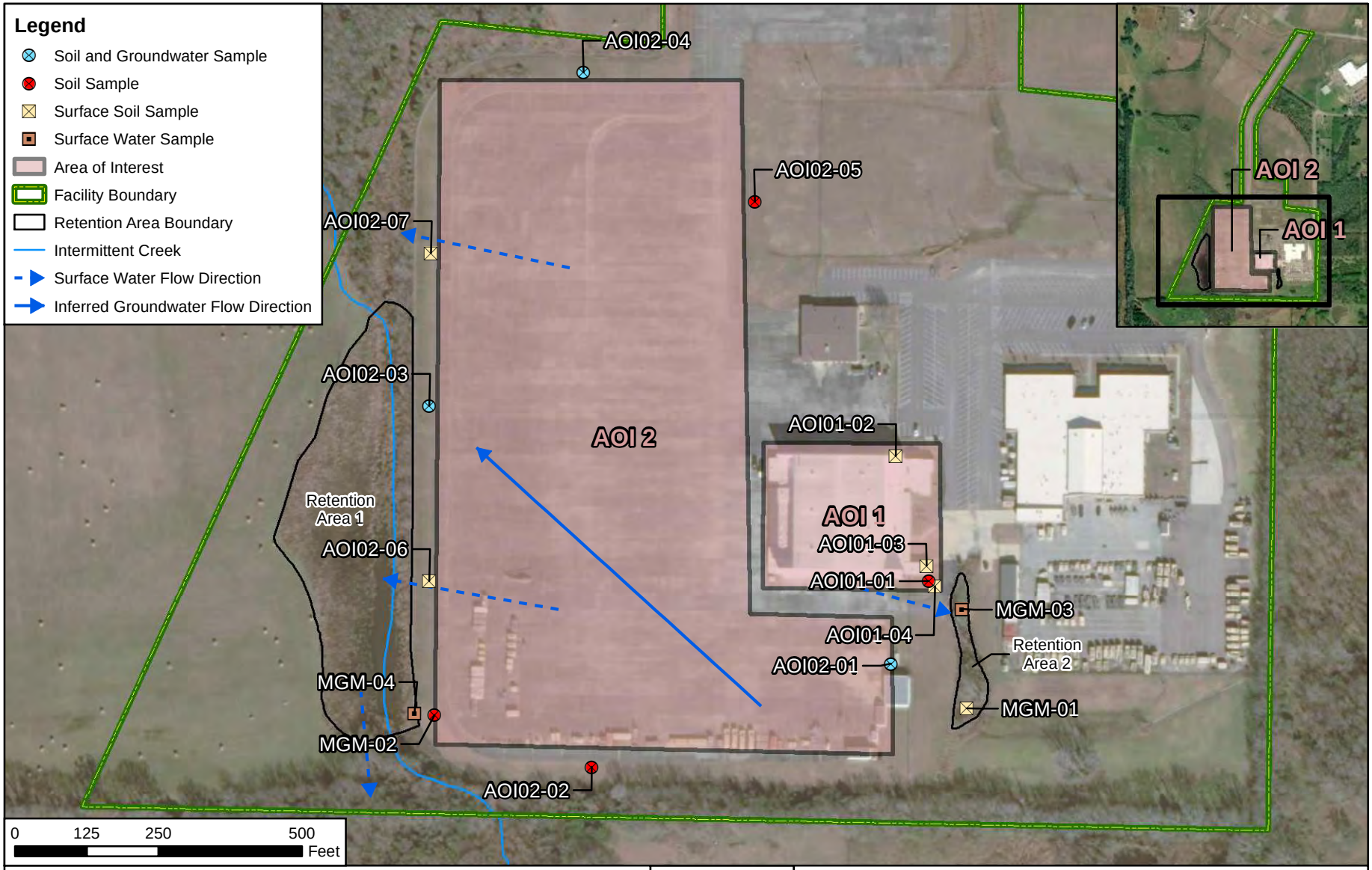

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	10/24/2022	GIS BY	MS	10/24/2022
SCALE	1:3,000	CHK BY	MC	10/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/24/2022

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.4**. **Table 6-2** through **Table 6-5** present results in soil, groundwater, and surface water for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

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

6.3 AOI 1

This section presents the analytical results for soil and surface water for AOI 1: Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room. Groundwater was not encountered within AOI 1 during the SI. The soil and surface water results are summarized on **Table 6-2**, **Table 6-3**, and **Table 6-5**. Soil and surface water results are presented on **Figure 6-1** through **Figure 6-5** and **Figure 6-8** through **Figure 6-9.** SLs are available for soil but not for surface water.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled from the surface soil interval (0 to 2 feet bgs) from boring locations AOI01-01 through AOI01-04 and MGM-01. Soil was also sampled from the shallow subsurface (between 5 to 15 feet bgs) from three intervals at boring location AOI01-01. Deep subsurface soil samples were not collected. AOI01-01, AOI01-03, AOI01-04, and MGM-01 were located to the east and southeast of the Mechanical Room, and AOI01-02 was located to the north of the Hangar. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

At AOI 1, PFOA, PFOS, and PFHxS exceeded the SLs in surface soil, and PFOS exceeded the SL in shallow subsurface soil. PFOA and PFHxS did not exceed the shallow subsurface soil SLs. PFBS and PFNA were below the SLs in both surface and shallow subsurface soil.

In surface soil, PFOA, PFOS, PFBS, and PFHxS were detected at all five locations. PFNA was detected at two locations. A summary of detections for each compound is provided below:

- PFOA concentrations ranged from 0.299 J micrograms per kilogram (µg/kg) to 165 µg/kg. PFOA exceeded the 19 µg/kg SL at two locations: AOI01-01 and AOI01-04.
- PFOS concentrations ranged from 3.68 µg/kg to 10,900 J µg/kg. PFOS exceeded the 13 µg/kg SL at four locations: AOI01-01, AOI01-03, AOI01-04, and MGM-01.
- The maximum PFBS concentration was 795 µg/kg, below the 1,900 µg/kg SL.
- PFHxS concentrations ranged from 6.24 µg/kg to 3,840 µg/kg. PFHxS exceeded the 130 µg/kg SL at two locations: AOI01-01 and AOI01-04.
- The maximum PFNA concentration was 0.051 J µg/kg, below the 19 µg/kg SL.

Shallow subsurface soil was only sampled at AOI01-01. PFOS was the only compound that exceeded the SL in shallow subsurface soil. A summary of detections is provided here:

- The maximum PFOA concentration was 11.6 µg/kg, below the 250 µg/kg SL.
- PFOS concentrations ranged from 0.263 J µg/kg to 499 µg/kg. PFOS exceeded the 160 µg/kg SL at the 5 to 7 feet bgs depth interval.
- The maximum PFBS concentration was 29.3 µg/kg, below the 25,000 µg/kg SL.
- The maximum PFHxS concentration was 232 µg/kg, below the 1,600 µg/kg SL.
- The maximum PFNA concentration was 0.025 µg/kg, below the 250 µg/kg SL.

6.3.2 AOI 1 Surface Water Analytical Results

One surface water sample (MGM-03) was collected at AOI 1. The sample was obtained from Retention Area 2, located south and hydraulically downgradient of the Mechanical Room. **Figure 6-8** and **Figure 6-9** present the ranges of detections in surface water. **Table 6-5** summarizes the surface water results.

