FINAL
Site Inspection Report
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

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)
ARNG Installations, Nationwide

July 2023

Prepared for:

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

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees celsius
%	percent
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
btoc	below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
DA	Department of the Army
DoD	Department of Defense
DQI	data quality indicator
DQO	data quality objective
EA	EA Engineering, Science, and Technology, Inc., PBC
EIS	Extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
ft	foot (feet)
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
HQ	Hazard Quotient
ICAL	initial calibration
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
MIL-SPEC	military specification
KYARNG	Kentucky Army National Guard
LC/MS/MS	liquid chromatography tandem mass spectrometry
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOQ	Limit of quantification
MS	matrix spike
MSD	matrix spike duplicate

NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanogram(s) per liter
No.	number
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RI	remedial investigation
RPD	relative percent difference
SI	site inspection
SL	screening level
TCRA	Time Critical Removal Action
TOC	total organic carbon
TPP	Technical Project Planning
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WHFRTC	Wendell H. Ford Regional Training Center
Wood	Wood Environment & Infrastructure Solutions, Inc.
WSP	WSP USA Environment & Infrastructure Inc.

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EXECUTIVE SUMMARY

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

The PA identified one Area of Interest (AOI) where PFAS-containing materials may have been stored, disposed, or released historically (see **Table ES-2** for AOI location). The objective of the SI is to identify whether there has been a release to the environment from the AOI 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 a comparison of SI results to SLs for the relevant compounds. This SI was completed at the Wendell H. Ford Regional Training Center (WHFRTC) in Muhlenberg County, Kentucky, and determined that further investigation is warranted for AOI 1: Fire Station/Building 325. WHFRTC will also be referred to as "Facility" throughout this document.

The Facility is operated by Kentucky ARNG (KYARNG) and encompasses approximately 11,261 acres in west-central Muhlenberg County, Kentucky. WHFRTC is located approximately 2,000 feet west of the corporate boundary of Central City and 4 miles north of Greenville. KYARNG began operating WHFRTC in 1969. Any structures that existed prior to KYARNG's operation of WHFRTC were demolished by the Peabody Coal Company before they began their strip-mining operations. The Facility currently includes about 70 structures consisting of the headquarters/administration building; a dining hall; five enlisted and four non-commissioned officer barracks; two field grade officers' quarters; a fire station; various military operation training areas; two firing ranges; and various smaller outbuildings, control towers, and storage sheds (AECOM Technical Services, Inc. [AECOM] 2019).

The PA identified one AOI for investigation during the SI phase. SI sampling results from the AOI were compared to OSD SLs. **Table ES-2** summarizes the SI results for the AOI. Based on the results of this SI, further evaluation under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted in a remedial investigation for AOI 1.

[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 for Soil and Groundwater

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

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

Abbreviations:
µg/kg = microgram(s) per kilogram
bgs = below ground surface
ng/L = nanogram(s) per liter

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Fire Station/Building 325	◐	●	◐	Proceed to RI

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

Abbreviations:
RI = remedial investigation

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum regarding Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program (Assistant Secretary of Defense, 2022) from the Office of the Secretary of Defense (OSD) dated 6 July 2022. The six compounds listed in the OSD memorandum are referred to as "relevant compounds" throughout this document and include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA)[1]. The ARNG performed this SI at the Wendell H. Ford Regional Training Center (WHFRTC) in Muhlenberg County, Kentucky. WHFRTC is also referred to as the "Facility" throughout this report.

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

1.2 SITE INSPECTION PURPOSE

A PA was performed at WHFRTC (AECOM Technical Services, Inc. [AECOM] 2019) that identified one Area of Interest (AOI) 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 AOI 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

Information in this section was obtained from the Final Preliminary Assessment Report, Wendell H. Ford Regional Training Center, Kentucky (AECOM 2019), and updated with new information obtained during the SI as applicable.

2.1 FACILITY LOCATION AND DESCRIPTION

The WHFRTC, formerly referred to as the Western Kentucky Training Site, is located on 11,261 acres of state-owned reclaimed coal strip-mining land in west-central Muhlenberg County, Kentucky. WHFRTC is located approximately 2,000 feet west of the corporate boundary of Central City and 4 miles north of Greenville (**Figure 2-1**). The Facility is accessed via Exit 53 on the Wendell H. Ford Western Kentucky Parkway at Kentucky Highway 181 (AECOM 2019).

KYARNG began operating WHFRTC in 1969. Any structures that existed prior to KYARNG's operation of WHFRTC were demolished by the Peabody Coal Company before they began their strip-mining operations. The Facility currently includes about 70 structures, consisting of the headquarters/administration building; a dining hall; five enlisted and four non-commissioned officer barracks; two field grade officers' quarters; a fire station; various military operation training areas; two firing ranges; and various smaller outbuildings, control towers, and storage sheds (AECOM 2019).

2.2 FACILITY ENVIRONMENTAL SETTING

WHFRTC lies within the Shawnee Hills section of the Interior Low Plateaus physiographic region, also known as the Western Kentucky Coalfield. Within the Shawnee Hills, the Facility is situated near the middle of the Ohio River Hills and Lowlands subsections (AECOM 2019).

The area surrounding WHFRTC is characterized by hilly uplands of low to moderate relief, dissected by streams, which occupy wide, poorly drained valleys. However, the topography of most of WHFRTC has been drastically changed by both surface and deep coal mining operations. The elevation varies from approximately 395 feet above mean sea level along Cypress Creek and Little Cypress Creek to just over 645 feet above mean sea level at the crests of strip mine spoil banks near the southern boundary of the training area (AECOM 2019) (**Figure 2-2**).

Land cover at WHFRTC includes open grassland and shrubs (ideal for maneuver training exercises), pine and hardwood forest (ideal for dismounted training, bivouacking, and concealment), open water bodies, wetlands, and riparian areas along Little Cypress Creek and Cypress Creek, and the developed cantonment area. Numerous active or abandoned oil wells can be found in the western portion of the training area (AECOM 2019).

Portions of WHFRTC include reclaimed strip-mined land. The abandoned strip-mined areas have very rugged topography with 50 feet or more of relief, whereas the reclaimed strip-mined areas have gently rolling topography with less severe relief (AECOM 2019).

2.2.1 Geology

WHFRTC is underlain by Recent soils, and by Pennsylvanian-aged bedrock from which coal, natural gas, and oil have been extracted. Part of the bedrock is of the Lisman Formation of Upper Pennsylvanian age and part is of the Carbondale Formation of Middle Pennsylvanian age. These formations are made up mostly of sandstone, siltstone, and shale. Thin beds of limestone, coal, and clay also occur. Limestone layers include the Madisonville and Providence Members of the Lisman Formation (AECOM 2019).

According to a final environmental assessment contained in an attachment to the PA report (AECOM 2019), approximately 23% of WHFRTC soils have recently developed in parent materials disturbed during the surface mining for coal. These soils are loamy and contain a mixture of fine earth and rock fragments that once were bedrock layers above the coal seams. They generally comprise the central portion of the training area and are found on the uplands. Approximately 28% of soils occur naturally on the landscape, including silty alluvium on floodplains or in small upland depressions, and soils formed in loess and silty or clayey materials weathered from sandstone, siltstone, or shale bedrock. Approximately 46% of soils are strip-mined areas that have been returned to original contour and covered with topsoil collected from original soils stockpiled prior to mining (AECOM 2019). The nature of the remaining 3% of Site soils was not detailed in the PA report.

Soil encountered during SI activities was largely consistent with the above expected lithology. Lean clay with some silt and sand with occasional iron staining was observed overlying bedrock within the borings. A sample for grain size analyses was collected at one location, AOI01-01, and analyzed via American Society for Testing and Materials (ASTM) International Method D-442. The results indicate that the soil sample was composed primarily of silt (57.65%) and clay (18.49%). Grain size results are provided in **Appendix G**. This result and Facility observations are consistent with the reported depositional environment of the region.

Depth to bedrock in the borings ranged from approximately four to 13 feet below ground surface (bgs), and borings were completed at depths between 15 and 50 feet bgs. Bedrock underlying the soils consisted of sandstone and shale. The bedrock is mostly weak/weathered at the top and becomes less weathered and more competent with depth. Boring logs are presented in **Appendix F**.

2.2.2 Hydrogeology

Water-bearing units in the region are the Tradewater and the Caseyville Formations. These formations yield significant quantities of water but become saline with depth. Median depths to water level in the Tradewater and Caseyville Formations are 18.2 feet and 34.4 feet bgs, respectively. Regional groundwater flow is toward the broad alluvial area along the Green River, northeast of WHFRTC. No sole source aquifers have been designated in Kentucky. A freshwater aquifer—approximately 1,100 feet bgs—lies several miles west of the Facility. The aquifer is within the New Cypress Pool formation (AECOM 2019).

The natural water table and drainage patterns beneath WHFRTC have been altered by mining activities. Groundwater features are shown on **Figure 2-3**. The water table is relatively close to the surface throughout most of WHFRTC as a result of surface mining activities. Abandoned underground mines found in the Kentucky No. 9 coal seam beneath WHFRTC are known to be flooded. Water levels in ten monitoring wells located at WHFRTC ranged from 5 to 64 feet bgs and averaged 29.74 feet bgs during a groundwater sampling event conducted in June 2004. Groundwater flow in the unconfined aquifer at the Facility is generally inferred to be to the northeast (AECOM 2019); however, a review of a topographic map for the Site indicates groundwater flow near AOI 1 may be to the north-northwest. AOI 1 is situated on a small rise and slopes downward to the west, northwest, north, and northeast. A topographic low area to the west and northwest of AOI 1 extends northwestward and likely influences the direction of groundwater flow from AOI 1. The first groundwater encountered during the SI at AOI 1 was observed near the soil/bedrock interface in two borings (WHFRTC-01 and AOI01-05) located at lower ground surface elevations than the nearby fire station, where AFFF has been stored historically. Groundwater was observed deeper in bedrock in two borings (AOI01-01 and AOI01-04) located at higher ground surface elevations closer to the fire station. During the SI, depth to groundwater at AOI 1 ranged from approximately 7 to 39 feet bgs, while one well (AOI01-02) was dry. Based on groundwater elevations calculated using depth to groundwater measurements and survey data collected during the SI (**Figure 2-4**), first encountered groundwater at AOI 1 flows generally to the north-northeast.

The KYARNG indicated that possible subsurface obstructions from the effects of past Site mining activities may exist, and that shallow groundwater may not be continuous across the Facility (KYARNG 2021). Therefore, Sonic drilling technology was used to reach groundwater at WHFRTC.

Because of the proximity of the Green River, most water supplies are obtained from surface-water. Public water supplies obtained from the Green River are available to local residents. Wells are not used to obtain drinking water (AECOM 2019).

Peabody Coal Company maintained and monitored several groundwater monitoring points on the property, as required by previously held mining permits; however, this monitoring is no longer required. The Kentucky Geological Survey installed 10 groundwater wells on WHFRTC in the spring of 2001 to monitor groundwater quality and water level fluctuation in the soil through wet and dry seasons (spring and fall).

WSP USA Environment & Infrastructure Inc. (WSP), formerly doing business as Wood Environment & Infrastructure Solutions, Inc. (Wood) initiated a desktop survey of potential private and public water supply wells within a four-mile distance of the WHFRTC boundary to identify potential receptor pathways and downstream and/or downgradient receptors. The desktop survey included a review of a list of water supply wells provided by the Kentucky Geological Survey records (https://kgs.uky.edu/kgsweb/datasearching/water/waterwellsearch.asp) and Kentucky Division of Water Maps Portal (https://watermaps.ky.gov). A total of 343 wells were identified within a four-mile distance of the installation (**Figure 2-3**). The 343 wells comprised two public water supply wells, 83 domestic wells, 17 agricultural wells, 169 monitoring wells, eight remediation wells, 44 mining

wells, and 20 wells of unknown use. Both identified public water supply wells are located almost four miles south-southwest of WHFRTC (approximately 4.5 miles south-southwest of AOI 1) at an interpreted hydraulically upgradient location from AOI 1. The closest domestic well identified as being active and at an interpreted hydraulically downgradient location from AOI 1 is located more than five miles from the AOI. Three domestic wells with status identified as unknown are located between three and four miles from AOI 1 at an interpreted hydraulically downgradient location from AOI 1.

2.2.3 Hydrology

WHFRTC is situated in the Cypress Creek sub-basin of the Pond River Watershed Basin. The only major tributary to Cypress Creek is Little Cypress Creek. Cypress Creek originates in west-central Muhlenberg County and flows 35.5 miles north and then west through McLean County before discharging into the Pond River 1.1 miles upstream from its confluence with the Green River (AECOM 2019).

The immediate watershed receiving discharge from the Facility is Cypress Creek, which is a low-gradient stream with 97% of its channel having been altered by channelization (AECOM 2019).

The only other major tributary in the watershed is Little Cypress Creek (a second-order creek), which originates 4.16 miles north of Greenville and flows 9.32 miles in a northerly direction before joining Cypress Creek northwest of Central City. Approximately 35% of Cypress Creek and 44% of Little Cypress Creek were channelized during the 1920s. Materials from dredging were placed into two spoil banks on either side of the creek, impeding the natural flow of water to adjacent wetlands (AECOM 2019).

WHFRTC is divided into 11 unique hydrologic planning units based on topography, direction of water flow, and receiving perennial stream. Cypress Creek Watershed is divided into four sub-watersheds, and Little Cypress Creek Watershed is divided into three sub-watersheds (AECOM 2019).

Several small unnamed tributaries and intermittent streams cross the Facility and drain into Cypress Creek on the west and north and into Little Cypress Creek on the south and east. In addition to surface streams, there are numerous sediment retention basins and ponds and lakes on the property related to mine reclamation activities. Surface water features are presented on **Figure 2-5** (AECOM 2019).

2.2.4 Climate

Data from nearby Madisonville, Kentucky, indicate that the average annual temperature between 1991 and 2021 was 58.8 degrees Fahrenheit (ºF) (www.noaa.gov). The warmest months are July and August, with normal daily mean temperatures of 79.6ºF and 78.9ºF, respectively. January is the coldest month, with a mean temperature of 35.8ºF. Average annual precipitation measured from 1991 to 2021 in Madisonville, Kentucky was 48.2 inches. Rainfall is heaviest during the month of April, averaging 4.64 inches; August is the driest month, averaging 2.99 inches (https://en.climate-data.org).

