FINAL
Site Inspection Report
Army Aviation Support Facility 1
Green Township, Summit County, Ohio

Perfluorooctanesulfonic Acid (PFOS) and
Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

December 2022

Prepared for:

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Table of Contents

Executive Summary ES-1
1. Introduction 1-1
1.1 Project Authorization 1-1
1.2 SI Purpose 1-1
2. Facility Background 2-1
2.1 Facility Location and Description 2-1
2.2 Facility Environmental Setting 2-1
2.2.1 Geology 2-1
2.2.2 Hydrogeology 2-1
2.2.3 Hydrology 2-2
2.2.4 Climate 2-3
2.2.5 Current and Future Land Use 2-3
2.2.6 Sensitive Habitat and Threatened/ Endangered Species 2-4
2.3 History of PFAS Use 2-4
3. Summary of Areas of Interest 3-1
3.1 AOI 1 3-1
3.1.1 Storage and Ramp Area 3-1
3.2 AOI 2 3-1
3.2.1 Green AASF1 Hangar 3-1
3.3 AOI 3 3-2
3.3.1 Wetland 3-2
4. Project Data Quality Objectives 4-1
4.1 Problem Statement 4-1
4.2 Goals of the Study 4-1
4.3 Information Inputs 4-2
4.4 Study Boundaries 4-2
4.5 Analytical Approach 4-2
4.6 Data Usability Assessment 4-3
4.6.1 Precision 4-3
4.6.2 Accuracy 4-4
4.6.3 Representativeness 4-5
4.6.4 Comparability 4-6
4.6.5 Completeness 4-6
4.6.6 Sensitivity 4-6
5. Site Inspection Activities 5-1
5.1 Pre-Investigation Activities 5-1
5.1.1 Technical Project Planning 5-1
5.1.2 Utility Clearance 5-2
5.1.3 Source Water and PFAS Sampling Equipment Acceptability 5-2
5.2 Soil Borings and Soil Sampling 5-2
5.3 Temporary Well Installation and Groundwater Grab Sampling 5-3
5.4 Synoptic Water Level Measurements 5-4
5.5 Surveying 5-4
5.6 Investigation-Derived Waste 5-4

5.7 Laboratory Analytical Methods....5-5
5.8 Deviations from SI QAPP Addendum....5-5
6. Site Inspection Results....6-1
6.1 Screening Levels....6-1
6.2 Soil Physicochemical Analyses....6-2
6.3 AOI 1....6-2
6.3.1 AOI 1 Soil Analytical Results....6-2
6.3.2 AOI 1 Groundwater Analytical Results....6-2
6.3.3 AOI 1 Conclusions....6-3
6.4 AOI 2....6-3
6.4.1 AOI 2 Soil Analytical Results....6-3
6.4.2 AOI 2 Groundwater Analytical Results....6-4
6.4.3 AOI 2 Conclusions....6-4
6.5 AOI 3....6-4
6.5.1 AOI 3 Soil Analytical Results....6-4
6.5.2 AOI 3 Groundwater Analytical Results....6-4
6.5.3 AOI 3 Conclusions....6-5
7. Exposure Pathways....7-1
7.1 Soil Exposure Pathway....7-1
7.1.1 AOI 1....7-1
7.1.2 AOI 2....7-2
7.1.3 AOI 3....7-2
7.2 Groundwater Exposure Pathway....7-2
7.2.1 AOI 1....7-2
7.2.2 AOI 2....7-3
7.2.3 AOI 3....7-3
8. Summary and Outcome....8-1
8.1 SI Activities....8-1
8.2 SI Goals Evaluation....8-1
8.3 Outcome....8-2
9. References....9-1

Appendices

Appendix A Data Validation Reports
Appendix B Field Documentation
B1. Log of Daily Notice of Field Activities
B2. Sampling Forms
B3. Survey Data
B4. Investigation-Derived Waste Logs
B5. Non-Conformance and Corrective Action Reports
Appendix C Photographic Log
Appendix D Laboratory Reports
Appendix E Boring Logs
Appendix F Analytical Results

Figures

Figure 2-1 Facility Location
Figure 2-2 Facility Topography
Figure 2-3 Groundwater Features
Figure 2-4 Groundwater Elevation Contours
Figure 2-5 Surface Water Features
Figure 3-1 Areas of Interest
Figure 5-1 Site Inspection Sample Locations
Figure 6-1 PFOA Detections in Soil
Figure 6-2 PFOS Detections in Soil
Figure 6-3 PFBS Detections in Soil
Figure 6-4 PFOA, PFOS, and PFBS Detections in Groundwater
Figure 7-1 Conceptual Site Model, AOI 1
Figure 7-2 Conceptual Site Model, AOI 2
Figure 7-3 Conceptual Site Model, AOI 3

Tables

Table ES-1 Screening Levels (Soil and Groundwater)
Table ES-2 Summary of Site Inspection Findings
Table ES-3 Site Inspection Recommendations
Table 5-1 Site Inspection Samples by Medium
Table 5-2 Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Table 6-1 Screening Levels (Soil and Groundwater)
Table 6-2 PFAS Detections in Surface Soil
Table 6-3 PFAS Detections in Subsurface Soil
Table 6-4 PFAS Detections in Groundwater
Table 8-1 Summary of Site Inspection Findings
Table 8-2 Site Inspection Recommendations

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CCV	Calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DERR	Division of Environmental Response and Revitalization
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct push technology
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FRB	field reagent blank
gpm	gallons per minute
GPRS	Ground Penetrating Radar Services, LLC
HA	Health Advisory
HEF	high expansion foam
HDPE	high-density polyethylene
IDW	investigation-derived waste
IIS	injection internal standards
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOQ	limit of quantitation
MDL	method detection limit

MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NOAA	National Oceanic and Atmospheric Administration
NOSC	Navy Operational Support Center
ODGS	Ohio Division of Geological Survey
ODNR	Ohio Department of Natural Resources
OHANG	Ohio Air National Guard
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent differences
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TCRA	Time Critical Removal Action
TOC	total organic carbon

TPP	Technical Project Planning
UCMR	Unregulated Contaminant Monitoring Rule
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

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Executive Summary

The Army National Guard (ARNG) G9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs). An SI was completed at the Army Aviation Support Facility 1 (AASF1) in Green Township, Summit County, Ohio. The Green AASF1 will also be referred to as the "facility" throughout this document.

Green AASF1 is located at 6000 W Airport Dr, North Canton, Ohio 44720. The facility is home to the 238th Aviation Regiment and is located in Green Township, Summit County, Ohio, on the north portion of the Akron-Canton Regional Airport. The property is leased by the State of Ohio, Adjutant General's Department from the Akron-Canton Airport. The facility currently has an AASF building, an aviation support area, helicopter parking area, vehicle maintenance area, and an armory. Hover operations and other flight training activities occur on and near the helicopter pad.

Three potential PFAS release areas were identified at Green AASF1 during the PA: the Storage and Ramp Area, the Green AASF1 Hangar, and the Wetland (AECOM, 2020). Green AASF1 includes a hangar equipped with a high expansion foam (HEF) fire suppression system. Tri-Max™ tanks were previously stored in the hangar before transferring to the outdoor storage area. A test of the HEF suppression system occurred, resulting in a full release of the system. Tri-Max™ tanks containing aqueous film forming foam were stored outside of Green AASF1 Building 5 (cold storage area) and on the ramp area. Unintentional releases from the tanks may have occurred at these locations. The close proximity of potential releases in the Green AASF1 Hangar and Storage and Ramp Area, coupled with surface water flow to the east, leaves the potential for migrating PFAS the third potential release area, the Wetland. These three potential PFAS release areas were grouped into three Areas of Interest (AOIs), which were investigated during the SI. The SI field activities were conducted from 16 to 18 June 2021 and included the collection of soil and groundwater samples.

To fulfill the project Data Quality Objectives set forth in the approved SI Quality Assurance Project Plan Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry compliant with Quality Systems Manual 5.3 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.9** of this Report.

The Department of Defense (DoD) has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 September 2021 (Assistant Secretary of Defense, 2021). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum and there is a release identified that is likely attributed to ARNG activities, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS.

The SLs are presented on **Table ES-1** below. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

Sample chemical analytical concentrations were compared against the project SLs as described in **Table ES-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Storage and Ramp potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 1 is warranted.
- At AOI 2, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Green AASF1 Hangar potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 2 is warranted.
- At AOI 3, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Wetland potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 3 is warranted.
- The detected concentrations of PFOA, PFOS, and PFBS in soil at all AOIs were below the SLs.

Table ES-2 summarizes the SI results for soil and groundwater. Based on the conceptual site models (CSMs) developed and revised in light of the SI findings, there is potential for exposure to drinking water receptors caused by DoD activities at or adjacent to the facility.

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, no further evaluation is warranted for AOI 1: Storage and Ramp Area, AOI 2: Green AASF1 Hangar, and AOI 3: Wetland.

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

Analyte	Residential (Soil) (µg/kg)[a], 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a], 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	1,900	25,000	600

Notes:

a.) Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 September 2021.

b.) USEPA. 2016a. Drinking Water Health Advisory (HA) for Perfluorooctanoic Acid (PFOA). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-005. May 2016. / USEPA. 2016b. Drinking Water HA for Perfluorooctane Sulfonic Acid (PFOS). Office of Water (4304T). Health and Ecological Criteria Division, Washington, DC 20460. USEPA Document Number: 822-R-16-004. May 2016.

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Storage and Ramp Area	◐	◐	◐
2	Green AASF1 Hangar	◐	◐	N/A
3	Wetland	◐	◐	◐

Legend:

N/A = not applicable

● = PFOA, PFOS, and/or PFBS detected; exceedance of the screening levels

◐ = PFOA, PFOS, and/or PFBS detected; no exceedance of the screening levels

○ = PFOA, PFOS, and PFBS not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Storage and Ramp Area	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action
2	Green AASF1 Hangar	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action
3	Wetland	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action

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1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this SI at Army Aviation Support Facility 1 (AASF1) in Green Township, Summit County, Ohio. The Green AASF1 is also referred to as the "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; US Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and polyfluoroalkyl substances (PFAS). The term PFAS is used throughout this report to encompass all PFAS chemicals being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the task order.

1.2 SI Purpose

A PA was performed at Green AASF1 (AECOM, 2020) that identified three potential PFAS release areas at the facility, which were grouped into three Areas of Interest (AOIs). The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

As stated in the *Federal Facilities Remedial Site Inspection Summary Guide* (USEPA, 2005), an SI has five goals:

1. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment;
2. Determine the potential need for a removal action;
3. Collect or develop data to evaluate potential release;
4. Collect data to better characterize the release for more effective and rapid initiation of a Remedial Investigation (RI), if determined necessary; and
5. Collect data to determine whether the release is more than likely the result of activities associated with the Department of Defense (DoD).

In addition to the USEPA-identified goals of an SI, the ARNG SI also identifies whether there are potential off-facility PFAS sources.

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2. Facility Background

2.1 Facility Location and Description

Green AASF1 is located at 6000 W Airport Dr, North Canton, Ohio 44720. The facility is home to the 238th Aviation Regiment and is located in Green Township, Summit County, Ohio, on the north portion of the Akron-Canton Regional Airport (**Figure 2-1**). The property is leased by the State of Ohio, Adjutant General's Department from the Akron-Canton Airport, and the lease applies to the Ohio ARNG (OHARNG). The facility currently has an AASF building, an aviation support area, helicopter parking area, vehicle maintenance area, and an armory. Hover operations and other flight training activities occur on and near the helicopter pad.

2.2 Facility Environmental Setting

Green AASF1 is located in the Appalachian Highlands region of Ohio. The Appalachian Highlands encompass the eastern part of the state and are characterized by alternating plateaus and plains and a higher relief than the adjacent Interior Plains. The terrain around the facility exhibits moderate to low relief (**Figure 2-2**). The elevation of the facility is approximately 1,215 feet above mean sea level. The facility is surrounded by farmland and deciduous forest to the north and west, the Akron-Canton Regional Airport to the southeast, and residential areas to the west.

2.2.1 Geology

Green AASF1 lies within the Appalachian Plateaus physiographic province, Akron-Canton Interlobate Plateau district. The facility occupies a hummocky area between two converging glacial lobes and is dominated by kames, kame terraces, eskers, kettles, kettle lakes, bogs, and fens (Ohio Division of Geological Survey [ODGS], 1998).

Green AASF1 is situated on sandy Wisconsinan-age clay to loam glacial till (ODGS, 1998). The glacial till unit is generally 21 to 50 feet thick and may be up to 80 feet thick locally (ODGS, 2004). The glacial till is underlain by shale and siltstone bedrock of the Allegheny and Pottsville Groups. The shale and siltstone are interbedded with minor very fine- to medium-grained sandstone and minor limestone. Incidental coal beds up to 12 feet thick may occur locally. The Allegheny and Pottsville Groups are up to 700 feet thick (**Figure 2-3**) (Slucher, E.R. *et al*., 2006).

Soil borings completed during the SI found well-graded sand, clay, and clayey sand as the dominant lithology of the soils below Green AASF1; the borings were completed at depths between 10 and 25 feet below ground surface (bgs). Below the first layers of sand, the lithology was predominantly clays, including fat clay, lean clay, and clayey sand. The clay layers extended the length of the boring. Some borings included sections of gravel in the deeper sandy layers. Samples for grain size analyses were collected at four locations, AOI01-01, AOI02-01, AOI03-03, and ESLR-01, and analyzed via American Society for Testing and Materials Method D-422. The results indicate that the soil samples are comprised primarily of silt (57.15 percent [%] to 75.94%) and clay (19.96% to 40.86%). These results and facility observations are consistent with the understood geologic environment of the area. Boring logs are presented in **Appendix E**, and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

Green AASF1 is located in the Appalachian Plateaus aquifer system. The aquifer system has two major hydrogeologic units within the vicinity of Green AASF1: (1) the surficial aquifer system and (2) the Pennsylvanian aquifers. The surficial aquifers consist of glacial or alluvial sand and gravel deposits surrounded by low-permeability glacial till and are concentrated in stream valleys. Yields

from the surficial aquifer are typically low in the vicinity of Green AASF1 and increase westward towards Singer Lake and Nimisila Reservoir. The Pennsylvanian aquifer is composed primarily of sandstone and shale from the Allegheny and Pottsville Groups. Yields from the sandstone and shale are generally three to ten gallons per minute (gpm). Yields as much as 50 gpm have been obtained from the Sharon conglomerate member of the Allegheny and Pottsville Groups at depths greater than 100 feet bgs (Schmidt, 1979).