PFOA, PFOS, PFBS, and PFHxS were detected at MGM-03. PFNA was not detected. PFOA was detected at a concentration of 1,500 nanograms per liter (ng/L). PFOS was detected at a concentration of 27,500 ng/L. PFBS was detected at a concentration of 6,410 ng/L. PFHxS was detected at a concentration of 34,500 ng/L.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFHxS were detected in soil at AOI 1 above their SLs. PFBS and PFNA were detected in soil below their SLs. PFOA, PFOS, PFBS, and PFHxS were detected in surface water. PFNA was not detected in surface water. There are no established SLs for surface water; therefore, these results are presented for informational purposes only. No groundwater samples were collected from AOI 1 during the SI. Based on the exceedances of the SLs in soil, further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil, groundwater, and surface water for AOI 2: Flight Ramp and Wash Rack. The results in soil, groundwater, and surface water are summarized on **Table 6-2** through **Table 6-5**. Soil, groundwater, and surface water results are presented on **Figure 6-1** through **Figure 6-9**. SLs are available for soil but not for surface water.

6.4.1 AOI 2 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI02-01 through AOI02-07 and MGM-02. Soil was also sampled from the shallow subsurface (between 8 and 15 feet bgs) at multiple intervals at AOI02-01 through AOI01-05, as well as MGM-02. Deep subsurface soil samples were not collected. AOI02-01 was located to the east of the Wash Rack, and AOI02-02 through AOI02-07 and MGM-02 encircled the Flight Ramp. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** and **Table 6-3** summarize the soil results.

At AOI 2, PFOS exceeded the SL in surface soil. PFOS was below the SL in shallow subsurface soil. PFOA, PFBS, PFHxS, and PFNA were below their SLs in both surface and shallow subsurface soil.

A summary of detections for each compound in surface soil is provided here:

- PFOA was detected at four locations and at a maximum concentration of 0.415 J µg/kg, below the 19 µg/kg SL.
- PFOS was detected at all locations. Concentrations ranged from 0.073 J µg/kg to 16.8 J µg/kg. PFOS exceeded the 13 µg/kg SL at one location, AOI02-01.
- PFBS was detected at seven locations and at a maximum concentration of 0.289 J µg/kg, below the 1,900 µg/kg SL.
- PFHxS was detected at seven locations and at a maximum concentration of 2.96 µg/kg, below the 130 µg/kg SL.
- PFNA was detected at three locations and at a maximum concentration of 0.214 J µg/kg, below the 19 µg/kg SL.

PFOA, PFOS, PFBS, PFHxS, and PFNA concentrations were detected below the SLs in shallow subsurface soil. A summary of the detections for each compound is provided here:

- PFOA and PFNA were not detected in any shallow subsurface soil sample.
- PFOS was detected in three samples and at a maximum concentration of 0.487 J µg/kg, below the 160 µg/kg SL.
- PFBS was detected in one sample at a concentration of 0.037 J µg/kg, below the 25,000 µg/kg SL.
- PFHxS was detected in two samples and at a maximum concentration of 0.097 J µg/kg, below the 1,600 µg/kg SL.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from AOI02-01, AOI02-03, and AOI02-04. AOI02-01 was located to the east of the Wash Rack, and AOI02-03 and AOI02-04 were located to the west and north of the Flight Ramp, respectively. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-4** summarizes the groundwater results.

PFOA, PFOS, PFHxS, and PFNA were detected in groundwater at concentrations above their SLs. PFBS was detected in groundwater at concentrations below the SL.

PFOA, PFOS, PFBS, and PFHxS were detected in all three wells. A summary of detections in groundwater is provided here:

- PFOA concentrations ranged from 3.85 J ng/L to 55.9 ng/L. PFOA exceeded the 6 ng/L SL at two locations, AOI02-01 and AOI02-03.
- PFOS concentrations ranged from 8.97 ng/L to 499 ng/L. PFOS exceeded the 4 ng/L SL at all three locations: AOI02-01, AOI02-03, and AOI02-04.
- The maximum PFBS concentration was 111 ng/L, below the 601 ng/L SL.
- PFHxS concentrations ranged from 17.0 ng/L to 974 ng/L. PFHxS exceeded the 39 ng/L SL at two locations, AOI02-01 and AOI02-03.
- PFNA was detected only at AOI02-01, above the 6 ng/L SL, at a concentration of 13.3 ng/L.

6.4.3 AOI 2 Surface Water Analytical Results

One surface water sample (MGM-04) was collected at AOI 2. The sample was obtained from Retention Area 2, located southwest and hydraulically downgradient of the Flight Ramp. PFOA, PFBS, and PFNA were not detected at MGM-04. PFOS was detected at a concentration of 3.89 J ng/L. PFHxS was detected at a concentration of 1.63 ng/L. **Figure 6-8** and **Figure 6-9** present the ranges of detections in surface water. **Table 6-5** summarizes the surface water results.

6.4.4 AOI 2 Conclusions

Based on the results of the SI, PFOS was detected in soil at concentrations above the SL. PFOA, PFBS, PFHxS, and PFNA were detected in soil at concentrations below their SLs. PFOA, PFOS, PFHxS, and PFNA were detected in groundwater at concentrations above their SLs. PFBS was detected in groundwater at concentrations below the SL. PFOS and PFHxS were also detected in surface water. There are no established SLs for surface water; therefore, these results are presented for informational purposes only. Based on the exceedances of the SLs in soil and groundwater, further evaluation at AOI 2 is warranted.

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Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest		AOI01												AOI02							
Sample ID		AOI01-01-SB-00-02		AOI01-02-SB-00-02		AOI01-02-SB-00-02-D		AOI01-03-SB-00-01		AOI01-04-SB-00-01		MGM-01-SB-00-02		AOI02-01-SB-00-02		AOI02-01-SB-00-02-D		AOI02-02-SB-00-02		AOI02-03-SB-00-02	
Sample Date		01/20/2022		01/18/2022		01/18/2022		01/21/2022		01/21/2022		01/19/2022		01/19/2022		01/19/2022		01/19/2022		01/19/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		0-1 ft		0-1 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft		0-2 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	216		0.280	J	0.293	J	5.81		795		4.39		0.053	J	0.085	J	ND	U	0.180	J
PFHxS	130	1890		6.24		7.11		123		3840		31.7		1.83		2.68		0.078	J	1.82	
PFNA	19	ND	U	0.035	J	0.051	J	ND	U	ND	U	0.026	J	0.159	J	0.214	J	0.031	J	ND	U
PFOA	19	148		0.299	J	0.387	J	3.89	J	165		1.26	J	0.213	J	0.415	J	ND	U	0.137	J
PFOS	13	10900	J	3.68		4.82		486		8330		358		11.4	J	16.8	J	0.601	J	0.558	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest		AOI02											
Sample ID		AOI02-03-SB-00-02-D		AOI02-04-SB-00-02		AOI02-05-SB-00-02		AOI02-06-SB-00-01		AOI02-07-SB-00-02		MGM-02-SB-00-02	
Sample Date		01/19/2022		01/19/2022		01/18/2022		01/19/2022		01/19/2022		01/19/2022	
Depth		0-2 ft		0-2 ft		0-2 ft		0-1 ft		0-2 ft		0-2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)													
PFBS	1900	0.289	J	ND	U	0.028	J	0.048	J	0.044	J	0.110	J
PFHxS	130	2.96		ND	U	0.061	J	0.066	J	0.230	J	0.813	J
PFNA	19	ND	U	ND	U	ND	U	ND	U	ND	U	0.090	J
PFOA	19	0.181	J	ND	U	ND	U	ND	U	ND	U	0.359	J
PFOS	13	1.11		0.080	J	0.073	J	0.785	J	0.595	J	5.66	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest		AOI01						AOI02													
Sample ID		AOI01-01-SB-05-07		AOI01-01-SB-10-12		AOI01-01-SB-13-15		AOI02-01-SB-08-10		AOI02-01-SB-13-15		AOI02-02-10-12		AOI02-02-13-15		AOI02-03-SB-08-10		AOI02-03-SB-13-15		AOI02-04-SB-08-10	
Sample Date		01/21/2022		01/21/2022		01/21/2022		01/20/2022		01/20/2022		01/20/2022		01/20/2022		01/19/2022		01/19/2022		01/19/2022	
Depth		5-7 ft		10-12 ft		13-15 ft		8-10 ft		13-15 ft		10-12 ft		13-15 ft		8-10 ft		13-15 ft		8-10 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	25000	29.3		0.287	J	ND	U	0.031	J	0.037	J	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	232		2.48		0.063	J	ND	U	0.097	J	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	250	0.025	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	11.6		0.125	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	499		4.34		0.263	J	0.115	J	0.115	J	ND	U	0.152	J	0.076	J	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest		AOI02							
Sample ID		AOI02-04-SB-13-15		AOI02-05-SB-13-15		MGM-02-SB-10-12		MGM-02-SB-13-15	
Sample Date		01/19/2022		01/18/2022		01/21/2022		01/21/2022	
Depth		13-15 ft		13-15 ft		10-12 ft		13-15 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)									
PFBS	25000	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	0.091	J	0.088	J
PFNA	250	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	0.419	J	0.487	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest		AOI02							
Sample ID		AOI02-01-GW		AOI02-03-GW		AOI02-03-GW-D		AOI02-04-GW	
Sample Date		01/21/2022		01/20/2022		01/20/2022		01/21/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)									
PFBS	601	111		72.3	J-	74.4	J-	5.07	
PFHxS	39	974		177	J-	166	J-	17.0	
PFNA	6	13.3		ND	U	ND	U	ND	U
PFOA	6	55.9		19.4		18.0		3.85	J
PFOS	4	499		8.97		7.47		129	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