2.2.5 Current and Future Land Use

WHFRTC serves as the primary training area for KYARNG. The majority of training occurs between June and October; however, training does occur throughout the remainder of the year (AECOM 2019).

WHFRTC is used almost entirely by military groups. Military users include units of the KYARNG and Kentucky Air National Guard, the Army and Marine Reserves, active Army units from Fort Knox and Fort Campbell, and Army schools. WHFRTC is also used for other training activities for Reserve Components from Kentucky and surrounding states. Other users include Youth Challenge, 4-H, Boy Scouts, Junior and Senior Reserve Officers' Training Corps, deer and turkey hunters (during scheduled hunts), Kentucky State Police, Department of Corrections, and local law enforcement agencies (AECOM 2019).

Some expansion of the training facilities is in the planning phase; however, in general, the future use of the Facility is not anticipated to change significantly (AECOM 2019). The Facility is fenced and has restricted access.

2.2.6 Sensitive Habitat and Threatened/Endangered Species

A wildlife survey has not occurred at the Facility. The following species are listed as federally endangered, threatened, proposed, and/or candidate species that could potentially be present at WHFRTC (USFWS 2021):

Clams:

- Clubshell, *Pleurobema clava* (endangered)
- Fanshell, *Cyprogenia stegaria* (endangered)
- Northern Riffleshell, *Epioblasma torulosa rangiana* (endangered)
- Pink Mucket (pearly mussel), *Lampsilis abrupta* (endangered)
- Purple Cat's Paw, *Epioblasma obliquata* (endangered)
- Rabbitsfoot, *Quadrula cylindrica* (threatened)
- Ring Pink (mussel), *Obovaria retusa* (endangered)
- Rough Pigtoe, *Pleurobema plenum* (endangered)
- Sheepnose Mussel, *Plethobasus cyphyus* (endangered)
- Spectaclecase (mussel), *Cumberlandia monodonta* (endangered)

Mammals:

- Northern Long-Eared Bat, *Myotis septentrionalis* (threatened)
- Gray Bat, *Myotis grisescens* (threatened)
- Indiana Bat, *Myotis sodalis* (endangered)

2.3 HISTORY OF PFAS USE

One potential PFAS release area (non-fire training area) was identified at the Facility during the PA (AECOM 2019). Interviews and records obtained during the PA indicate that the WHFRTC Fire Department stores AFFF on two trucks kept at Fire Station/Building 325. Angus Tridol

S 3% AFFF is stored in 5-gallon buckets on each truck and in a material storage room at the fire station. Angus Tridex 3% AFFF is also stored in the fire station storage room, as well as non-AFFF fire suppressants such as Purple K and ABC fire extinguishers. The fire chief stated during interviews that AFFF concentrate has not spilled from their storage containers. Only water and Class A foam have been used by the WHFRTC Fire Department on Facility, according to WHFRTC staff. Additionally, no crashes have occurred at WHFRTC that required fire department emergency response, and no fire training operations are performed by the fire department at WHFRTC. The WHFRTC Fire Department performs prescribed burns at the Facility but uses only water to mitigate forest and wildfires. No fire department equipment that uses AFFF is currently tested or washed out at WHFRTC. There is no fire suppression system at Building 325. According to interviews with WHFRTC Fire Department staff, all building fire suppression systems at WHFRTC use water or dry chemical suppression agents, such as Purple K. There are no documented uses of AFFF at Building 325, or anywhere on WHFRTC by the WHFRTC Fire Department.

The WHFRTC Fire Department used AFFF during a response to an off-Facility fire in Central City in 2016. The WHFRTC Fire Chief reported that the fire truck used in response to the fire was most likely washed at the WHFRTC fire station after responding to the fire. It is unclear whether any AFFF deployed remained on the truck at the time of washing.

A more detailed description of the AOI is presented in Section 3.

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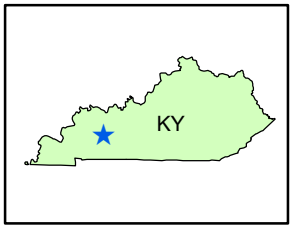
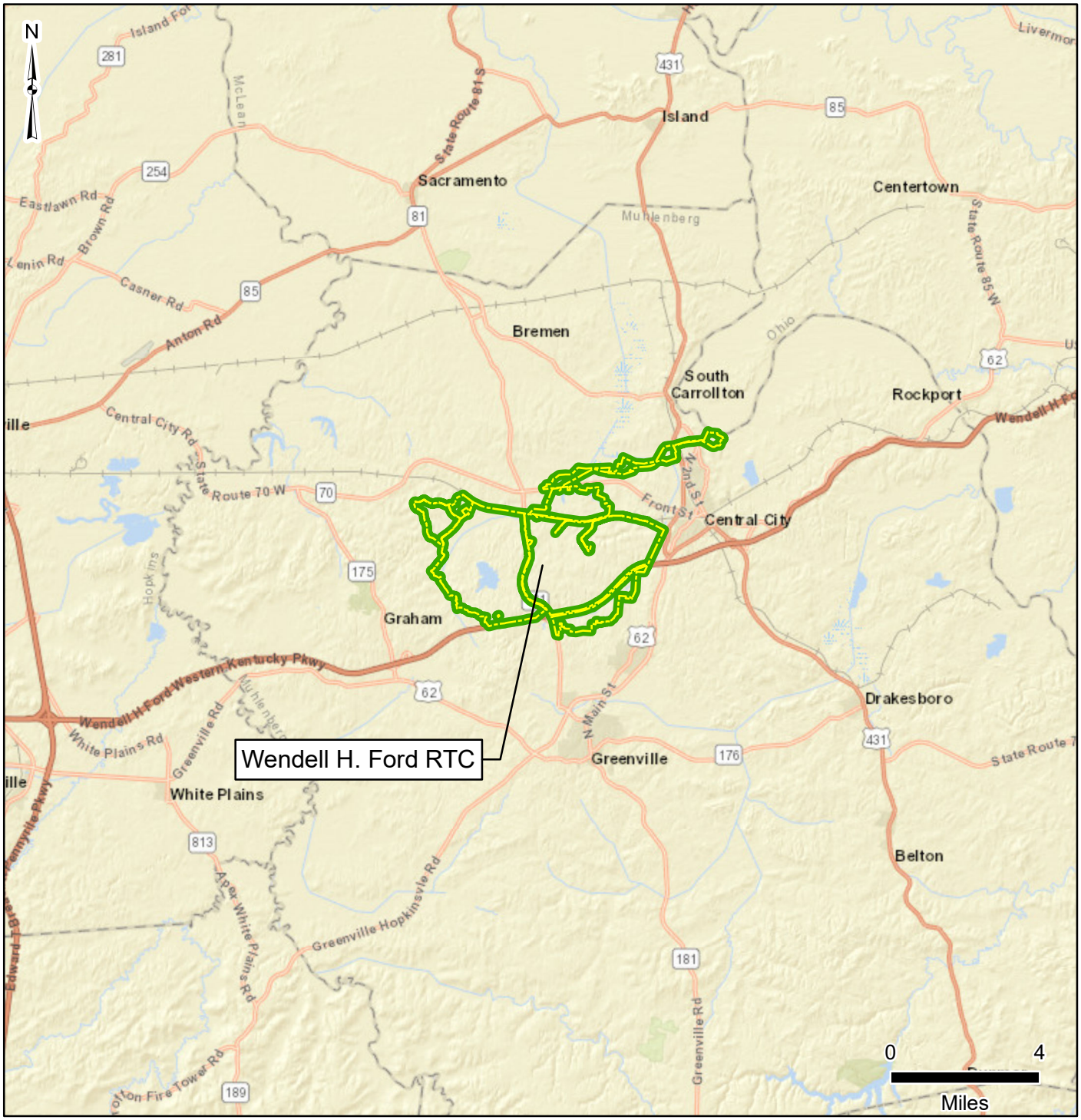
Muhlenberg County, Kentucky

Figure 2-1
Facility Location





Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2019

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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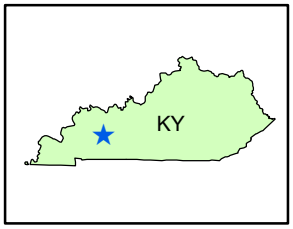
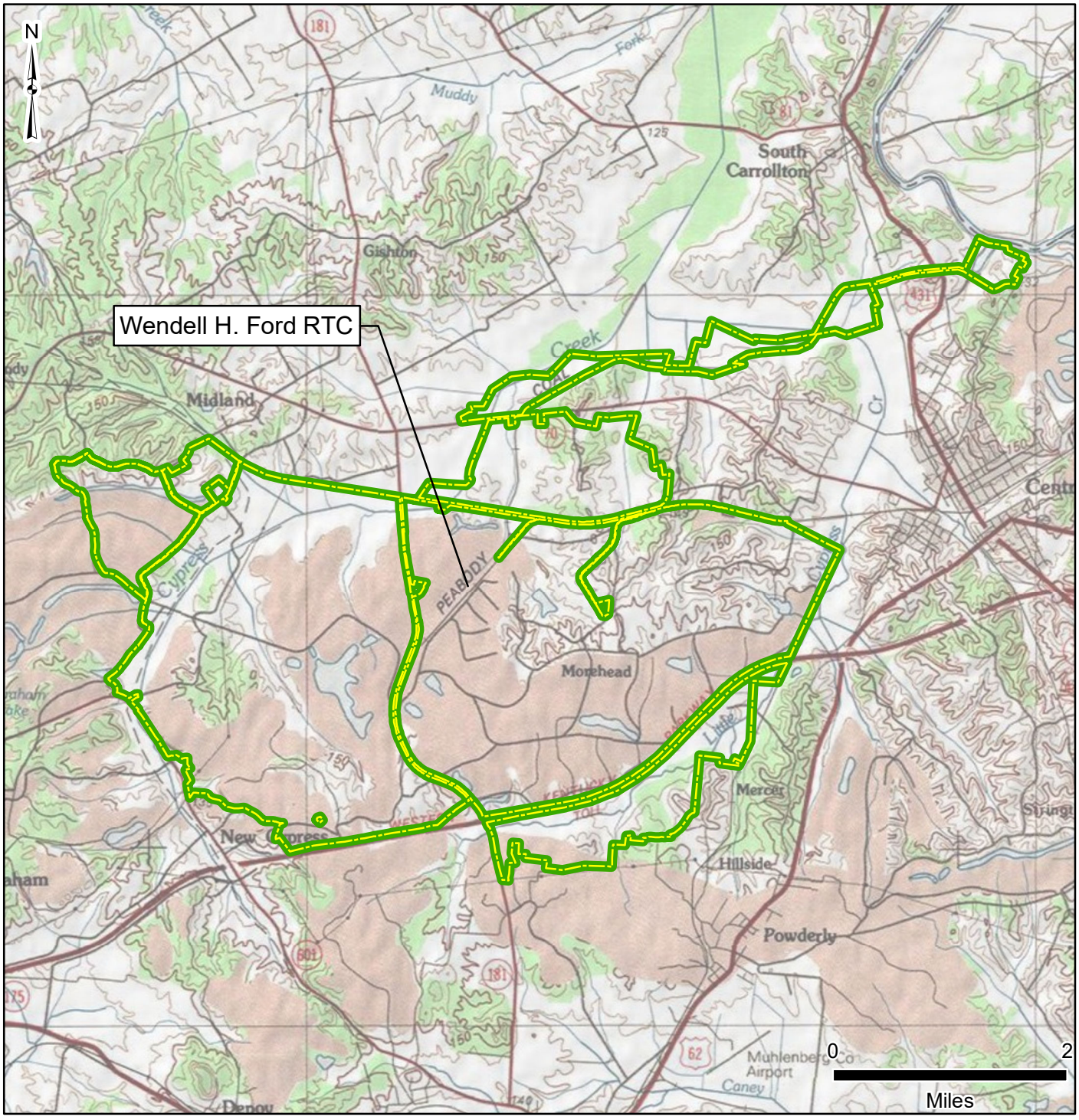
Figure 2-2
Facility Topography





Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2019

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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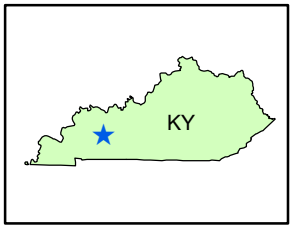
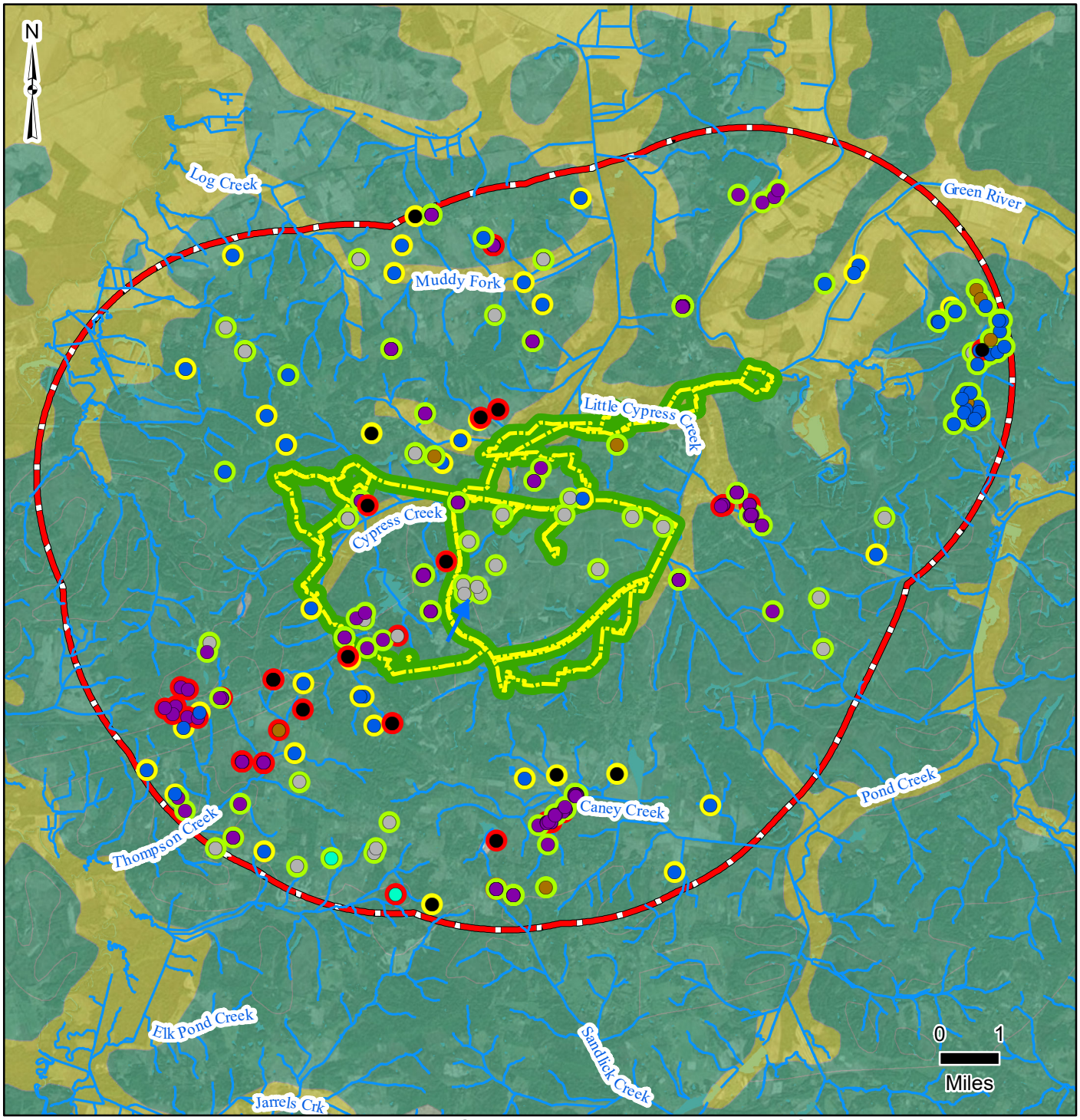
Figure 2-3
Groundwater Features