The property is located on a groundwater divide in both the surficial aquifer system and the Pennsylvanian aquifers. Groundwater in the eastern part of the property flows east, towards a tributary of the West Branch of Nimishillen Creek; groundwater in the western part of the property flows west, southwest, and northwest toward a tributary of Nimisila Creek (**Figure 2-3**). Based on monitoring well data from the Ohio Water Wells database, the depth to water in the immediate vicinity of Green AASF1 is estimated to be between 15 to 30 feet bgs (Ohio Department of Natural Resources [ODNR], 2020).

Domestic, industrial, public/semi-public, agricultural/irrigation, and monitoring wells are located within 4 miles of the facility (**Figure 2-3**). A query of the Ohio Water Wells database showed several private drinking water wells within a 0.5 mile radius of the facility, as well as one public/semi-public supply well on the property. According to the ODNR, the well (well log number 788781) was installed in 1996 to a depth of 360 feet bgs into the sandstone aquifer; however, interviewees confirmed that this drinking water well has been inactive for approximately 10 years (ODNR, 2018). Drinking water within the facility is now provided by Aqua Ohio, a public water utility provider and a subsidiary of Aqua America. Aqua Ohio serves multiple counties and receives the drinking water it distributes from groundwater and a series of surface water locations at Evans, Pine, Hamilton, and McKelvey Lakes and Lake Erie (Aqua, 2018). The adjacent Akron-Canton Regional Airport drinking water supplies are provided by the city of North Canton, located about 3.5 miles south. Drinking water from the city of North Canton is supplied by a series of six groundwater drinking wells in and around the North Canton area.

The Unregulated Contaminant Monitoring Rule (UCMR) sampling program was an addition to the 1996 Safe Drinking Water Act which requires every five years the USEPA issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems. PFAS was added as part of the UCMR 3 list (USEPA, 2017a). The UCMR 3 dataset was evaluated to determine which public water systems were sampled for PFAS within a 20-mile radius of the facility. Based on this rule, the City of North Canton public drinking water was sampled. The sampling results for PFOA and PFOS were non-detect. No other public water system within 20 miles of the facility had detections of PFOA or PFOS (USEPA, 2017a). PFAS analyses performed in 2016 had method detection limits (MDLs) that were higher than currently achievable. Thus, it is possible that low concentrations of other PFAS were not detected during the UCMR 3 but might be detected if analyzed today.

Depths to water measured in June 2021 during the SI ranged from 2.27 to 18.31 feet bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate groundwater flow direction is generally to the east.

2.2.3 Hydrology

Regional surface water features include Willowdale Lake to the southwest, the Nimisila Reservoir to the west, and the Portage Lakes to the northwest. The Nimisila Reservoir is used to maintain a constant water supply in the Portage Lakes, and surface water is withdrawn from the Portage Lakes for industrial use.

No surface water flows onto Green AASF1. Three streams flow to the east, west, and north of the facility, respectively (**Figure 2-5**). An unnamed tributary of the West Branch of Nimishillen Creek begins approximately 2,000 feet from the eastern boundary of the facility and flows to the

southeast. An unnamed tributary of Nimisila Creek begins approximately 2,800 feet from the western boundary of the facility and flows to the south/southwest for approximately 2.5 miles, where it enters Willowdale Lake. An unnamed stream flowing to the north begins approximately 1,800 feet from the northern boundary of the facility. Lake Cable, a popular lake for recreational activities, is located approximately four miles south of Green AASF1. Recreational use of nearby surface water bodies, including Willowdale Lake, Lake Cable, and other surrounding tributaries is high.

Three small forested/shrub wetlands are located within and directly surrounding the facility boundary. Two wetland areas are located outside the southeast boundary of the facility; one wetland is located outside the northeast corner of the facility boundary, and one wetland is located on the southeastern edge of the facility (CHA, 2015). An approximately 18.4-acre forested/shrub wetland begins approximately 930 feet from the north property boundary and drains into the unnamed stream to the north of the facility. Surface drainage from Green AASF1 empties into these wetlands, as well as into the unnamed streams to the north and east of the facility. Any surface drainage not emptied into these wetlands is captured by grated drains throughout the facility and the adjacent property and is discharged through an outfall east of the facility, within the Akron-Canton Airport facility boundary. Discharge from this outfall eventually flows into Schumacher Ditch, approximately 1.5 miles east of Green AASF1. Schumacher Ditch flows through Stark County and parts of the City of Green and discharges to the west branch of Nimisila Creek.

The Akron-Canton Airport property is broken up into eight designated drainage areas, with Green AASF1 located in the northern-most drainage area, which is about 500 acres. This area drains surface water to the east/southeast and discharges through a designated outfall on the eastern boundary of Akron-Canton Airport, and it eventually flows into Schumacher Ditch. This outfall is operated and managed by the Akron-Canton Airport and holds a National Pollutant Discharge Elimination System permit (CHA, 2015). Four side channels are associated with this ditch; however, Schumacher Ditch is the main waterway that captures stormwater and surface flow from this entire drainage area, including the outfall associated with Green AASF1 (EDG, 1994).

2.2.4 Climate

The climate at Green AASF1 is temperate, humid subtropical, with cool to cold winters and long, hot summers. The average temperature is 49.9 degrees Fahrenheit (°F), with summer highs of 80.1 °F and winter lows of 21.4 °F. The average annual precipitation is 39.62 inches (National Oceanic and Atmospheric Administration [NOAA], 2020).

2.2.5 Current and Future Land Use

The Green AASF1 is located on the northern portion of the Akron-Canton Regional Airport, with various small residential areas surrounding the facility, and several small local parks to the north and west. A small taxiway extends from the OHARNG apron to the intersection of Taxiway K and D at the Akron-Canton Airport (CHA, 2015). A helicopter pad and work area, where hover operations and other flight training activities are performed, are present within the facility (CHA, 2015). Directly east of the facility boundary lies Runway 19. Within the facility boundaries are an AASF hangar, an armory building, helicopter parking area, and vehicle maintenance area. Within the National Guard complex is a Navy Operational Support Center (NOSC) that was built in 2011 and is leased by the US Navy Reserve. This one-story facility was constructed under the Base Realignment and Closure process and consolidated NOSC Akron and NOSC Cleveland (CHA, 2015). ARNG has an active lease of Green AASF until 2061, and future land use is not anticipated to change during that time.

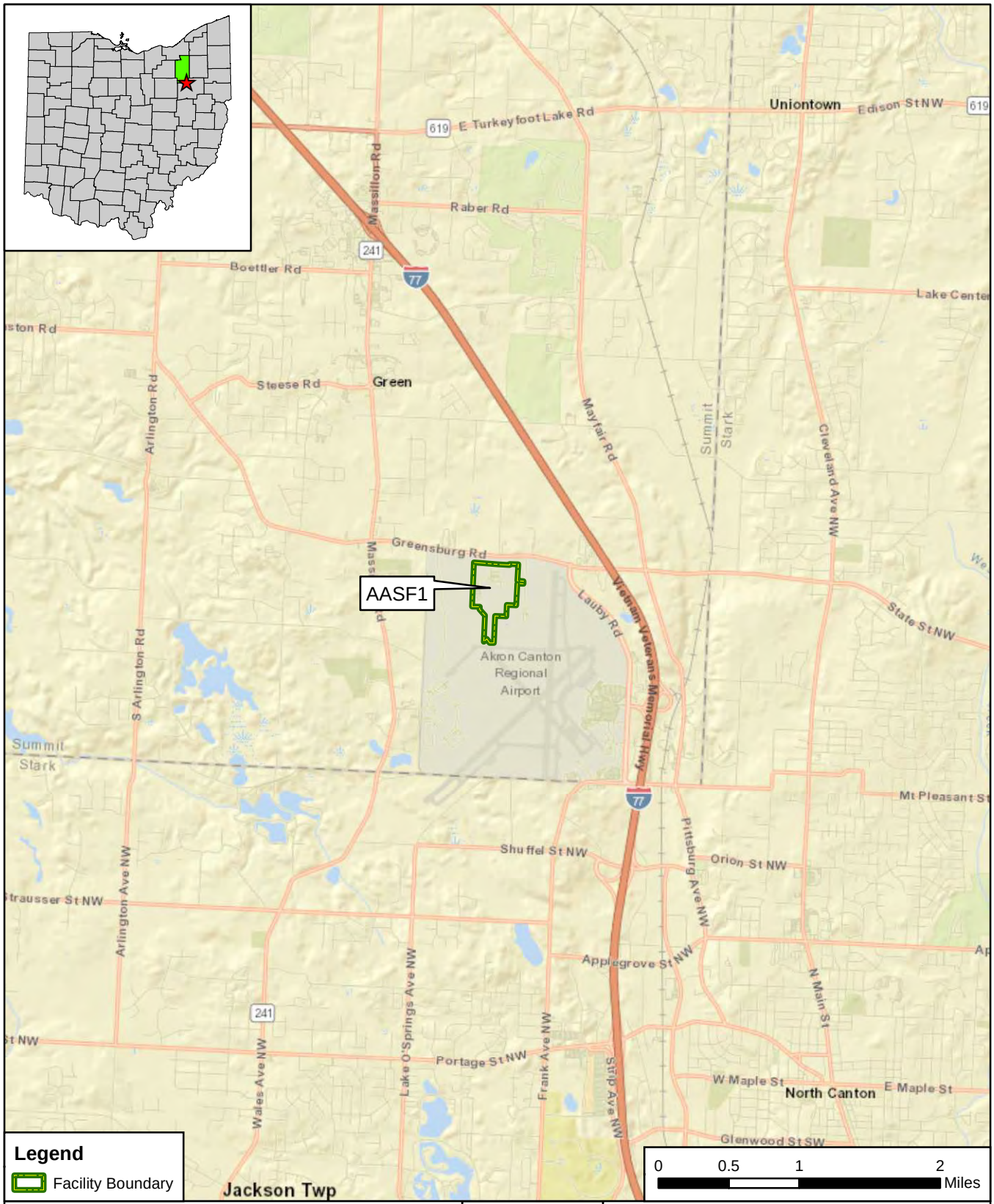
2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Summit County, Ohio (US Fish and Wildlife Service [USFWS], 2021).

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Northern long-eared bat, *Myotis septentrionalis* (threatened); Indiana bat, *Myotis sodalis* (endangered)
- **Flowering plants:** Northern wild monkshood, *Aconitum noveboracense* (threatened)

2.3 History of PFAS Use

Three potential PFAS release areas where aqueous film forming foam (AFFF) may have been used or released historically were identified at Green AASF1 during the PA (AECOM, 2020). Green AASF1 includes a hangar equipped with a high expansion foam (HEF) fire suppression system. Tri-Max™ tanks were previously stored in the hangar before they were transferred to the outdoor storage area. A test of the HEF suppression system occurred in 2007 that resulted in a full release of the system with the bay doors closed and foam washed down the hangar drains which connect to a municipal sewer system. Tri-Max™ tanks that contained AFFF were stored outside of Green AASF1 Building 5 (cold storage area) and on the ramp area. Unintentional releases of the tanks may have occurred at these locations. The close proximity of releases and potential releases in the hangar and storage areas coupled with surface water flow to the east leaves the potential for migrating PFAS to impact the wetland area on the east side of the facility.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
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SCALE	1:63,360	CHK BY	CH	12/9/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	12/9/2021

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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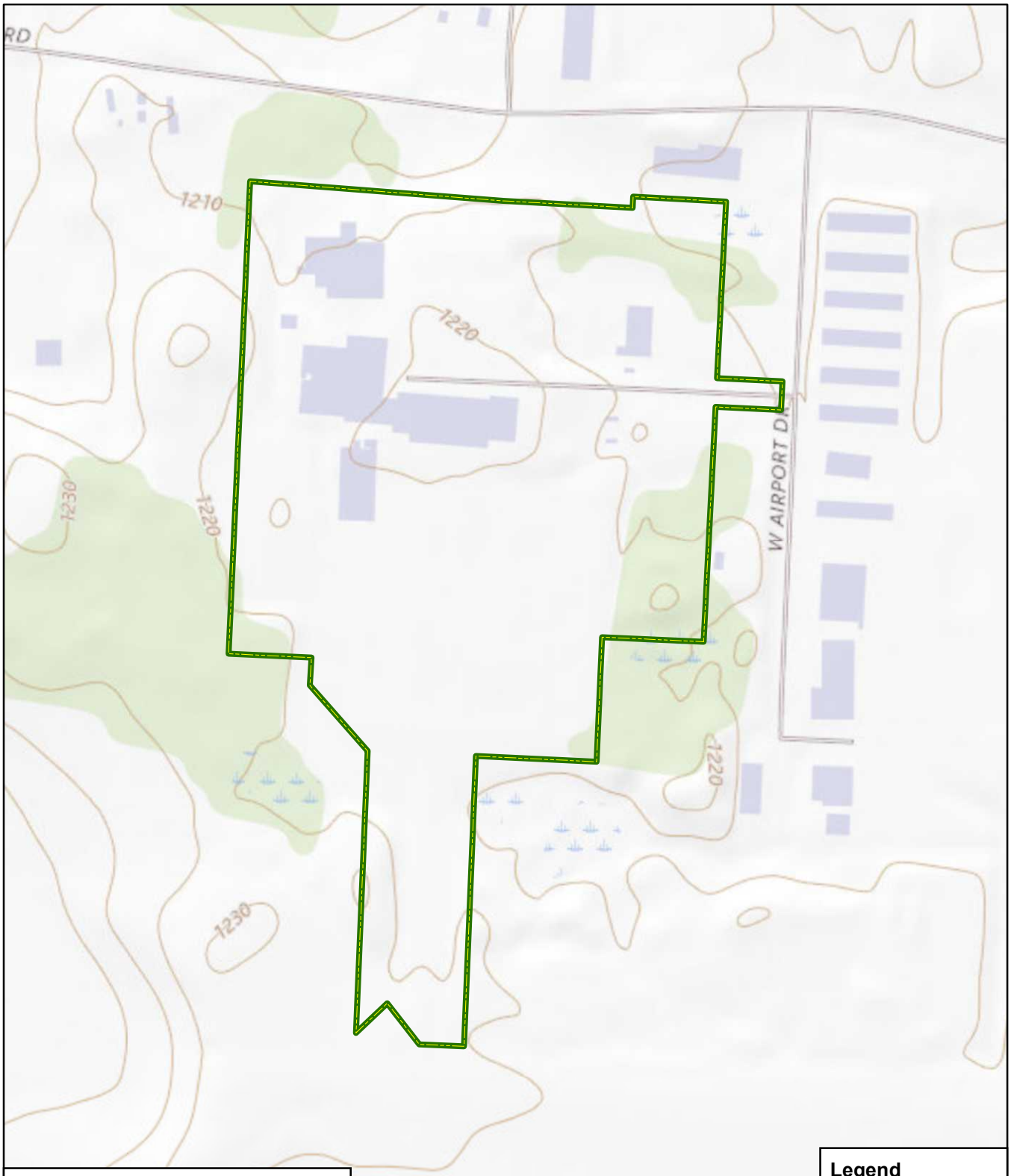