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

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Water
Site Inspection Report, AASF #1 R W Shepherd Hope Hull

Area of Interest	AOI01		AOI02			
Sample ID	MGM-03-SW		MGM-04-SW		MGM-04-SW-D	
Sample Date	01/21/2022		01/21/2022		01/21/2022	
Analyte	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)						
PFBS	6410		ND	U	ND	U
PFHxS	34500		1.63	J	ND	UJ
PFNA	ND	U	ND	U	ND	U
PFOA	1500		ND	U	ND	U
PFOS	27500		3.89	J	2.35	J

J = Estimated concentration

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

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

Notes

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

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
MGM	Montgomery
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
ng/l	nanogram per liter
SW	surface water

Facility Boundary
Intermittent Creek
Inferred Groundwater Flow Direction

PFOA Results (µg/Kg)

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

N

0 165 330 660 Feet

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

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,960	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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Figure 6-1

Facility Boundary
Intermittent Creek
Inferred Groundwater Flow Direction

PFOS Results (µg/Kg)

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

N

0 165 330 660 Feet

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

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,960	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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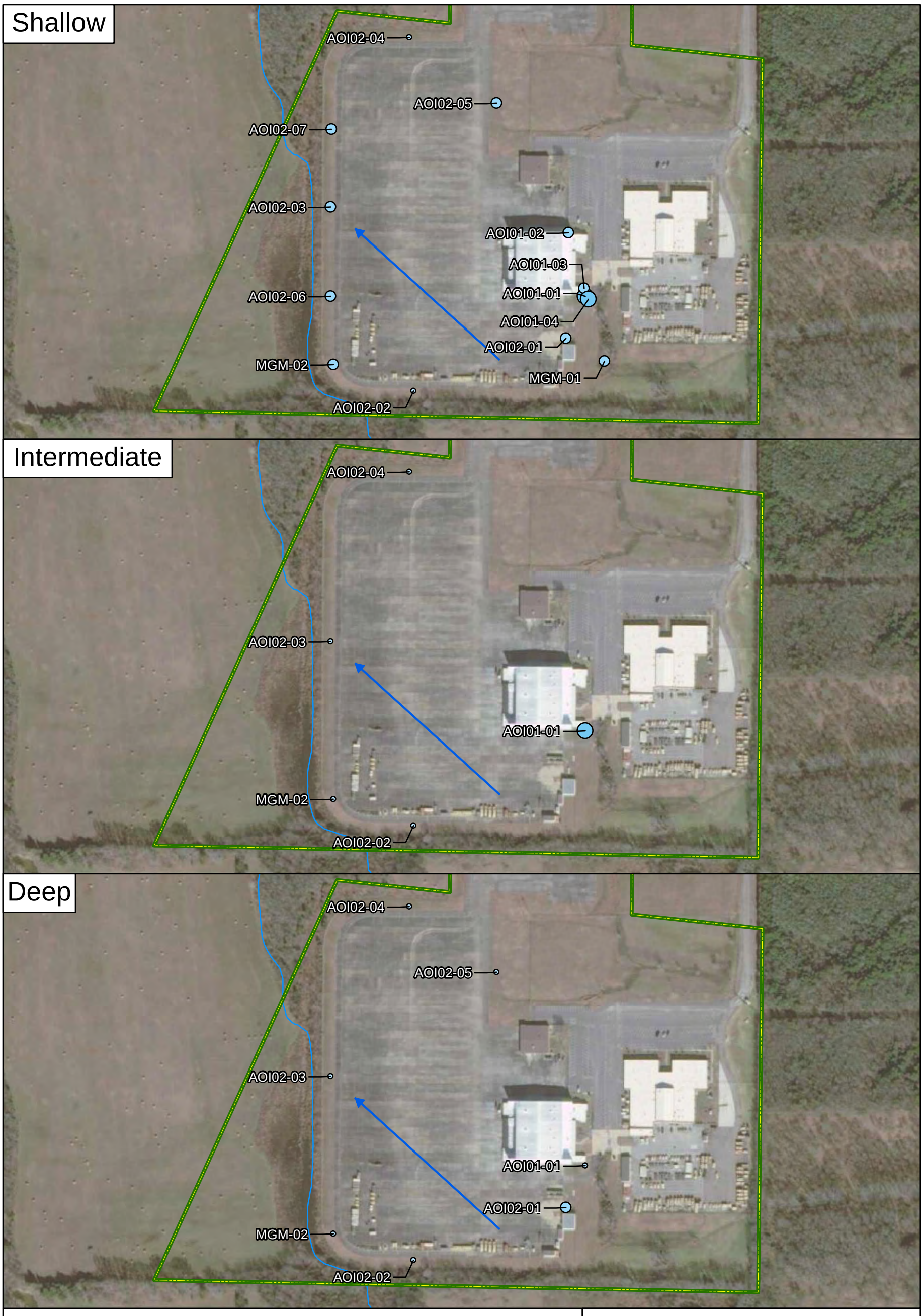
Germantown, MD 20876

Figure 6-2



Facility Boundary
Intermittent Creek
Inferred Groundwater Flow Direction

PFBS Results (µg/Kg)

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

N

0 165 330 660 Feet

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

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,960	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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Figure 6-3

Shallow

AOI02-04
AOI02-05
AOI02-07
AOI02-03
AOI01-02
AOI01-03
AOI01-01
AOI02-06
AOI01-04
AOI02-01
MGM-02
MGM-01
AOI02-02

Intermediate

AOI02-04
AOI02-03
AOI01-01
MGM-02
AOI02-02

Deep

AOI02-04
AOI02-05
AOI02-03
AOI01-01
AOI02-01
MGM-02
AOI02-02

Facility Boundary
Intermittent Creek
Inferred Groundwater Flow Direction

PFHxS Results (µg/Kg)

