FINAL
Site Inspection Report
Army Aviation Support Facility No. 2
Tupelo, Mississippi

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

May 2023

Prepared for:

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

UNCLASSIFIED

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FTA	Fire Training Area
GPRS	Ground Penetrating Radar Systems, LLC
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MDEQ	Mississippi Department of Environmental Quality
MIL-SPEC	military specification
MSARNG	Mississippi Army National Guard
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
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

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
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Executive Summary

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

The PA identified two Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2**). 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 Tupelo Army Aviation Support Facility (AASF) #2 in Tupelo, Mississippi and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1 and AOI 2. The Tupelo AASF #2 will also be referred to as the "facility" throughout this document.

The Tupelo AASF occupies 38.99 acres along West Jackson Street, on the eastern side of Tupelo Regional Airport in Tupelo, Mississippi. The mission of the facility is to support operations and use of ARNG aviation. The AASF houses multiple guard units and repairs and maintains aircraft. The building was designed to be a state emergency mobilization site for the State of Mississippi and operates in a dual role as an emergency center and AASF.

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 and AOI 2.

[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	Western Release Areas	◐	●	●	Proceed to RI
2	Bladder Rupture Release	◐	●	●	Proceed to RI

Legend:
● = 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 the Tupelo Army Aviation Support Facility (AASF) #2 in Tupelo, Mississippi. The Tupelo AASF #2 is also referred to as the "facility" throughout this document.

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

1.2 SI Purpose

A PA was performed at Tupelo AASF #2 (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

Tupelo AASF #2 is located on the eastern side of Tupelo Regional Airport in Lee County, Tupelo, Mississippi (**Figure 2-1**). AASF #2 is situated approximately 1.5 miles south of McCullough Boulevard and 1 mile west of Natchez Trace Parkway. The latitude, longitude, and surface elevation at the main gate of the AASF #2 are 34°16'21.6" N; 88°45'52.5" W, and 321 feet above mean sea level, respectively. Construction of the current AASF was finished in 2011, and it encompasses 38.99 acres. According to leasing documents, the land has been leased to the State of Mississippi from the Tupelo Airport Authority since December 2007. The term of the lease is 40 years and is set to end on 10 December 2047. Prior to construction of the current facility, the Old AASF was operated by the Mississippi ARNG (MSARNG) from the 1960s to 2008 and was located at the southern end of the airport, approximately 0.5 miles south of its current location; the Old AASF is currently privately owned by an aviation salvage company.

The mission of the facility is to support operations and use of ARNG aviation. AASF #2 houses multiple guard units and repairs and maintains aircraft. The building was designed to be a state emergency mobilization site for the State of Mississippi and operates in a dual role as an emergency center and AASF.

2.2 Facility Environmental Setting

Tupelo is in the Black Belt Prairie physiographic region, which is a crescent-shaped region approximately 25 miles wide that stretches from Alabama, through northeastern Mississippi, into southern Tennessee. The topography of the facility generally slopes to the east and north as shown on **Figure 2-2**. The Black Belt Prairie is characterized by its dark, fertile soil used primarily for farmland, and it is underlain by Cretaceous-aged geologic units (National Aeronautics and Space Administration, 2018). The facility sits at an elevation of about 330 to 350 feet above mean sea level.

2.2.1 Geology

Tupelo is situated on top of the Cretaceous-aged Selma Group, with locally overlying yellowish-orange alluvium deposits composed primarily of clay, silt, and sand. The Selma Group has three members: the Demopolis Chalk, the Coffee Sand, and the Mooreville Chalk. In the eastern section of the Tupelo 7.5-minute Quadrangle, Coffee Sand outcrops are present. In the western section, closer to the AASF, Demopolis Chalk outcrops are present (Mississippi Department of Environmental Quality [MDEQ], 2019a).

As shown on **Figure 2-3**, AASF #2 is situated 1 mile west of the Coffee-Demopolis contact. The contact at this point is mapped at a ground surface elevation of approximately 300 feet. Bedrock in this area dips west about 30 feet per mile (Mississippi State Geological Survey, 1962) and the ground surface elevation of AASF #2 ranges from about 330 to 315 feet; the top of the Coffee Sand underlying AASF #2 may be encountered at a depth as shallow as 45 feet below ground surface (bgs).

The Selma Group overlies the Eutaw and Tuscaloosa formations. Mineral resources in Lee County include limestone, water, and rocks with sufficient calcium and aluminum silicates to manufacture mineral wool (Mississippi State Geological Survey, 1946).

Soil borings completed during the SI found silty clay and sandy clay as the dominant lithology of the unconsolidated sediments below the AASF #2. The borings were completed at depths

between 15.5 and 40 feet bgs. Isolated layers of sand to silty sand were also observed in the boring logs, at thicknesses ranging from 1.5 to 3.5 feet. Many of the logs also reported varying percentages of chalk fragments included in the sand packages before encountering the underlying chalk. Samples for grain size analyses were collected at two locations, AOI01-01 (from 16.5-18.5 feet bgs) and AOI02-02 (from 38-40 feet bgs), and were analyzed via American Society for Testing and Materials Method D-422. The results indicate that the soil samples are comprised primarily of silt (57.12 percent [%] to 59.3%) and clay (29.86% to 34.89%). These facility observations are consistent with the understood depositional environment. Boring logs are presented in **Appendix E**, and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

AASF #2 sits atop the Coffee Sand, Eutaw-McShan, and Gordo (part of the Tuscaloosa formation) aquifers and may also overly the Paleozoic aquifer, although its lateral extent is not fully known (MDEQ, 2014; Strom and Mallory, 1995). The Paleozoic aquifer system consists of chert beds, sandstone, shale, and limestone, whereas the Gordo, Eutaw-McShan, and Coffee Sand aquifers consist mostly of clay, sand, and, in the case of the Coffee Sand aquifer, sandstone (O'Hara, 1996).

The Eutaw-McShan aquifer is confined by the Mooreville Chalk, which ranges in thickness from approximately 115 to 160 feet (MDEQ, 2019a). Various sources disagree with the latitude at which the Mooreville Chalk becomes absent. Boswell states that the Mooreville Chalk is absent at Tupelo and to the north of the city, meaning that the Coffee Sand and Eutaw-McShan aquifers are hydraulically connected (Boswell, 1976). However, Strom and Mallory state that the disappearance of the Mooreville Chalk occurs at a latitude close to the Union-Pontotoc county boundary, meaning the Eutaw-McShan aquifer is confined at Tupelo (Strom and Mallory, 1995). Additionally, the Tupelo 7.5-minute quadrangle map identified the Mooreville Chalk in Tupelo (MDEQ, 2019a), further suggesting the Eutaw-McShan is confined at the facility.

The 2014 MDEQ groundwater assessment surveyed a few wells within Lee County that were tapping into the Coffee Sand, Eutaw-McShan, and Gordo aquifers. The surveyed wells that collect water in the Coffee Sands aquifer were 147 and 200 feet bgs, 606 feet bgs in the Eutaw-McShan aquifer, and 669 feet bgs in the Gordo aquifer.

No potable water wells are located within facility boundaries. Drinking water at AASF #2 and the local area is supplied by the City of Tupelo, which purchases drinking water from the Northeast Mississippi Regional Water District, who obtains the water from the Tombigbee River, approximately 18 miles east of the facility. However, a domestic well exists approximately 400 feet east of the facility boundary (**Figure 2-3**) and is completed within the Eutaw-McShan aquifer at 550 feet bgs. The US Geological Survey (USGS) National Ground Water Information System and the MDEQ Borehole Collection provide borehole data for wells around Tupelo (USGS, 2019; MDEQ, 2019b). No wells downgradient of AASF #2 that collect water at depths less than 400 feet bgs have been identified, suggesting that none of the identified wells are collecting water in the Coffee Sand aquifer. Based on the research presented above, these wells should be screened within the Eutaw-McShan aquifer.

Depths to water measured in September 2021 during the SI ranged from 4.94 to 11.29 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate groundwater flow direction is generally to the east.

2.2.3 Hydrology

AASF #2 is situated within the eastern portion of Kings Creek-Town Creek Watershed; the Little Coonewah Creek-Coonewah Creek watershed is present to the west of the facility and bisects the Tupelo Regional Airport (**Figure 2-5**). Local surface water features include small, unnamed

ponds and tributaries that flow into Kings Creek. A drainage ditch associated with one of the unnamed tributaries runs along the eastern facility boundary and flows north. Stormwater at AASF #2 is directed towards one of two retention ponds located within the northeastern portion of the facility. These retention ponds overflow into the drainage ditch system that flows north before joining Kings Creek to the northeast and ultimately flows southeast through the City of Tupelo.

2.2.4 Climate

The humid subtropical climate at Tupelo AASF #2 is characterized as having long, hot summers, and a relatively short, mild winter (Mississippi State Geological Survey, 1946). The average temperature is 73.4 degrees Fahrenheit (°F). Seasonally, temperatures vary from a summer average monthly high of 92 °F to a winter average monthly low of 32 °F. Average precipitation is 55 inches (World Climate, 2022).

2.2.5 Current and Future Land Use

AASF #2 is a controlled access facility and is located adjacent to the Tupelo Regional Airport. The Tupelo Regional Airport is owned and operated by the Tupelo Airport Authority. AASF #2 operates in a dual role as a state emergency center and AASF. 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 insects, birds, flowering plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Lee County, Mississippi (US Fish and Wildlife Service [USFWS], 2022).

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Birds:** Wood stork, *Mycteria americana* (threatened)
- **Flowering plants:** Prices potato-bean, *Apios priceana* (threatened)
- **Mammals:** Northern long-eared bat, *Myotis septentrionalis* (threatened)
- **Reptiles:** Alligator snapping turtle, *Macrochelys temminckii* (proposed threatened)

2.3 History of PFAS Use

Five potential release areas identified at the facility during the PA were grouped into two AOIs based on proximity to one another as well as groundwater flow direction (AECOM, 2020). AASF #2 includes one building that serves a dual role as an emergency center and AASF. The hangar is equipped with fire suppression systems that utilize AFFF. At the facility, there have been documented releases from the fire suppression system by way of testing and system malfunction, and AFFF may also have been released at the facility during fire training activities. Descriptions of AOI 1 and AOI 2 are presented in **Section 3**.

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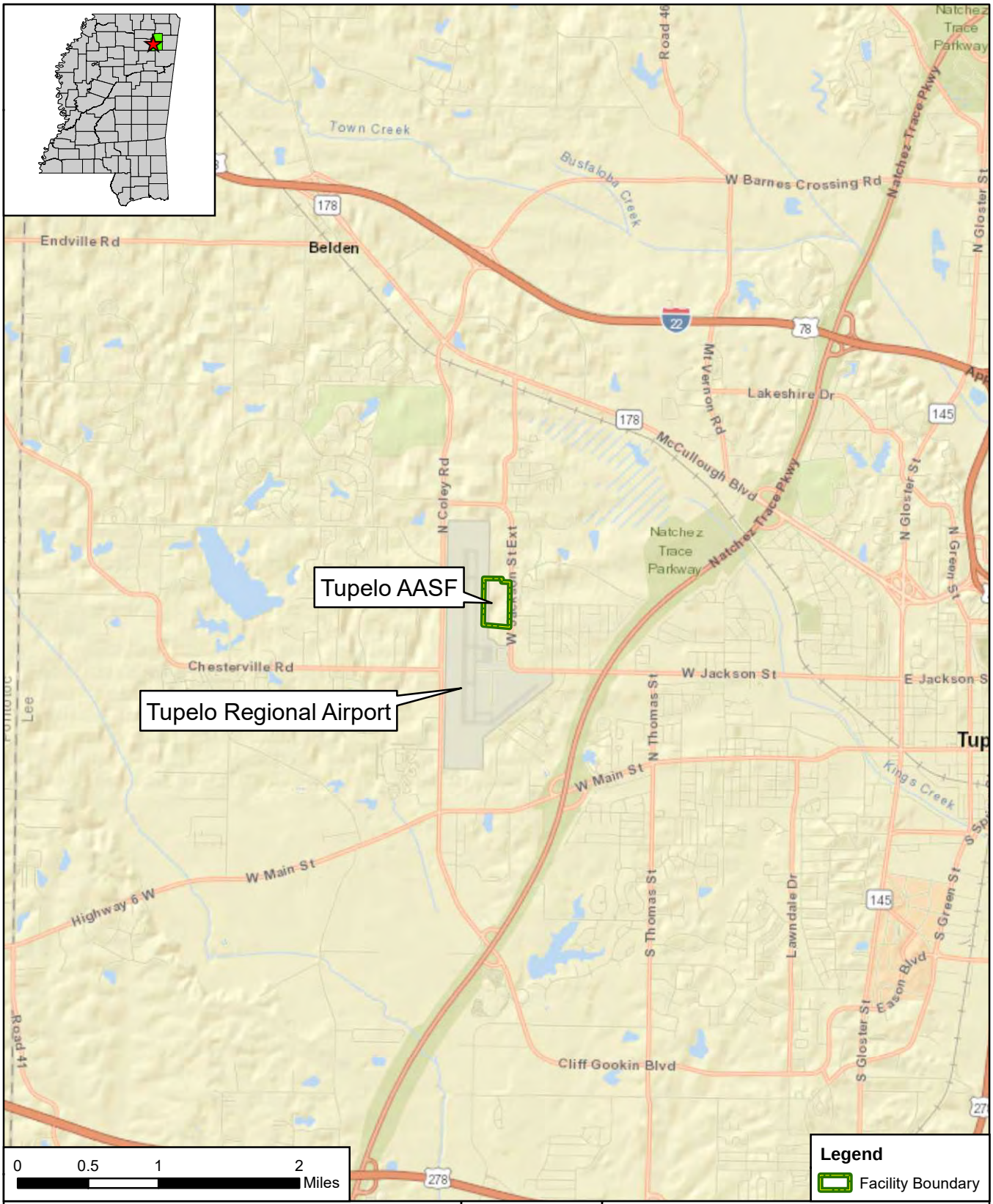