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	1/31/2022	GIS BY	MS	1/31/2022
SCALE	1:6,000	CHK BY	JW	1/31/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	1/31/2022

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Facility Topographic Map

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Figure 2-2

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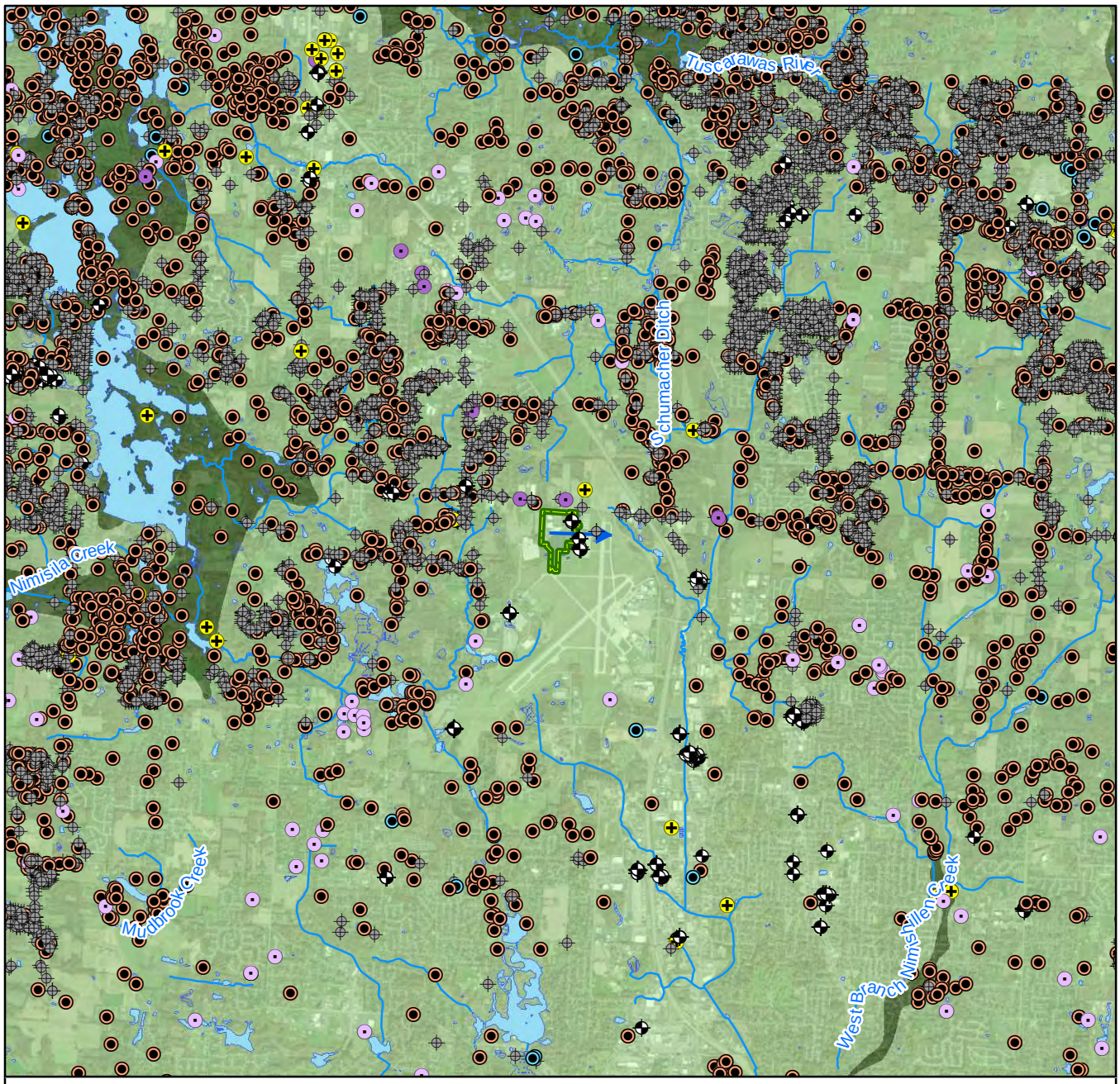

Facility Boundary
Water Body
Wetland
River/Stream
Groundwater Flow Direction

Geology

Allegheny and Pottsville Groups, Undivided
Logan and Cuyahoga Formations, Undivided

Wells

Domestic Well
Commercial Well
Agriculture/Irrigation Well
Industrial Well
Municipal/Public Water Supply Well
Monitoring Well/Piezometer
Other Well

0 0.75 1.5 3 Miles

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	12/9/2021	GIS BY	MS	12/9/2021
SCALE	1:95,040	CHK BY	CH	12/9/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	12/9/2021

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Groundwater Features

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Figure 2-3

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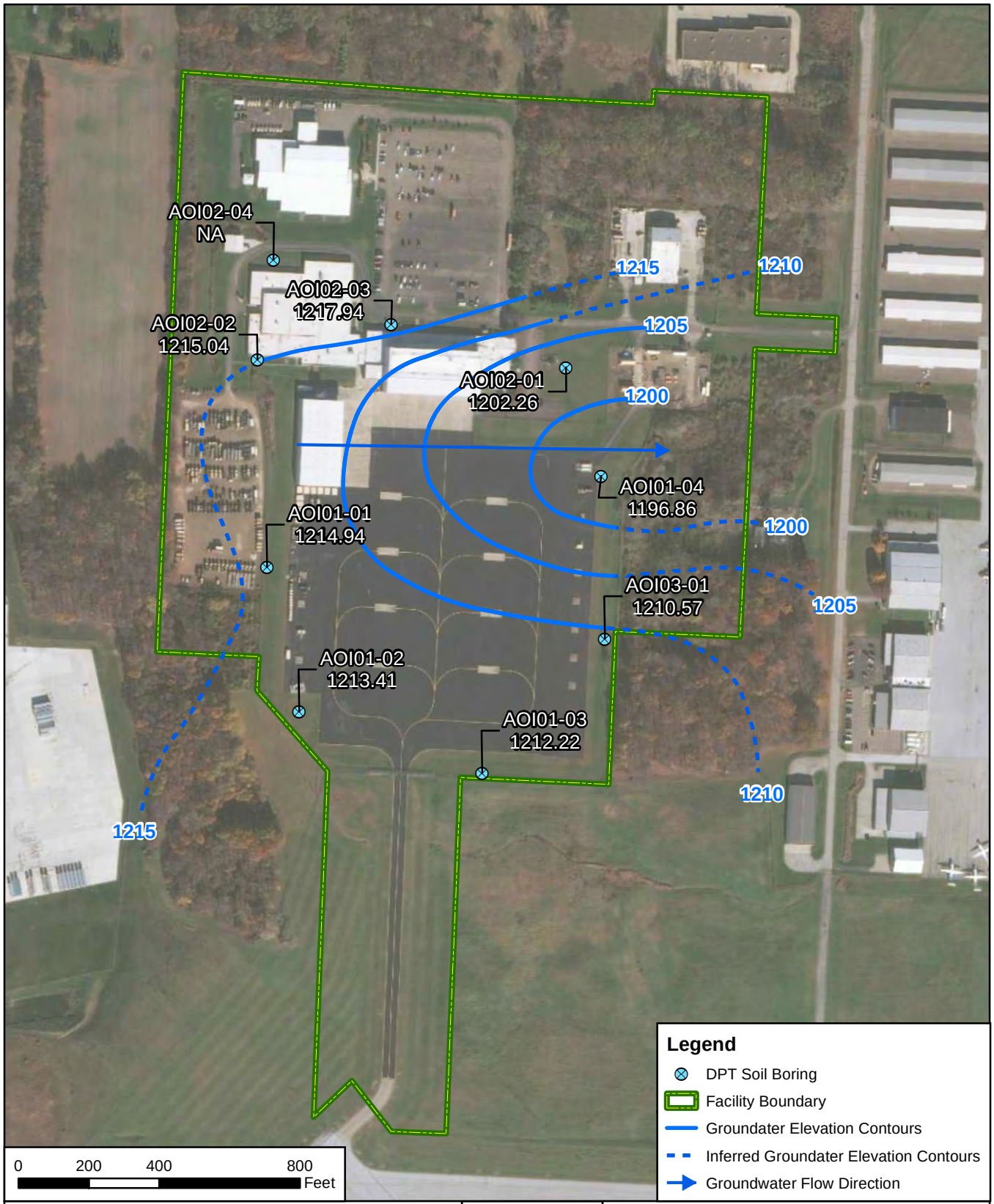

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	1/26/2022	GIS BY	MS	1/26/2022
SCALE	1:4,800	CHK BY	JW	1/26/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	1/26/2022

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Groundwater Elevation Contours

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Figure 2-4

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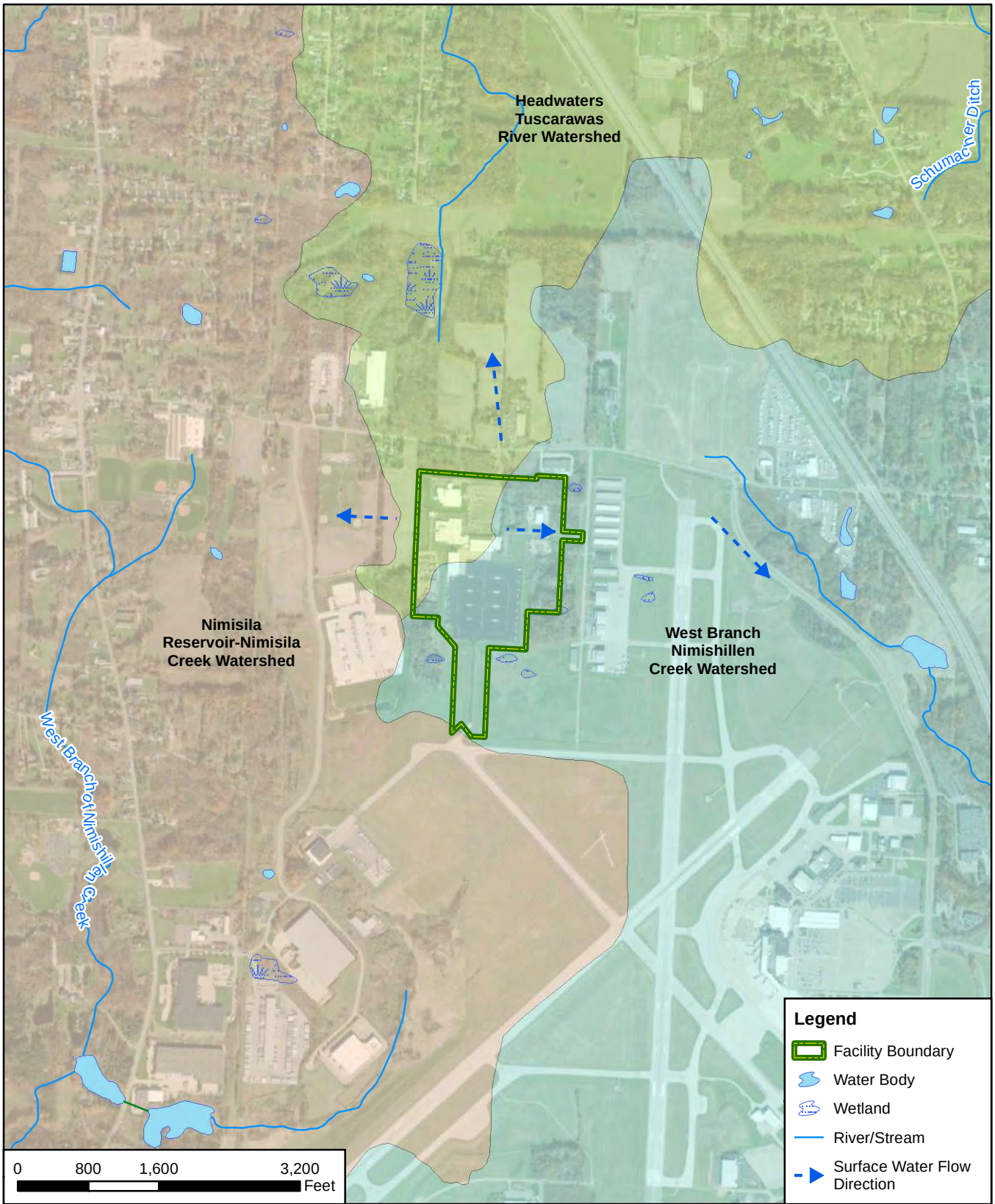

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	12/9/2021	GIS BY	MS	12/9/2021
SCALE	1:19,200	CHK BY	CH	12/9/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	12/9/2021

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Surface Water Features

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Figure 2-5

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, three potential PFAS release areas, the Storage and Ramp Area, Green AASF1 Hangar, and Wetland, were identified at Green AASF1 and grouped into three AOIs (AECOM, 2020). The potential PFAS release areas are shown on **Figure 3-1**.

3.1 AOI 1

AOI 1 consists of one potential PFAS release area. This potential release area is described below.

3.1.1 Storage and Ramp Area

AOI 1 is the Storage and Ramp Area. During the PA, 11 TriMax™ 30 tanks were stored outside the southern border of Green AASF1 Building 5 (cold storage area), on the northwestern portion of the aircraft parking area. Nine of the tanks were filled with concentrated 3% AFFF, while two of the tanks were empty. These tanks have all since been removed from the facility. Interviewees confirmed that one of the empty tanks was previously released during an off-facility training event at the Akron-Canton Airport in approximately 2014 or 2015. While no spills or releases were reported from the nine full tanks stored outside, the storage of these tanks in a non-climate-controlled area since at least 2017 without inspection for several years indicates a potential for unintended spills or releases.