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

N

0 165 330 660 Feet

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

PFHxS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,960	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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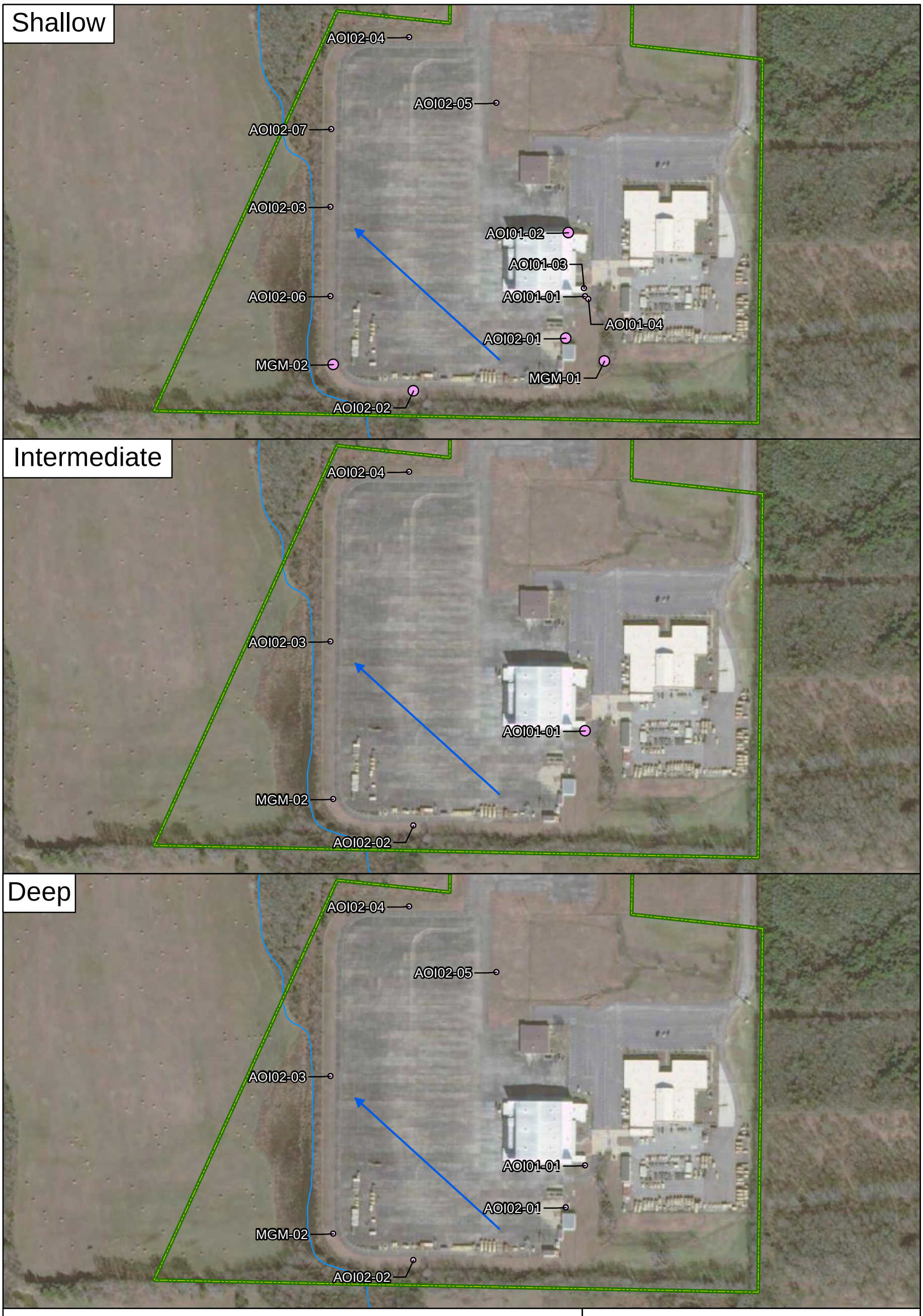
Figure 6-4



Facility Boundary
Intermittent Creek
Inferred Groundwater Flow Direction

PFNA Results (µg/Kg)

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

N

0 165 330 660 Feet

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

PFNA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,960	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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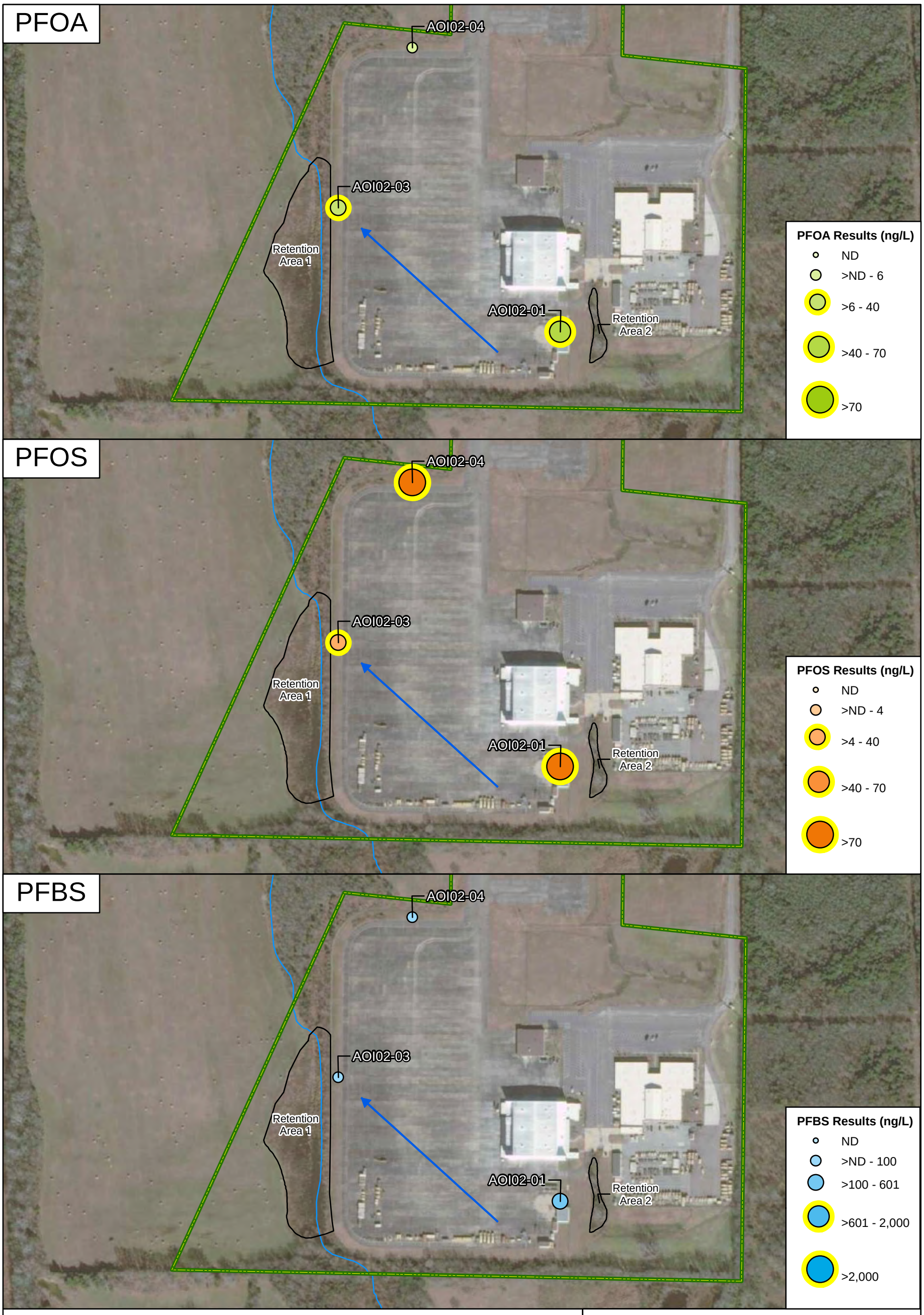
Figure 6-5



Legend

- Facility Boundary
- Retention Area Boundary
- Intermittent Creek
- Inferred Groundwater Flow Direction