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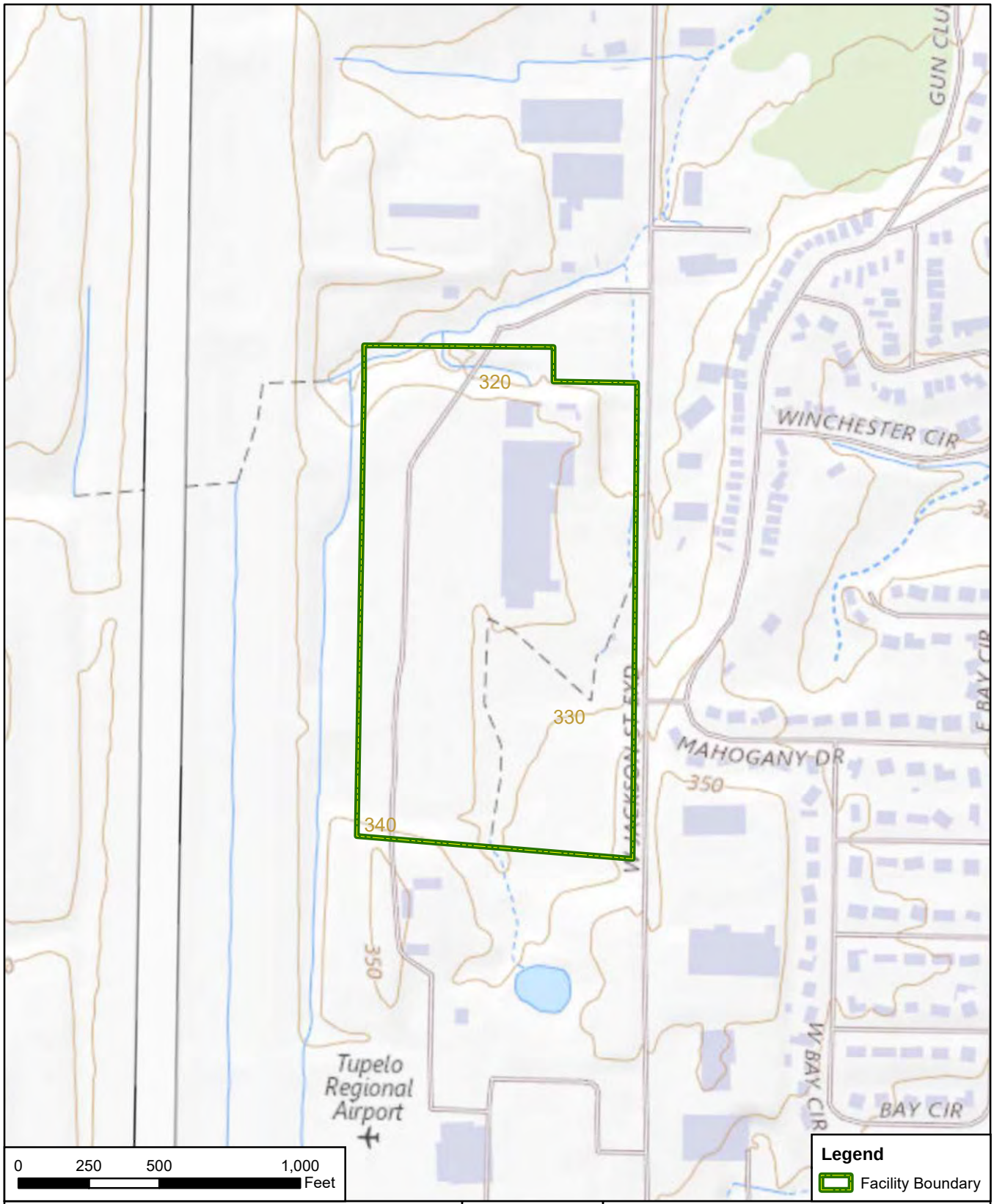
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	8/15/2022

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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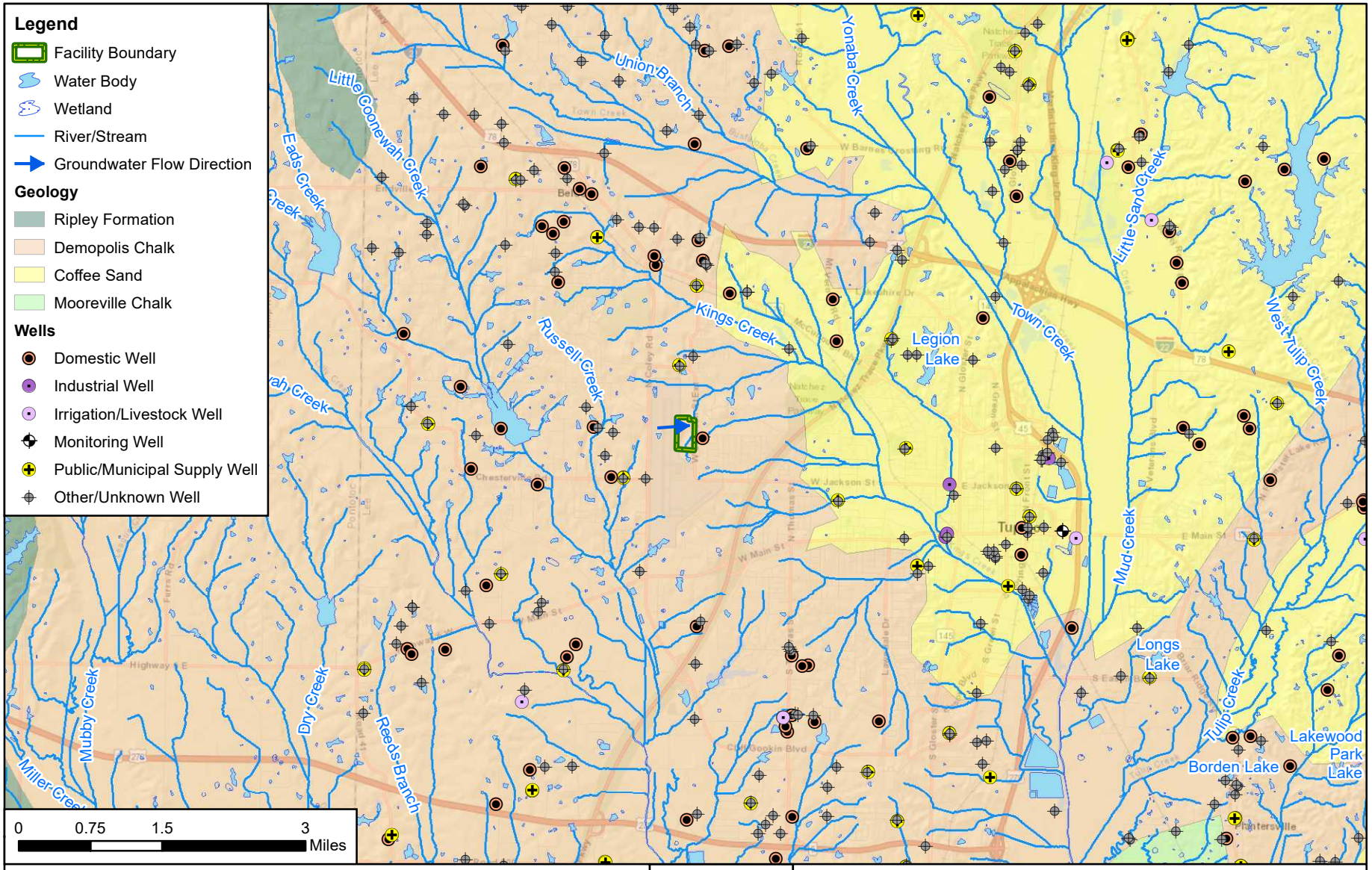
Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



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Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

CLIENT	ARNG			
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Groundwater Elevations, September 2021

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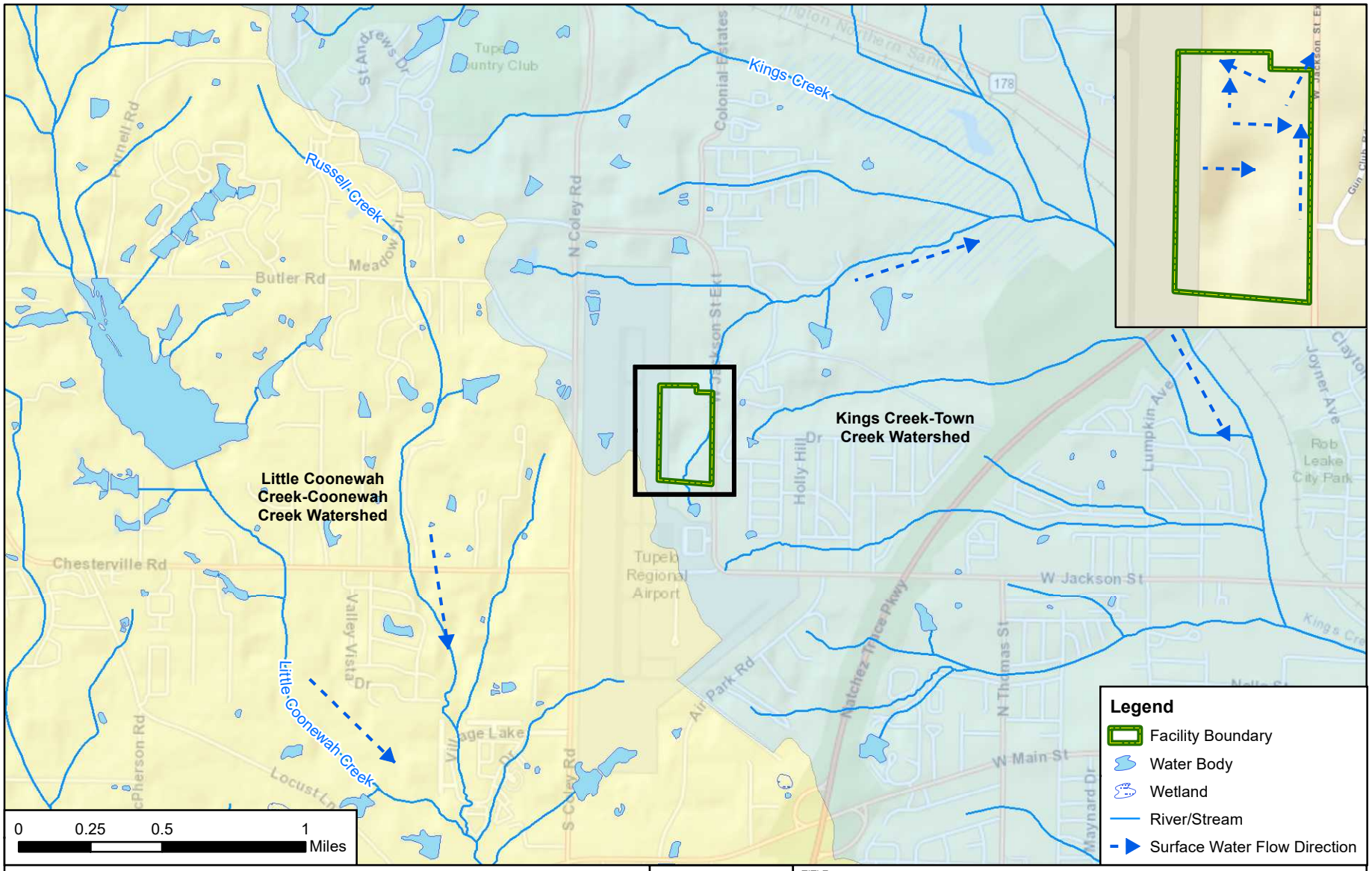
Figure 2-4



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TITLE

Surface Water Features

AECOM

12420 Milestone Center Drive
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Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, five potential release areas were identified at Tupelo AASF #2 and grouped into two AOIs (AECOM, 2020). The potential release areas are shown on **Figure 3-1**. Additional, adjacent potential release areas identified at the Tupelo Regional Airport and Old AASF Property and Hangar are also shown on **Figure 3-1** for informational purposes and will not be evaluated as part of this SI.

3.1 AOI 1 Western Release Areas

AOI 1 Western Release Areas encompasses Release Areas A, B, C, and E. During a training event, an unknown quantity of AFFF was discharged into the wash rack (Release Area A), which discharges to the oil/water separator (OWS) and, subsequently, the sanitary sewer. Additionally, during an initial test of the hangar suppression system, an unknown quantity of AFFF was pumped out and directed towards the trench drain at the hangar bay doors. The trench drain flows to the OWS; however, in the event of activation of the fire suppression system, a trigger lock bypasses the OWS, and the trench drains are discharged to a retention pond in the northern area of the facility. In this event, a manual valve on the retention pond is supposed to be closed in order to prevent the AFFF and water from leaving the property until the release can be cleaned up. Facility staff interviewed during the PA did not know if either the trigger lock or manual valve were activated during testing. Therefore, it is unknown if test water entered the OWS or were discharged directly to the retention pond. Foam may have also been discharged to stormwater drains on the apron during testing (collectively Release Area B). As a result, an unknown quantity of AFFF may have flowed directly into a retention pond to the north of AOI 1 (Release Area C) from either of these drains during testing. Lastly, out-of-date AFFF was stored in a hazardous waste storage area (Release Area E), although no spills or leaks were reported.