Facility Data
- Facility Boundary
- 4-Mile Well Search Radius

Well Type
- Public Water System
- Domestic
- Agriculture
- Monitoring Well
- Mining
- Well Use Unknown

Well Status
- Active
- Inactive
- Status Unknown

Hydrology/ Hydrogeology
- Inferred Groundwater Flow Direction
- River/Stream
- Water Body

Geology
- Siltstone
- Sand

Data Sources:
ESRI 2020
AECOM 2019

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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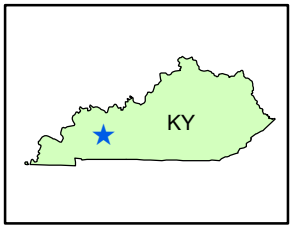
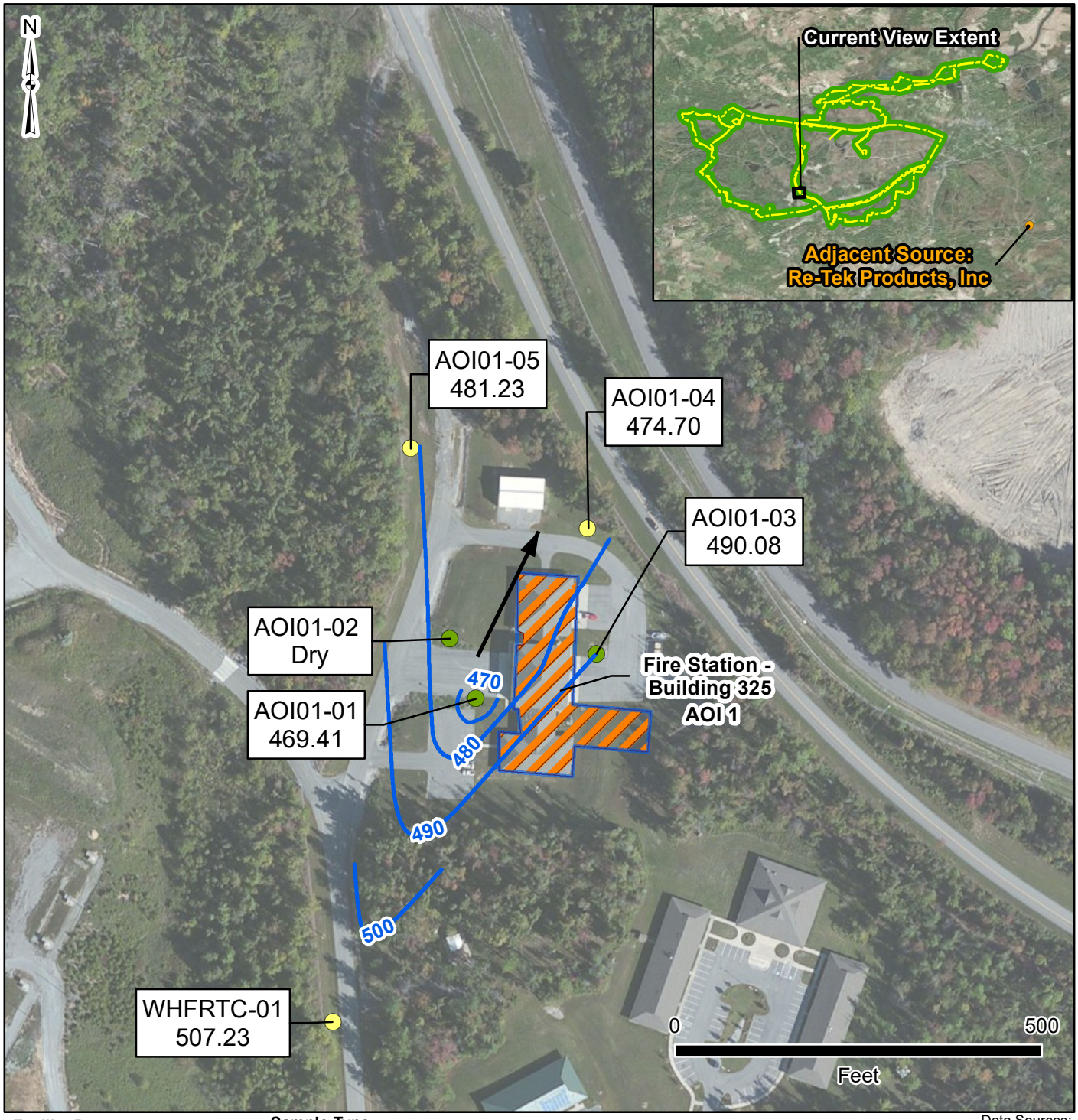
Figure 2-4
Groundwater Elevations, November 2021





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Sample Type
- Soil Boring/Temporary Monitoring Well
- Temporary Monitoring Well

Hydrogeology
- Goundwater Elevation Contour (10')
- Inferred Groundwater Flow Direction

Data Sources:
ESRI 2020
AECOM 2019

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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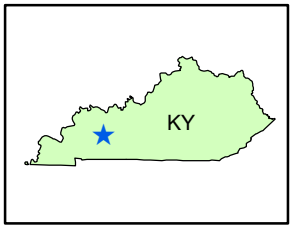
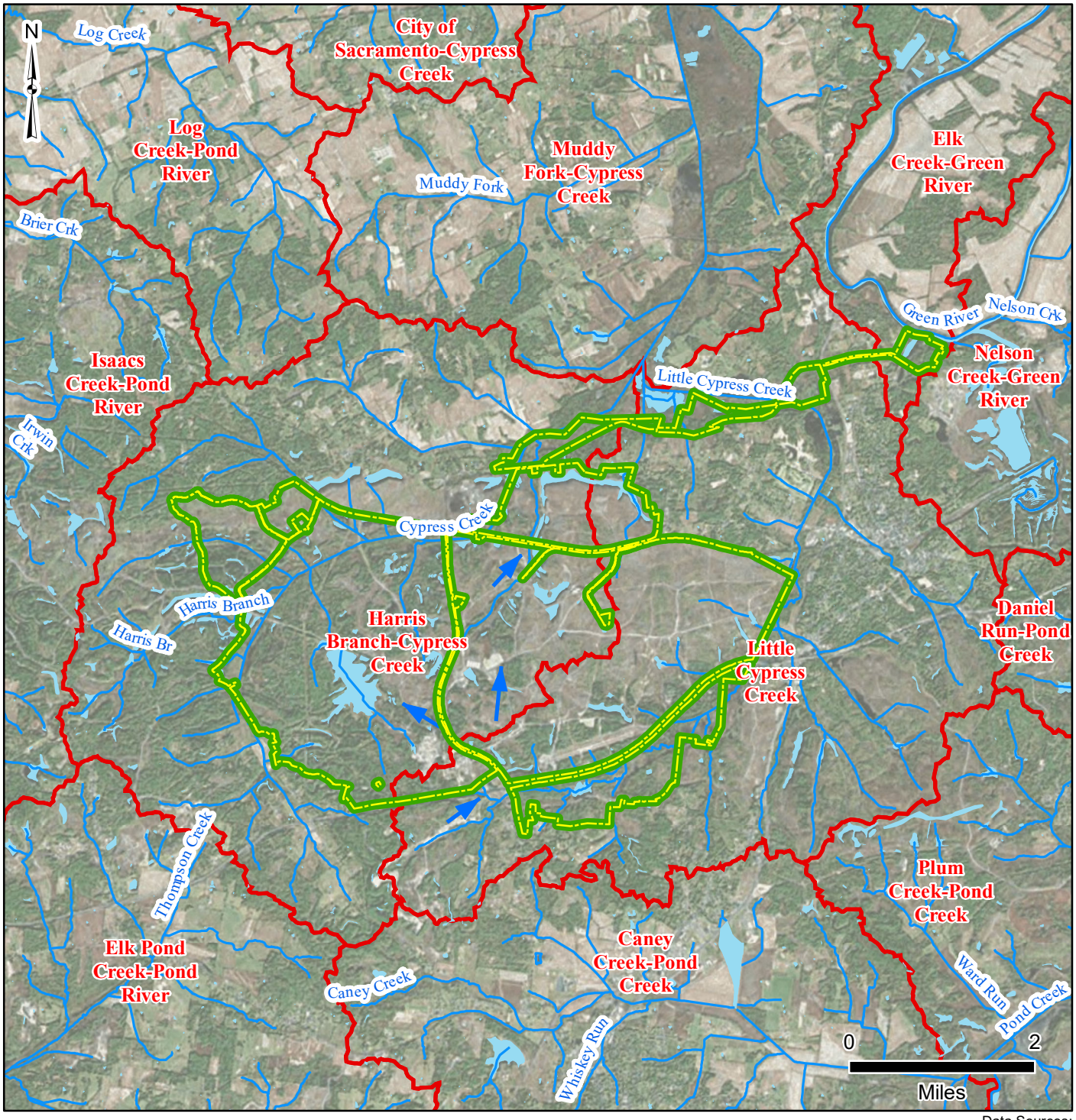
Army National Guard Site Inspections
Site Inspection Report
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

Figure 2-5
Surface Water Features





Facility Data

- Facility Boundary

Hydrology

- Surface Water Flow Direction
- River/Stream
- Water Body
- Watershed Boundary

Data Sources:
ESRI 2020
AECOM 2019

Date:.....January 2022
Prepared By:.....WSP
Prepared For:.....USACE

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3. SUMMARY OF AREA OF INTEREST

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. One potential release area was identified at WHFRTC and designated as: AOI 1 Fire Station/Building 325. The AOI is shown on **Figure 3-1**.

3.1 AOI 1 – FIRE STATION/BUILDING 325

Building 325, the Facility fire station, is located in the northern portion of the cantonment area at WHFRTC, east of the intersection of St-1032 and St-1026. The fire station was considered a potential PFAS release site based on the storage of AFFF. The geographic coordinates for the fire station are 37°26'03.60"N and 87°21'00.37"W. According to interviews with the Facility fire department staff, construction of Building 325 was completed in 2005 (AECOM 2019).

WHFRTC Fire Department stores AFFF on two trucks kept at the fire station apparatus bay. Angus Tridol S 3% AFFF is stored in 5-gallon buckets on each truck and in a material storage room at the fire station. Angus Tridex 3% AFFF is also stored in the fire station storage room, as well as non-AFFF fire suppressants such as Purple K and ABC fire extinguishers. The fire chief stated during interviews that AFFF concentrate has not spilled from their storage containers. Only water and Class A foam have been used by the WHFRTC Fire Department on Facility, according to WHFRTC staff. Additionally, no crashes have occurred at WHFRTC that required fire department emergency response, and no fire training operations are performed by the fire department at WHFRTC. WHFRTC Fire Department performs prescribed burns at the Facility, but only uses water to mitigate forest and wildfires. No fire department equipment that uses AFFF is currently tested or washed out at the Facility. There is no fire suppression system at Building 325. According to interviews with WHFRTC Fire Department staff, all building fire suppression systems at WHFRTC use water or dry chemical suppression agents, such as Purple K. There are no documented uses of AFFF at Building 325, or anywhere on Facility by the WHFRTC Fire Department (AECOM 2019).

The WHFRTC Fire Department used AFFF during response to an off-Facility fire in Central City in 2016. The WHFRTC Fire Chief reported that the fire truck used in response to the fire was most likely washed at the WHFRTC fire station after responding to the fire. It is unclear whether any AFFF deployed remained on the truck at the time of washing. Floor drains inside the building direct runoff through sand traps and into the Facility main sanitary sewer system. The sanitary sewer system connects to the Greenville Wastewater Plant, located approximately 3 miles southeast of the Facility. Runoff outside the station is channelized to a stormwater outfall adjacent to Highway 181 east of the fire station (AECOM 2019).

3.2 ADJACENT SOURCES

One potential off-Facility source of PFAS is located adjacent to the Facility and is not under the control of the KYARNG. A description of the off-Facility source is presented below and shown on **Figure 3-1**.

3.2.1 Re-Tek Products, Inc.

WHFRTC has a mutual agreement to respond to emergencies within Muhlenberg County. According to the PA report, the WHFRTC Fire Department used AFFF during response to a fire at a rubber warehouse owned by Re-Tek Products, Inc. located at 3320 Cleaton Road, Central City, Kentucky, on 15 October 2016. The location of the fire is approximately 5.8 miles east of WHFRTC at an interpreted cross-gradient (shallow groundwater flow) direction. During their response, the WHFRTC Fire Department expelled water and AFFF. Approximately 75 gallons of AFFF was used to suppress the fire by the WHFRTC Fire Department, according to the KYARNG incident report. Other local fire departments responded to the emergency, including McLean County Fire Department. The WHFRTC Fire Chief reported that the fire truck used in response to the fire was most likely washed at the WHFRTC fire station after responding to the fire (AECOM 2019).