N

0 175 350 700 Feet

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

PFOA, PFOS, and PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	10/5/2022	GIS BY	MS	10/5/2022
SCALE	1:4,200	CHK BY	VG	10/5/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/5/2022

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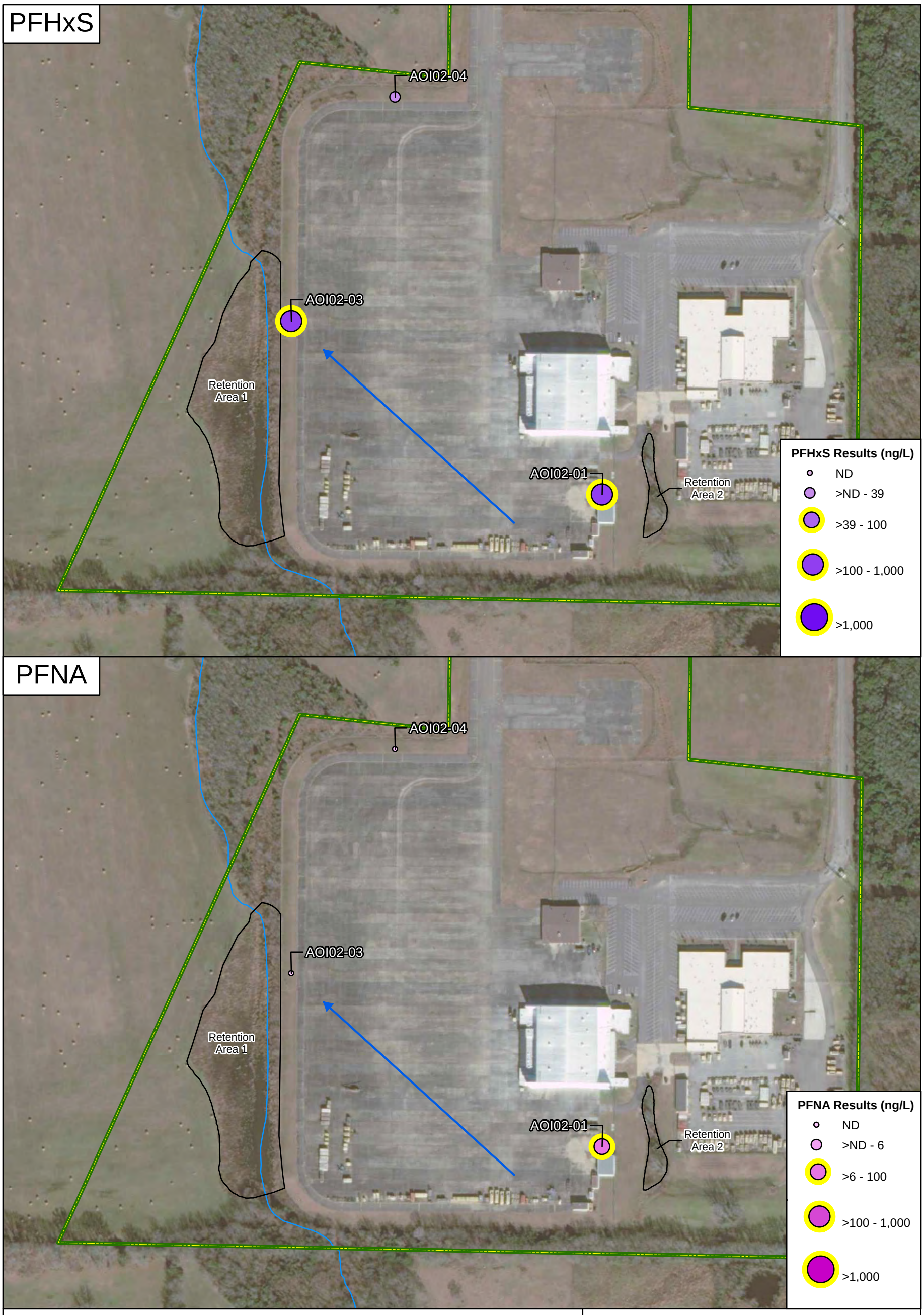
Figure 6-6



Legend

- Facility Boundary
- Retention Area Boundary
- Intermittent Creek
- Inferred Groundwater Flow Direction

N

0 125 250 500 Feet

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

PFHxS and PFNA Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	8/11/2022	GIS BY	MS	8/11/2022
SCALE	1:3,000	CHK BY	VG	8/11/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	8/11/2022

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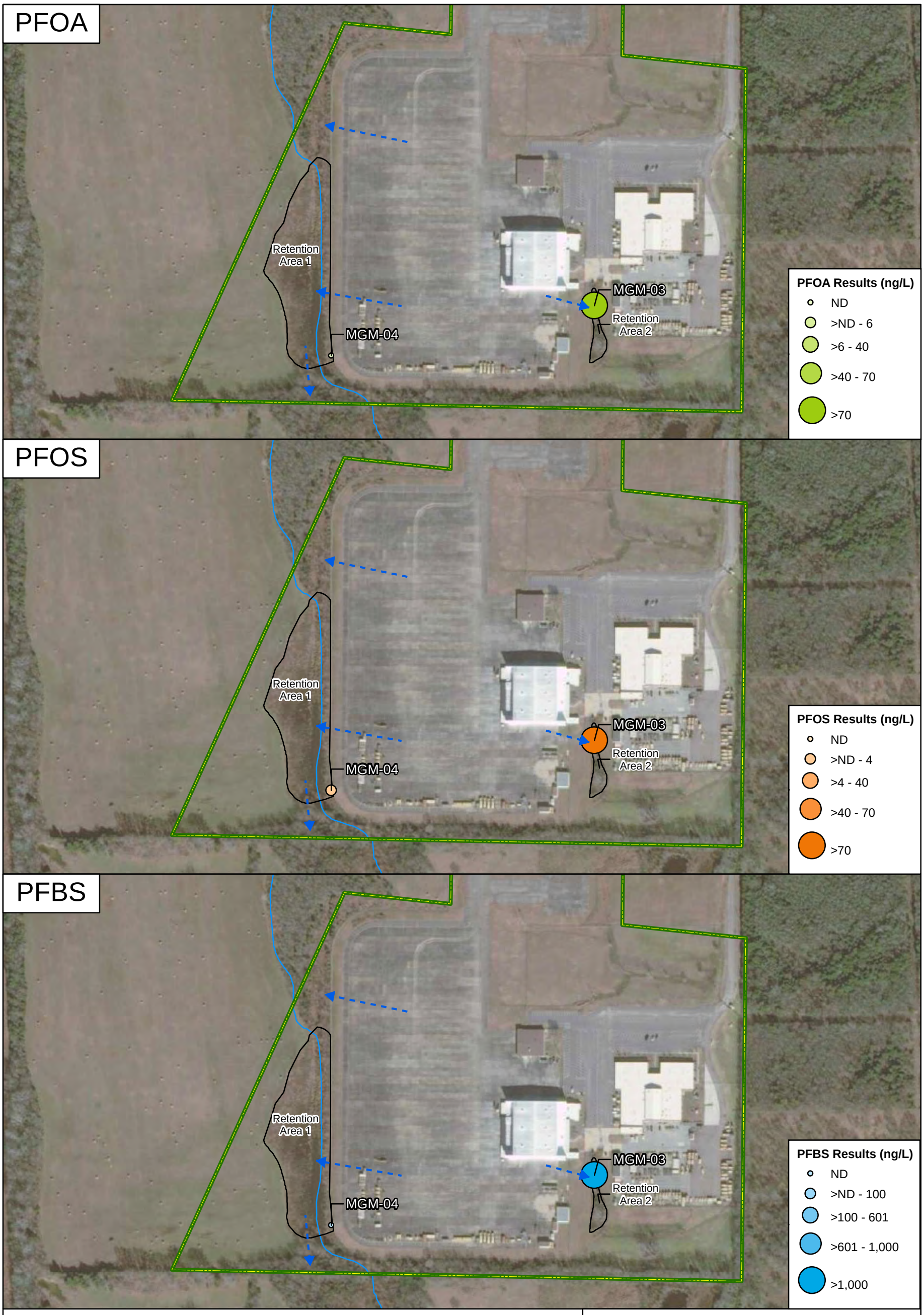
Figure 6-7