The long-term storage location of the TriMax™ tanks falls within a surface water divide; depending on various factors, surface water can flow to either the east or the west of the facility. Surface water flow to the west migrates towards off-facility wetlands and other grassy areas. Surface water flow to the east is towards an identified on-facility wetland, as well as towards a designated surface drainage system. Any potential spills or releases on or around this TriMax™ Storage area have the potential to migrate to and impact these various areas.

Historical aerial photography shows the presence of mobile fire extinguishers along the paved ramp area from at least 2006 until 2018. Generally, safety standards require at least one mobile fire extinguisher for every two helicopters. During interviews, it could not be confirmed if the mobile extinguishers previously stored along the ramp area contained AFFF or PFAS-containing material; however, given the historic presence of TriMax™ tanks and other previous AFFF storage at the facility there is the potential for these mobile fire extinguishers to have contained PFAS. Any potential spills or releases in this area would follow the same pattern as the long-term TriMax™ storage and leave the potential for PFAS exposure.

3.2 AOI 2

AOI 2 consists of one potential PFAS release area. This potential release area is described below.

3.2.1 Green AASF1 Hangar

AOI 2 is the Green AASF1 Hangar. The Green AASF1 Hangar was constructed between 1987 and 1988 and includes a main hangar that is used for aviation maintenance and aircraft storage. Original construction of the Green AASF Hangar did not include a fire suppression system. The Green AASF1 Hangar was retrofitted in 2006 to include a HEF fire suppression system. This fire suppression system included a 400-gallon tank that contained concentrated Buckeye HEF 2.2%. In 2007, a test of the system occurred that resulted in a full release of the system. According to interviewees, the bay doors were closed, and all foam from the test was washed down the drains within the Green AASF1 Hangar. The drains within the Green AASF1 Hangar are connected to

an underground oil water separator that then routes any residual material to the local municipal wastewater system.

Five TriMax™ tanks that were located within the TriMax™ storage area were previously stored inside the Green AASF1 Building area (since approximately 2000 or 2001) and then transferred to outside storage sometime within the last several years. The long-term and undocumented storage of these tanks within Green AASF1 leave the potential for unintended spills or releases.

During the site visit, interviewees noted that 26 5-gallon containers of AFFF concentrate were removed from the Green AASF1 Hangar and were properly transported and disposed of off-facility in approximately April 2018. According to base personnel, all 26 5-gallon buckets of AFFF were unopened and unused during the entire duration of storage at the facility. It is estimated that the containers were located within the facility for approximately 10 years prior to disposal; however, it is unknown where the buckets originated from. Interviewees also had no knowledge of the procurement of the AFFF buckets, and there was no knowledge of spills or releases during their time of storage at the facility.

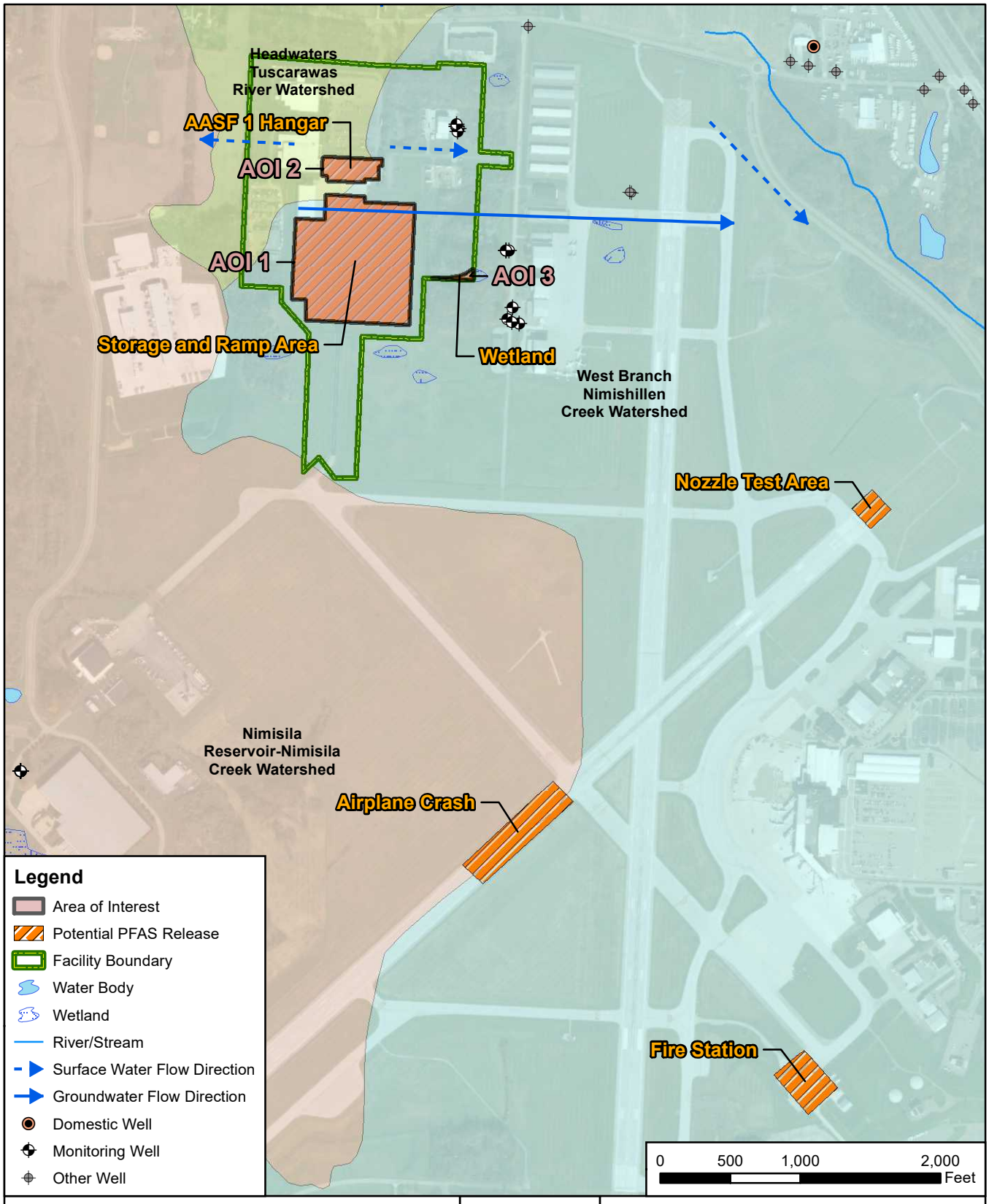
3.3 AOI 3

AOI 3 consists of one potential PFAS release area. This potential release area is described below.

3.3.1 Wetland

AOI 3 is a small wetland on the southeast edge of the facility property that extends on- and off-facility. Several wetlands exist directly around the facility. Surface drainage from Green AASF1 empties into these various wetlands, including the wetland partially located within the facility property, as well as into the unnamed streams to the north and east of the facility. Any surface runoff not directed into these wetlands is captured by grated drains throughout the facility and the adjacent property. These drain discharge through an outfall east of the facility, within the Akron-Canton Airport facility boundary.

While there have been no known or suspected releases directly into the on-facility wetland, the historical storage of AFFF and potential releases at AOI 1 and AOI 2 coupled with the close proximity of the wetland and general surface water flow direction to the east leave the potential for migrating PFAS to impact this wetland. This wetland can receive and store potentially impacted stormwater and surface water runoff from around the facility.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	3/30/2022	GIS BY	MS	3/30/2022
SCALE	1:12,000	CHK BY	CH	3/30/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	3/30/2022

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Areas of Interest

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Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

Project Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data and define the level of certainty required to support project decision-making process. The specific DQOs established for this facility are described below. These DQOs were developed in accordance with the USEPA's seven-step iterative process (USEPA, 2006).

4.1 Problem Statement

The following problem statement was developed during project planning:

The presence of PFAS, which may pose a risk to human health or the environment, in environmental media at the facility is currently unknown. PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. The regulatory framework for managing PFAS at both the federal and state level continues to evolve.

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 September 2021 (Assistant Secretary of Defense, 2021). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS.

The SLs are presented in **Section 6.1** of this Report.

The following quotes from the DA policy documents form the basis for this project (DA, 2016; DA, 2018):

- "The Army will research and identify locations where PFOS- and/or PFOA-containing products, such as AFFF, are known or suspected to have been used. Installations shall coordinate with installation/facility fire response or training offices to identify AFFF use or storage locations. The Army will consider FTAs, AFFF storage locations, hangars/buildings with AFFF suppression systems, fire equipment maintenance areas, and areas where emergency response operations required AFFF use as possible source areas. In addition, metal plating operations, which used certain PFOS-containing mist suppressants, shall be considered possible source areas.".
- "Based on a review of site records…determine whether a CERCLA PA is appropriate for identifying PFOS/PFOA release sites. If the PA determines a PFOS/PFOA release may have occurred, a CERCLA SI shall be conducted to determine presence/absence of contamination.".
- "Identify sites where perfluorinated compounds are known or suspected to have been released, with the priority being those sites within 20 miles of the public systems that tested above USEPA Health Advisory (HA) levels." (USEPA, 2016a; USEPA, 2016b).

4.2 Goals of the Study

The following goals were established for this SI:

1. Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.

2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.
3. Determine the potential need for a Time Critical Removal Action (TCRA) (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.
4. Collect data to better characterize the release areas for more effective and rapid initiation of a RI (if determined necessary).
5. If PFOA, PFOS, and PFBS are determined to be present, aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities).
6. Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.

4.3 Information Inputs

Primary information inputs included:

- The PA for Green AASF1 (AECOM, 2020);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2021a); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-1**). 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).

4.5 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the DoD Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs and decision rules as defined in the SI QAPP Addendum (AECOM, 2021a). These rules governed response actions based on the results of the SI sampling effort.

The decision rules described in the **Worksheet #11** of the SI QAPP Addendum identify actions based on the following:

Groundwater:

- Is there a human receptor within 4 miles of the facility?
- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?

- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the conceptual site model (CSM) suggest in terms of source, pathway and receptor?

Soil:

- What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0 to 2 feet bgs)?
- What is the concentration of PFOA, PFOS, and PFBS in deep soil (i.e., vadose zone and capillary fringe)?
- What does the CSM suggest in terms of source, pathway, and receptor?

Soil and groundwater samples were collected from each of the potential release areas. Groundwater was encountered at approximately 2.27 to 18.31 feet bgs.

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) 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, 2017b).

Data Quality Indicators (DQIs) (Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity) are important components in assessing data usability. These DQIs were evaluated in the subsequent sections and demonstrate that the data presented in this SI report are of high quality. Although the SI data are considered reliable, some degree of uncertainty can be associated with the data collected. Specific factors that may contribute to the uncertainty of the data evaluation are described below. The Data Validation Report (DVR) (**Appendix A**) presents explanations for all qualified data in greater detail.

4.6.1 Precision

Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured with the field duplicate relative percent differences (RPD); laboratory precision is measured with calibration verification, internal standard recoveries, laboratory control spike (LCS) and matrix spike (MS) duplicate RPD.

Injection internal standards (IIS) were added by the laboratory after sample extraction and prior to analysis as a legacy requirement of DoD QSM 5.1 to measure relative responses of target analytes. Even though not required under DoD QSM 5.3, the IIS are still added to the sample after extraction as an additional quality control (QC) measure. The IIS percent recoveries were within the established precision limits presented in the QAPP Addendum (AECOM, 2021a).

LCS/LCS duplicate (LCS/LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSDs performed during the

laboratory analyses were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

MS/MS duplicate (MS/MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a), with limited exceptions. The MS/MSD performed on parent sample GRN-AOI02-01-SB-2-4 displayed a relative percent difference (RPD) greater than the QC limit for perfluorohexanoic acid (PFHxA). The field sample result associated with MS/MSD RPD exceedance was qualified as estimate and should be considered usable as qualified.

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a) with limited exceptions. Three separate field duplicate pairs displayed positive results in one sample and non-detect results in the other sample. The field duplicate pair results were qualified as estimate and the qualified field duplicate pair results should be considered usable as estimated values.

4.6.2 Accuracy

Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its "true" or expected value, the more accurate the measurement. The more precise or reproducible the result, the more reliable or accurate the result. Accuracy is measured through percent recoveries in the LCS/LCSD, MS/MSD, and surrogates.

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis. The LCS/LCSDs performed during the laboratory analyses were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2021a).

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. The EIS area counts were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a), with several exceptions. Five investigative field samples and eight QC samples displayed EIS area counts less than the lower QC limit for several target analytes. Field sample results are not qualified based on QC sample EIS area count anomalies and should be considered usable as reported. The positive field sample results associated with low EIS area counts were qualified as estimate with a high bias, while non-detect results were qualified as estimate and should be considered usable as qualified.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. The MS/MSDs performed during that laboratory analyses were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2021a), with limited exceptions. Two parent samples displayed MS/MSD percent recoveries outside the QC limits. The positive parent sample result associated with low MS/MSD percent recovery was qualified as estimate with a low bias. The positive parent sample result associated with the high MS/MSD percent recovery was qualified as estimate with a high bias. The associated field sample results should be considered usable as qualified.

Calibration verifications (CCV) were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. The calibration verifications performed during the laboratory analyses were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2021a), with one exception. One CCV displayed percent recoveries less than the QC limit for perfluorohexanesulfonic acid (PFHxS) and PFOS. These were not target analytes in the associated batch, so there was no impact on data quality.

4.6.3 Representativeness

Representativeness qualitatively expresses the degree to which data accurately reflect site conditions. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences.

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) Compliant with Quality Systems Manual (QSM) Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branched and linear isomers when available were used, and isotopically labeled standards were used for quantitation.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory, with limited exceptions. The field samples submitted in SDG 221061935 were received by the laboratory at 6.2 degrees Celsius (°C). The samples were still considered preserved, the associated field sample results were qualified as estimate and should be considered usable as qualified. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2021a) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. Six instrument blanks and one method blank displayed concentrations for multiple analytes greater than the detection limit (DL). The positive field sample results associated with the blank detections that displayed concentrations less than five times the blank detections were qualified as likely false positives and should be treated as non-detect. The remaining field sample results associated with the blank detections were all greater than five times the blank concentration or were non-detect, and these associated field sample results should be considered usable as reported.