Although no permanent surface water bodies are present within AOI 1, facility stormwater flows into this retention pond (Release Area C) via a system of stormwater drains. Additionally, the retention pond receives drainage from the hangar whenever the fire suppression system is activated. The retention pond drains into an unnamed tributary of Kings Creek; therefore, both release events may have potentially impacted surface water, sediment, and surface soil at Release Area C. Potential releases may have migrated from surface soil to subsurface soil and groundwater via leaching.

3.2 AOI 2 Bladder Rupture Release

AOI 2 encompasses Release Area D and is located east of AOI 1. Due to a hardware malfunction from tank installation, approximately 800-gallons of AFFF were discharged inside the AASF building. The AFFF subsequently flowed out of the building, into the parking lot to the east, filled the eastern drainage ditches and retention pond, and eventually flowed out onto W Jackson Street; the foam was allowed to naturally dissipate.

The eastern drainage ditch and retention pond discharge into the same unnamed tributary as Release Area C in AOI 1. Consequently, there may have been a release to surface water, sediment, and surface soil. Additionally, foam that dissipated on the parking lot and W Jackson Street was likely transported by overland flow to surface soils and/or sediment. Depending on infiltration rates, potential releases may migrate from the surface soil to subsurface soil and groundwater via leaching and also infiltrate from the pond to groundwater.

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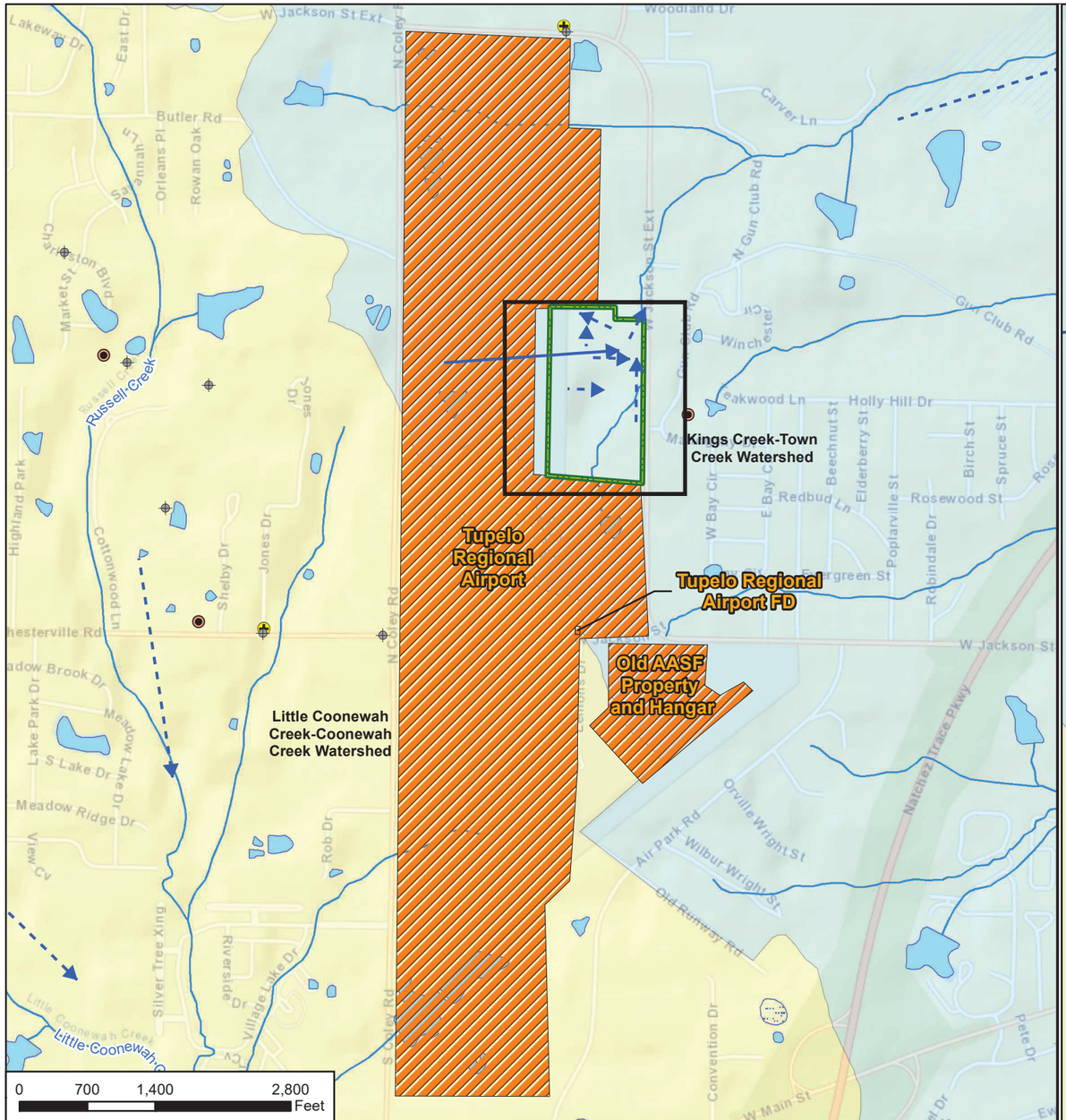

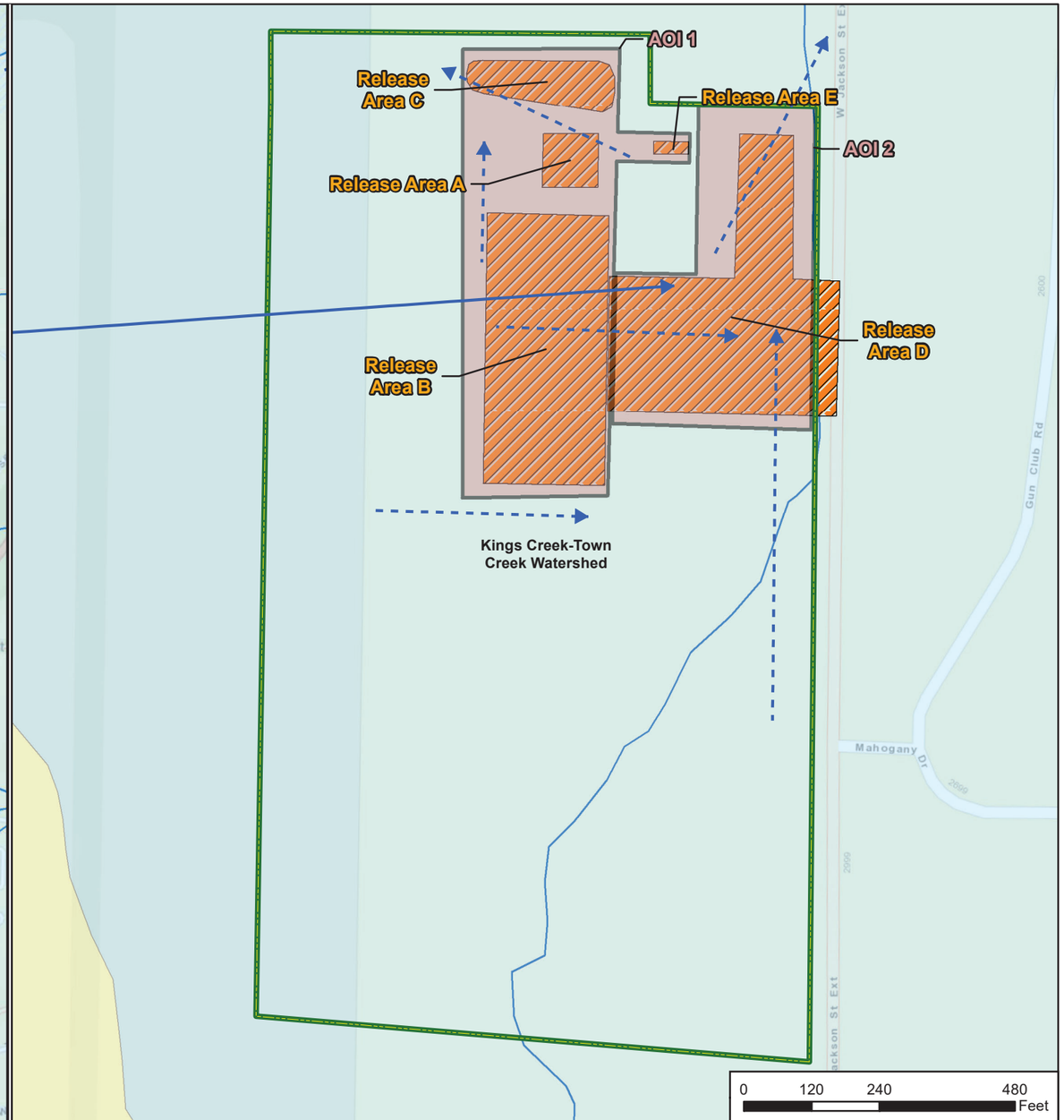

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- Area of Interest
- Potential Release Area
- Facility Boundary
- Water Body
- Wetland
- River/Stream
- Surface Water Flow Direction
- Groundwater Flow Direction
- Domestic Well
- Other/Unknown Well
- Public Water System

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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, 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

ARNG 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 Tupelo AASF #2 (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2021a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

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

4.4 Analytical Approach

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

4.5 Data Usability Assessment

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

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

5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and 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, Tupelo Army Aviation Support Facility No. 2, Tupelo, Mississippi* dated July 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Tupelo Army Aviation Support Facility No. 2, Tupelo, Mississippi* dated August 2021 (AECOM, 2021a); and
- *Final Site Safety and Health Plan, Tupelo Army Aviation Support Facility No. 2, Tupelo, Mississippi* dated August 2021 (AECOM, 2021b).

The SI field activities were conducted from 27 August to 8 September 2021 and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation, groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a), except as noted in **Section 5.8**.

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

- Twenty-three (23) soil samples from 13 boring locations;
- Four groundwater samples from four permanent monitoring wells;
- Sixteen (16) 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**, land survey data are provided in **Appendix B3**, and a Field Change Request form is provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

The 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 8 March 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, MSARNG, USACE, MDEQ, and representatives familiar with the facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2021a).

A TPP Meeting 3 was held on 7 March 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

AECOM's drilling subcontractor, Cascade Technical Services, LLC. placed a ticket with the Mississippi 811 utility clearance provider to notify them of intrusive work on 23 August 2021. However, because the AASF is a private facility, the participating "Call Before You Dig" locators did not clear utilities at the entire facility. Therefore, AECOM contracted Ground Penetrating Radar Systems, LLC. (GPRS), a private utility location service, to perform utility clearance. GPRS. performed utility clearance of the proposed boring locations on 27 August 2021 with input from the AECOM field team and Tupelo AASF facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in 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 use in this investigation. A sample from a potable water source at Tupelo AASF was collected on 16 July 2021, prior to mobilization, and analyzed for LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water sample 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, 2021a). Prior to the start of field work each day, a Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via sonic methods, in accordance with the SI QAPP Addendum (AECOM, 2021a). A GeoProbe® 8140LC was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1** and depths are provided **Table 5-2**. In general, soil samples were collected for chemical analysis from the vadose zone of each boring drilled using the sonic rig, specifically three soil samples: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table. Additionally, one surface soil sample was collected from each of the eight

surface soil borings, which were advanced using a hand auger to depths ranging from 0.5 to 2 feet bgs.

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**.

Soil borings completed during the SI found silty and sandy clay as the dominant lithology of the unconsolidated sediments below the AASF #2. The borings were completed at depths between 15.5 and 40 feet bgs. Isolated layers of sand and silty sand were also observed in the boring logs at thicknesses ranging from 1 to 3.5 feet. These facility observations are consistent with the understood depositional environment.

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, 2021a).

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

Sonic borings were converted to permanent monitoring wells in accordance with the SI QAPP Addendum (AECOM, 2021a), with the exception of AOI02-02 (see **Section 5.8** for more details). Borings were installed with a flush mount surface completion in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 Permanent Well Installation and Groundwater Sampling

During the SI, two permanent monitoring wells were installed within the potential source areas, and two permanent monitoring wells were installed upgradient and side-gradient of the potential source areas. The locations of the wells are shown on **Figure 5-1**.

A GeoProbe® 8140LC drill rig was used to install four (4) 2-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 40 poly-vinyl chloride (PVC), flush threaded 10-foot sections of riser, 0.010-inch slotted well screen, and a threaded bottom cap. A filter pack of 20/40 silica sand was installed in the annulus around the well screen to a minimum of 2 feet above the well screen.

A 2-foot-thick bentonite seal was placed above the filter sand and hydrated with distilled water. Bentonite grout was placed in the well annulus from the top of the bentonite seal to ground surface. The bentonite grout was allowed to set for 24 hours prior to well completion in accordance with the SI QAPP Addendum (AECOM, 2021a). All monitoring wells were completed with flush mount well vaults. The screen intervals of each of the groundwater monitoring wells are provided in **Table 5-2**.

Development and sampling of wells was completed in accordance with the SI QAPP Addendum (AECOM, 2021a). The newly installed monitoring wells were developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Samples were collected no sooner than 24 hours following development via low-flow sampling methods using a GeoTech® peristaltic pump with disposable PFAS-free, HDPE tubing. New tubing was used at each well. The wells were purged at a rate determined in the field to reduce draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2021a).

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

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 8 September 2021. Groundwater elevation measurements were collected from the four new permanent monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Mississippi-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021a). Survey data from the newly installed wells on the facility were collected on 8 September 2021 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 84 datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B3**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2021a) 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 containerized in three 55-gallon drums and staged at the Wash Rack. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW under a separate contract.

Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were containerized in seven 55-gallon drums totaling approximately 303 gallons and staged at the Wash Rack. The containerized liquid IDW will be characterized,

managed, and disposed of by ARNG (either by offsite disposal or onsite disposal, with treatment as appropriate) under a separate contract in accordance with *SOP No. 042A for Treating Liquid Investigation-Derived Material (Purge water, drilling water, and decontamination fluids)* (EA Engineering, Science, and Technology, Inc., 2021).