The Re-Tek Products, Inc. fire location is identified as a potential release area. However, because it is several miles outside the boundary of WHFRTC at an interpreted cross-gradient location, the Re-Tek Products, Inc. fire area is not considered an adjacent off-Facility potential source of PFAS for WHFRTC.

Army National Guard Site Inspections
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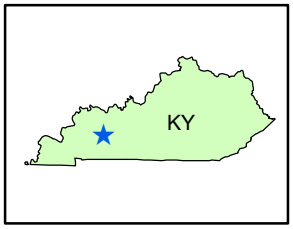
Figure 3-1
Area of Interest



Facility Data
- Facility Boundary
- Area of Interest (AOI)
- Potential PFAS Release Site
- No Suspected Release

Well Type
- Mining Well
- Monitoring Well

Hydrology/Hydrogeology
- Surface Water Flow Direction
- Inferred Shallow Groundwater Flow Direction
- River/Stream
- Water Body

Data Sources:
ESRI 2020
AECOM 2019

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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4. PROJECT DATA QUALITY OBJECTIVES

As identified during the data quality objective (DQO) process and outlined in the SI Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP) Addendum (EA/Wood 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOI 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 the presence or absence of relevant compounds at the sampled AOI.

4.1 PROBLEM STATEMENT

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

4.2 INFORMATION INPUTS

Primary information inputs for the SI include the following:

- The PA Report for WHFRTC (AECOM 2019)
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific UFP-QAPP Addendum (EA/Wood 2021a)
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 STUDY BOUNDARIES

The scope of the SI was bounded horizontally by the property limits of the Facility (**Figure 2-2**). The scope of the SI was bounded vertically by the depth of temporary monitoring wells installed within groundwater, where encountered (maximum depth of 50 feet bgs). Off-Facility sampling was not included in the scope of this SI. If future off-Facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s). Temporal boundaries were limited to the earliest available time field resources were available to complete the study.

4.4 ANALYTICAL APPROACH

Samples were analyzed by Eurofins, accredited under the DoD Environmental Laboratory Accreditation Program (DoD ELAP; Accreditation Number 1.01) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 021). PFAS data underwent 100 percent (%) Stage 2B validation in accordance with the DoD General Data Validation Guidelines (2019a) and DoD Data Validation Guidelines Module 3: Data Validation Procedure of Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual (QSM) Table B-15 (2020). PFAS data were compared to applicable SLs within this document and decision rules as defined in the UFP-QAPP Addendum (EA/Wood 2021a).

4.5 DATA USABILITY ASSESSMENT

The Data Usability Assessment, 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).

The environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the Data Usability Assessment and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the UFP-QAPP Addendum (EA/Wood 2021a).

5. SITE INSPECTION ACTIVITIES

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

- *Final Preliminary Assessment Report, Wendell H. Ford Regional Training Center, Kentucky,* dated January 2019 (AECOM 2019)

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

- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Wendell H. Ford Regional Training Center, Muhlenberg County, Kentucky* dated August 2021 (EA/Wood 2021a)

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

- *Final Accident Prevention Plan/Site Safety and Health Plan Addendum, Wendell H. Ford Regional Training Center, Kentucky,* dated April 2021 (EA/Wood 2021b).

The SI field activities were conducted from 15 through 22 November 2021 and consisted of utility clearance, Sonic drilling technology boring and soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA/Wood 2021a), except as noted in **Section 5.8**.

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

- Eight soil samples from three locations (soil borings);
- Five grab groundwater samples from five of six temporary well locations;
- Eight quality assurance/quality control (QA/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 medium. Field documentation is provided in **Appendix B**. A log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2,** land survey data are provided in **Appendix B3,** and investigation-derived waste (IDW) placement data are provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 PRE-INVESTIGATION ACTIVITIES

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

5.1.1 Technical Project Planning

The U.S. Army Corps of Engineers (USACE) TPP Process, Engineers Manual 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 AOI identified in the PA.

A combined TPP Meeting 1 and 2 was held on 30 June 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with Engineer Manual 200-1-2 (DA 2018). The stakeholders for this SI included ARNG, KYARNG, USACE, Kentucky Department for Environmental Protection, 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 UFP-QAPP Addendum (EA/Wood 2021a).

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

5.1.2 Utility Clearance

WSP contacted the Utility Notification Center (Kentucky 811) to notify them of intrusive work at the Facility. WSP contracted Blood Hound, a private utility location service, to perform utility clearance at the Facility. Utility clearance was performed at each of the proposed boring locations on 10 November 2021 with input from the WSP field team. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared by WSP's drilling subcontractor, GSE, Inc., using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was evaluated to determine if it was PFAS-free prior to the start of field activities. A sample from a potable water source at the Facility fire station, was collected on 27 July 2021, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the sample of the potable water source used for decontamination of drilling equipment during the SI (WHFPOT01) are provided in **Appendix E**. A discussion of the results is presented in the Data Usability Assessment (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures appendix to the Programmatic UFP-QAPP (EA/Wood 2021a).

5.2 SOIL BORINGS AND SOIL SAMPLING

Soil samples were collected via Sonic drilling methods in accordance with Standard Operating Procedure 019, *Monitoring Well Installation* (EA 2014). A TSi 150CC track-mounted Sonic drill rig sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring in compliance with utility clearance procedures. The soil boring locations are shown on **Figure 5-1**, and boring sample depths are provided in **Table 5-1**. Certain boring locations were adjusted slightly (less than 50-foot offset) for reasons including drill rig access, utility avoidance and bias toward sampling within observed drainage features.

Three discrete soil samples were planned to be collected for chemical analysis from each of the three soil borings: one sample at the surface (0 to 2 feet bgs) and two subsurface soil samples. One subsurface soil sample was to be collected approximately 1 foot above the groundwater table, and one subsurface sample was to be collected at the mid-point between the surface and the groundwater table (not to exceed 15 feet bgs). However, the UFP-QAPP Addendum (EA/Wood 2021a) specified only two samples be collected if refusal was encountered at 6 feet bgs or shallower. Because shallow bedrock was encountered less than 6 feet bgs at one soil boring location (AOI01-03), only two soil samples were collected at this location. Three soil samples were collected at the other two soil boring locations.

During drilling, the uppermost saturated zone was observed at depths ranging from approximately 10 to 30 feet bgs in three borings (AOI01-04, AOI01-05, and WHFRTC-01) and was not observed in three other borings (AOI01-01 through AOI01-03). Following installation of temporary monitoring wells, the static groundwater depths in five of the wells ranged from approximately 7 to 39 feet bgs, while one well (AOI01-02) was dry.

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

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

International Method D-422 and USEPA Method 9045D), in accordance with the UFP-QAPP Addendum (EA/Wood 2021a).

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

Sonic borings were converted to temporary wells, which were subsequently abandoned after sampling and surveying in accordance with the UFP-QAPP Addendum (EA/Wood 2021a). After removal of the casings, boreholes were abandoned using bentonite chips. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 TEMPORARY WELL INSTALLATION AND GROUNDWATER GRAB SAMPLING

Temporary wells were installed using a TSi 150CC track-mounted Sonic-drill rig sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 10-foot section of 1-inch Schedule 40 polyvinyl chloride (PVC) screen with sufficient casing to reach the ground surface. New PVC pipe and screen were used at each location to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected using a PFAS-free 0.85-inch Geotech Bladder pump with PFAS-free HDPE tubing. Samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well intervals. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected in a separate container. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there was any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected in laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express under standard chain-of-custody procedures to the laboratory and analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA/Wood 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. Two field blanks were collected in accordance with the UFP-QAPP Addendum (EA/Wood 2021a). In instances when non-dedicated sampling

equipment was used, such as a bladder pump, one equipment blank per day was collected and analyzed for the same parameters as the groundwater samples. A temperature blank was placed in each cooler for use in confirming that samples were preserved at or below 6°C during shipment.

Following well surveying (described below in **Section 5.5**), temporary wells were abandoned in accordance with the SI UFP-QAPP Addendum (EA/Wood 2021a) by removing the PVC and backfilling the hole with bentonite chips.

5.4 SYNOPTIC WATER LEVEL MEASUREMENTS

A synoptic groundwater gauging event was performed on 22 November 2021. Groundwater elevation measurements were collected from the new temporary monitoring wells. Water level measurements were taken from the survey mark on the northern side of the well casing. Groundwater elevation data are provided in **Table 5-3**. A groundwater flow contour map is provided as **Figure 2-4**.

5.5 SURVEYING

The northern side of each new temporary well casing was surveyed using a Carlson BRx7 GNSS Receiver and the Kentucky Transportation Cabinet VRS System. Positions were collected in the applicable Universal Transverse Mercator zone projection with World Geodetic System 1984 datum (horizontal) and North American Vertical Datum 1988 (vertical). Surveying data were collected on 22 November 2021 and are provided in **Appendix B3**.

5.6 INVESTIGATION-DERIVED WASTE

As of the date of this report, the disposal of PFAS IDW is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the UFP-QAPP Addendum (EA/Wood 2021a) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil and rock cuttings) generated during the SI activities were distributed on the downgradient side of the borehole, while liquid IDW (i.e., purge water and decontamination fluids) was discharged directly to the ground surface slightly downgradient of the source of generation. The IDW was not sampled and assumes the characteristics of the associated soil or groundwater samples collected from that source location. Geographic coordinates were collected using a Global positioning system (GPS) around each location where IDW was placed. A map depicting the locations of the IDW placement with coordinates is provided in **Appendix B4**.

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

5.7 LABORATORY ANALYTICAL METHODS

Samples were analyzed by LC/MS/MS, compliant with QSM Version 5.3 Table B-15 (DoD, 2020), at Eurofins in Lancaster, Pennsylvania, a DoD ELAP and NELAP-certified laboratory. Soil samples were also analyzed for TOC using EPA Method 9060A, pH by EPA Method 9045D, and grain size by ASTM D422.

5.8 DEVIATIONS FROM SI UFP-QAPP ADDEMDUM

Deviations from the UFP-QAPP Addendum occurred based on conditions encountered during field activities. These deviations were discussed between EA, Wood, the ARNG, and/or USACE, as applicable. Deviations from the UFP-QAPP Addendum (EA/Wood 2021a) are noted below:

- For temporary monitoring wells, a 10-foot screen was used rather than a 5-foot screen, based on observations during drilling to attempt to screen the wells across the groundwater zone. In spite of the longer screen the water table in temporary monitoring well AOI01-03 was above the top of the screen.
- At location AOI01-02 the boring was advanced to 40 feet bgs. Apparent groundwater was not observed during drilling; however, considering the depth, the advancement of the boring 31 feet into bedrock, and the depths to water in the other wells installed (7.74 to 36.76 feet bgs), a temporary monitoring well was installed. The well remained dry for the duration of the SI field efforts. Therefore, a groundwater sample was not collected from this location.

Table 5-1. Site Inspection Samples by Medium

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS[1]	TOC[2]	pH[3]	Grain Size[4]	Comments
Soil Samples							
AOI01-01-SB-(0-2)	18 Nov 2021	0-2	X	X	X	X	
AOI01-01-SB-(3-5)	18 Nov 2021	3-5	X				
AOI01-01-SB-(6-7)	18 Nov 2021	6-7	X				
AOI01-02-SB-(0-2)	17 Nov 2021	0-2	X				MS/MSD
AOI01-02-SB-(4-6)	17 Nov 2021	4-6	X				
AOI01-02-SB-(8-9)	17 Nov 2021	8-9	X				
AOI01-03-SB-(0-2)	18 Nov 2021	0-2	X				
AOI01-03-SB-(2.5-3)	18 Nov 2021	2.5-3	X				
WHFRTC-DUP-01	18 Nov 2021	0-2	X				AOI01-01-SB-(0-2)
Groundwater Samples							
WHFRTC-01-GW	20 Nov 2021		X				
AOI01-01-GW	22 Nov 2021		X				
AOI01-03-GW	22 Nov 2021		X				
AOI01-04-GW	20 Nov 2021		X				MS/MSD
AOI01-05-GW	20 Nov 2021		X				
WHFRTC-DUP-02	20 Nov 2021		X				WHFRTC-01-GW
Blank Samples							
WHFRTC-EB-01	17 Nov 2021		X				
WHFRTC-EB-02	18 Nov 2021		X				
WHFRTC-EB-03	20 Nov 2021		X				
WHFRTC-EB-04	22 Nov 2021		X				
WHFRTC-FB-01	20 Nov 2021		X				
WHFRTC-FB-02	22 Nov 2021		X				

Notes:
1. PFAS were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15.
2. TOC was analyzed using USEPA Method 9060A.
3. pH was analyzed using USEPA Method 9045D.
4. Grain size was analyzed using ASTM International Method D-422.