Field blanks and equipment blanks were also collected for groundwater and soil samples. All equipment blanks and field blanks were non-detect for all target analytes.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The decontamination samples, GRN-PW-01 and GRN-PW-01-FD, displayed concentrations for several target analytes greater than the DLs. The remaining field sample results associated with the blank detections were all greater than five times the blank concentration or were non-detect. The associated field sample results should be considered usable as reported.

Field samples were extracted and analyzed within the appropriate holding time in order to qualitatively express the degree to which data accurately reflect site conditions, with limited exceptions. Eight field samples were re-extracted and reanalyzed outside technical holding time due to QC failures. The associated field sample results were qualified as estimate and should be

considered usable as qualified. The holding time for pH analysis is “immediate”, and all field samples analyzed for pH were qualified as estimate and should be considered usable as qualified.

Overall, the data are usable for evaluating the presence or absence of PFAS at the facility. Sufficient usable data were obtained to meet the objectives of the SI.

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. The laboratory provided data that met system QC acceptance criteria for all samples tested. Project completeness was determined by evaluating the planned versus actual quantities of data. Percent completeness per parameter is as follows and reflects the exclusion of “X” flagged data, if applicable:

- PFAS in groundwater by DoD QSM B-15 at 100%
- PFAS in soil by DoD QSM B-15 at 100%
- pH in soil by USEPA Method 9045D at 100%
- Total organic carbon (TOC) by USEPA Method 9060 at 100%

One groundwater sample was not collected due to refusal. This is described further in **Section 5.2**.

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, an MDL study, and calibration standards at the limit of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the QAPP Addendum (AECOM, 2021a). The laboratory provided the requested MDL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the QAPP Addendum (AECOM, 2021a), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the DL were reported and qualified “J” as estimated values by the laboratory.

5. Site Inspection Activities

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

- *Final Preliminary Assessment Report, AASF1, Green Township, Summit County, Ohio* dated June 2020 (AECOM, 2020);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, AASF1, Green Township, Summit County, Ohio* dated June 2021 (AECOM, 2021a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, AASF1, Green Township, Summit County, Ohio* dated June 2021 (AECOM, 2021b).

The SI field activities were conducted from 16 to 18 June 2021 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a).

The following samples were collected during the SI and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 to fulfill the project DQOs:

- Twenty-five (25) soil samples from nine boring locations;
- Eight grab groundwater samples from eight temporary well locations;
- Twelve (12) quality assurance (QA) samples.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, land survey data are provided in **Appendix B3**, investigation-derived waste (IDW) logs are provided in **Appendix B4,** and Nonconformance and Corrective Action Reports are included in **Appendix B5**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 23 November 2020, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, OHARNG, USACE, Ohio Environmental Protection Agency (Ohio EPA), and representatives familiar with the facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2021a).

Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

AECOM's drilling subcontractor, Cascade Technical Services, LLC, placed a ticket with Ohio811 "Call Before You Dig" utility clearance provider to notify them of intrusive work on 7 June 2021. However, because the AASF is a private facility, the participating "Call Before You Dig" locators did not clear utilities at the entire facility. Therefore, AECOM contracted Ground Penetrating Radar Services, LLC (GPRS), a private utility location service, to complete the on-facility utility clearance. GPRS performed utility clearance of the proposed boring locations on 11 June 2021 with input from the AECOM field team and Green AASF1 facility staff. General locating services and ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface soils 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 confirmed to be acceptable for use in a PFAS investigation prior to the start of field activities. A sample from the potable water source at Green AASF1 was collected on 5 January 2021, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water sample are provided in **Appendix F**. A discussion of the results is presented in **Section 4.6.3**.

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 (SOPs) appendix to the SI QAPP Addendum (AECOM, 2021a). Prior to the start of field work each day, a PFAS Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via direct push technology (DPT), in accordance with the SI QAPP Addendum (AECOM, 2021a). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top five feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1** and depths are provided **Table 5-1**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 2 feet above the groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table.

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

Soil borings completed during the SI found well-graded sand, clay, and clayey sand as the dominant lithology of the soils below Green AASF1. The borings were completed at depths between 10 and 25 ft bgs. Below the first layers of sand, the lithology was predominantly clays, including fat clay, lean clay, and clayey sand. The clay layers extended the length of the boring. Some borings included sections of gravel in the deeper sandy layers. These observations are consistent with the understood geologic environment of the area.

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

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

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

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, wherever conditions allowed, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

The temporary wells were allowed to recharge after installation before collection of groundwater samples. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. 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 [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

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

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

Temporary wells were abandoned in accordance with the SI QAPP Addendum (AECOM, 2021a) by removing the PVC and backfilling the hole with wetted bentonite chips. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 16 to 18 June 2021. Groundwater elevation measurements were collected from the 8 new temporary monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-2**.

5.5 Surveying

The northern side of each well casing was surveyed by Ohio-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021a). Survey data from the newly installed wells on the facility were collected on 18 June 2021 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 84 datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B3**.

5.6 Investigation-Derived Waste

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

Soil IDW (i.e., soil cuttings) generated during the SI activities was containerized in one properly labeled 55-gallon drum. The soil IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location. The IDW is currently stored on-facility at a location designated by the OHARNG Environmental Office. ARNG will manage disposal of the solid IDW and ensure proper disposal in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Liquid IDW generated during SI activities (i.e. purge water, development water, and decontamination fluids) was containerized in one properly-labeled 55-gallon drum (see SOP 3-05). The liquid IDW was not sampled and assumes the PFAS characteristics of the associated groundwater samples collected from that source location. The containerized IDW is currently stored on-facility at a location designated by OHARNG. Liquid IDW drums were only filled 75% full to account for freeze/thaw cycles. ARNG will manage and dispose of the liquid IDW under a separate contract in accordance with SOP No. 042A for Treating Liquid Investigation-Derived Material (purge water, drilling water, and decontamination fluids) (EA Engineering, Science, and

Technology, Inc., 2021). ARNG will coordinate proper disposal in accordance with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018). The IDW logs describing the storage location and relative volume of soil and liquid IDW are documented 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 for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. The 18 PFAS analyzed as part of the ARNG SI program include the following:

- 6:2 fluorotelomer sulfonic acid (6:2 FTS)
- 8:2 fluorotelomer sulfonic acid (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.8 Deviations from SI QAPP Addendum

Four deviations from the SI QAPP Addendum were identified following conclusion of the field sampling activities. The deviations are noted below. Documentation of the deviations, such as in a Nonconformance and Corrective Action Report, are also included in **Appendix B5**.

- During SI fieldwork, the coordinates of the proposed location for AOI01-03 were discovered to be outside the facility's fence line. AOI01-03 was relocated inside the facility fence line.
- During SI fieldwork, temporary monitoring well AOI02-04 did not contain any water; therefore, a groundwater sample was not collected from this location.
- Upon visual review of the boring location AOI02-03, the OHARNG discovered that the temporary well installed during the SI had not been properly abandoned. As a result, the field team re-mobilized to the facility on 9 July 2021 to complete the abandonment of this temporary well using wetted bentonite chips. This action was documented in a Nonconformance and Corrective Action Report provided in **Appendix B5**.
- Upon review of field documentation, it was discovered that one surface soil sample, AOI01-01-SB-2-4, was not collected during the SI field effort. As a result, the field team

re-mobilized to the facility on 24 August 2021 to collect this surface soil sample and shipped it to the laboratory for analysis. This action was documented in a Nonconformance and Corrective Action Report provided in **Appendix B5**.

- Upon review of field documentation, it was discovered that minimum temporary well purging and/or groundwater sample turbidity requirements were not met during the SI field effort. As a result, the laboratory performed extra processes to enable adequate analysis of samples collected with high turbidity. This action was documented in a Nonconformance and Corrective Action Report provided in **Appendix B5**.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Green AASF1, Ohio

Sample Identification	Sample Collection Date, Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
GRN-AOI01-01-SB-0-2	6/17/2021 14:20	0-2					
GRN-AOI01-01-SB-2-4	6/17/2021 14:35	2-4	x				
GRN-AOI01-01-SB-2-4 MS	6/17/2021 14:35	2-4	x				MS/MSD
GRN-AOI01-01-SB-2-4 MSD	6/17/2021 14:35	2-4	x				MS/MSD
GRN-AOI01-02-SB-0-2	6/17/2021 13:20	0-2	x	x	x		
GRN-AOI01-02-SB-4-6	6/17/2021 13:30	4-6	x				
GRN-AOI01-02-SB-4-6-DUP	6/17/2021 13:30	4-6	x				FD
GRN-AOI01-02-SB-6-8	6/17/2021 13:35	6-8	x				
GRN-AOI01-03-SB-0-2	6/17/2021 11:00	0-2	x	x	x	x	
GRN-AOI01-03-SB-0-2-DUP	6/17/2021 11:00	0-2		x	x		FD
GRN-AOI01-03-SB-2-4	6/17/2021 11:05	2-4	x				
GRN-AOI01-03-SB-2-4-DUP	6/17/2021 11:05	2-4	x				FD
GRN-AOI01-04-SB-0-2	6/17/2021 8:50	0-2	x				
GRN-AOI01-04-SB-6-8	6/17/2021 9:00	6-8	x				
GRN-AOI01-04-SB-13-15	6/17/2021 9:05	13-15	x				
GRN-AOI02-01-SB-0-2	6/16/2021 15:00	0-2	x				
GRN-AOI02-01-SB-7-9	6/16/2021 15:25	7-9	x				
GRN-AOI02-01-SB-13-15	6/16/2021 15:30	13-15	x				
GRN-AOI02-02-SB-0-2	6/17/2021 15:40	0-2	x				
GRN-AOI02-02-SB-4-6	6/17/2021 15:50	4-6	x	x	x		
GRN-AOI02-02-SB-4-6-DUP	6/17/2021 15:50	4-6	x				FD
GRN-AOI02-02-SB-8-10	6/17/2021 15:55	8-10	x				
GRN-AOI02-03-SB-0-2	6/16/2021 16:30	0-2	x				
GRN-AOI02-03-SB-2-4	6/16/2021 16:35	2-4	x				
GRN-AOI02-03-SB-4-6	6/16/2021 16:40	4-6	x				
GRN-AOI02-04-SB-0-2	6/18/2021 8:30	0-2	x				
GRN-AOI02-04-SB-6-8	6/18/2021 8:35	6-8	x	x	x		
GRN-AOI02-04-SB-13-15	6/18/2021 8:40	13-15	x				
GRN-AOI03-01-SB-0-2	6/17/2021 10:05	0-2	x				
GRN-AOI03-01-SB-2-4	6/17/2021 10:10	2-4				x	
GRN-AOI03-01-SB-4-6	6/17/2021 10:15	4-6	x				
Groundwater Samples							
GRN-AOI01-01-GW	6/18/2021 8:15	NA	x				
GRN-AOI01-02-GW	6/17/2021 15:00	NA	x				
GRN-AOI01-03-GW	6/17/2021 13:15	NA	x				
GRN-AOI01-04-GW	6/18/2021 9:00	NA	x				
GRN-AOI02-01-GW	6/17/2021 9:40	NA	x				
GRN-AOI02-01-GW-DUP	6/17/2021 9:40	NA	x				FD
GRN-AOI02-02-GW	6/18/2021 10:00	NA	x				
GRN-AOI02-03-GW	6/17/2021 10:45	NA	x				
GRN-AOI02-03-GW-MS	6/17/2021 10:50	NA	x				MS/MSD
GRN-AOI02-03-GW-MSD	6/17/2021 10:55	NA	x				MS/MSD
GRN-AOI03-01-GW	6/17/2021 12:20	NA	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Green AASF1, Ohio

Sample Identification	Sample Collection Date, Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
GRN-FRB-01	6/17/2021 11:00	NA	x				
GRN-ERB-01	6/17/2021 13:30	NA	x				
GRN-ERB-02	6/18/2021 10:00	NA	x				

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

Table 5-2
Soil Boring Depths, Temporary Well Screen Intervals, and Groundwater Elevations
Site Inspection Report, Green AASF1, Ohio

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
AOI 1	AOI01-01	10	5 - 10	1217.738	1217.210	2.8	2.27	1214.94
AOI 1	AOI01-02	15	5 - 15	1216.3337	1215.980	2.92	2.57	1213.41
AOI 1	AOI01-03	15	5 - 15	1216.444	1216.022	4.22	3.80	1212.22
AOI 1	AOI01-04	20	10 - 20	1215.613	1215.174	18.75	18.31	1196.86
AOI 2	AOI02-01	25	15 - 25	1216.134	1215.879	13.88	13.62	1202.26
AOI 2	AOI02-02	15	5 - 15	1220.082	1219.927	5.05	4.89	1215.04
AOI 2	AOI02-03	10	5 - 10	1223.294	1222.983	5.35	5.04	1217.94
AOI 2	AOI02-04	15	5 - 15	1219.969	1219.517	NA	NA	NA
AOI 3	AOI03-01	15	5 - 15	1215.940	1215.275	5.37	4.71	1210.57

Notes:

[1] Temporary well screen set above total depth to capture groundwater interface

bgs = below ground surface
btoc = below top of casing
NA = not applicable
NAVD88 = North American Vertical Datum 1988