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other environmental media generated during the field activities were disposed of at a licensed solid waste landfill via the AASF #2 waste disposal.

5.7 Laboratory Analytical Methods

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

5.8 Deviations from SI QAPP Addendum

One deviation from the SI QAPP Addendum is noted below. The change is documented in a Field Change Request Form (**Appendix B4**).

- During the installation of permanent monitoring wells, one boring (AOI02-02) was advanced up to 40 feet bgs without encountering groundwater. The borehole was allowed to remain open overnight to evaluate potential groundwater recharge into the borehole; however, dry conditions persisted. This location was at a similar ground surface elevation as the other soil borings, but sandy, water-bearing layers encountered in other borings were not observed in AOI02-02. Three subsurface soil samples were collected at AOI02-02 (0-2, 13-15, and 38-40 feet bgs). Because groundwater was not observed at AOI02-02, no groundwater sample was collected, and a permanent well was not installed at this location.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Tupelo AASF #2, Mississippi

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	8/31/2021 1203	0-2	X	X	X		
AOI01-01-SB-00-02-D	8/31/2021 1203	0-2	X				FD
AOI01-01-SB-00-02-MS	8/31/2021 1203	0-2		X	X		MS
AOI01-01-SB-00-02-MSD	8/31/2021 1203	0-2		X	X		MSD
AOI01-01-SB-06-08	8/31/2021 1240	6-8	X				
AOI01-01-SB-11-13	8/31/2021 1340	11-13	X				
AOI01-01-SB-16.5-18.5	8/31/2021 1510	16.5-18.5				X	
AOI01-02-SS-00-02	8/31/2021 1615	0-2	X				
AOI01-03-SS-00-0.5	8/31/2021 1510	0-0.5	X				
AOI01-04-SS-00-01	8/31/2021 1650	0-1	X				
AOI02-01-SB-00-02	9/2/2021 1120	0-2	X				
AOI02-01-SB-00-02-D	9/2/2021 1120	0-2	X				FD
AOI02-01-SB-5.25-7.25	9/2/2021 1155	5.25-7.25	X				
AOI02-01-SB-9.5-11.5	9/2/2021 1205	9.5-11.5	X				
AOI02-02-SB-00-02	9/1/2021 1135	0-2	X	X	X		
AOI02-02-SB-00-02-D	9/1/2021 1135	0-2	X	X	X		FD
AOI02-02-SB-13-15	9/1/2021 1355	13-15	X				
AOI02-02-SB-38-40	9/1/2021 1620	38-40	X			X	
AOI02-03-SS-00-02	9/1/2021 1545	0-2	X				
AOI02-04-SS-00-02	9/1/2021 1345	0-2	X				
AOI02-05-SS-00-02	9/1/2021 1620	0-2	X				
AOI02-06-SS-00-02	9/1/2021 1430	0-2	X				
AOI02-07-SS-00-01	9/1/2021 1510	0-1	X				
TUP-01-SB-00-02	8/30/2021 1048	0-2	X	X	X		
TUP-01-SB-00-02-MS	8/30/2021 1048	0-2	X				MS
TUP-01-SB-00-02-MSD	8/30/2021 1048	0-2	X				MSD
TUP-01-SB-02-04	8/30/2021 1053	2-4	X				
TUP-01-SB-07-09	8/30/2021 1105	7-9	X				
TUP-02-SB-00-02	9/1/2021 0845	0-2	X				
TUP-02-SB-00-02-MS	9/1/2021 0845	0-2	X				MS
TUP-02-SB-00-02-MSD	9/1/2021 0845	0-2	X				MSD
TUP-02-SB-3.5-5.5	9/1/2021 0900	3.5-5.5	X				
TUP-02-SB-06-08	9/1/2021 0910	6-8	X				
Groundwater Samples							
AOI01-01-GW	9/3/2021 1040	NA	x				
AOI02-01-GW	9/8/2021 1255	NA	x				
TUP-01-GW	9/2/2021 1535	NA	x				
TUP-01-GW-D	9/2/2021 1535	NA	x				FD
TUP-01-GW-MS	9/2/2021 1535	NA	x				MS
TUP-01-GW-MSD	9/2/2021 1535	NA	x				MSD
TUP-02-GW	9/3/2021 0915	NA	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Tupelo AASF #2, Mississippi

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
TUP-FRB-01	8/30/2021 1300	NA	x				
TUP-ERB-01	8/31/2021 1150	NA	x				Hand Auger
TUP-ERB-02	8/31/2021 1200	NA	x				DPT Drill Shoe
TUP-ERB-03	9/2/2021 0715	NA	x				Well Development Pump
TUP-PW-01	7/16/2021 1458	NA	x				
TUP-PW-02	9/2/2021 1045	NA	x				Pressure Washer

Notes:
AASF = Army Aviation Support Facility
AOI = area of interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
DPT = direct push technology
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
QSM = Quality Systems Manual
SB = soil boring
SS = surface soil
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths, Permanent Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, Tupelo AASF #2, Mississippi

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Permanent Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	AOI01-01	18.5	8.25 - 18.25 [2]	330.14	330.21	11.22	11.29	318.92
2	AOI02-01	15.5	5.5 - 15.5	317.99	318.20	4.73	4.94	313.26
	AOI02-02[1]	40	NA	NA	NA	NA	NA	NA
Facility-wide	TUP-01	37.5	4 - 14 [2]	334.1	334.19	7.7	7.79	326.40
	TUP-02	15.5	5.5 - 15.5	330.52	330.69	10.78	10.95	319.74

Notes:

[1]Groundwater was not encountered and no temporary well was installed.

[2]Permanent well screen set above total depth to capture groundwater interface.

AASF = Army Aviation Support Facility
AOI = area of interest
bgs = below ground surface
btoc = below top of casing
NAVD88 = North American Vertical Datum 1988

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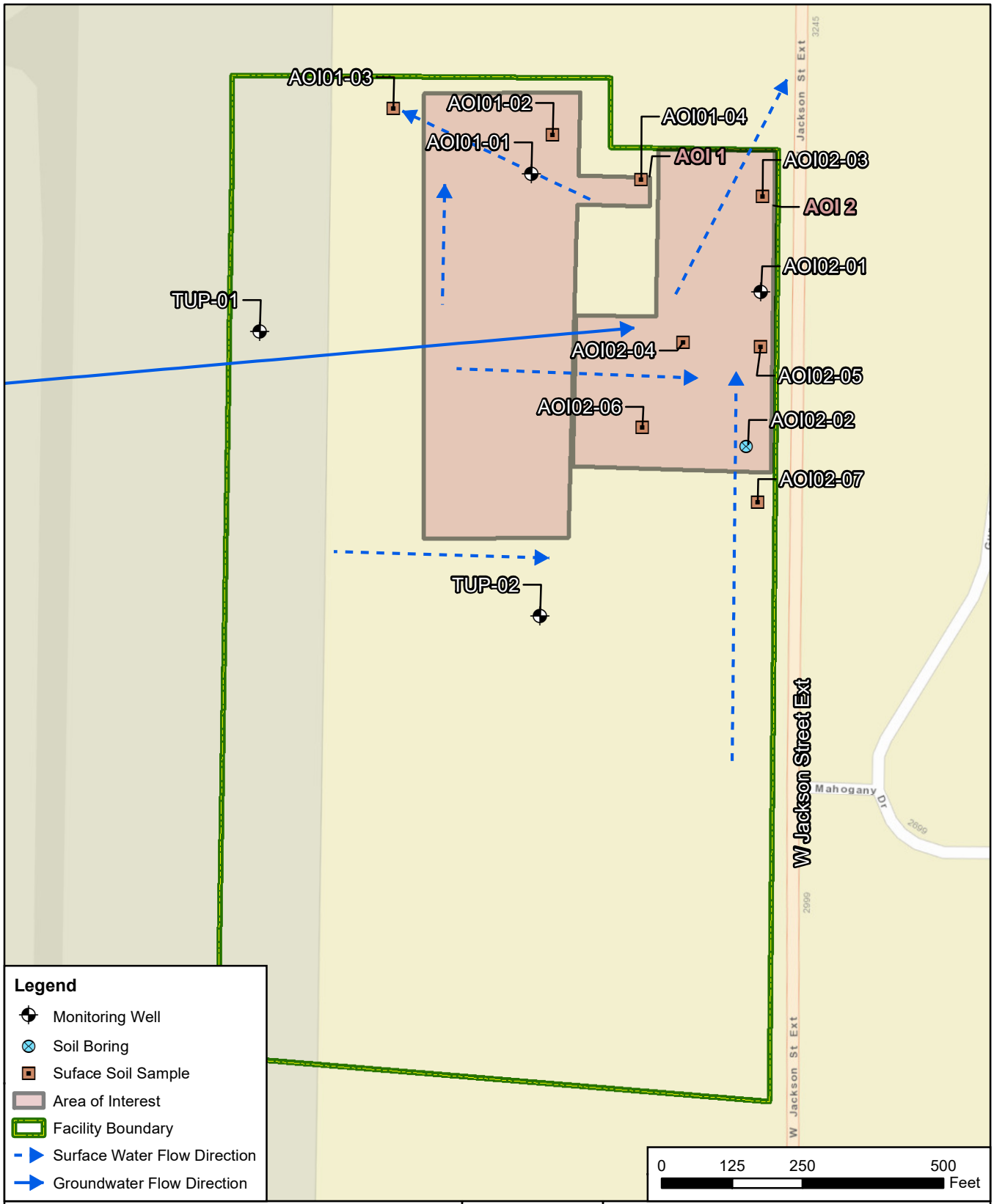

CLIENT	ARNG			
PROJECT	Site Inspection at Tupelo AASF, MS			
REVISED	9/9/2022	GIS BY	MS	9/9/2022
SCALE	1:3,000	CHK BY	SS	9/9/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	9/9/2022

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** and **Section 6.4**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

b.) 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 groundwater in comparison to SLs for AOI 1: Western Release Areas. The soil and groundwater results are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

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

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI01-01 through AOI01-04. Soil was also sampled from shallow subsurface soil (6 to 8 feet bgs and 11 to 13 feet bgs) from boring location AOI01-01. No samples were collected from the deep subsurface soil (i.e., deeper than 15 feet bgs) at AOI 1. PFOA, PFOS, and PFNA were detected in surface soil at concentrations below their respective SLs. PFOA was detected at three of the four locations, with concentrations ranging from 0.113 J micrograms per kilogram (µg/kg) to 6.68 µg/kg. PFOS was only detected AOI01-03, with a concentration of 0.108 J µg/kg. PFNA was detected at three of four boring locations, with concentrations ranging from 0.069 J µg/kg to 9.18 µg/kg. The maximum concentrations for PFOA, PFOS, and PFNA in surface soil were detected at boring AOI01-03, which was located at the western end of Release Area E. PFHxS and PFBS were not detected in surface soil at AOI 1. PFOA, PFOS, PFHxS, PFBS, and PFNA were not detected in either of the shallow subsurface soil samples collected at boring AOI01-01.

Soil samples were also collected from the upgradient facility boundary location TUP-01 and from the side-gradient location TUP-02. Soil from these two borings were collected from the surface (0 to 2 feet bgs) and shallow subsurface (between 2 and 9 feet bgs) intervals. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected at either boring in the surface soil or shallow subsurface soil samples.

6.3.2 AOI 1 Groundwater Analytical Results

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

Groundwater was sampled from permanent monitoring well AOI01-01. PFOA was detected above the SL of 6 nanograms per liter (ng/L), with a concentration of 7.75 ng/L. PFHxS was detected

below the SL of 39 ng/L, with a concentration of 1.29 J ng/L. PFBS was detected below the SL of 601 ng/L, with a concentration of 3.82 J ng/L. PFOS and PFNA were not detected in groundwater at AOI 1.

Groundwater was also sampled from the upgradient facility boundary monitoring well TUP-01 and the from the side-gradient location TUP-02. At the upgradient TUP-01, PFHxS was detected above the SL of 39 ng/L, with a concentration of 43.1 ng/L. PFOA, PFOS, and PFBS were detected and did not exceed their SLs at TUP-01, with concentrations of 2.61 J ng/L, 4.00 ng/L, and 11.7 ng/L, respectively. PFNA was not detected at TUP-01. At the side-gradient location TUP-02, PFOA and PFBS were detected below their SLs, with concentrations of 1.19 J ng/L and 1.39 J ng/L, respectively. PFOS, PFHxS, and PFNA were not detected at TUP-02.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFNA were detected in soil below their respective SLs. PFOA was detected in groundwater at a concentration above the SL. Additionally, PFHxS was detected in groundwater above the SL at monitoring well TUP-01, which is located at the western facility boundary and upgradient of AOI 1. Based on the exceedance of the PFOA SL in groundwater, further evaluation at AOI 1 is warranted.

6.4 AOI 2

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

6.4.1 AOI 2 Soil Analytical Results

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

Soil was sampled from surface soil (0 to 2 feet bgs) from boring locations AOI02-01 through AOI02-07. Soil was also sampled from shallow subsurface soil (5.25 to 7.25 feet bgs and 9.5 to 11.5 feet bgs) at AOI02-01. AOI02-02 was additionally sampled for shallow subsurface soil (13 to 15 feet bgs) and deep subsurface soil (38 to 40 feet bgs). PFOA, PFOS, and PFNA were detected in surface soil, at concentrations below their respective SLs. PFOA was detected in two of seven borings, with concentrations of 0.108 J µg/kg at AOI02-02 and 0.144 J µg/kg at AOI02-05. PFOS was detected six of seven borings, with detected concentrations ranging from 0.074 J µg/kg to 0.181 J µg/kg. PFNA was detected in five of seven borings, with concentrations ranging from 0.029 J µg/kg to 0.069 J µg/kg. The maximum concentrations of PFOS and PFNA in surface soil were observed at AOI02-07. PFHxS and PFBS were not detected in the surface soil at any of the seven borings.