Abbreviations:
bgs = below ground surface
DUP = field duplicate
EB = equipment rinsate blank
FB = field reagent blank
MS/MSD = matrix spike/ matrix spike duplicate
PFAS = per- and polyfluoroalkyl substances
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

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Table 5-2. Soil Boring Depths and Temporary Well Screen Intervals

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)
1	AOI01-01	38	28–38
	AOI01-02	40	24.6–34.6
	AOI01-03	50	39–49
	AOI01-04	35	25–35
	AOI01-05	15	5–15
Upgradient	WHFRTC-01	16	5.4–15.4

Abbreviations:
bgs = below ground surface

Table 5-3. Groundwater Elevation

Monitoring Well ID	Top of Casing Elevation (feet NAVD88)	Depth to Water (feet btoc)	Groundwater Elevation (feet NAVD 88)
AOI01-01	508.39	38.98	469.41
AOI01-02	504.89	DRY	DRY
AOI01-03	508.64	18.56	490.08
AOI01-04	506.12	31.42	474.70
AOI01-05	494.61	13.38	481.23
WHFRTC-01	514.05	6.82	507.23

Abbreviations:
btoc = below top of casing
NAVD88 = North American Vertical Datum of 1988

Army National Guard Site Inspections
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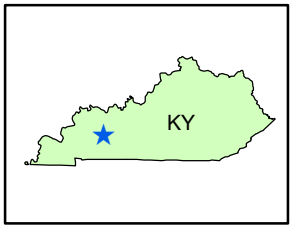
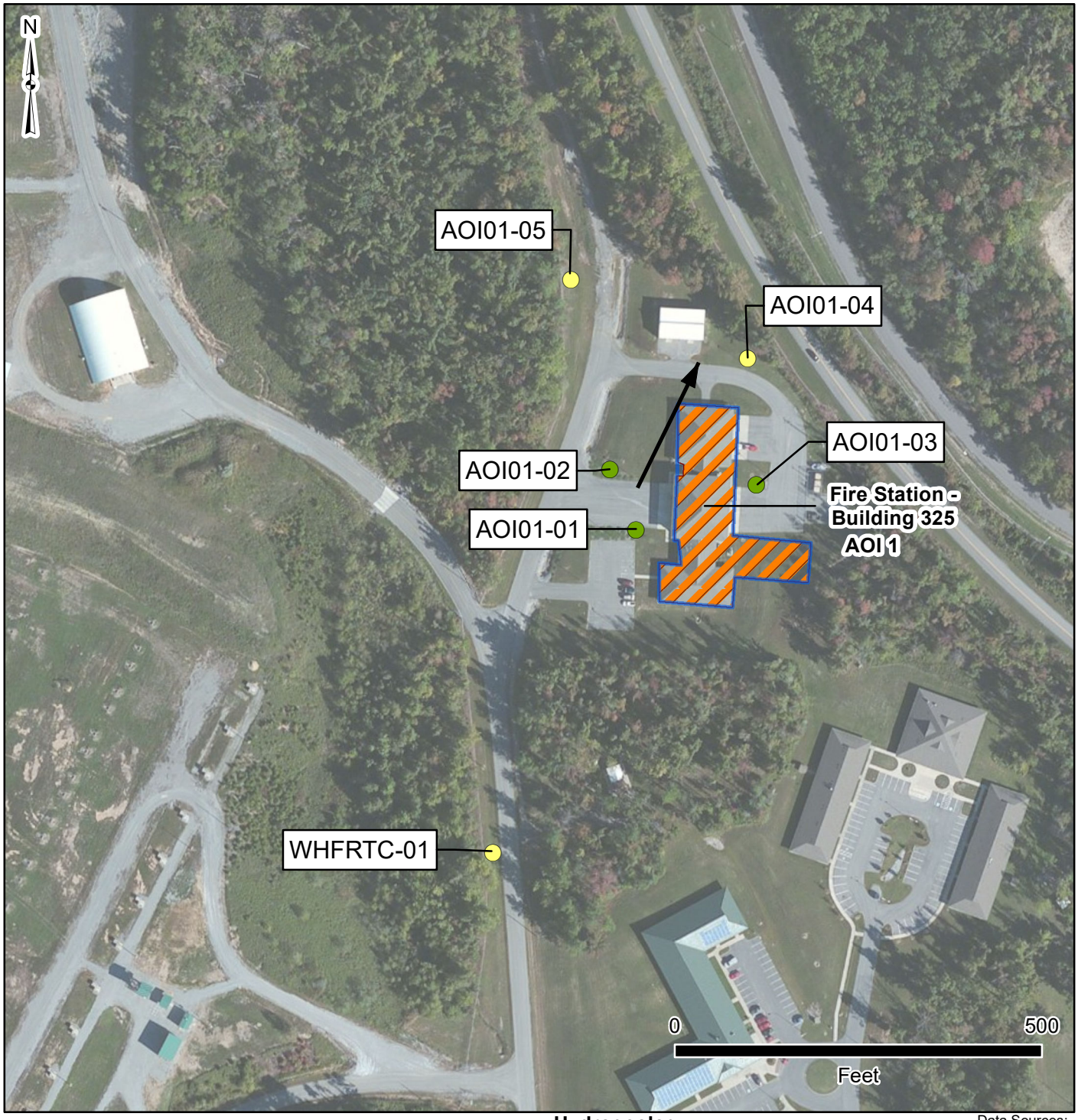
Muhlenberg County, Kentucky

Figure 5-1
Site Inspection Sample Locations





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Sample Type
- Soil Boring/Temporary Monitoring Well
- Temporary Monitoring Well

Hydrogeology
- Inferred Groundwater Flow Direction

Data Sources:
ESRI 2020
AECOM 2019

Date:.....January 2022
Prepared By:.....WSP
Prepared For:.....USACE

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6. SITE INSPECTION RESULTS

This section presents the analytical results of the SI. The SLs for relevant compounds, for both soil and groundwater, are presented in **Table 6-1** in **Section 6.1**. A discussion of the results for the AOI is provided in **Section 6.3**. **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 G**, and the laboratory reports are provided in **Appendix E**.

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 an OSD memorandum (Assistant Secretary of Defense 2022). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum 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**.

Table 6-1. Screening Levels for Soil and Groundwater

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

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

Abbreviations:
µg/kg = microgram(s) per kilogram
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
HFPO-DA hexafluoropropylene oxide dimer acid
ng/L = nanogram(s) per liter
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexanesulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid

The data in the subsequent sections are compared against the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the Facility: the residential scenario is applied to surface soil results (0 to 2 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 E** contains the results of the TOC, pH, and grain size sampling. TOC in the samples collected at AOI 1 was 3,900 milligrams per kilogram. The grain size results correlate with the clays, silts, and sands observed during drilling activities. Soil pH in the sample collected at AOI 1 was 6.1 Standard Units.

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, important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions, and are therefore relatively mobile in groundwater (Xiao et al. 2015) but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006, Guelfo and Higgins 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, although 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: Fire Station/Building 325. The soil and groundwater results are summarized in **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Soil samples were collected from three boring locations associated with AOI 1 during the SI. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Tables 6-2** through **Table 6-4** summarize the soil results.

Surface soil (0 to 2 feet bgs) was sampled from boring locations AOI01-01 through AOI01-03. Soil was also sampled from shallow subsurface soil (2.5 to 6 feet bgs) in the three borings and from deep subsurface soil intervals (6 to 9 feet bgs) from boring locations AOI01-01 and AOI01-02. PFOA, PFOS, PFHxS, and PFNA were detected in surface soil at concentrations below their respective SLs. PFOS was detected in one of three surface soil samples at a concentration of 2.3 J+ micrograms per kilogram (µg/kg); PFOA was detected in one of three surface soil samples at

a concentration of 0.8 J+ µg/kg; PFHxS was detected in one of three surface soil samples at a concentration of 0.65 J µg/kg; and PFNA was detected in one of three surface soil samples at a concentration of 0.56 J µg/kg. PFBS was not detected in the surface soil samples.

PFHxS was detected in shallow subsurface soil at a concentration below the SL. PFHxS was detected in one of three shallow subsurface soil samples at a concentration of 0.75 J µg/kg. PFOA, PFOS, PFNA, and PFBS were not detected in the shallow subsurface samples.

No PFOA, PFOS, PFBS, PFHxS, or PFNA were detected in deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater samples were collected from five of six temporary monitoring wells at AOI 1 (AOI01-01, AOI01-03, AOI01-04, AOI04-05, and WHFRTC-01). Monitoring well AOI01-02, which was installed adjacent to the fire station driveway, was dry following installation. Considering sample location WHFRTC-01 (upgradient of AOI 1) was not at the WHFRTC installation boundary and the potential for off-Facility groundwater flow variations, there is some uncertainty as to whether location WHFRTC-01 identified any off-Facility PFAS releases. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOS and PFOA were detected at concentrations exceeding their respective SLs. PFOS was detected in three of five groundwater samples collected at AOI 1 at concentrations ranging from 2.4 J+ ng/L to 9 ng/L, and it exceeded the SL at one location (AOI01-03). PFOA was detected in three of five groundwater samples at concentrations ranging from 2.5 ng/L to 32 ng/L, and it exceeded the SL at two locations (AOI01-03 and AOI01-05). PFBS, PFHxS, and PFNA were detected at concentrations below their respective SLs. PFBS was detected in three of five groundwater samples at concentrations ranging from 1.5 J ng/L to 5.9 ng/L; PFHxS was detected in two of four groundwater samples at concentrations of 14 ng/L; and PFNA was detected in three of five groundwater samples at concentrations ranging from 1 ng/L to 3.9 ng/L.

6.3.3 Conclusions

The results of the SI showed that four PFAS constituents (PFOS, PFOA, PFHxS, and PFNA) were detected in soil, none of which exceeded their screening levels (See **Tables 6-2 to 6-4**). PFOS and PFOA were detected in groundwater at AOI 1 above their respective SLs, while PFBS, PFHxS, and PFNA were detected in groundwater at concentrations below their respective SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 1 is warranted.

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Wendell H. Ford Regional Training Center, Kentucky

	Area of Interest	AOI 1							
	Location ID	AOI01-01		AOI01-01		AOI01-02		AOI01-03	
	Sample Name	AOI01-01-SB-(0-2)		WHFRTC-DUP-01		AOI01-02-SB-(0-2)		AOI01-03-SB-(0-2)	
	Parent Sample ID			AOI01-01-SB-(0-2)					
	Depth	0-2 ft		0-2 ft		0-2 ft		0-2 ft	
	Sample Date	11/18/2021		11/18/2021		11/17/2021		11/18/2021	
Analyte	**OSD Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS[3] (µg/kg)									
PFBS	1900	ND		ND		ND		ND	
PFOA	19	ND		ND		ND		0.8	J+
PFNA	19	ND		ND		ND		0.56	J
PFHxS	130	ND		ND		ND		0.65	J
PFOS	13	ND		ND		ND		2.3	J+

Notes

Gray Fill — Detected concentration exceeded OSD Screening Level

References

1. Assistant Secretary of Defense. July 2022. *Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1* . May 2022.
2. The Screening Levels for soil are based on a residential scenario for direct ingestion of contaminated soil.
3. PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15

Interpreted Qualifiers

J = Estimated concentration
J+ = Estimated quantity but may bias high

Chemical Abbreviations

PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOS	Perfluorooctanesulfonic acid
PFOA	Perfluorooctanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	Feet
LC/MS/MS	liquid chromatography tandem mass spectrometry
ND	analyte not detected above the LOD (LOD values are presented in Appendix E)
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoralkyl substances
QSM	Quality Systems Manual
Qual	interpreted qualifier
µg/kg	micrograms/kilogram

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Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Wendell H. Ford Regional Training Center, Kentucky

	Area of Interest	AOI-01					
	Location ID	AOI01-01		AOI01-02		AOI01-03	
	Sample Name	AOI01-01-SB-(3-5)		AOI01-02-SB-(4-6)		AOI01-03-SB-(2.5-3)	
	Parent Sample ID						
	Depth	3-5 ft		4-6 ft		2.5-3 ft	
	Sample Date	11/18/2021		11/17/2021		11/18/2021	
Analyte	**OSD Screening Level[1, 2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS[3] (µg/kg)							
PFBS	25000	ND		ND		ND	
PFOA	250	ND		ND		ND	
PFNA	250	ND		ND		ND	
PFHxS	1600	ND		ND		0.75	J
PFOS	160	ND		ND		ND	

Notes

Gray Fill — Detected concentration exceeded OSD Screening Level

References

1. Assistant Secretary of Defense. July 2022. *Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1* . May 2022.
2. The SL for soil is based on incidental ingestion of soil industrial/commercial worker >2 ft.
3. PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOS	Perfluorooctanesulfonic acid
PFOA	Perfluorooctanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	Feet
LC/MS/MS	liquid chromatography tandem mass spectrometry
ND	analyte not detected above the LOD (LOD values are presented in Appendix E)
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoralkyl substances
QSM	Quality Systems Manual
Qual	interpreted qualifier
µg/kg	micrograms/kilogram

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Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Wendell H. Ford Regional Training Center, Kentucky

	Area of Interest	AOI 1			
	Location ID	AOI01-01		AOI01-02	
	Sample Name	AOI01-01-SB-(6-7)		AOI01-02-SB-(8-9)	
	Parent Sample ID				
	Depth	6-7 ft		8-9 ft	
	Sample Date	11/18/2021		11/17/2021	
Analyte	**OSD Screening Level[1, 2]**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS[3] (µg/kg)					
PFBS	25000	ND		ND	
PFOA	250	ND		ND	
PFNA	250	ND		ND	
PFHxS	1600	ND		ND	
PFOS	160	ND		ND	

Notes

Gray Fill — Detected concentration exceeded OSD Screening Level

References

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

2. The SL for soil is based on incidental ingestion of soil industrial/commercial worker >2 ft.

3. PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15

Chemical Abbreviations

PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOS	Perfluorooctanesulfonic acid
PFOA	Perfluorooctanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	Feet
LC/MS/MS	liquid chromatography tandem mass spectrometry
ND	analyte not detected above the LOD (LOD values are presented in Appendix E)
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoralkyl substances
QSM	Quality Systems Manual
Qual	interpreted qualifier
µg/kg	micrograms/kilogram

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Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Wendell H. Ford Regional Training Center, Kentucky

	Location ID	WHFRTC-01		WHFRTC-01		AOI01-01		AOI01-03		AOI01-04		AOI01-05	
	Sample Name	WHFRTC-01-GW		WHFRTC-DUP-02		AOI01-01-GW		AOI01-03-GW		AOI01-04-GW		AOI01-05-GW	
	Parent Sample ID			WHFRTC-01-GW									
	Sample Date	11/20/2021		11/20/2021		11/22/2021		11/22/2021		11/20/2021		11/20/2021	
Analyte	**OSD Screening Level[1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Groundwater, PFAS[2] (ng/L)													
PFOA	6	2.5		2.8		ND		15		ND		32	
PFNA	6	1	J	1.2	J	ND		3.9		ND		2.4	
PFBS	601	2.7		2.9		ND		1.5	J	ND		5.9	
PFHxS	39	ND		ND		ND		14		ND		14	
PFOS	4	2.4	J+	2.7	J+	ND		9		ND		3.4	J+

Notes

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

2. PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated quantity but may bias high

Chemical Abbreviations

PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOS	Perfluorooctanesulfonic acid
PFOA	Perfluorooctanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
HQ	Hazard Quotient
ID	identification
LC/MS/MS	liquid chromatography tandem mass spectrometry
ND	analyte not detected above the LOD (LOD values are presented in Appendix E)
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoralkyl substances
QSM	Quality Systems Manual
Qual	interpreted qualifier
ng/l	nanograms/liter