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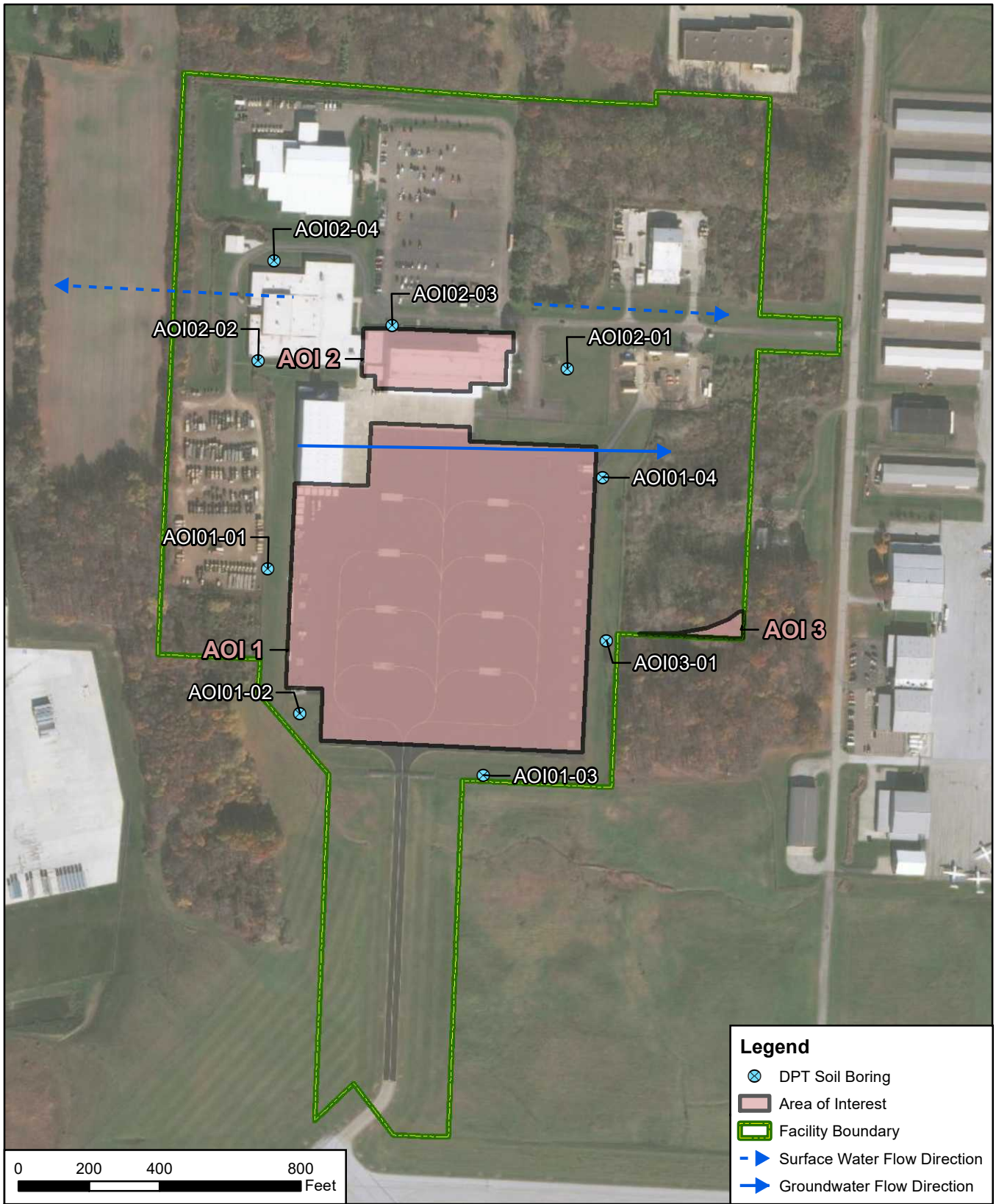

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at AASF1, OH			
REVISED	3/9/2022	GIS BY	MS	3/9/2022
SCALE	1:4,800	CHK BY	JW	3/9/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	3/9/2022

N

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\OH\Green_Armory_Figures\Green_Armory_SI_Figures\SI_Report\Fig_5-1_Green_AASF1_SI_Final_Sample_Locations.mxd

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.5**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil, or groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix D**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 15 September 2021 (Assistant Secretary of Defense, 2021). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS.

The SLs are presented on **Table 6-1** below. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain PFAS within the boundaries of the facility.

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

Analyte	Residential (Soil) (µg/kg)[a,b] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a,b] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a,b]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	1,900	25,000	600

Notes:

a.) Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 15 September 2021.

b.) USEPA, 2021. Risk Based Screening Levels Calculated for PFBS in Groundwater and Soil using USEPA's Regional Screening Level Calculator. HQ = 0.1. 8 April 2021.

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 site: 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 and pH, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC and pH sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (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, which includes one potential PFAS release area: the TriMax™ Storage and Ramp Area. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.3.1 AOI 1 Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at the potential PFAS release area: TriMax™ Storage and Ramp Area. **Figure 6-1** through **Figure 6-3** present the ranges of detections of PFOA, PFOS, and PFBS in soil. **Table 6-2** through **Table 6-3** summarize the detected compounds in soil.

At AOI 1, soil was sampled from surface soil (0 to 2 feet bgs), shallow subsurface soil (4 to 6 feet bgs and 6 to 8 feet bgs), and deep subsurface soil (6 to 8 feet bgs and 13 to 15 feet bgs) from boring locations AOI01-02 and AOI01-04. Soil was sampled from surface (0 to 2 feet bgs) and shallow subsurface (2 to 4 feet bgs) soil at locations AOI01-01 and AOI01-03. PFOA, PFOS, and PFBS were detected in surface soil at AOI01-02 at 0.518 J micrograms per kilogram (µg/kg), 0.158 J µg/kg, and 0.044 J µg/kg, respectively. No other surface soil location at AOI 1 exhibited detections of PFOA, PFOS, and PFBS. In shallow subsurface soil, PFOA was detected at AOI01-02, at a concentration of 0.404 J µg/kg. PFOA, PFOS, and PFBS were not detected at any other shallow subsurface sample location or at any deep subsurface soil sample location.

6.3.2 AOI 1 Groundwater Analytical Results

PFOA, PFOS, and PFBS in groundwater did not exceed the SLs at any of the four groundwater sample locations at AOI 1: AOI01-01 (screened from 5-10 feet bgs), AOI01-02 (screened from 5-15 feet bgs), AOI01-03 (screened from 5-15 feet bgs), and AOI01-04 (screened from 10-20 feet bgs). **Figure 6-4** presents the ranges of detections of PFOA, PFOS, and PFBS in groundwater. **Table 6-4** summarizes the detected compounds in groundwater.

Within the potential PFAS release area at AOI 1, groundwater was sampled from temporary monitoring well locations AOI01-01 through AOI01-04. The SLs for PFOA, PFOS, and PFBS in groundwater were not exceeded at any sample location. PFOA was detected at AOI01-01 at 16.4

nanograms per liter (ng/L) and at AOI01-03 at 1.75 J ng/L. PFOS was detected at AOI01-01 at a concentration of 1.22 J ng/L and at AOI01-03 at 2.28 J ng/L. PFBS was detected at each sample location other than AOI01-04, at concentrations ranging from 1.29 J ng/L to 3.31 J ng/L. Groundwater analytical results at AOI 1 are consistent with the soil detections observed in this area.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were detected in soil at AOI 1; however, the detected concentrations were at least two orders of magnitude lower than their respective soil SLs. PFOA, PFOS, and PFBS were detected in groundwater at AOI 1 at concentrations below their respective groundwater SLs. Based on the soil and groundwater results from this SI, no further investigation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes one potential PFAS release area, the Green AASF 1 Hangar. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.4.1 AOI 2 Soil Analytical Results

PFOA, PFOS, and PFBS did not exceed the SLs in soil at the potential release area, Green AASF1 Hangar. **Figure 6-1** through **Figure 6-3** present the ranges of detections of PFOA, PFOS, and PFBS in soil. **Table 6-2** through **Table 6-3** summarize the detected compounds in soil.

At the Green AASF1 Hangar, soil was sampled from surface soil (0 to 2 feet bgs) at locations AOI02-01, AOI02-02, AOI02-03, and AOI02-04. Due to variations in groundwater level at AOI 2, shallow subsurface and deep subsurface soil samples were taken at varying depths:

- AOI02-01 shallow subsurface soil was collected from 2 to 4 feet bgs and 7 to 9 feet bgs, and the deep subsurface soil sample was collected from 13 to 15 feet bgs.
- AOI02-02 shallow subsurface soil was collected from 4 to 6 feet bgs, and deep subsurface soil was collected from 8 to 10 feet bgs.
- AOI02-03 shallow subsurface soil was collected from 2 to 4 feet bgs, and deep subsurface soil was collected from 4 to 6 feet bgs.
- AOI02-04 shallow subsurface soil was collected from 6 to 8 feet bgs, and deep subsurface soil was collected from 13 to 15 feet bgs.

PFOA, PFOS, and PFBS were not detected in any soil depth interval at AOI02-01. At AOI02-02, PFOS and PFBS were detected in surface soil at concentrations of 0.066 J µg/kg and 0.027 J µg/kg. PFOS, PFOA, and PFBS were not detected at AOI02-02 in shallow or deep subsurface soil. At AOI02-03, PFOS, PFOA, and PFBS were all detected in surface soil at concentrations of 0.329 J µg/kg, 0.150 J µg/kg, and 0.055 J µg/kg, respectively. Similarly, PFOS, PFOA, and PFBS were detected in shallow subsurface soil at AOI02-03 at concentrations of 0.205 J+ µg/kg, 0.127 J µg/kg, and 0.051 J µg/kg, respectively. PFOS and PFBS were detected in deep subsurface soil at AOI02-03 at concentrations of 0.137 J µg/kg and 0.023 J µg/kg, respectively. At AOI02-04, PFBS was detected in surface soil at a concentration of 0.046 J µg/kg. PFOS and PFOA were not detected in surface soil. Similarly, PFOS, PFOA, and PFBS were not detected in shallow subsurface or deep subsurface soil.

6.4.2 AOI 2 Groundwater Analytical Results

PFOA, PFOS, and PFBS in groundwater did not exceed SLs at AOI 2. **Figure 6-4** presents the ranges of detections for PFOA, PFOS, and PFBS in groundwater. **Table 6-4** summarizes the detected compounds in groundwater.

Within the Green AASF1 Hangar potential PFAS release area, groundwater was sampled from temporary monitoring well locations AOI02-01 (screened from 15-25 feet bgs), AOI02-02 (screened from 5-15 feet bgs) and AOI02-03 (screened from 5-10 feet bgs). No groundwater SLs were exceeded at any temporary well location. PFOS was only detected at AOI02-03 at a concentration of 12.9 J ng/L. PFOA was detected at AOI02-01 and AOI02-03 at concentrations ranging from 2.95 J ng/L and 9.86 J ng/L. PFBS was detected below the groundwater SL at AOI02-02 and AOI02-03 at concentrations of 1.05 J ng/L and 24.0 J ng/L, respectively. Groundwater concentrations of PFOA, PFOS, and PFBS are consistent with soil concentrations observed in this area.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were detected in soil and groundwater at AOI 2; however, the detected concentrations were below their respective soil and groundwater SLs. Based on the soil and groundwater results from this SI, no further investigation at AOI 2 is warranted.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3, which includes one potential PFAS release area, the wetland, where on-facility drainage discharges. The detected compounds in soil and groundwater are presented in **Table 6-2** through **Table 6-4**. The detections of PFOA, PFOS, and PFBS in soil and groundwater are presented on **Figure 6-1** through **Figure 6-4**.

6.5.1 AOI 3 Soil Analytical Results

PFOA, PFOS, and PFBS in soil did not exceed the SLs in soil at the potential PFAS release area in AOI 3. **Figure 6-1** through **Figure 6-3** present the ranges of detections of PFOA, PFOS, and PFBS in soil. **Table 6-2** through **Table 6-3** summarize the detected compounds in soil.

At AOI 3, soil was sampled from three intervals at one location, AOI03-01. PFOA and PFOS were detected at concentrations two orders of magnitude below the SLs. PFBS was not detected in AOI 3. PFOA and PFOS were detected in surface soil (0 to 2 feet bgs) at concentrations of 0.193 J µg/kg and 0.146 J µg/kg, respectively. At AOI 3, PFOA, PFOS, and PFBS were not detected in shallow subsurface (2 to 4 feet bgs) or deep (4 to 6 feet bgs) subsurface soil samples.

6.5.2 AOI 3 Groundwater Analytical Results

PFOA, PFOS, and PFBS did not exceed groundwater SLs at the one groundwater sample collected from AOI 3. **Figure 6-4** presents the ranges of detections for PFOA, PFOS, and PFBS in groundwater. **Table 6-4** summarizes the detected compounds in groundwater.

At AOI 3, groundwater was sampled from one temporary monitoring well location, AOI03-01 (screened from 5-15 feet bgs). PFOA, PFOS, and PFBS were detected at concentrations of 4.40 J ng/L, 3.20 J ng/L, and 2.64 J ng/L, respectively. Groundwater concentrations of PFOA, PFOS, and PFBS are consistent with soil concentrations observed in this area.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, PFOA and PFBS were detected in surface soil at AOI 3 at concentrations below their respective SLs, and PFBS was not detected in soil. PFOA, PFOS, and PFBS were detected in groundwater at concentrations below their respective SLs. Based on the soil and groundwater results from this SI, no further investigation of AOI 3 is warranted.