PFOA, PFOS, PFHxS, PFBS, and PFNA were not detected in the shallow subsurface soil samples collected at AOI 2. Similarly, PFOA, PFOS, PFHxS, PFBS, and PFNA were not detected in the deep subsurface soil sample at AOI02-02.

As discussed in **Section 6.3.1**, soil was also collected from the upgradient facility boundary location TUP-01. Soil was collected from the surface (0 to 2 feet bgs) and shallow subsurface (2 to 4 feet bgs and 7 to 9 feet bgs) intervals. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in either the surface soil or shallow subsurface soil samples.

6.4.2 AOI 2 Groundwater Analytical Results

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

Groundwater was sampled from permanent monitoring well AOI02-01. PFOA was detected above the SL of 6 ng/L, with a concentration of 68.4 ng/L. PFNA was detected above the SL of 6 ng/L, with a concentration of 11.7 ng/L. PFOS, PFHxS, and PFBS were detected below their SLs, with concentrations of 1.61 J ng/L, 9.11 ng/L, and 3.11 J ng/L, respectively.

As discussed in **Section 6.3.2**, groundwater was also sampled from the upgradient facility boundary monitoring well TUP-01. At the upgradient TUP-01, PFHxS exceeded the SL of 39 ng/L, with a concentration of 43.1 ng/L. PFOA, PFOS, and PFBS were detected and did not exceed their SLs at TUP-01, with concentrations of 2.61 J ng/L, 4.00 ng/L, and 11.7 ng/L, respectively. PFNA was not detected at TUP-01.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFNA were detected in soil below their SLs. PFOA and PFNA were detected in groundwater at concentrations above their SLs. Additionally, PFHxS was detected above the SL in groundwater at monitoring well TUP-01, which is located at the western facility boundary and upgradient of AOI 2. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 2 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Tupelo AASF #2

Area of Interest		AOI01										AOI02									
Sample ID		AOI01-01-SB-00-02		AOI01-01-SB-00-02-D		AOI01-02-SS-00-02		AOI01-03-SS-00-0.5		AOI01-04-SS-00-01		AOI02-01-SB-00-02		AOI02-01-SB-00-02-D		AOI02-02-SB-00-02		AOI02-02-SB-00-02-D		AOI02-03-SS-00-02	
Sample Date		08/31/2021		08/31/2021		08/31/2021		08/31/2021		08/31/2021		09/02/2021		09/02/2021		09/01/2021		09/01/2021		09/01/2021	
Depth		0-2 ft		0-2 ft		0-2 ft		0-0.5 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	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	19	ND	U	ND	U	0.180	J	9.18		0.069	J	ND	U	ND	U	0.034	J	0.046	J	0.056	J
PFOA	19	ND	U	ND	U	0.842	J	6.68		0.113	J	ND	U	ND	U	0.108	J	ND	UJ	ND	U
PFOS	13	ND	U	ND	U	ND	U	0.108	J	ND	U	ND	UJ	0.074	J	0.087	J	0.111	J	0.126	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

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

Notes

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

Sample IDs with "-SS-" indicate a dedicated surface soil location, whereas IDs with "-SB-" indicate a soil boring location.

Limit of Detection (LOD) ranges for relevant constiuents reported as not detected (ND):

PFBS: 0.058-0.073 µg/kg

PFHxS: 0.116-0.146 µg/kg

PFNA: 0.058-0.073 µg/kg

PFOA: 0.231-0.292 µg/kg

PFOS: 0.231-0.292 µg/kg

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
SS	surface soil
TUP	Tupelo
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, Tupelo AASF #2

Area of Interest		AOI02								Sitewide			
Sample ID		AOI02-04-SS-00-02		AOI02-05-SS-00-02		AOI02-06-SS-00-02		AOI02-07-SS-00-01		TUP-01-SB-00-02		TUP-02-SB-00-02	
Sample Date		09/01/2021		09/01/2021		09/01/2021		09/01/2021		08/30/2021		09/01/2021	
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	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	19	ND	U	0.049	J	0.029	J	0.069	J	ND	U	ND	U
PFOA	19	ND	U	0.144	J	ND	U	ND	U	ND	U	ND	U
PFOS	13	0.077	J	0.082	J	ND	U	0.181	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 residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

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

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

Notes

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

Sample IDs with "-SS-" indicate a dedicated surface soil location, whereas IDs with "-SB-" indicate a soil boring location.

Limit of Detection (LOD) ranges for relevant constiuents reported as not detected (ND):

PFBS: 0.058-0.073 µg/kg

PFHxS: 0.116-0.146 µg/kg

PFNA: 0.058-0.073 µg/kg

PFOA: 0.231-0.292 µg/kg

PFOS: 0.231-0.292 µg/kg

Chemical Abbreviations

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

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
SS	surface soil
TUP	Tupelo
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, Tupelo AASF #2

Area of Interest		AOI01				AOI02						Sitewide							
Sample ID		AOI01-01-SB-06-08		AOI01-01-SB-11-13		AOI02-01-SB-5.25-7.25		AOI02-01-SB-9.5-11.5		AOI02-02-SB-13-15		TUP-01-SB-02-04		TUP-01-SB-07-09		TUP-02-SB-3.5-5.5		TUP-02-SB-06-08	
Sample Date		08/31/2021		08/31/2021		09/02/2021		09/02/2021		09/01/2021		08/30/2021		08/30/2021		09/01/2021		09/01/2021	
Depth		6-8 ft		11-13 ft		5.25-7.25 ft		9.5-11.5 ft		13-15 ft		2-4 ft		7-9 ft		3.5-5.5 ft		6-8 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																			
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

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

Notes

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

Limit of Detection (LOD) ranges for relevant constiuents reported as not detected (ND):

PFBS: 0.056-0.063 µg/kg
PFHxS: 0.112-0.127 µg/kg
PFNA: 0.056-0.063 µg/kg
PFOA: 0.224-0.254 µg/kg
PFOS: 0.224-0.254 µg/kg

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

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Tupelo AASF #2

Area of Interest	AOI02	
Sample ID	AOI02-02-SB-38-40	
Sample Date	09/01/2021	
Depth	38-40 ft	
Analyte	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)		
PFBS	ND	U
PFHxS	ND	U
PFNA	ND	U
PFOA	ND	U
PFOS	ND	U

Interpreted Qualifiers

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

Notes

ND = Analyte not detected above the LOD.

Limit of Detection (LOD) for relevant constiuents reported as not detected (ND):

PFBS: 0.059 µg/kg
PFHxS: 0.117 µg/kg
PFNA: 0.059 µg/kg
PFOA: 0.235 µg/kg
PFOS: 0.235 µg/kg

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
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Tupelo AASF #2

	Area of Interest	AOI01		AOI02		Sitewide					
	Sample ID	AOI01-01-GW		AOI02-01-GW		TUP-01-GW		TUP-01-GW-D		TUP-02-GW	
	Sample Date	09/03/2021		09/08/2021		09/02/2021		09/02/2021		09/03/2021	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)											
PFBS	601	3.82	J	3.11	J	11.7		11.3		1.39	J
PFHxS	39	1.29	J	9.11		43.1		42.2		ND	U
PFNA	6	ND	U	11.7		ND	U	ND	U	ND	U
PFOA	6	7.75		68.4		2.61	J	2.60	J	1.19	J
PFOS	4	ND	U	1.61	J	3.74	J	4.00		ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

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

Notes

ND = Analyte not detected above the LOD.

Limit of Detection (LOD) for relevant constiuents reported as not detected (ND):

PFBS: 2.00 ng/L

PFHxS: 3.00 ng/L

PFNA: 2.00 ng/L

PFOA: 2.00 ng/L

PFOS: 2.00 ng/L

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
TUP	Tupelo
USEPA	United States Environmental Protection Agency
ng/l	nanogram per liter

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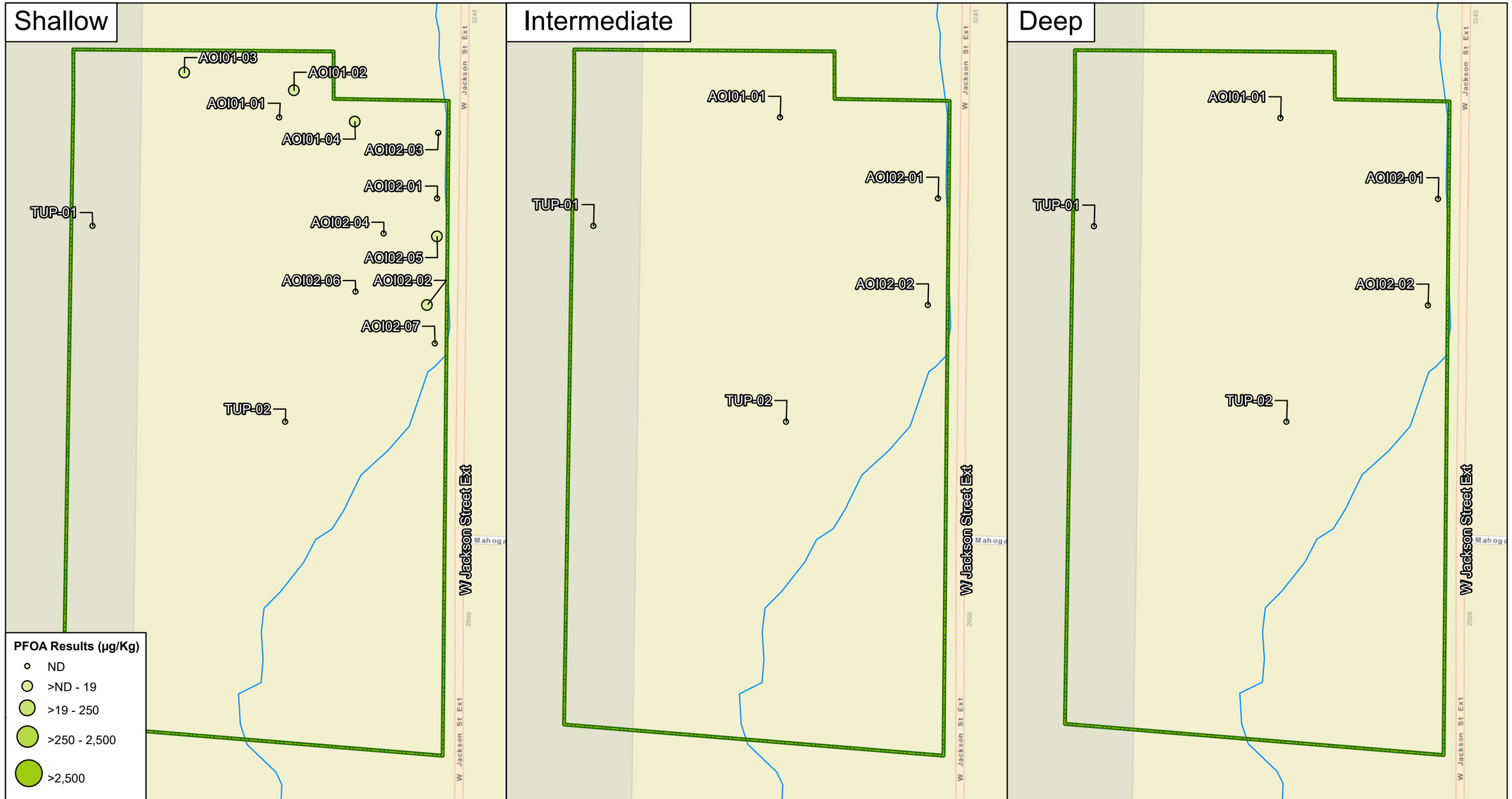

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SCALE	1:3,000	CHK BY	SS	4/10/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/10/2023