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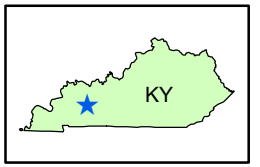
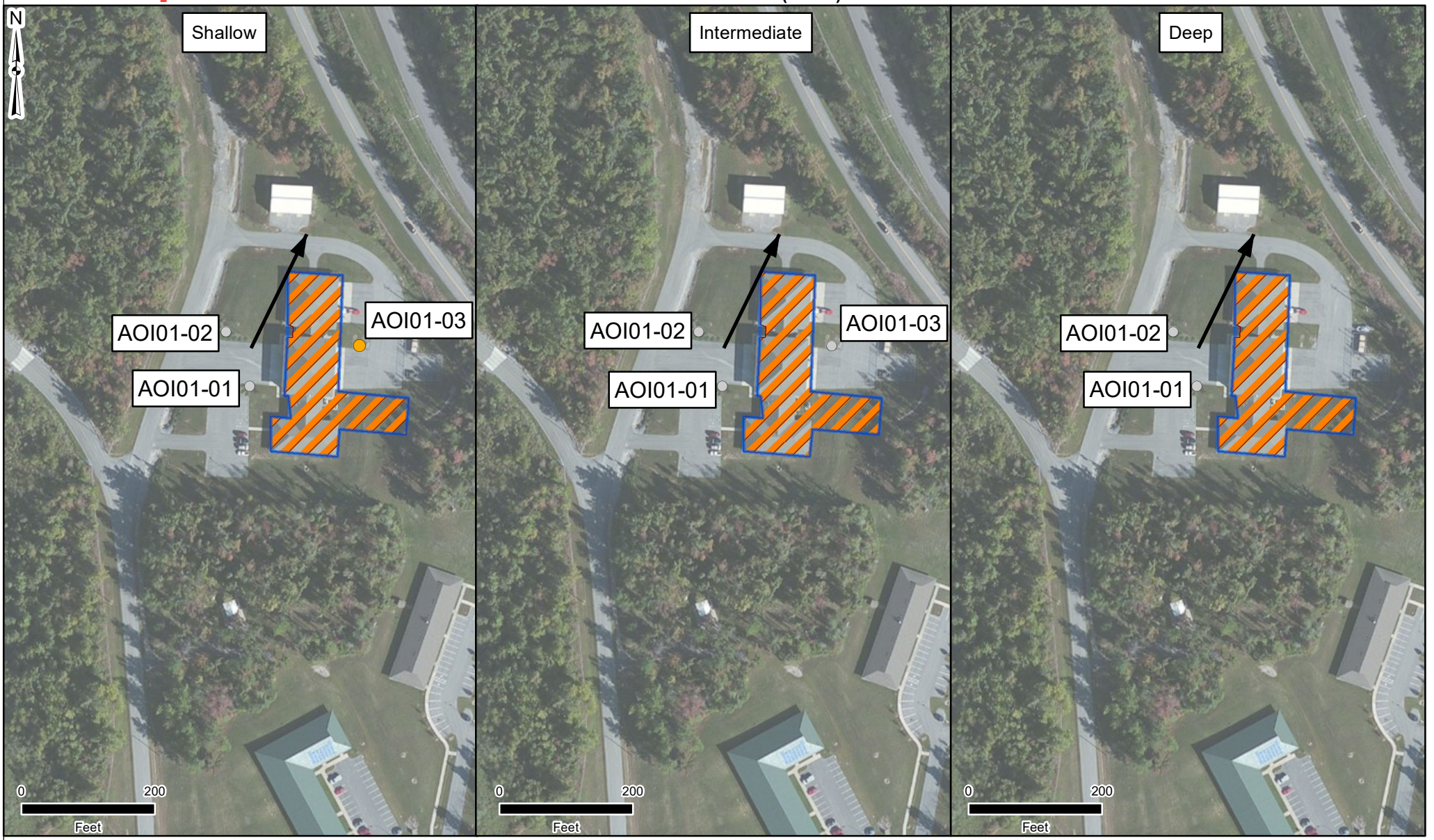
Army National Guard Site Inspections
Site Inspection Report
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

Figure 6-1
PFOS Detections in Soil (AOI 1)





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

PFOS Results (µg/kg)
- ND (Non-Detect)
- >ND - 13
- >13 -160
- >160 - 1,600
- >1,600

NOTES:
PFAS = Per- and Polyfluoroalkyl Substances
PFOS = perfluorooctanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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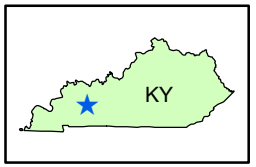
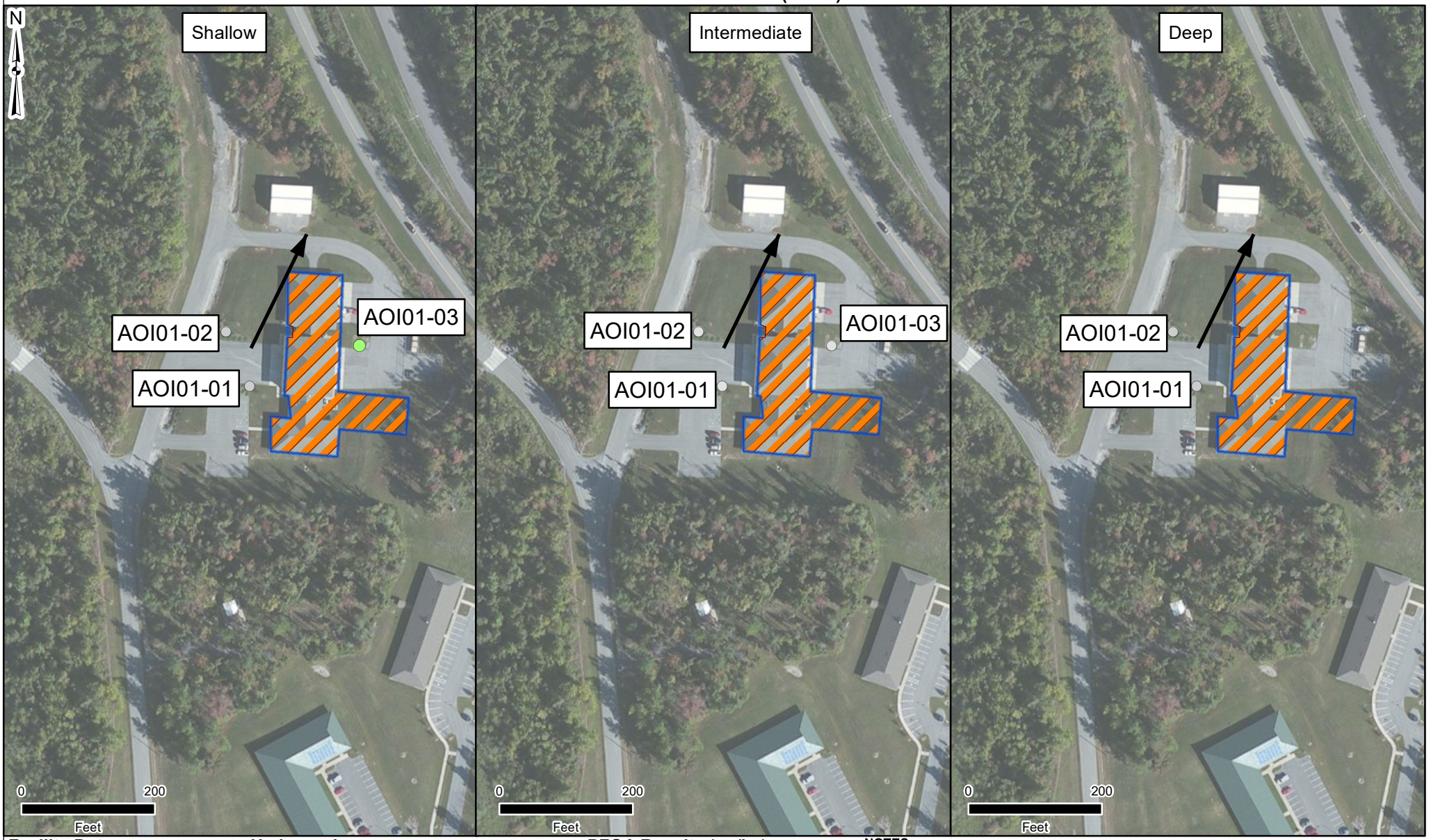
Site Inspection Report
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

Figure 6-2
PFOA Detections in Soil (AOI 1)





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

PFOA Results (µg/kg)
- ND (Non-Detect)
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

NOTES:
PFAS = Per- and Polyfluoroalkyl Substances
PFOA = perfluorooctanoic acid
ND = Non-Detect
(µg /Kg) = Microgram(s) per Kilogram
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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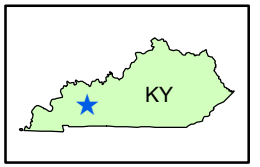
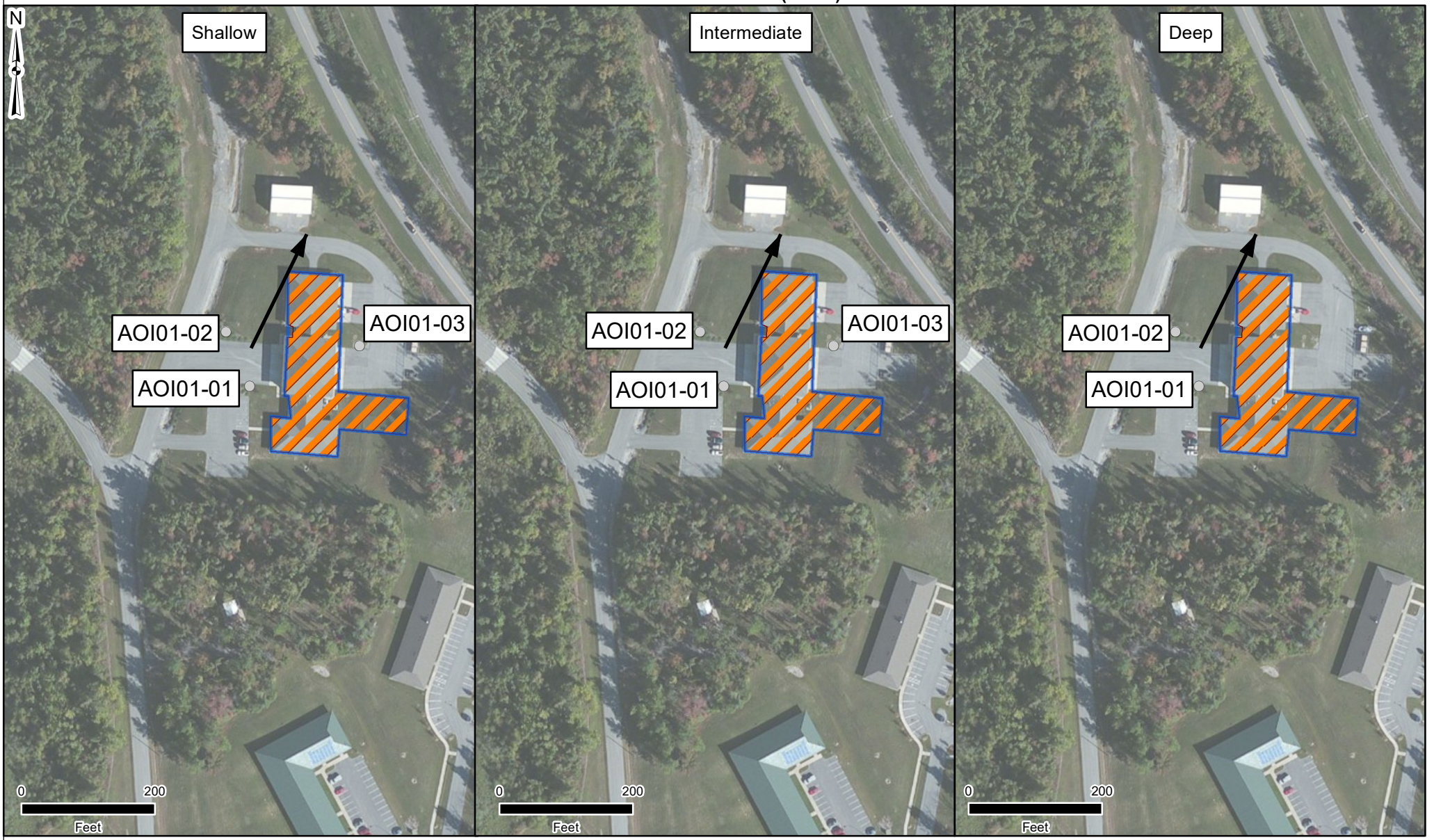
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

Figure 6-3
PFBS Detections in Soil (AOI 1)





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

PFBS Results (µg/kg)
- ND (Non-Detect)
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