Legend

- Facility Boundary
- Retention Area Boundary
- Intermittent Creek
- Surface Water Flow Direction

N

0 175 350 700 Feet

PFOA, PFOS, and PFBS Detections in Surface Water

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	10/24/2022	GIS BY	MS	10/24/2022
SCALE	1:4,200	CHK BY	VG	10/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/24/2022

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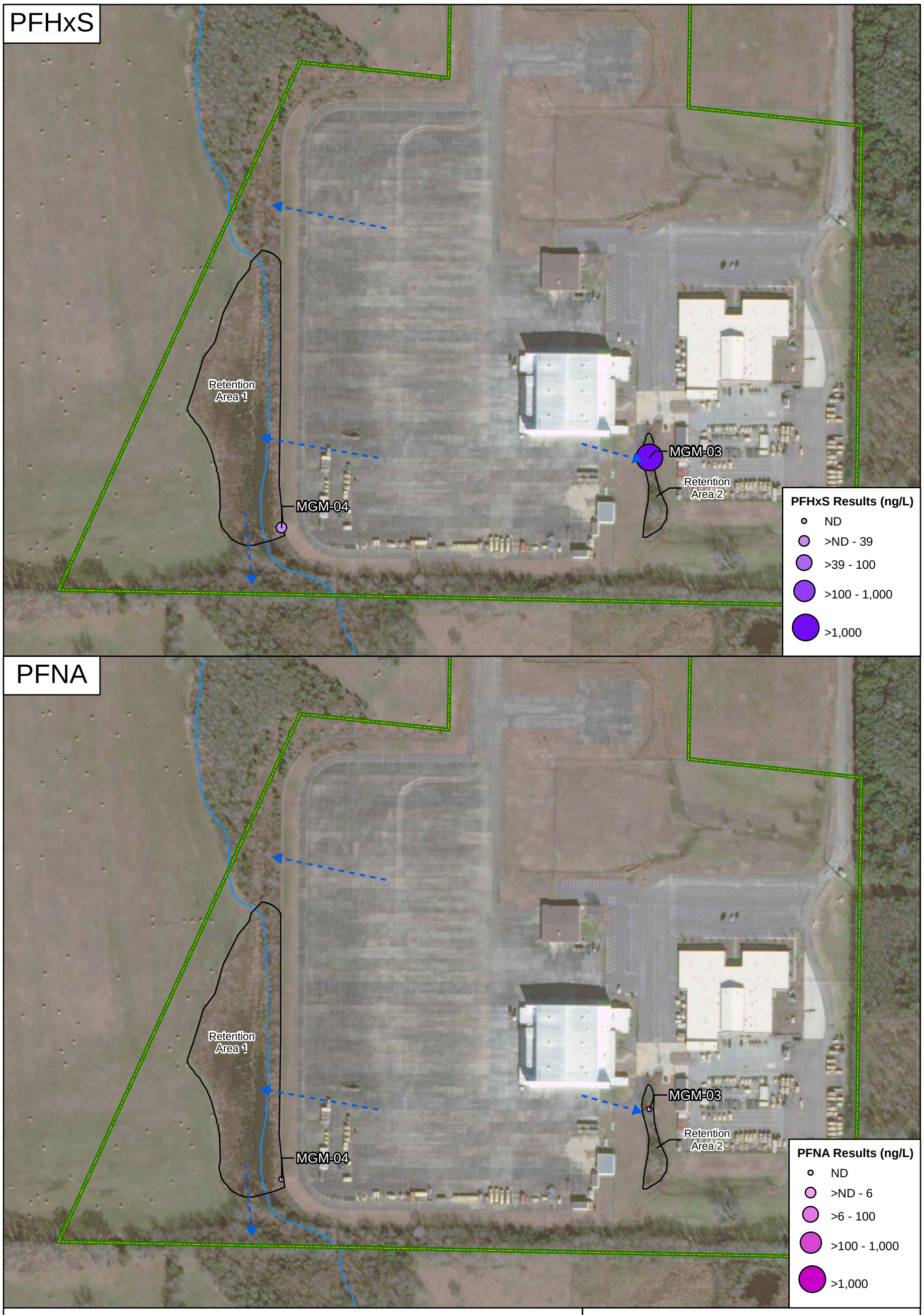
Figure 6-8



Legend

- Facility Boundary
- Retention Area Boundary
- Intermittent Creek
- Surface Water Flow Direction

N

0 125 250 500 Feet

PFHxS and PFNA Detections in Surface Water

CLIENT	ARNG			
PROJECT	Site Inspection at AASF #1 R W Shepherd Hope Hull, AL			
REVISED	10/24/2022	GIS BY	MS	10/24/2022
SCALE	1:3,000	CHK BY	VG	10/24/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	10/24/2022

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Figure 6-9

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-2**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

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

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

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1

AOI 1 consists of three potential release areas. The AASF #1 hangar contains an overhead fire suppression system supplied by two 800-gallon AFFF concentration tanks located in the mechanical room, as well as smaller stationary AFFF floor tanks on the hangar floor. Between 2006 to 2009, an unknown quantity of AFFF was reportedly released to the unpaved, grassy area south of the mechanical room. A 5-gallon jug of 3% AFFF concentrate was observed in the

hazardous waste storage room during the PA site visit. Floor and trench drains inside the hangar and mechanical room convey to the OWS and then the sanitary sewer. Grassy areas are present adjacent to the hangar doors and mechanical room.

At AOI 1, PFOA, PFOS, and PFHxS were detected in surface soil above their SLs. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust; therefore, the surface soil exposure pathways for those receptors are considered potentially complete. PFOS was detected in subsurface soil and exceeded the SL. Future construction workers could contact constituents in subsurface soil via incidental ingestion; therefore, the subsurface soil exposure pathway for this receptor is considered potentially complete. The facility is gated and over 500 feet from the nearest residential structures; therefore, the surface soil pathways for the residential and trespasser/recreational user receptors are considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 consists of two potential release areas. Mobile AFFF Tri-Max™ 30 extinguisher units were staged along the flight ramp from 2001 to 2017 and may have been emptied before being removed from the facility. The Tri-Max™ 30 units may have also been used at the wash rack, located south of the hangar building. Grassy areas are present adjacent to the flight ramp and wash rack.

At AOI 2, PFOS was detected in surface soil in the vicinity of the Wash Rack at concentrations above the residential SL. PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in subsurface soil below their industrial/commercial composite worker SLs. Site workers and construction workers could contact constituents in surface soil via incidental ingestion and inhalation of dust; therefore, the surface soil exposure pathways for those receptors are considered potentially complete. Active construction was observed at the Flight Ramp during the SI. Current and future construction workers could contact constituents in subsurface soil via incidental ingestion; therefore, the shallow subsurface soil exposure pathway for this receptor is considered potentially complete. The facility is gated and over 500 feet from the nearest residential structures; therefore, the surface soil exposure pathways for the residential and trespasser/recreational user receptors are considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

Groundwater was not encountered at AOI 1 during the SI; therefore, groundwater samples were not collected, and an evaluation based on AOI-specific data cannot be made in this report. However, based on proximity, the groundwater exposure pathway at AOI 1 can be reasonably assumed to be similar to that at AOI 2 discussed below. The human receptors for shallow groundwater are shown as incomplete on **Figure 7-1** at this time.