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Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Green Armory AASF1

Area of Interest		AOI 1								AOI 2								AOI 3	
Sample ID		GRN-AOI01-01-SB-0-2		GRN-AOI01-02-SB-0-2		GRN-AOI01-03-SB-0-2		GRN-AOI01-04-SB-0-2		GRN-AOI02-01-SB-0-2		GRN-AOI02-02-SB-0-2		GRN-AOI02-03-SB-0-2		GRN-AOI02-04-SB-0-2		GRN-AOI03-01-SB-0-2	
Sample Date		06/17/2021		06/17/2021		06/17/2021		06/17/2021		06/16/2021		06/17/2021		06/16/2021		06/18/2021		06/17/2021	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																			
PFBA	-	0.134	J	0.151	J	0.090	J	ND		ND		ND		0.102	J	ND		0.069	J+
PFBS	1900	ND	UJ	0.044	J	ND		ND		ND		0.027	J	0.055	J	0.046	J	ND	
PFHpA	-	0.175	J	0.057	J	ND		ND		ND		ND		0.040	J	ND		0.033	J
PFHxA	-	0.329	J	0.085	J	ND		ND		ND		0.026	J	0.053	J	ND		0.048	J
PFHxS	-	ND	UJ	0.048	J	ND		0.038	J	ND		ND		0.032	J	ND		ND	
PFNA	-	ND	UJ	ND	UJ	ND		ND		ND		ND		0.032	J	ND		0.024	J
PFOA	130	ND	UJ	0.518	J	ND		ND		ND		ND		0.150	J	ND		0.193	J
PFOS	130	ND	UJ	0.158	J	ND		ND		ND		0.066	J	0.329	J	ND		0.146	J
PFPeA	-	0.634	J	0.071	J	0.177	J	ND		ND		0.024	J	0.047	J	ND		0.025	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

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

Table 6-3
PFAS Detections in Subsurface Soil
Site Inspection Report, Green AASF1

Area of Interest		AOI 1																AOI02	
Sample ID		GRN-AOI-01-01-SB-2-4		GRN-AOI01-02-SB-4-6		GRN-AOI01-02-SB-4-6-DUP		GRN-AOI01-02-SB-6-8		GRN-AOI01-03-SB-2-4		GRN-AOI01-03-SB-2-4-DUP		GRN-AOI01-04-SB-6-8		GRN-AOI01-04-SB-13-15		GRN-AOI02-01-SB-2-4	
Sample Date		08/24/2021		06/17/2021		06/17/2021		06/17/2021		06/17/2021		06/17/2021		06/17/2021		06/17/2021		06/17/2021	
Depth		2 - 4 ft		4 - 6 ft		4 - 6 ft		6 - 8 ft		2 - 4 ft		2 - 4 ft		6 - 8 ft		13 - 15 ft		2 - 4 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																			
6:2 FTS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND	UJ	0.247	J	ND		0.075	J	ND	UJ	ND		ND		0.269	J
PFBS	25000	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFDoA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFHpA	-	ND		ND	UJ	0.195	J	ND		0.060	J	0.026	J	ND		ND		0.127	J
PFHxA	-	ND		ND	UJ	1.44	J	ND		0.095	J	0.039	J	ND		ND		0.878	J
PFHxS	-	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFNA	-	ND		ND	UJ	0.036	J	ND		ND		ND		ND		ND		ND	
PFOA	1600	ND		ND	UJ	0.404	J	ND		ND		ND		ND		ND		ND	
PFOS	1600	ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFPeA	-	ND		ND	UJ	0.599	J	ND		0.175	J	0.069	J	0.035	J	ND		1.79	J-

Grey Fill: Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

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

Table 6-3
PFAS Detections in Subsurface Soil
Site Inspection Report, Green AASF1

Area of Interest		AOI 2																	
Sample ID		GRN-AOI02-01-SB-7-9		GRN-AOI02-01-SB-13-15		GRN-AOI02-02-SB-4-6		GRN-AOI02-02-SB-4-6-DUP		GRN-AOI02-02-SB-8-10		GRN-AOI02-03-SB-2-4		GRN-AOI02-03-SB-4-6		GRN-AOI02-04-SB-6-8		GRN-AOI02-04-SB-13-15	
Sample Date		06/16/2021		06/16/2021		06/17/2021		06/17/2021		06/17/2021		06/16/2021		06/16/2021		06/18/2021		06/18/2021	
Depth		7 - 9 ft		13 - 15 ft		4 - 6 ft		4 - 6 ft		8 - 10 ft		2 - 4 ft		4 - 6 ft		6 - 8 ft		13 - 15 ft	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																			
6:2 FTS	-	ND		0.154	J	ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND	UJ	ND		ND		0.043	J	ND		ND		ND	
PFBS	25000	ND		ND		ND		ND		ND		0.051	J	0.023	J	ND		ND	
PFDoA	-	ND		ND		ND	UJ	ND		ND		ND		ND		ND		ND	
PFHpA	-	ND		ND		ND		ND		ND		0.034	J	0.022	J	ND		ND	
PFHxA	-	ND		ND		ND		ND		ND		0.069	J	0.045	J	0.031	J	ND	
PFHxS	-	ND		ND		ND		ND		0.077	J	0.066	J	0.062	J	ND		ND	
PFNA	-	ND		ND		ND		ND		ND		0.024	J	ND		ND		ND	
PFOA	1600	ND		ND		ND		ND		ND		0.127	J	ND		ND		ND	
PFOS	1600	ND		ND		ND		ND		ND		0.205	J+	0.137	J	ND		ND	
PFPeA	-	ND		ND		ND	UJ	ND		ND		0.062	J	0.035	J	ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

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

Table 6-3
PFAS Detections in Subsurface Soil
Site Inspection Report, Green AASF1

Area of Interest		AOI 3			
Sample ID		GRN-AOI03-01-SB-2-4		GRN-AOI03-01-SB-4-6	
Sample Date		06/17/2021		06/17/2021	
Depth		2 - 4 ft		4 - 6 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)					
6:2 FTS	-	ND		ND	
PFBA	-	ND		ND	
PFBS	25000	ND		ND	
PFDoA	-	0.031	J	ND	
PFHpA	-	ND		ND	
PFHxA	-	ND		ND	
PFHxS	-	ND		ND	
PFNA	-	ND		ND	
PFOA	1600	ND		ND	
PFOS	1600	ND		ND	
PFPeA	-	ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

J+ = Estimated concentration, biased high

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

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

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Green Armory AASF1

Area of Interest		AOI 1								AOI 2								AOI 3	
Sample ID		GRN-AOI01-01-GW		GRN-AOI01-02-GW		GRN-AOI01-03-GW		GRN-AOI01-04-GW		GRN-AOI02-01-GW		GRN-AOI02-01-GW-DUP		GRN-AOI02-02-GW		GRN-AOI02-03-GW		GRN-AOI03-01-GW	
Sample Date		06/18/2021		06/17/2021		06/17/2021		06/18/2021		06/17/2021		06/17/2021		06/18/2021		06/17/2021		06/17/2021	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (ng/L)																			
6:2 FTS	-	2.69	J	ND	UJ	ND	UJ	ND		ND	UJ	ND	UJ	ND		ND	UJ	ND	UJ
PFBA	-	178		ND	UJ	12.7	J	ND		16.3	J	15.3	J	ND		7.25	J	5.58	J
PFBS	600	3.31	J	1.57	J	1.29	J	ND		ND	UJ	ND	UJ	1.05	J	24.0	J	2.64	J
PFHpA	-	162		ND	UJ	5.06	J	1.46	J	ND	UJ	ND	UJ	ND		7.96	J	ND	UJ
PFHxA	-	583		ND	UJ	19.9	J	4.12		1.52	J	1.32	J	ND		7.78	J	0.956	J
PFHxS	-	ND		ND	UJ	2.32	J	ND		ND	UJ	ND	UJ	ND		14.9	J	17.0	J
PFNA	-	2.30	J	ND	UJ	ND	UJ	ND		ND	UJ	ND	UJ	ND		3.29	J	ND	UJ
PFOA	40	16.4		ND	UJ	1.75	J	ND		3.52	J	2.95	J	ND		9.86	J	4.40	J
PFOS	40	1.22	J	ND	UJ	2.28	J	ND		ND	UJ	ND	UJ	ND		12.9	J	3.20	J
PFPeA	-	1240		ND	UJ	39.1	J	7.38		2.23	J	2.01	J	ND		13.0	J	ND	UJ
Total PFOA+PFOS	-	17.6		ND		4.03		ND		3.52		2.95		ND		22.8		7.60	

Grey Fill	Detected concentration exceeded OSD Screening Levels
Bold Font	Detected concentration exceeded USEPA HA Screening Levels

References

a. Assistant Secretary of Defense, 2021. Risk Based Screening Levels Calculated for PFBS, PFOS, and PFOA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 September 2021. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AOI	Area of Interest
DUP	duplicate
GRN	Green
GW	groundwater
HA	Health Advisory
HQ	hazard quotient
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
USEPA	United States Environmental Protection Agency
ng/L	nanogram per liter
-	not applicable

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at AASF1, OH			
REVISED	12/10/2021	GIS BY	MS	12/10/2021
SCALE	1:4,800	CHK BY	EG	12/10/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	12/10/2021

Legend

Facility Boundary

0 200 400 800 Feet

Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA Detections in Soil

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at AASF1, OH			
REVISED	12/10/2021	GIS BY	MS	12/10/2021
SCALE	1:4,800	CHK BY	GC	12/10/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	12/10/2021

Legend

Facility Boundary

0 200 400 800 Feet

Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOS Detections in Soil

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at AASF1, OH			
REVISED	12/10/2021	GIS BY	MS	12/10/2021
SCALE	1:4,800	CHK BY	GC	12/10/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	12/10/2021

Legend

Facility Boundary

0 200 400 800 Feet

N

Depth intervals shown represent respective sampling position within a given soil boring location.

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PFBS Detections in Soil

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3

PFOA

PFOS

PFBS

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at AASF1, OH			
REVISED	12/10/2021	GIS BY	MS	12/10/2021
SCALE	1:4,800	CHK BY	EG	12/10/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	12/10/2021

Legend

Facility Boundary

Groundwater Flow Direction

0 200 400 800 Feet

Depth intervals shown represent respective sampling position within a given soil boring location.

N

PFOA, PFOS, and PFBS Detections in Groundwater

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-4

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-3**. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if PFOA, PFOS, or PFBS 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 PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway may warrant further investigation.

In general, the potential routes of exposure to PFAS 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 PFAS toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers (though unlikely due to restricted access), residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1

From at least 2006 to 2018, PFAS were potentially released at the TriMax™ Storage and Ramp area due to leaks or spills. PFOA, PFOS, and PFBS were detected below the SLs in soil at AOI 1 and confirm the release of PFAS to soil.

Based on the results of the SI in AOI 1, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Off-facility recreational users may be potentially exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. Lastly, ground-disturbing activities could also potentially result in

construction worker exposure to PFOA in subsurface soil via ingestion. There is no ongoing construction at Green AASF1; however, future construction activities may include ground disturbing activities. The AOI 1 CSM is presented on **Figure 7-1**.

7.1.2 AOI 2

The Green AASF1 Hangar was constructed between 1987 and 1988. The Hangar was retrofitted in 2006 to include a HEF fire suppression system, and a test was conducted in 2007 that resulted in a full release of the system. During the test of the fire suppression system, released AFFF traveled to Hangar drains that connect to an OWS followed by a municipal sewer system.

Based on the results of the SI in AOI 2, ground-disturbing activities could potentially result in site worker and future construction worker exposure to PFOA, PFOS, and PFBS via inhalation of dust or ingestion of surface soil, and future construction worker exposure to PFOA, PFOS, and PFBS in subsurface soil. No construction is currently occurring at AOI 2; however, future construction activities may include ground disturbing activities. Off-facility residents and recreational users may be potentially exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities, but this exposure is likely insignificant. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

On-facility surface drainage empties into AOI 3, the wetland area on the southeast edge of the facility property that extends off-facility. While there have been no known or suspected releases directly to the wetland, the close proximity of AOIs 1 and 2 coupled with surface water flow direction to the east leaves potential for migrating PFAS to impact this wetland. PFOA and PFOS were detected below the SLs in soil at AOI 3 and confirm the release of PFAS to soil at AOI 3. Based on the results of the SI, ground-disturbing activities could potentially result in site worker, construction worker, and trespasser exposure to PFOA and PFOS via inhalation of dust or ingestion of surface soil. Off-facility residents may potentially be exposed to PFOA and PFOS via inhalation of dust caused by on-facility ground disturbing activities. Subsurface soil is not considered a potentially complete pathway, due to no detections of PFAS. Exposure to PFAS from AOI 3 is likely insignificant. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from temporary monitoring wells at levels below the SLs in the AOI 1 area. There are several off-facility potable wells downgradient of AOI 1; therefore, the ingestion exposure pathway for off-facility residents and off-facility recreational users is considered potentially complete. Water at the facility is supplied by a public water utility company, not on-facility wells. Therefore, the ingestion exposure pathway for site workers and trespassers is considered incomplete. The ingestion pathway for future construction workers is potentially complete, as groundwater may be encountered during construction activities. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, and PFBS were detected in groundwater from temporary monitoring wells below SLs at AOI 2. There are off-facility potable wells downgradient of AOI 2; therefore, the ingestion exposure pathway for off-facility residents and off-facility recreational users is potentially complete. The ingestion exposure pathway for site workers and trespassers is incomplete due to on-facility water being provided by a public utility company. While there is no ongoing construction at the facility, the exposure pathway for future construction workers is potentially complete as groundwater may be encountered during construction activities. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

PFOA, PFOS, and PFBS were detected in the groundwater at the lone temporary monitoring well at AOI 3. Though detected, PFOA, PFOS, and PFBS concentrations were all below their respective SLs. The ingestion exposure pathway for off-facility residents from downgradient potable wells is potentially complete. The ingestion pathway for site workers and trespassers is incomplete due to on-facility water being provided by a public utility company. There is no ongoing construction at the facility, but the exposure pathway for future construction workers is potentially complete as groundwater at the facility may be encountered during construction activities. The CSM for AOI 3 is presented on **Figure 7-3**.