NOTES:
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = perfluorobutanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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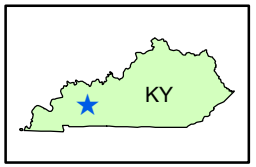
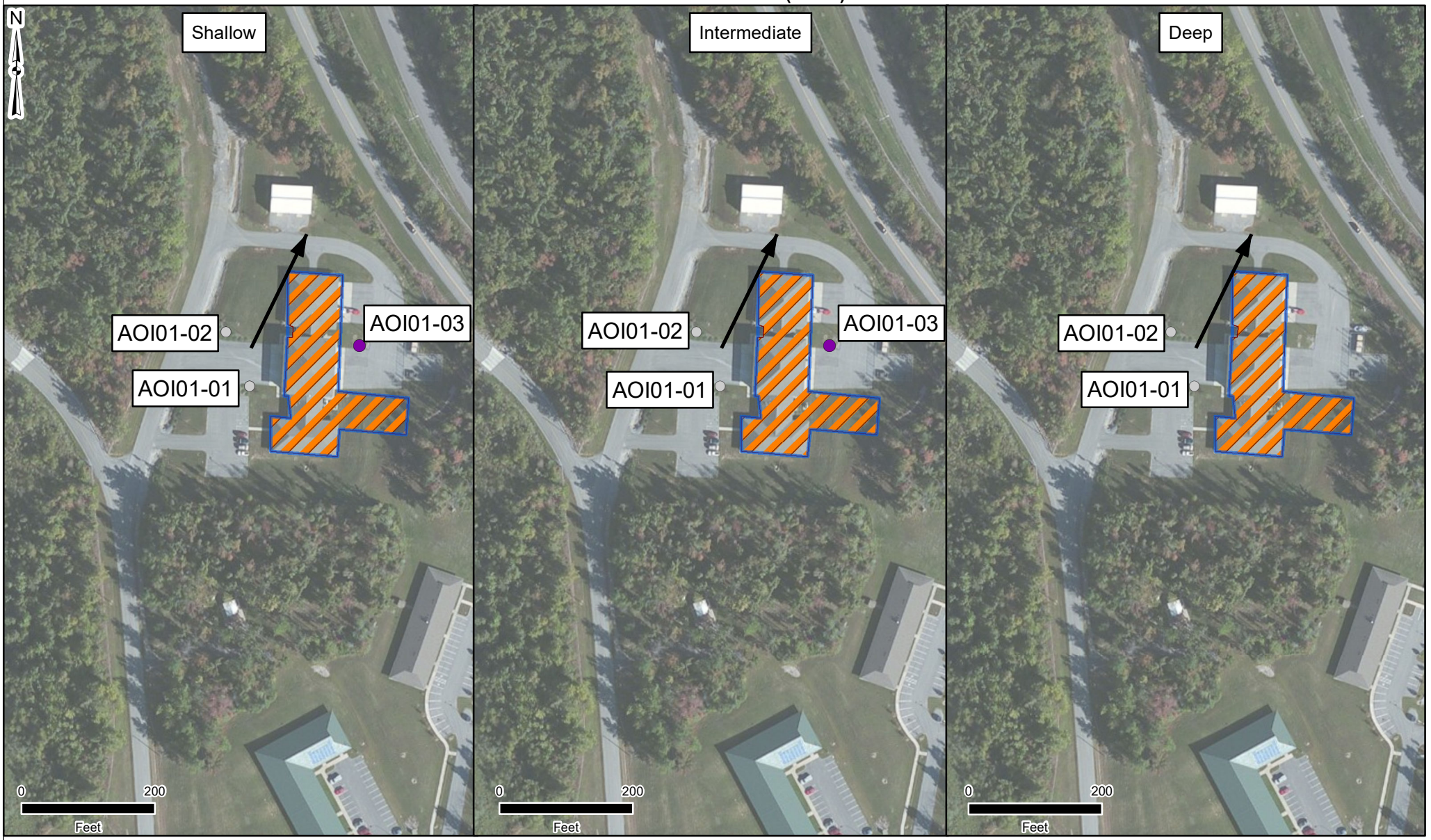
Muhlenberg County, Kentucky

Figure 6-4
PFHxS Detections in Soil (AOI 1)





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

PFHxS Results (µg/kg)
- ND (Non-Detect)
- >ND - 13
- >13 -130
- >130 - 1,600
- >1,600

NOTES:
PFAS - Per- and Polyfluoroalkyl Substances
PFHxS = perfluorohexanesulfonic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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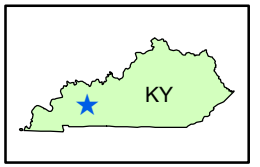
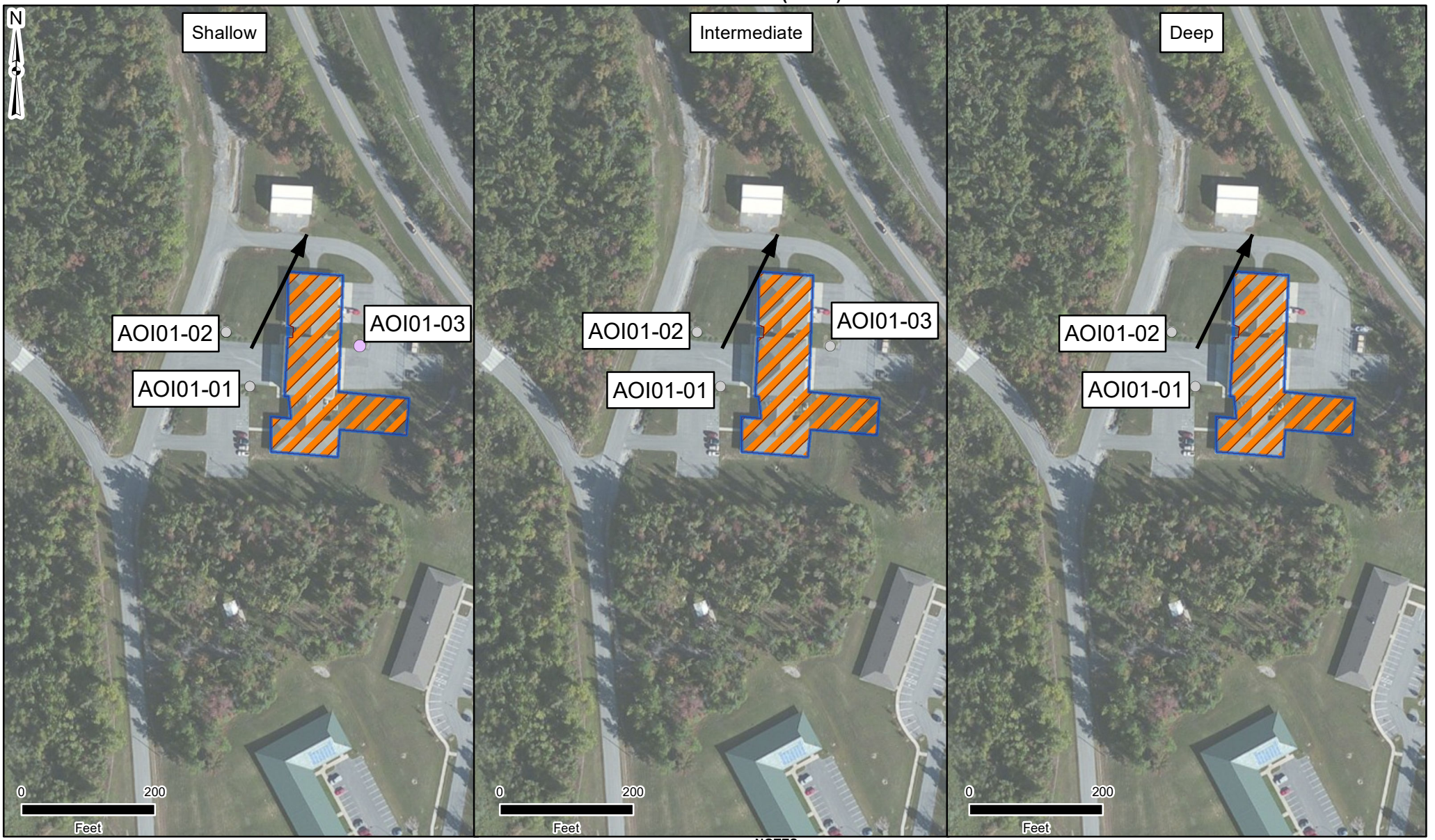
Muhlenberg County, Kentucky

Figure 6-5
PFNA Detections in Soil (AOI 1)





Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

PFNA Results (µg/kg)
- ND (Non-Detect)
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

NOTES:
PFAS = Per- and Polyfluoroalkyl Substances
PFNA = perfluorononanoic acid
ND = Non-Detect
(µg/Kg) = Microgram(s) per Kilogram
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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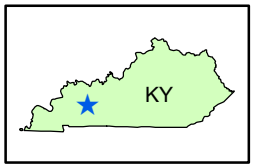
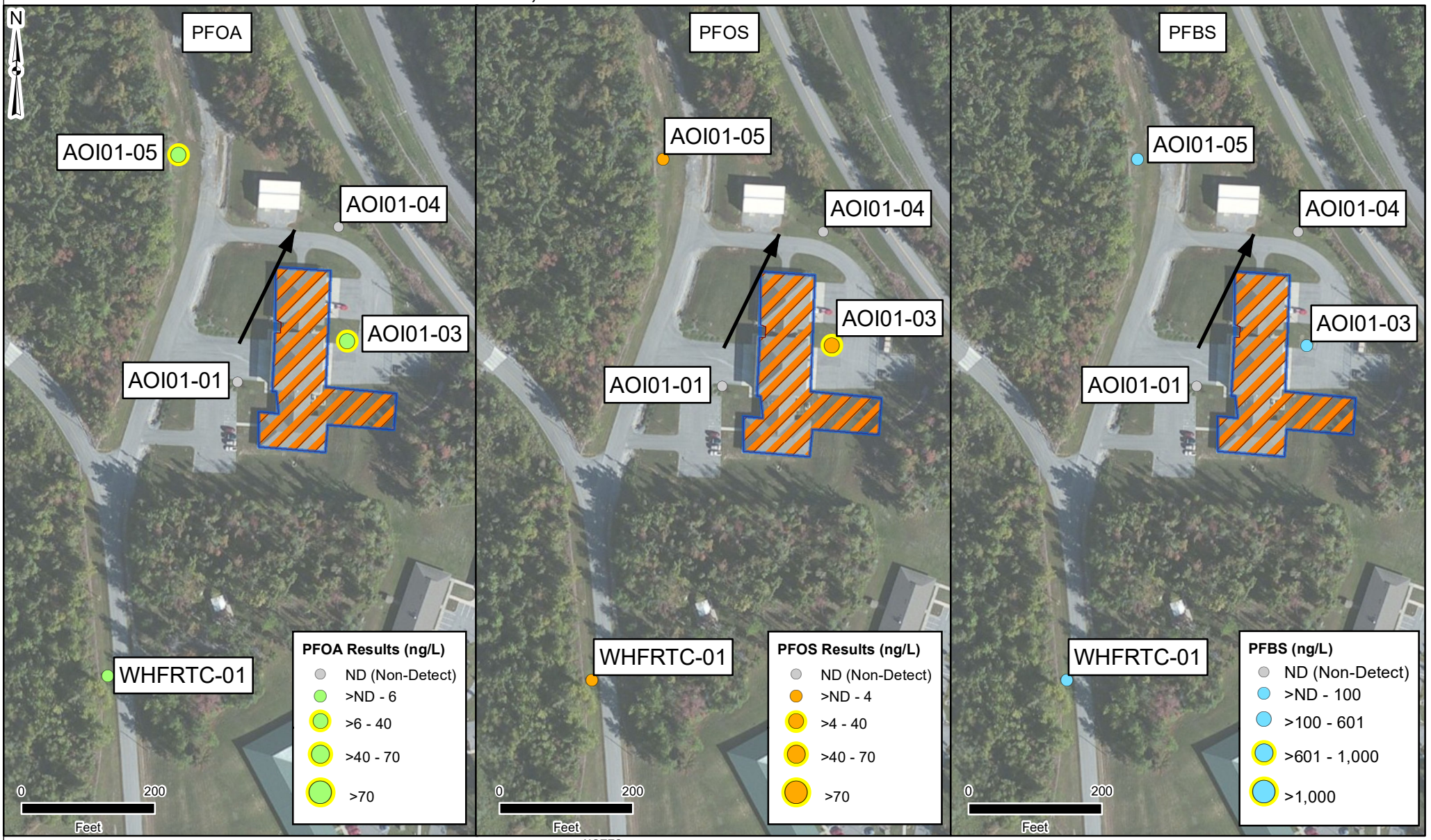
Muhlenberg County, Kentucky