7.2.2 AOI 2

At AOI 2, PFOA, PFOS, PFHxS, and PFNA were detected in groundwater at concentrations above their SLs. Depths to water measured during the SI at the three well locations ranged from 0.40 to 19.44 feet bgs. Based on the groundwater depths and widespread clay layer observed during the SI, the groundwater encountered appeared to be consistent with very shallow perched groundwater.

Both site workers and construction workers could come in contact with constituents in the shallow perched groundwater via incidental ingestion; therefore, the groundwater exposure pathway for this receptor is considered potentially complete. No known public supply wells or private drinking water wells exist at the facility or the surrounding area within a 1-mile radius. It is possible that unregistered, private, domestic wells exist downgradient of AOI 2, which may result in potential exposure via ingestion of groundwater. Due to the absence of known private wells and public water system wells within a 1-mile radius of the facility, the pathway for exposure to off-facility residents and recreational users via ingestion of groundwater is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3 Surface Water and Sediment Exposure Pathway

The SI results in surface water were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria. Sediment samples were not collected; therefore, data from the SI results in soil, groundwater, and surface water, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors. These compounds are water soluble and can migrate readily from soil to surface water via leaching and run-off. Additionally, based on the very shallow, perched groundwater conditions and swelling clay observed during the SI, surface water runoff appears to be the primary mechanism of hydrologic transport at the facility.

7.3.1 AOI 1

PFOA, PFOS, PFBS, and PFHxS were detected in a surface water sample obtained from Retention Area 2, located downslope of AOI 1. Additionally, PFOA, PFOS, and PFHxS were detected in surface soil at AOI 1. Therefore, based on the known compounds within the surface water and soluble properties of these compounds, the surface water and sediment ingestion exposure pathway for site workers and future construction workers is considered potentially complete.

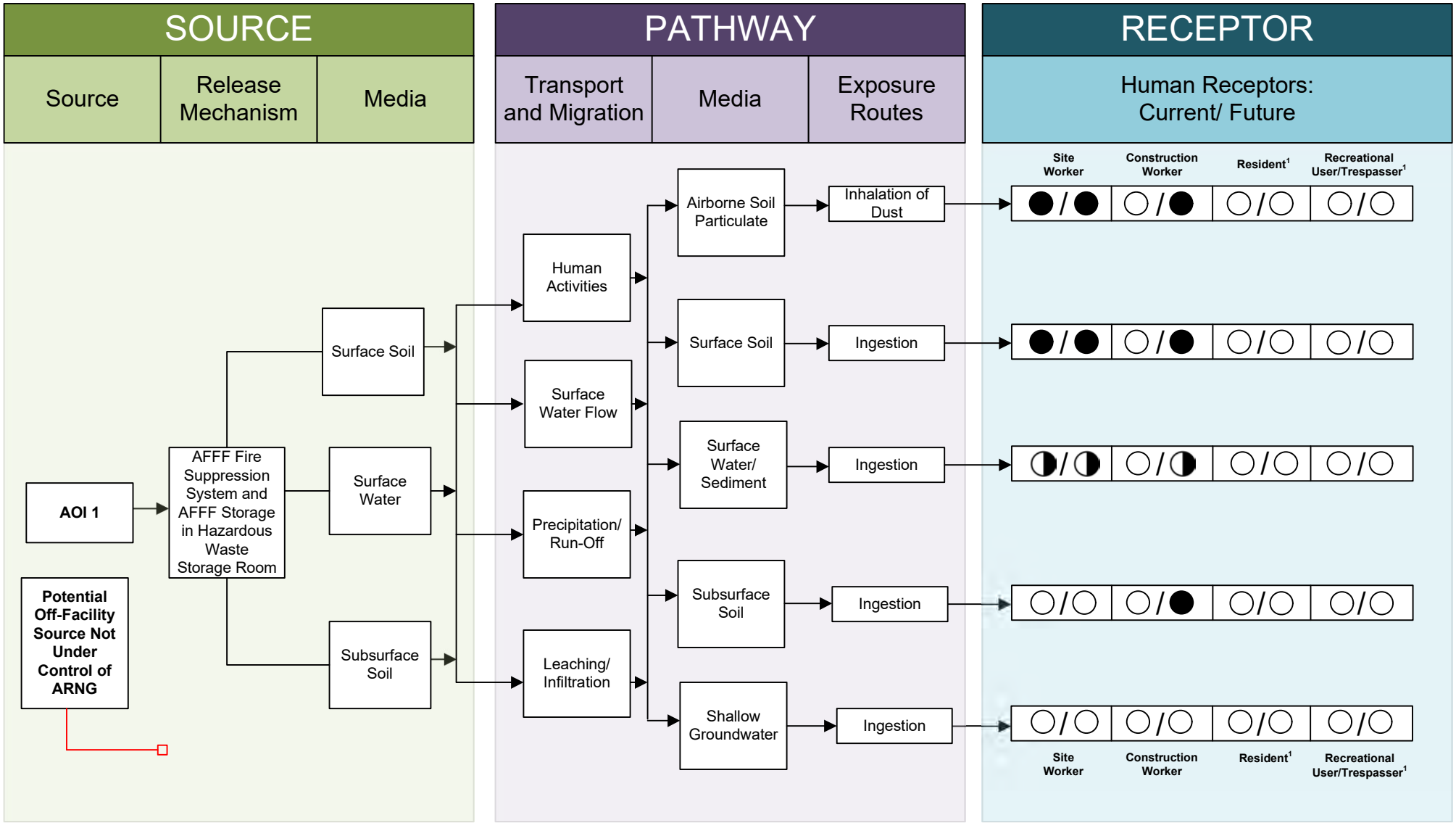
Based on site observations, Retention Area 2 appears to be impounded and does not drain off-facility. As discussed in **Section 2.2.3**, no outflow or surface water bodies flowing from AOI 1 were identified. Instead, Retention Area 2 is the low point within the southeast corner of the facility. Due to the absence of surface water features allowing drainage from Retention Area 2 to off-facility receptors, the surface water and sediment ingestion exposure pathway for off-facility residents and recreational users is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

PFOS and PFHxS were detected in a surface water sample obtained from Retention Area 1, located southwest and hydraulically downgradient of the Flight Ramp. Additionally, at AOI 2, PFOA, PFOS, PFBS, PFHxS, and PFNA was detected in surface soil, and PFOA, PFOS, PFHxS, and PFNA were detected in shallow groundwater. Therefore, based on the known compounds within the surface water and soluble properties of PFAS, the surface water and sediment ingestion exposure pathway for site workers, construction workers, or recreational users is considered potentially complete.

Surface water in the vicinity of AOI 2 may drain toward Retention Area 1, located west-southwest of the flight ramp. During highwater conditions, Retention Area 1 may drain southward via an intermittent stream. The stream then drains to Pintlala Creek, located 2.5 miles southwest of the facility. Pintlala Creek drains to the northwest, into the Alabama River. Due to the presence of surface water features allowing drainage from Retention Area 1 to off-facility receptors, the

surface water and sediment ingestion exposure pathway for off-facility recreational users is considered potentially complete. The CSM for AOI 2 is presented on **Figure 7-2**.