Legend

Facility Boundary

River/Stream

0 125 250 500 Feet

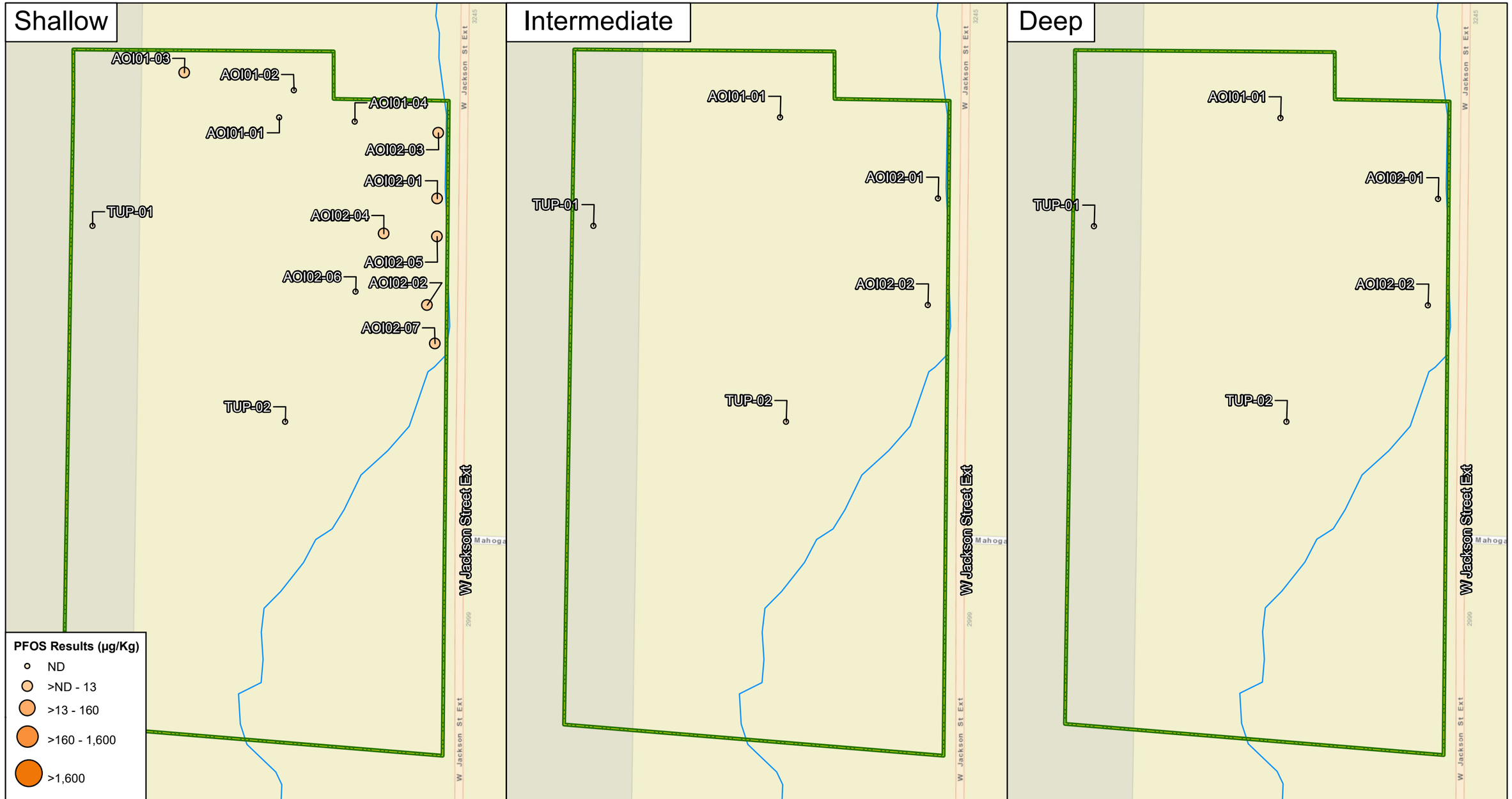
Exceedances of the OSD SL are depicted with a yellow halo.
The soil depth interval for each sample is presented on Table 5-1.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1



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PROJECT	Site Inspection at Tupelo AASF, MS			
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SCALE	1:3,000	CHK BY	SS	4/10/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/10/2023

Legend

Facility Boundary

River/Stream

0 125 250 500 Feet

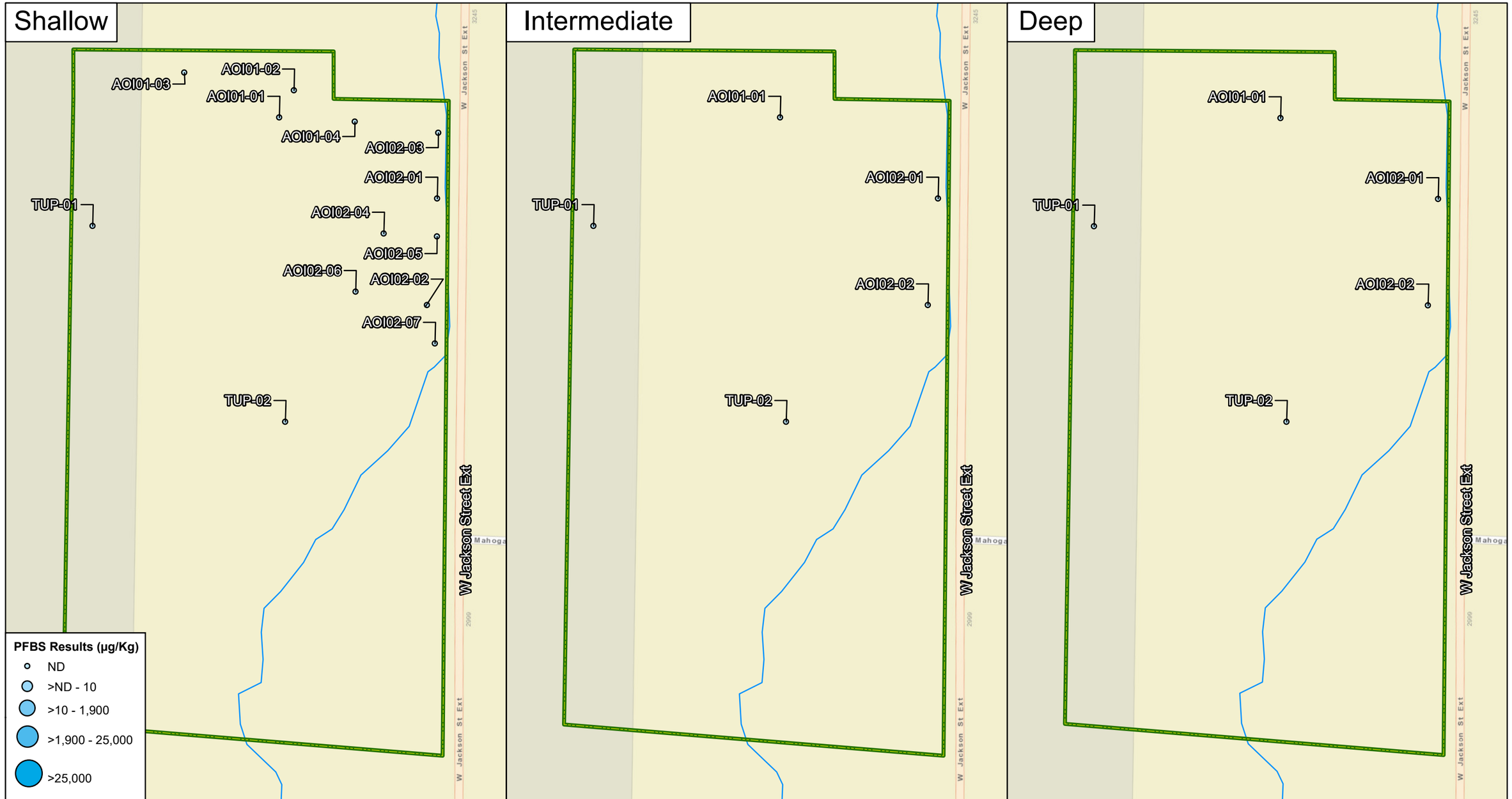
Exceedances of the OSD SL are depicted with a yellow halo.
The soil depth interval for each sample is presented on Table 5-1.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2



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PROJECT	Site Inspection at Tupelo AASF, MS			
REVISED	4/10/2023	GIS BY	MS	4/10/2023
SCALE	1:3,000	CHK BY	SS	4/10/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/10/2023

Legend

Facility Boundary

River/Stream

0 125 250 500 Feet

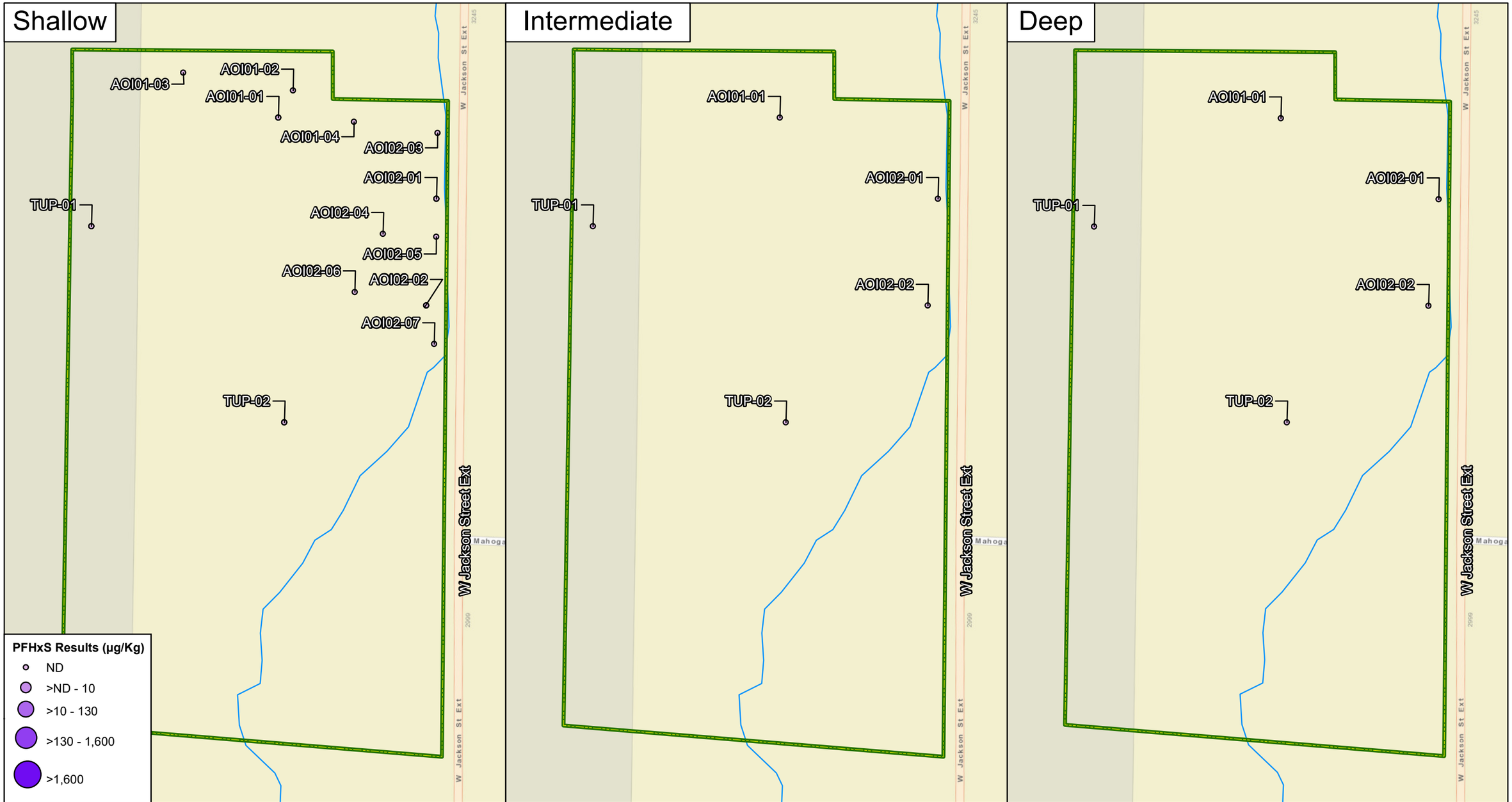
Exceedances of the OSD SL are depicted with a yellow halo.
The soil depth interval for each sample is presented on Table 5-1.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFBS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-3



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PROJECT	Site Inspection at Tupelo AASF, MS			
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SCALE	1:3,000	CHK BY	SS	4/10/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/10/2023

Legend

Facility Boundary

River/Stream

0 125 250 500 Feet

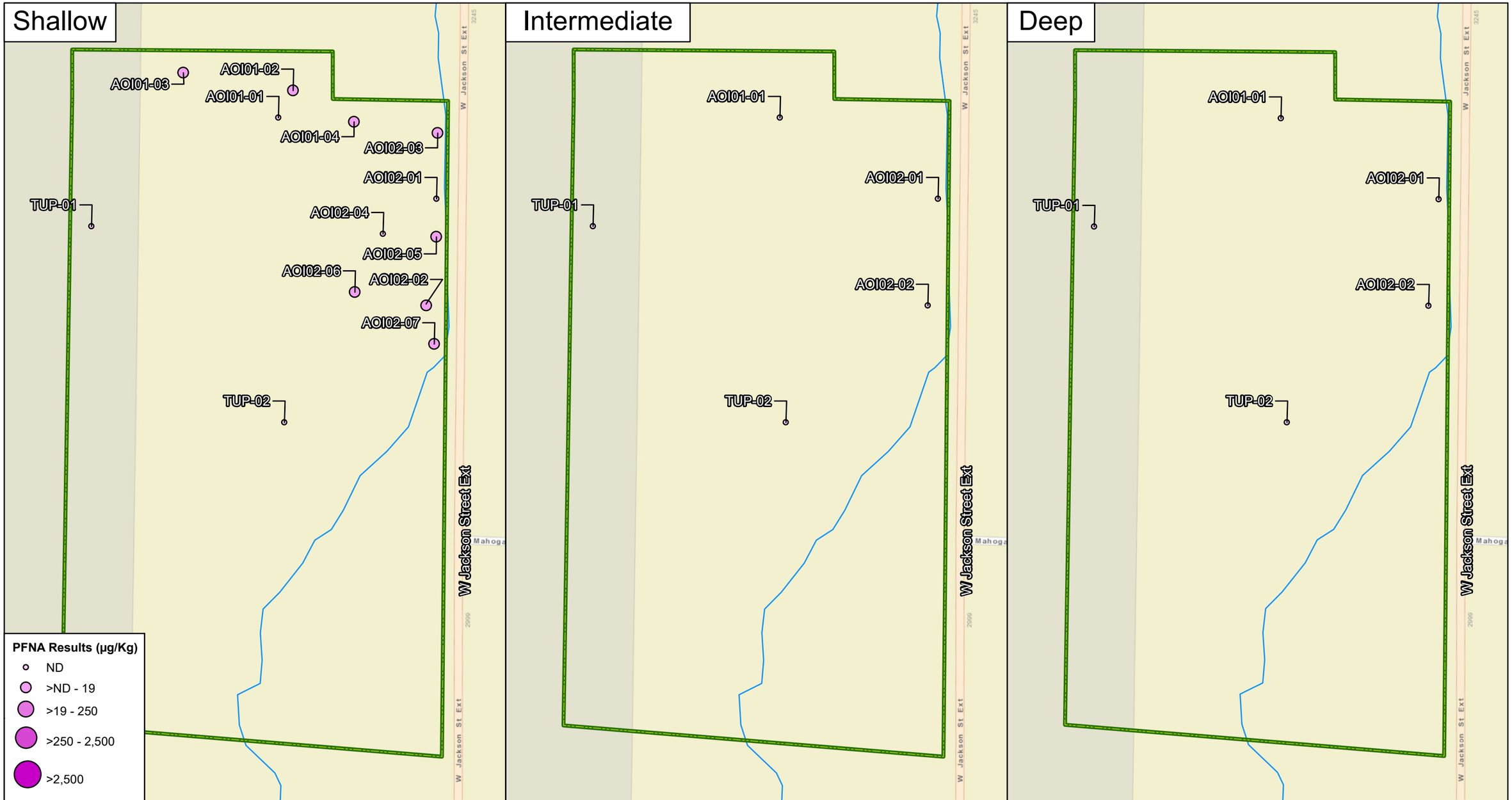
Exceedances of the OSD SL are depicted with a yellow halo.
The soil depth interval for each sample is presented on Table 5-1.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFHxS Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-4