Figure 6-6
PFOA, PFOS and PFBS Detections in Groundwater





Facility Data
Area of Interest (AOI)
Potential PFAS Release Site

Hydrogeology
Inferred Groundwater Flow Direction

NOTES:
PFAS = Per- and Polyfluoroalkyl Substances
PFOS = perfluorooctanesulfonic acid
PFOA = perfluorooctanoic acid
PFBS = perfluorobutanesulfonic acid
ND = Non-Detect
ng/L = nanogram(s) per liter
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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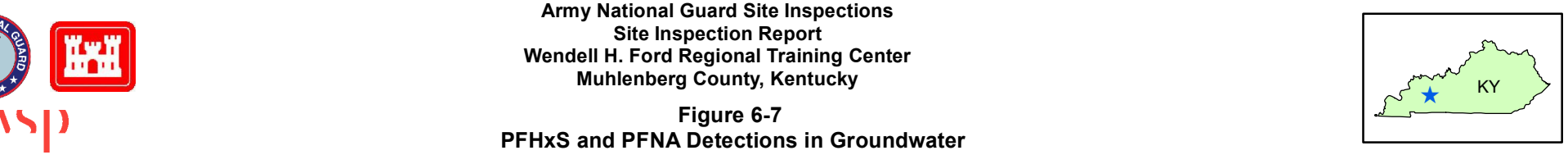
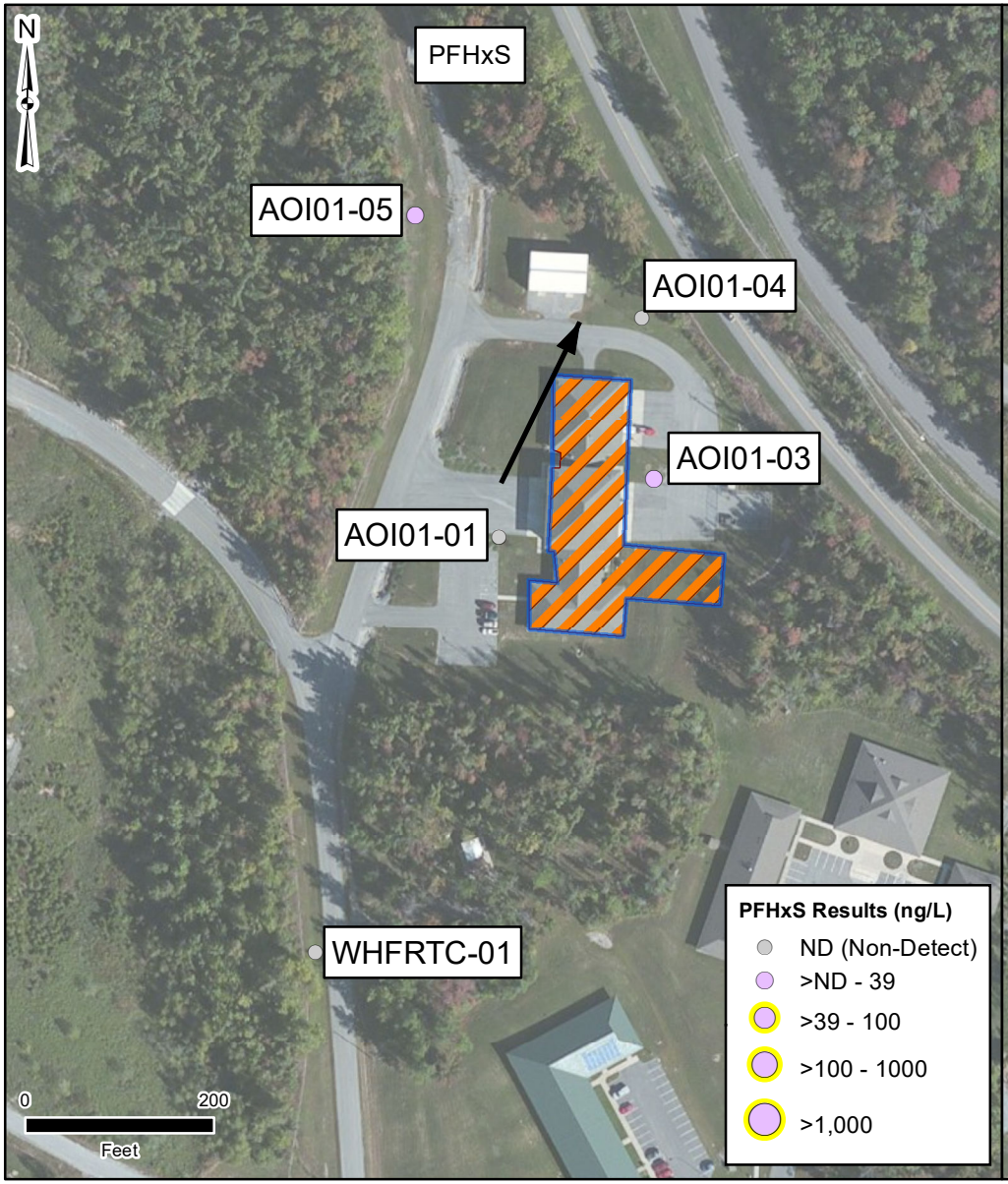
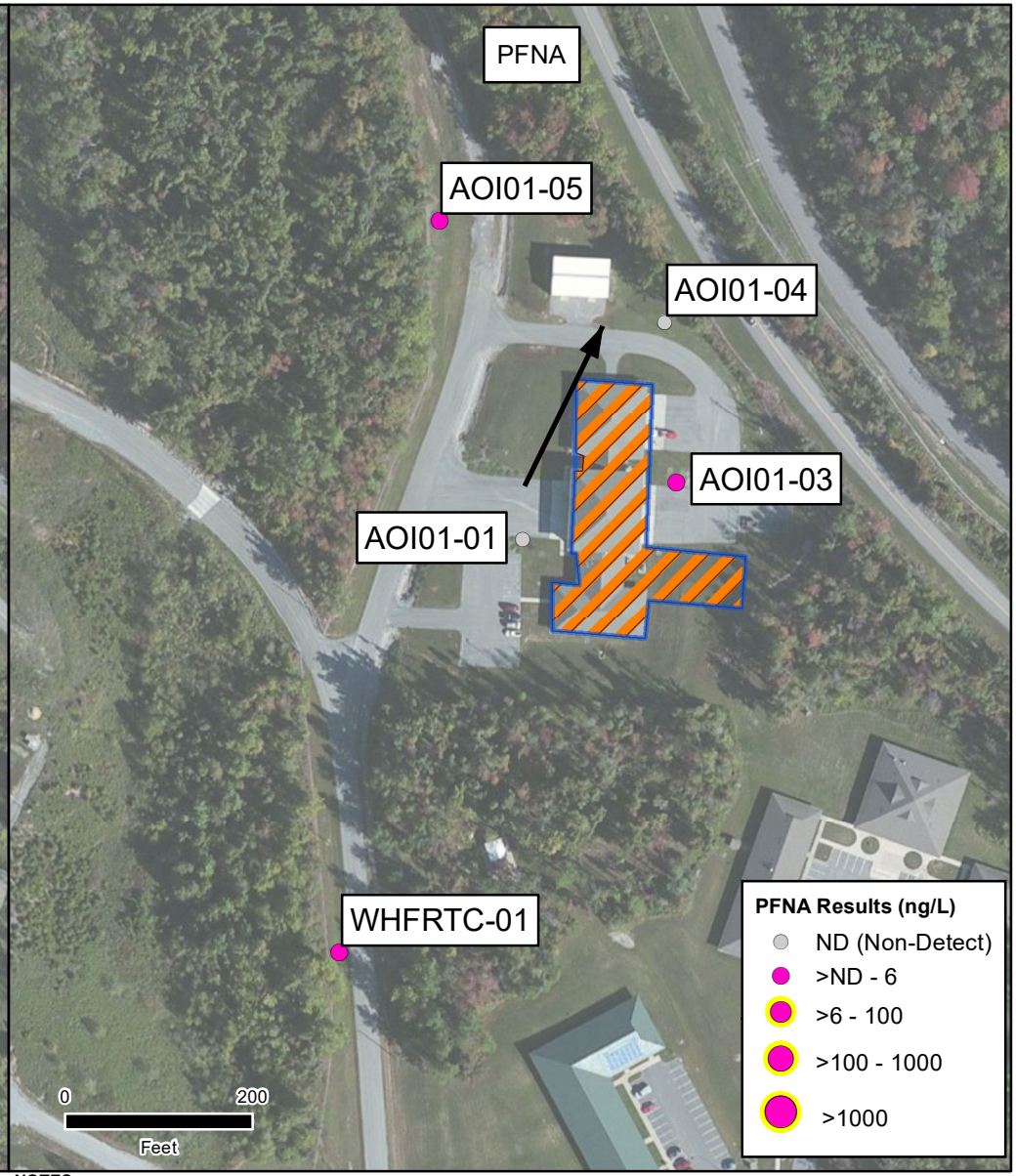
Army National Guard Site Inspections
Site Inspection Report
Wendell H. Ford Regional Training Center
Muhlenberg County, Kentucky

Figure 6-7
PFHxS and PFNA Detections in Groundwater







Facility Data
- Area of Interest (AOI)
- Potential PFAS Release Site

Hydrogeology
- Inferred Groundwater Flow Direction

NOTES:
PFAS - Per-and Polyfluoroalkyl Substances
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
ND = Non-Detect
ng/L = nanogram(s) per liter
Exceedances of The Office of the Secretary of Defense (OSD) Screening Level (SL) are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....October 2022
Prepared By:.....WSP
Prepared For:.....USACE

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7. EXPOSURE PATHWAYS

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

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

If any of these elements are missing, the pathway is incomplete. The CSM figure uses 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 CSM indicates 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, recreational users, trespassers, and off-facility residents.

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 each AOI based on the aforementioned criteria.

7.1.1 AOI 1 – Fire Station/Building 325

WHFRTC Fire Department stores AFFF on two trucks kept at Fire Station/Building 325. Angus Tridol S 3% AFFF is stored in 5-gallon buckets on each truck and in a material storage

room at the fire station. Angus Tridex 3% AFFF is also stored in the fire station storage room, as well as non-AFFF fire suppressants such as Purple K and ABC fire extinguishers. The fire chief stated during interviews that AFFF concentrate has not spilled from their storage containers. Only water and Class A foam have been used by the WHFRTC Fire Department on Facility, according to WHFRTC staff. There are no documented uses of AFFF at Building 325, or anywhere on WHFRTC by the WHFRTC Fire Department.

The WHFRTC Fire Department used AFFF during response to an off-Facility fire in Central City in 2016. The WHFRTC Fire Chief reported that the fire truck used in response to the fire was most likely washed at the WHFRTC fire station after responding to the fire. It is unclear whether any AFFF deployed remained on the truck at the time of washing.

PFOA, PFOS, PFHxS, and PFNA were detected below their SLs in surface soil at AOI 1. Facility workers, construction workers, and visitors/recreational users could contact constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for Facility workers, construction workers, or visitor/ recreational user are potentially complete. PFHxS was detected in subsurface soil at AOI 1. Construction workers could contact constituents in subsurface soil via incidental ingestion and inhalation of dust; therefore, the subsurface soil exposure pathway for construction workers is potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2 GROUNDWATER EXPOSURE PATHWAY

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

7.2.1 AOI 1 – Fire Station/Building 325

PFOA and PFOS were detected above their respective SLs in groundwater samples collected at AOI 1 (**Table 6-5**). Depths to water measured at AOI 1 in November 2021 during the SI ranged from approximately 7 to 39 feet bgs; therefore, the exposure pathway for ingestion of groundwater is potentially complete for construction workers involved in ground disturbing activities that extend to the water table. No potable wells are located within the Facility boundary. The Facility receives potable water from a municipal source; therefore the exposure pathway for groundwater to Facility workers and Facility visitors/recreational users is incomplete. Two public water system wells are located approximately 4.5 miles south-southwest and hydraulically upgradient of AOI 1, and several domestic water supply wells are located within a 4-mile radius of the Facility, the closest identified as being active and at an interpreted hydraulically downgradient location from AOI 1 being located more than five miles from the AOI. The concentration at the potential point of exposure for off-site residents is not known, therefore, the exposure pathway for ingestion of groundwater is potentially complete for off-site residential receptors. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3 SURFACE WATER AND SEDIMENT EXPOSURE PATHWAY

Because there are no natural surface water bodies at AOI 1, surface water and sediment were not sampled as part of the SI. Therefore, the exposure pathways for surface water and sediment are incomplete.

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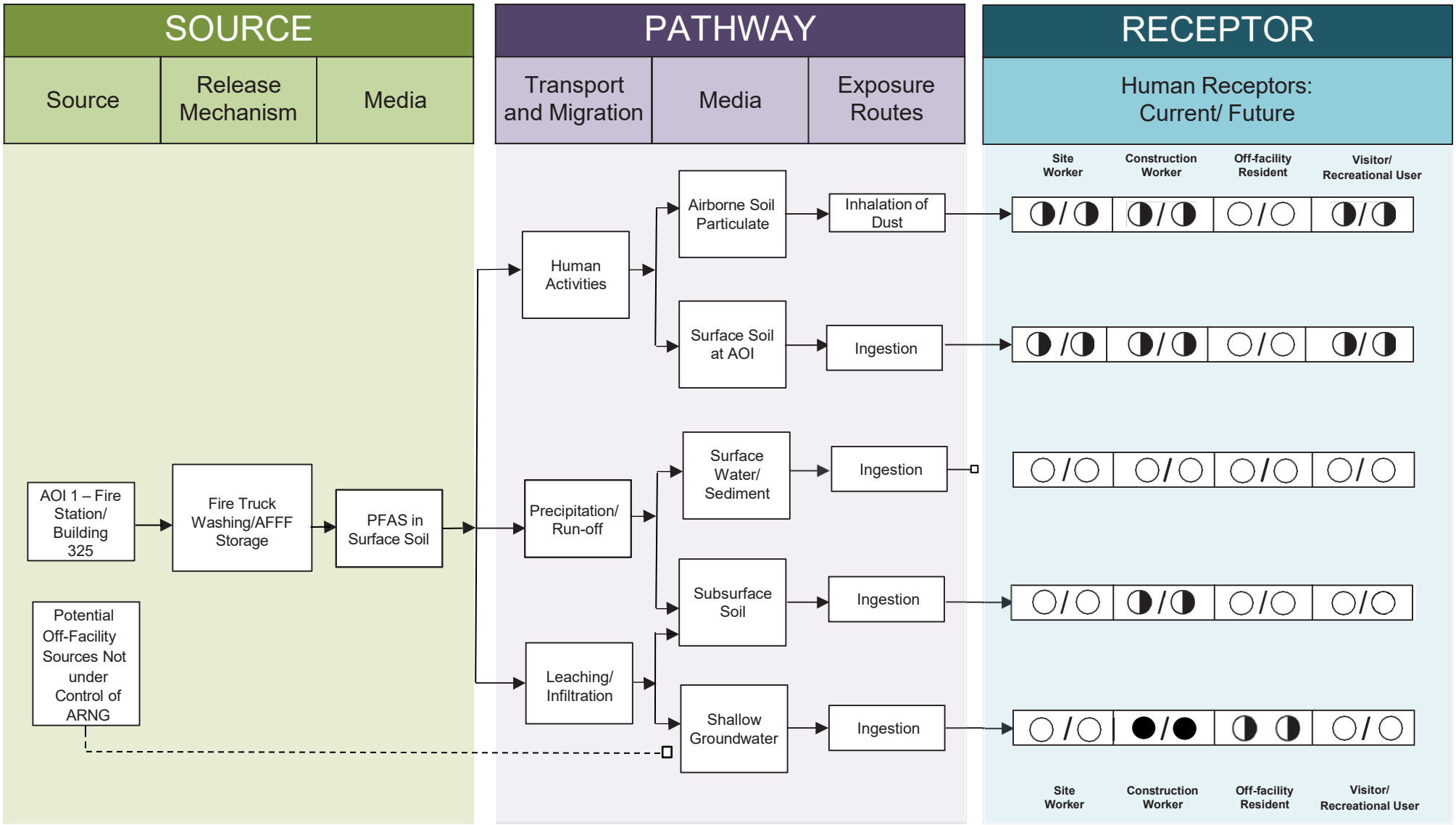

LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway with no Exceedances of Screening Levels
- Potentially Complete Pathway with Exceedances of Screening Levels

Figure 7-1
Conceptual Site Model, AOI 1
Wendell H. Ford Regional Training Center

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8. SUMMARY AND OUTCOME

This section summarizes the 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 at the Facility were conducted from 15 through 22 November 2021. The SI field activities included soil and groundwater sampling. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA/Wood 2021a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved UFP-QAPP Addendum (EA/Wood 2021a), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 (DoD 2020) as follows.

- Eight (8) soil samples from three locations (soil borings locations)
- Five (5) grab groundwater samples from five of six temporary well locations
- Eight (8) 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 the AOI to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSM was refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOI, as described in **Section 7**.

8.2 OUTCOME

Based on the results of this SI, further evaluation in the form of an RI is warranted for AOI 1. Based on the CSM developed and revised based on the SI findings, there is potential for exposure to receptors from AOI 1 from sources on the Facility resulting from historical DoD activities.

Sample analytical concentrations collected during the SI were compared against the project SLs in soil and groundwater, as described in **Table 6-1**. The SI results relative to the SLs are summarized below.

At AOI 1:

- PFOA, PFOS, PFHxS, and PFNA were detected in soil at AOI 1 at concentrations below the SLs.

- PFOA, PFOS, PFBA, PFHxS, and PFNA were detected in groundwater at AOI 1. PFOA and PFOS exceeded their respective SLs, while PFBS, PFHxS, and PFNA did not exceed the SLs.

Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

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

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

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

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary	Future Action
1	Fire Station/Building 325	◐	●	◐	Proceed to RI

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

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