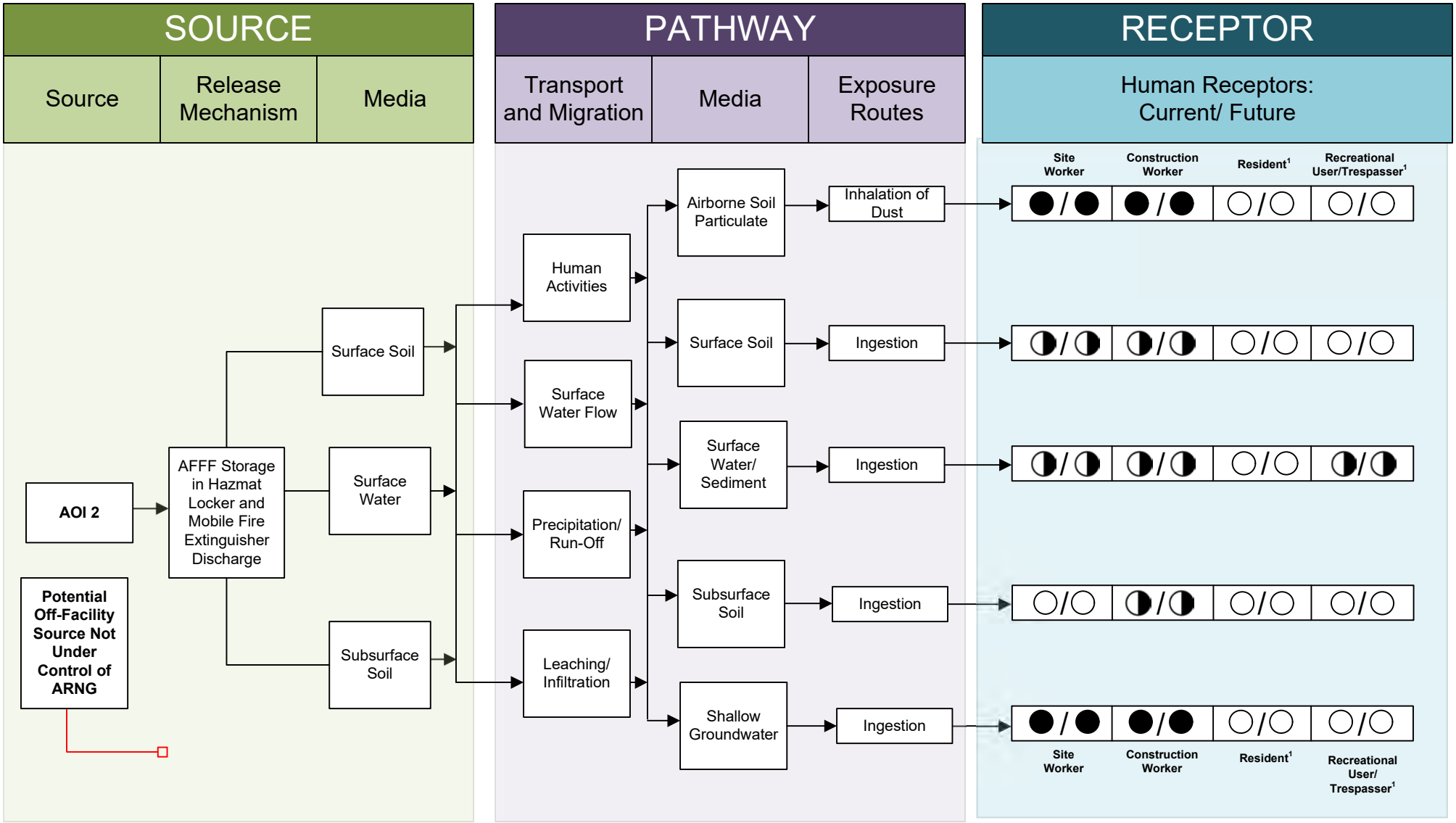
LEGEND

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

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Groundwater was not encountered at AOI 1 during the SI; therefore, groundwater samples were not collected and an evaluation based on AOI-specific data cannot be made. However, based on proximity, the groundwater exposure pathway at AOI 1 can be reasonably assumed to be similar to that at AOI 2.

Figure 7-1
Conceptual Site Model, AOI 1
AASF #1, Montgomery, Alabama



LEGEND

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

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Active construction was observed at the Flight Ramp during the SI.
3. Very shallow, perched groundwater was encountered at AOI 2 during the SI.

Figure 7-2
Conceptual Site Model, AOI 2
AASF #1, Montgomery, Alabama

8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 18 to 21 January 2022 and consisted of utility clearance, direct push boring, hollow stem augering, soil sample collection, temporary monitoring well installation, and grab groundwater sample collection. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021), except as previously noted in **Section 5.9**.

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

- Twenty-seven (27) soil samples from 13 locations;
- Three grab groundwater samples from six temporary wells;
- Two surface water samples from two surface water bodies; and
- Twenty (20) QA/QC samples.

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

8.2 Outcome

Based on the results of this SI, further evaluation is warranted in an RI for AOI 1: Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room and AOI 2: Flight Ramp and Wash Rack. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to receptors from AOI 1 and AOI 2 from sources on the facility resulting from historical DoD activities. Sample analytical concentrations collected during the SI were compared to the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - In soil, PFOA, PFOS, and PFHxS exceeded their SLs. PFBS and PFNA did not exceed the SLs.
        - PFOA exceeded the SL of 19 µg/kg in surface soil at AOI01-01 (148 µg/kg) and AOI01-04 (165 µg/kg).
        - PFOS exceeded the SL of 13 µg/kg in surface soil at AOI01-01 (10,900 J µg/kg), AOI01-03 (486 µg/kg), AOI01-04 (8,330 µg/kg), and MGM-01 (358 µg/kg). PFOS also exceeded the SL of 160 µg/kg in subsurface soil at AOI01-01 from 5 to 7 feet bgs (499 µg/kg).

        - PFHxS exceeded the SL of 130 µg/kg in surface soil at AOI01-01 (1,890 µg/kg) and AOI01-04 (3,840 µg/kg).
    - Groundwater was not encountered at AOI 1.
    - PFOA, PFOS, PFBS, and PFHxS were also detected in the surface water. There are no established SLs for surface water; therefore, these results are presented for informational purposes only.
    - Based on the results of the SI, further evaluation of AOI 1 is warranted in an RI.
- At AOI 2:
    - In soil, PFOS exceeded the SL of 13 µg/kg in surface soil at AOI02-01 (16.8 J µg/kg). PFOA, PFBS, PFHxS and PFNA did not exceed their SLs.
    - In groundwater, PFOA, PFOS, PFHxS, and PFNA were detected at concentrations that exceeded their SLs. PFBS did not exceed its SL.
        - PFOA exceeded the SL of 6 ng/L at AOI02-01 (55.9 ng/L) and AOI02-03 (19.4 ng/L).
        - PFOS exceeded the SL of 4 ng/L at AOI02-01 (499 ng/L), AOI02-03 (8.97 ng/L), and AOI02-04 (129 ng/L).
        - PFHxS exceeded the SL of 39 ng/L at AOI02-01 (974 ng/L) and AOI02-03 (177 J- ng/L).
        - PFNA exceeded the SL of 6 ng/L at AOI02-01 (13.3 ng/L).
    - PFOS and PFHxS were also detected in the surface water.
    - Based on the results of the SI, further evaluation of AOI 2 is warranted in an RI.

Very shallow perched groundwater was encountered at three of the six monitoring wells (AOI02-01, AOI02-03, and AOI02-04) installed during the SI. Groundwater was not encountered at the three remaining planned monitoring wells, including AOI02-05, which was advanced to a depth of 59 feet bgs. Due to the groundwater observations under localized perched conditions, the flow direction of groundwater beneath the facility could not be properly evaluated. At this time, regional groundwater at the facility is assumed to flow toward the northwest, as inferred from the flow patterns of larger surface water features.

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Hangar Fire Suppression System, Mechanical Room, and Hazardous Waste Storage Room	●	N/A[1]	N/A	Proceed to RI
2	Flight Ramp and Wash Rack	●	●	N/A	Proceed to RI

Legend:

1. Groundwater was not encountered within AOI 1 at the time of the SI

N/A = not applicable

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

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