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PROJECT	Site Inspection at Tupelo AASF, MS			
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SCALE	1:3,000	CHK BY	SS	4/10/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	4/10/2023

Legend

Facility Boundary

River/Stream

0 125 250 500 Feet

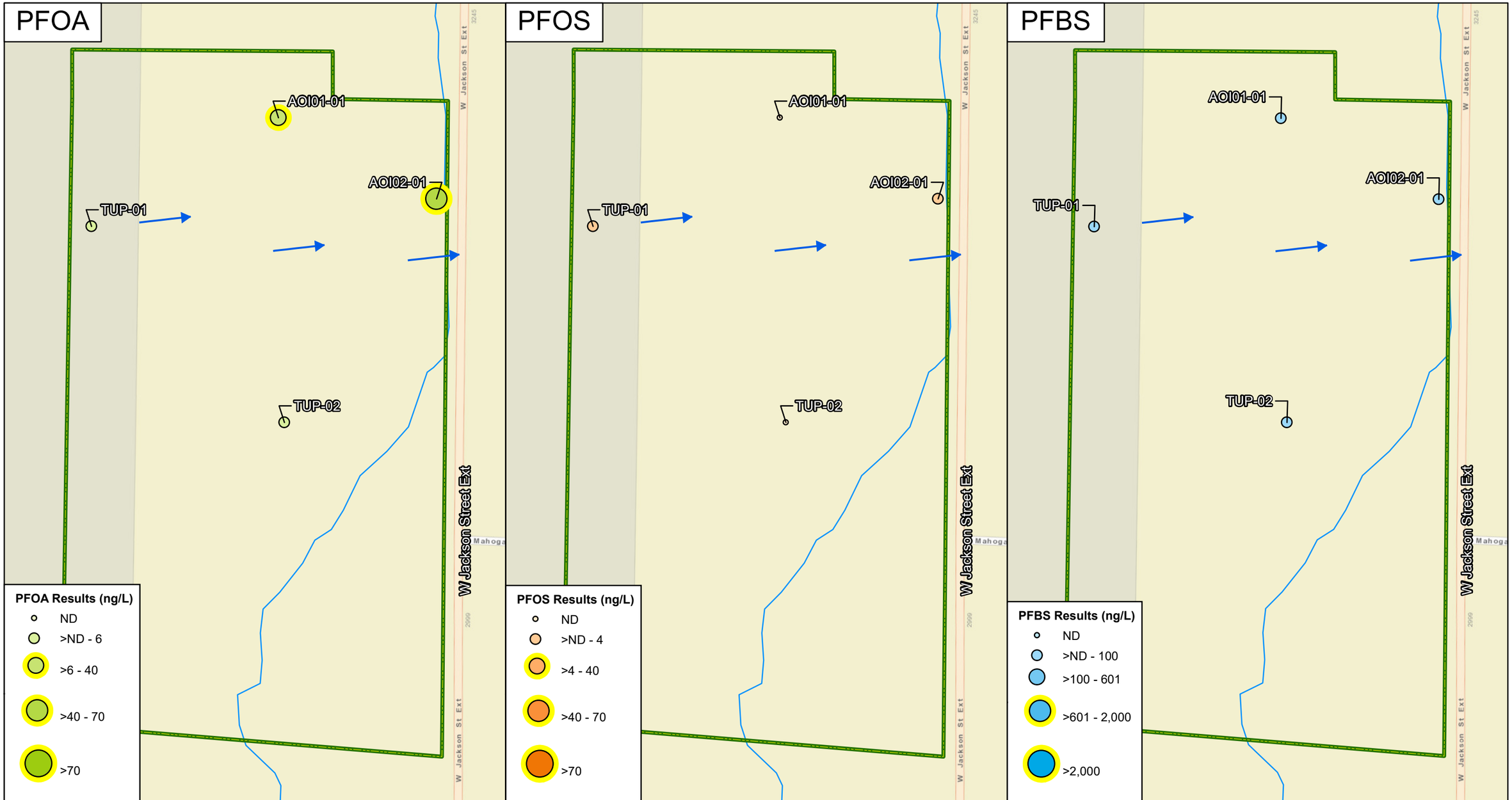
Exceedances of the OSD SL are depicted with a yellow halo.
The soil depth interval for each sample is presented on Table 5-1.
Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFNA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-5



CLIENT	ARNG			
PROJECT	Site Inspection at Tupelo AASF, MS			
REVISED	10/5/2022	GIS BY	MS	10/5/2022
SCALE	1:3,000	CHK BY	SS	10/5/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	10/5/2022

Legend

- Facility Boundary
- River/Stream
- Groundwater Flow Direction

0 125 250 500 Feet

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

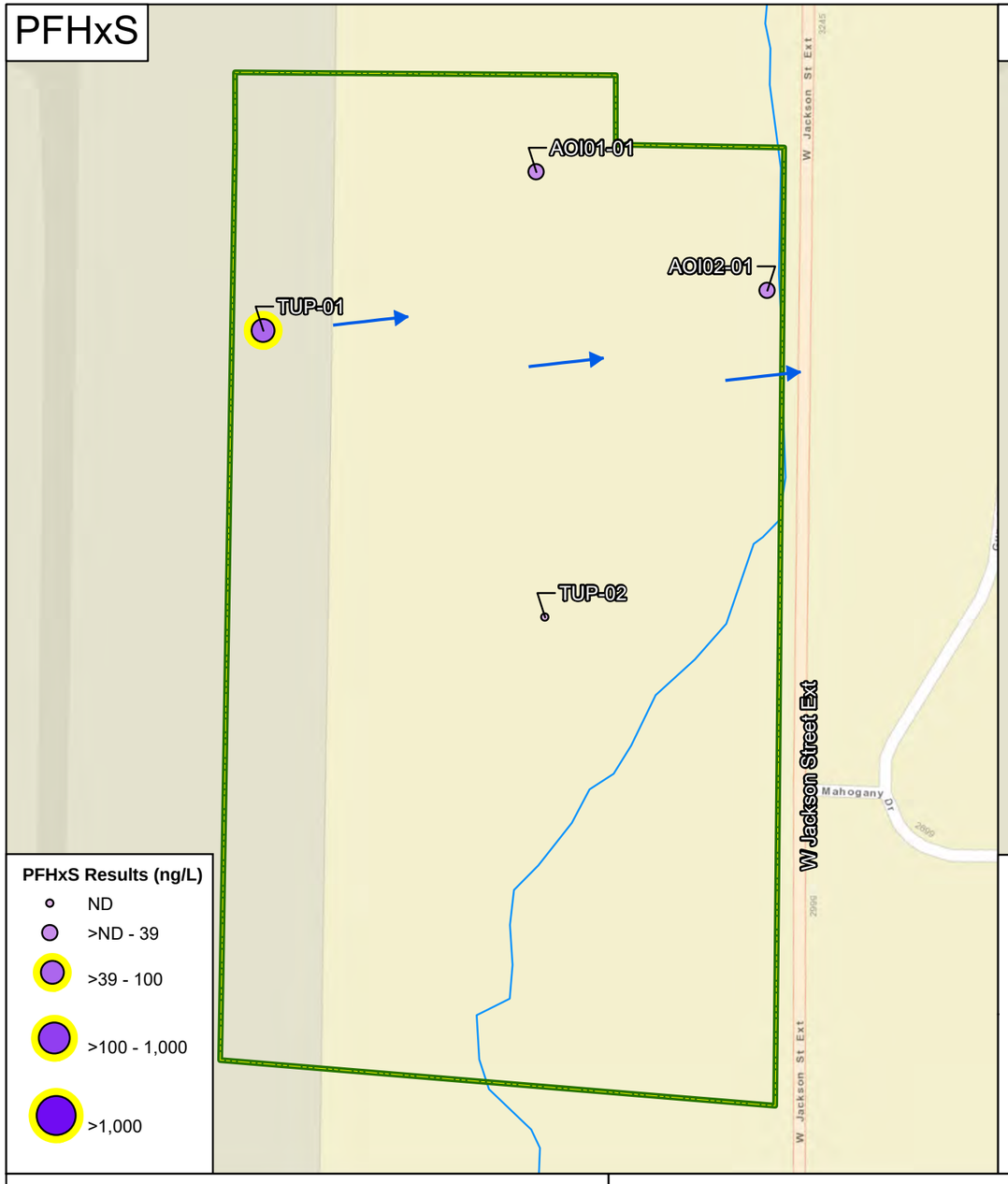
N

PFOA, PFOS, and PFBS Detections in Groundwater

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-6

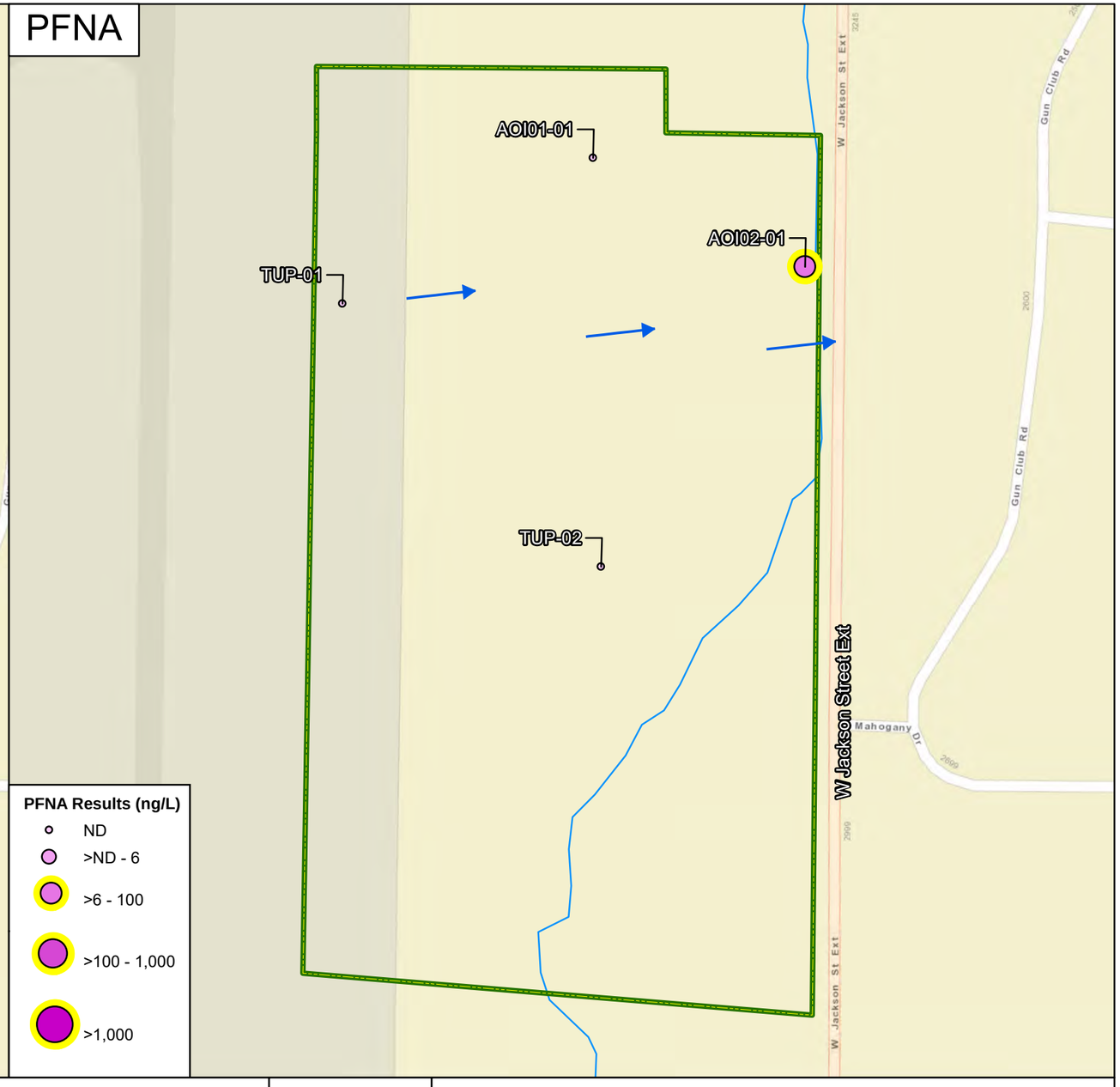
PFHxS



PFHxS Results (ng/L)

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

PFNA



PFNA Results (ng/L)

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

CLIENT	ARNG			
PROJECT	Site Inspection at Tupelo AASF, MS			
REVISED	8/16/2022	GIS BY	MS	8/16/2022
SCALE	1:3,000	CHK BY	SS	8/16/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	CM	8/16/2022

Legend

- Facility Boundary
- River/Stream
- Groundwater Flow Direction

0 125 250 500 Feet

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

N

PFHxS and PFNA Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** and **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 Remedial Investigation (RI) or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

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

In general, the potential routes of exposure to the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers (although unlikely due to restricted access), residents outside the facility boundary, and recreational users outside of the facility boundary. On-facility residents are not anticipated in the foreseeable future.

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

AFFF may have been released at AOI 1 during fire training activities and subsequent testing of the systems. AFFF was used at the Wash Rack during fire training, and mobile fire extinguishers containing AFFF were discharged to the apron stormwater drains.

PFOA, PFOS, and PFNA were detected below their respective SLs in surface soil at AOI 1. Site workers, construction workers, and trespassers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers, construction workers, and trespassers are potentially complete. Additionally, nearby off-facility recreational users and off-facility residents may potentially be exposed to constituents via inhalation of dust. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in subsurface soil at AOI 1. Therefore, all shallow subsurface pathways are considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

Due to a hardware malfunction approximately 800 gallons of AFFF were discharged at the AASF. The AFFF subsequently flowed out of the building, into the parking lot to the east, filled the eastern drainage ditches and retention pond, and eventually flowed out onto W Jackson Street; the foam was allowed to naturally dissipate.

PFOA, PFOS, and PFNA were detected in surface soil at AOI 2. Site workers, construction workers, and trespassers could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers, construction workers, and trespassers are potentially complete. Additionally, nearby off-facility recreational users and off-facility residents may potentially be exposed to constituents via inhalation of dust. PFOA, PFOS, PFHxS, PFNA, and PFBS were not detected in subsurface soil at AOI 2. Therefore, all shallow subsurface pathways 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.

No wells that collect water at depths less than 400 feet bgs have been identified downgradient of the AASF (MDEQQ, 2019b; USGS, 2019), suggesting that none of the identified downgradient wells are collecting water in the Coffee Sand aquifer. Drinking water at the AASF and the local area is supplied by the City of Tupelo, which purchases drinking water from the Northeast Mississippi Regional Water District, who obtains the water from the Tombigbee River, approximately 18 miles east of the facility. Therefore, the ingestion exposure pathway for off-facility residents and site workers is considered incomplete for both AOIs. Unique features of each AOI are presented below.

7.2.1 AOI 1

PFOA concentrations exceeded the groundwater SL in monitoring well AOI01-01. PFHxS and PFBS were detected in groundwater, at concentrations below SLs at AOI 1. Additionally, PFHxS and PFOS in groundwater exceeded their SLs at the upgradient, western facility boundary monitoring well TUP-01. Depths to water at the facility measured in September 2021 during the SI ranged from 4.94 to 11.29 feet bgs. Consequently, shallow groundwater may be encountered during future construction activities; therefore, the ingestion exposure pathway for construction workers is considered potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA and PFNA exceeded their respective SLs in groundwater at monitoring well AOI02-01. PFOS, PFHxS, and PFBS were detected in groundwater, at concentrations below the SLs in AOI02-01. AOI 2 is also downgradient of AOI 1, and impacts at AOI 1 may potentially flow to AOI

2. The ingestion exposure pathway for construction workers is considered potentially complete because water was encountered at shallow depths (less than 15 feet bgs) across the facility. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3 Surface Water and Sediment Exposure Pathway

The SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors.

7.3.1 AOI 1

PFAS are water soluble and can migrate readily from soil to surface water via leaching and run-off. Because PFOA, PFOS, PFHxS, PFNA, and/or PFBS were detected in soil and groundwater at AOI 1, it is possible that those compounds may have migrated from soil and groundwater to on-facility drainage features and downgradient streams in the Kings Creek-Town Creek Watershed. Therefore, the surface water and sediment ingestion exposure pathways for site workers, construction workers, recreational users and trespassers are considered potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

PFOA, PFOS, PFHxS, PFNA, and/or PFBS were detected in soil and groundwater at AOI 2; therefore, it is possible that those compounds may have migrated from soil and groundwater to on-facility drainage features and downgradient streams in the Kings Creek-Town Creek Watershed. Consequently, the surface water and sediment ingestion exposure pathways for site workers, construction workers, recreational users and trespassers are considered potentially complete. The CSM for AOI 2 is presented on **Figure 7-2**.

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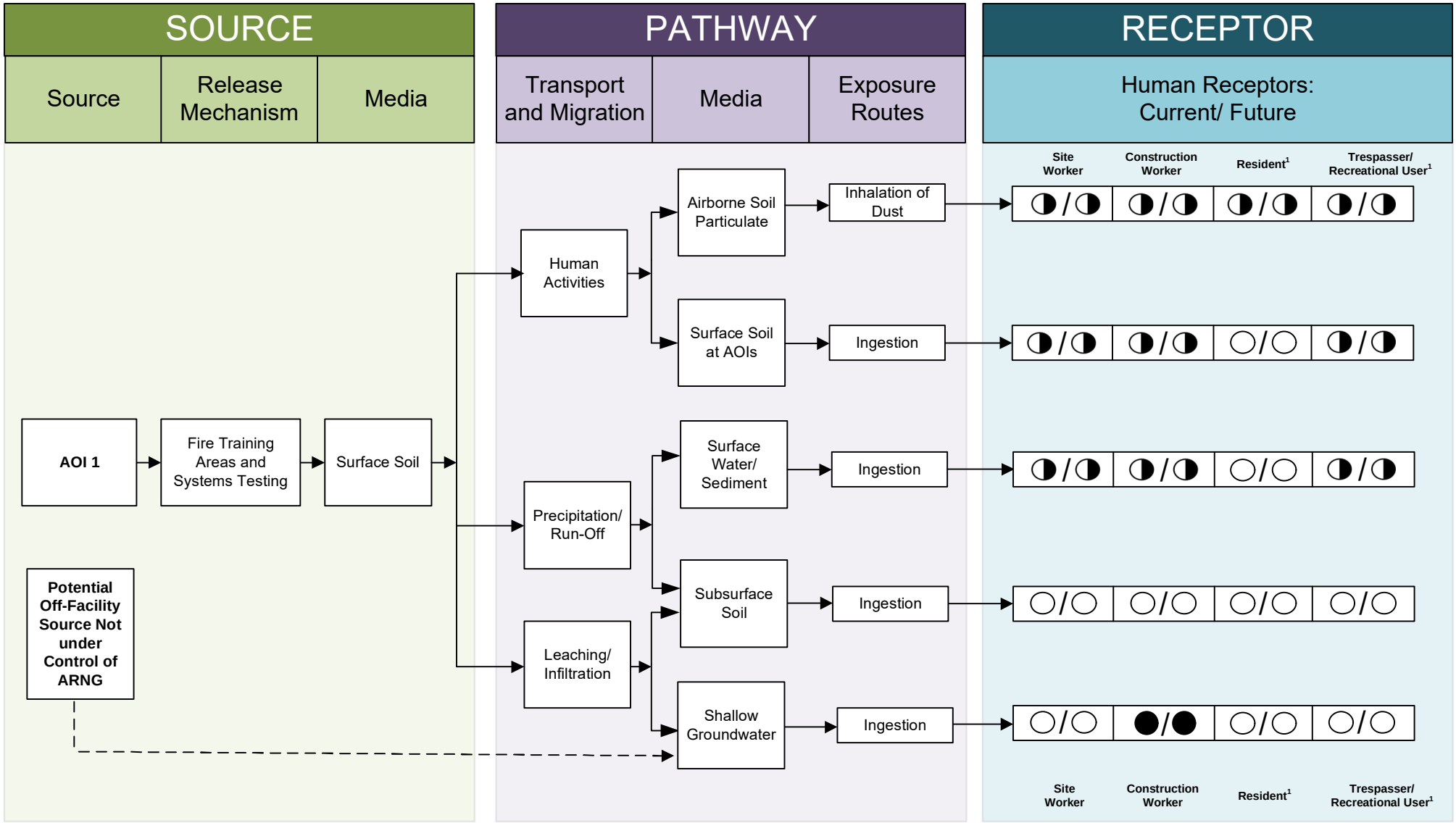
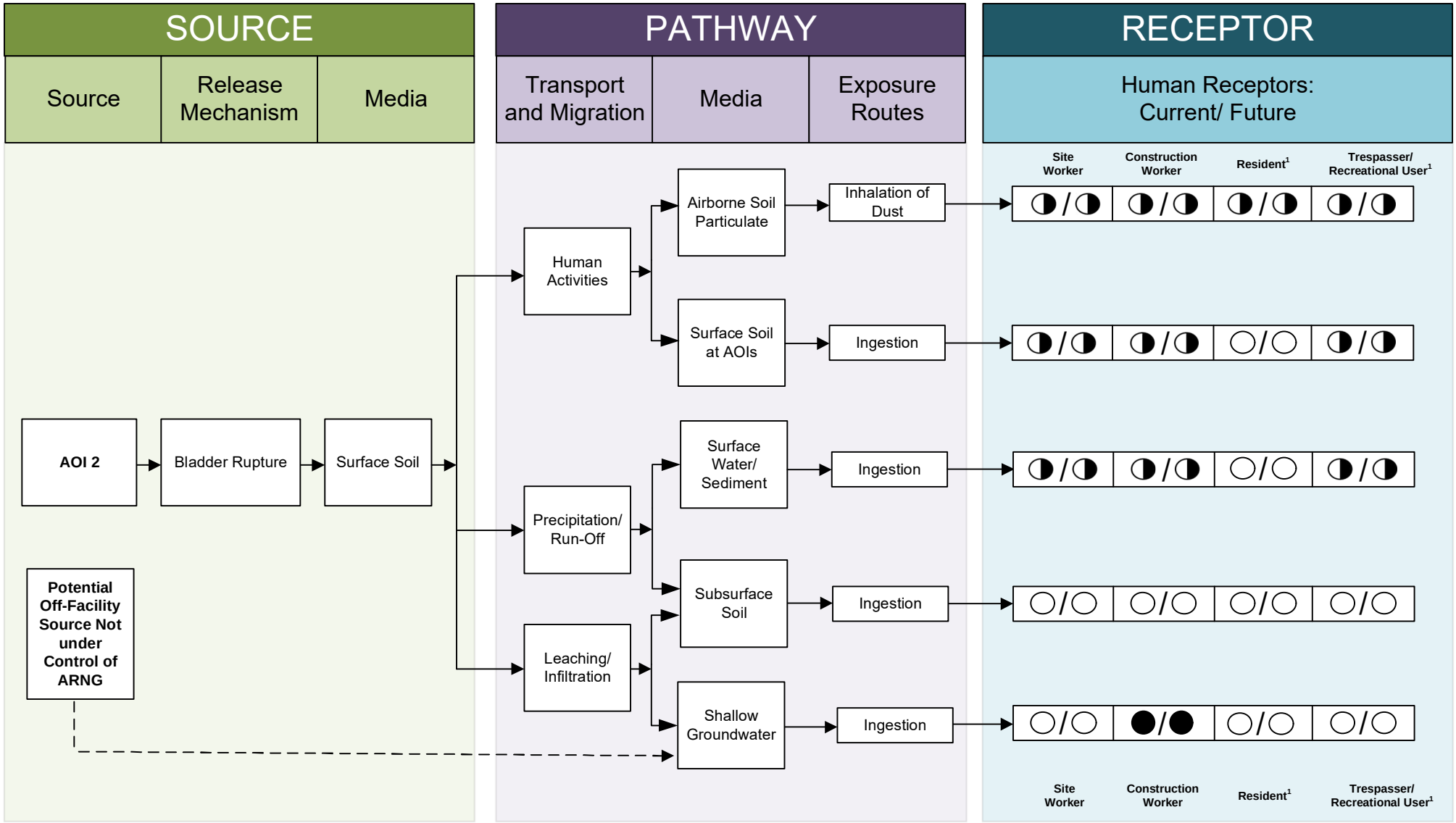


LEGEND

- 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 user receptors refer to an off-site resident and recreational user.

Figure 7-1
Conceptual Site Model, AOI 1
Western Release Areas



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 user receptors refer to an off-site resident and recreational user.

Figure 7-2
Conceptual Site Model, AOI 2
Bladder Rupture Release

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 27 August to 8 September 2021 and consisted of utility clearance, direct push boring, soil sample collection, permanent monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a), except as previously noted in **Section 5.8**.

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

- Twenty-three (23) soil samples from 13 boring locations;
- Four groundwater samples from four permanent monitoring wells;
- Sixteen (16) 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 and AOI 2 (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, there is no potential for exposure to drinking water receptors from AOI 1 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:
    - PFOA in groundwater exceeded the SL of 6 ng/L, with a concentration of 7.75 ng/L at AOI01-01. PFHxS and PFBS were detected below their SLs in groundwater at AOI 1. PFHxS exceeded the SL of 39 ng/L at the upgradient facility boundary location TUP-01, with a concentration of 43.1 ng/L. Based on the results of the SI, further evaluation of AOI 1 is warranted in an RI.
    - The detected concentrations of PFOA, PFOS, and PFNA in soil at AOI 1 were below their respective SLs.
- At AOI 2:
    - PFOA and PFNA were detected in groundwater above their SLs. PFOA exceeded the SL of 6 ng/L, with a concentration of 68.4 ng/L. PFNA exceeded the SL of 6 ng/L,

with a concentration of 11.7 ng/L. PFOS, PFHxS, and PFBS were detected in groundwater below the SLs. Based on the results of the SI, further evaluation of AOI 2 is warranted in an RI.

- The detected concentrations of PFOA, PFOS, and PFNA in soil at AOI 2 were below their SLs.

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	Western Release Areas	◐	●	●	Proceed to RI
2	Bladder Rupture Release	◐	●	●	Proceed to RI

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

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