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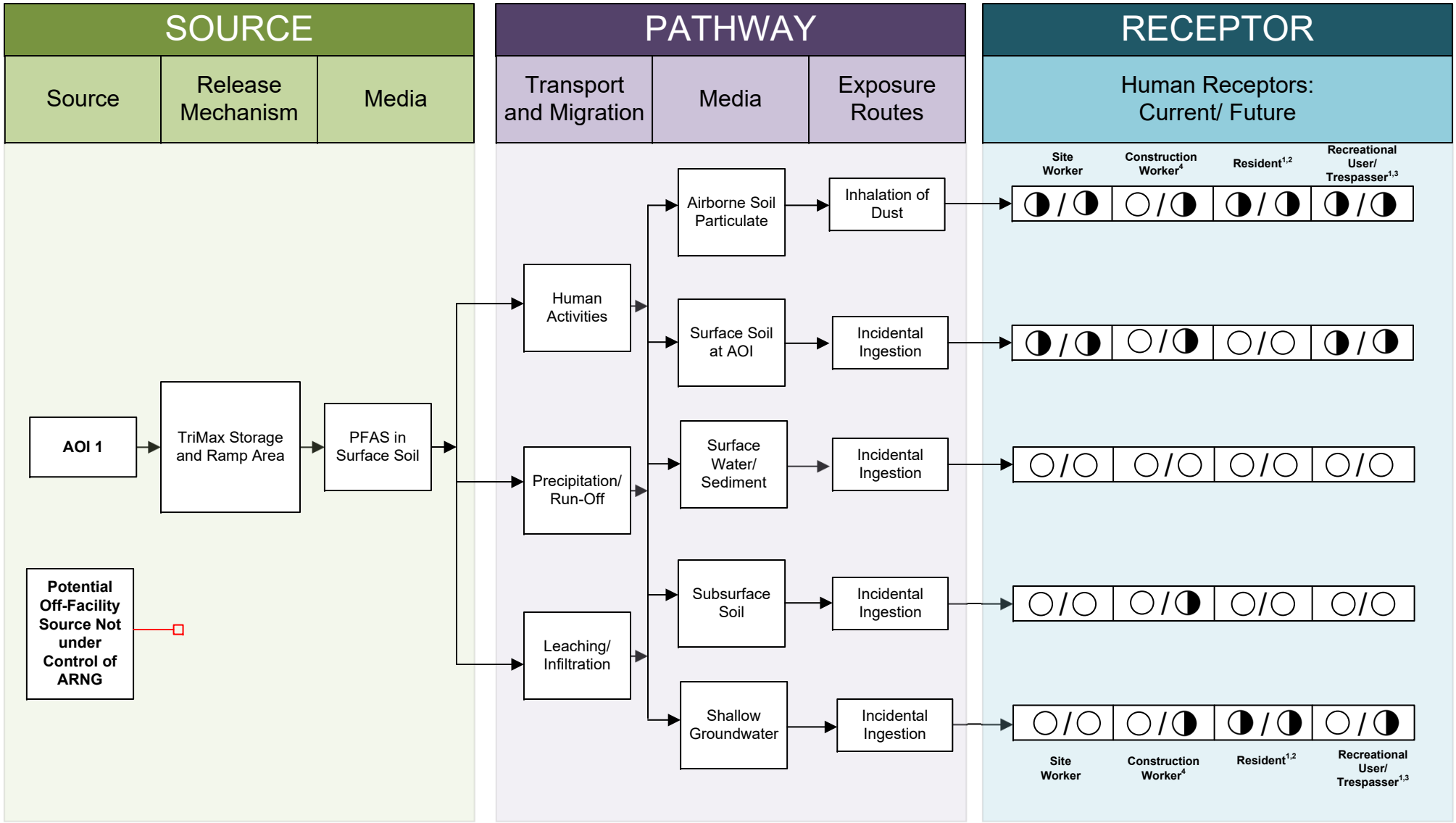


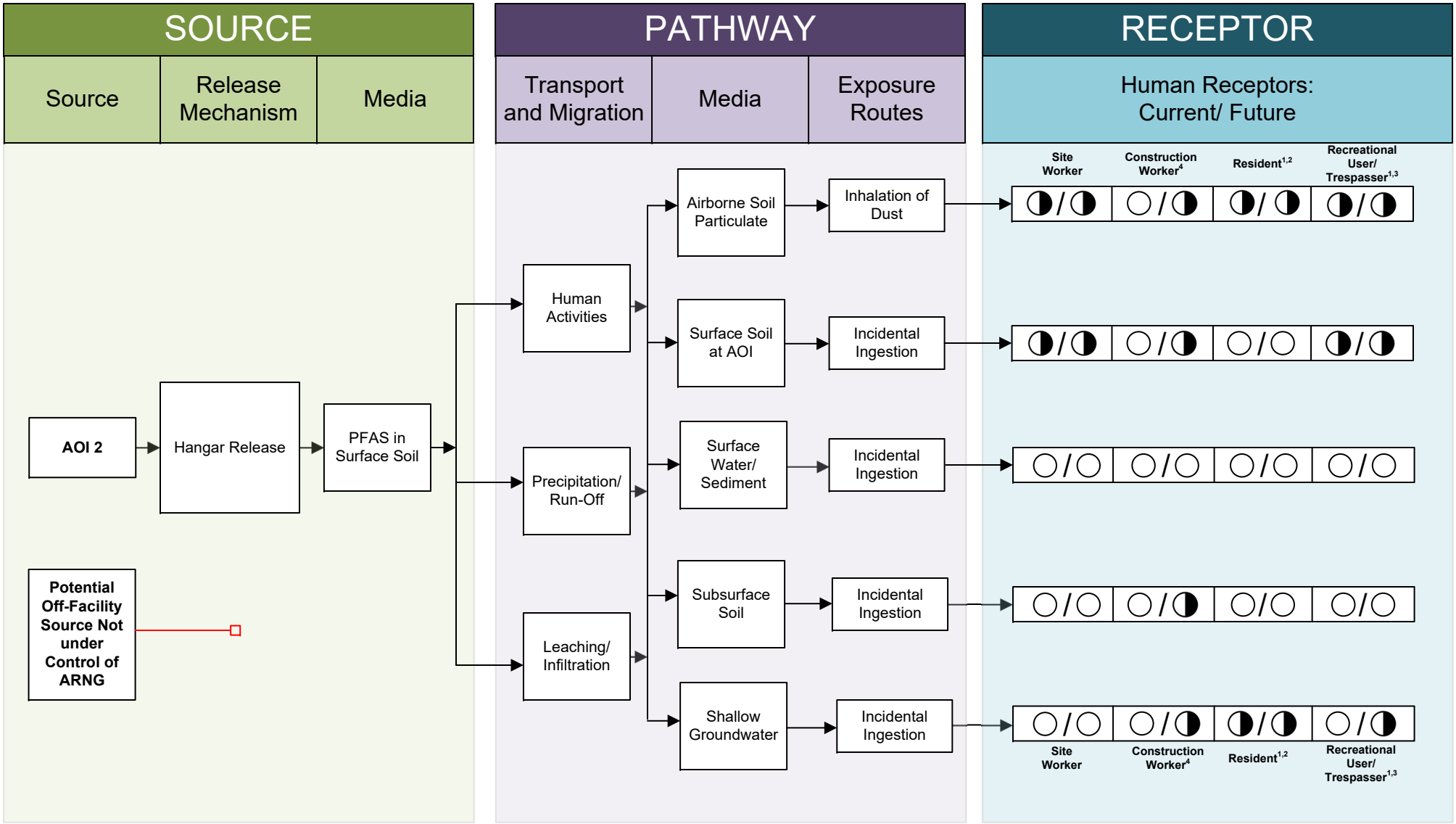
LEGEND

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

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Human consumption of fish potentially affected by PFAS is possible.
4. Active construction within AOI 1 was occurring as of the date of SI field work.

Figure 7-1
Conceptual Site Model
AOI 1
Green AASF1 Site Inspection Report



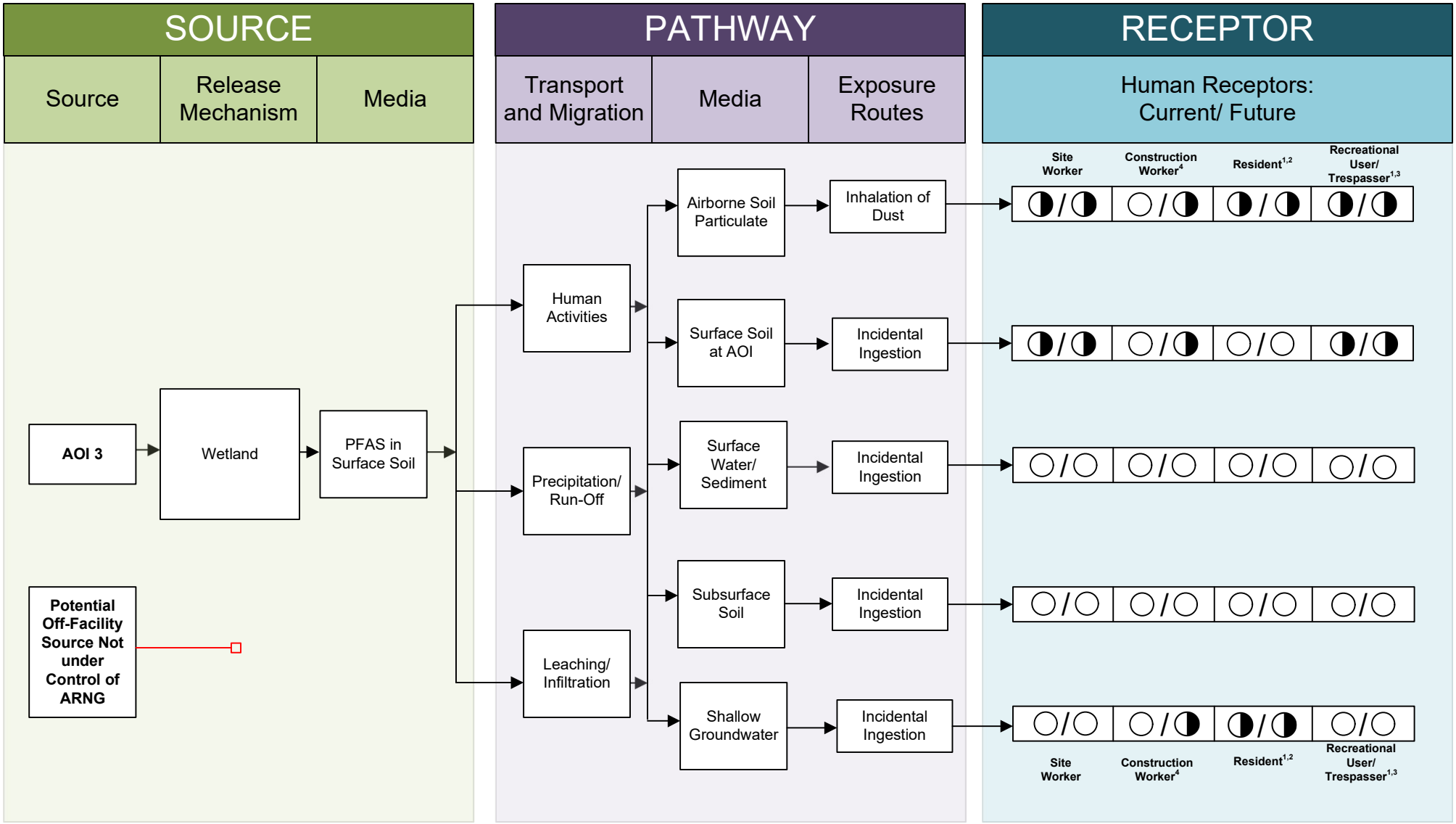
LEGEND

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

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Human consumption of fish potentially affected by PFAS is possible.
4. Active construction within AOI 1 was occurring as of the date of SI field work.

Figure 7-2
Conceptual Site Model
AOI 2
Green AASF1 Site Inspection Report



LEGEND

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

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Human consumption of fish potentially affected by PFAS is possible.
4. Active construction within AOI 1 was occurring as of the date of SI field work.

Figure 7-3
Conceptual Site Model
AOI 3
Green AASF1 Site Inspection Report

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8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 16 to 18 June 2021 and consisted of utility clearance, direct push boring, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

- Twenty-five (25) soil samples from nine boring locations;
- Eight grab groundwater samples from eight temporary well locations;
- Twelve (12) quality assurance (QA) samples.

The information gathered during this investigation was used to determine if PFOA, PFOS, and/or PFBS were present at or above SLs. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure to PFOA, PFOS, and PFBS at the AOIs, which are described in **Section 7**.

8.2 SI Goals Evaluation

As described in **Section 4.2**, the SI activities were designed to achieve six main goals or DQOs. This section describes the SI goals and the conclusions that can be made for each based on the data collected during this investigation.

1. *Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.*

   PFOA, PFOS, and PFBS were detected at the facility in soil and groundwater. PFOA, PFOS, and PFBS were detected at the potential source areas as well as at the facility boundary near the wetland area between the potential source areas and potential drinking water receptors that use potable wells off-facility. No PFAS detections in soil or groundwater at any AOI exceeded SLs.

2. *Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.*

   All three potential PFAS release areas were removed from further consideration based on the groundwater and soil data collected during this SI: the Storage and Ramp Area in AOI 1; the Green AASF1 Hangar in AOI 2; and the Wetland in AOI 3. PFOA, PFOS, and PFBS were not detected in groundwater and/or soil above the SLs in any of these areas; therefore, these areas pose no significant threat to human health or the environment.

3. *Determine the potential need for a TCRA (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.*

Based on the data collected during this SI, there is a potentially complete pathway between the potential PFAS release areas and downgradient drinking water receptors. However, based on detected concentrations of PFOA, PFOS, and PFBS in groundwater samples, there are no exceedances of the SLs. Therefore, downgradient testing of off-facility potable wells is unnecessary.

4. *Collect data to better characterize the release areas for more effective and rapid initiation of a RI (if determined necessary).*

   The geological data collected as part of the SI indicate a semi-permeable and low-conductivity environment, with soils dominated by clays beyond the first few feet of sand. Soil borings completed during the SI found well-graded sand, clay, and clayey sand as the dominant lithology of the soils below Green AASF1; the borings were completed at depths between 10 and 25 feet below ground surface (bgs). Below the first layers of sand, the lithology was predominantly clays, including fat clay, lean clay, and clayey sand. The clay layers extended the length of the boring. Some borings included sections of gravel in the deeper sandy layers. Samples for grain size analyses were collected at four locations, AOI01-01, AOI02-01, AOI03-03, and ESLR-01, and analyzed via American Society for Testing and Materials Method D-422. The results indicate that the soil samples are comprised primarily of silt (57.15 percent [%] to 75.94%) and clay (19.96% to 40.86%). These site observations are consistent with a clay to loam glacial till, which categorizes the area of the facility.

   Depth to water at Green AASF1 ranges from approximately 2 to 18 feet bgs. Groundwater flow direction at the facility is generally to the east. These geologic and hydrogeologic observations inform development of technical approach for an RI, if pursued.

5. *If PFOA, PFOS, and PFBS are determined to be present, aim to evaluate whether the concentrations can be attributed to on-facility or off-facility sources that were identified within 4 miles of the installation as part of the PA (e.g., fire stations, major manufacturers, other DoD facilities)*

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the groundwater flow direction analysis, the results of the SI indicate that the source of detected concentrations of PFOA, PFOS, and PFBS at the facility is likely attributable to ARNG activities.

6. *Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.*

   Detections of PFOA, PFOS, and PFBS in soil and groundwater at potential source areas and the facility boundary indicate there is a potentially complete pathway between source and receptor. Though the exposure is likely insignificant.

8.3 Outcome

Based on the CSMs developed and revised in light of the SI findings, there is potential for PFAS exposure to off-facility drinking water receptors from potential PFAS sources on facility resulting from historical DoD activities due to the presence of private wells in the downgradient direction, though exposure is likely insignificant. Sample analytical concentrations collected during the SI were compared against the project SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Storage and Ramp potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 1 is warranted.

- At AOI 2, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Green AASF1 Hangar potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 2 is warranted.
- At AOI 3, detected concentrations of PFOA, PFOS, and PFBS in groundwater at the Wetland potential PFAS release area were below their respective SLs. Based on the results of the SI, no further evaluation of AOI 3 is warranted.
- The detected concentrations of PFOA, PFOS, and PFBS in soil at all AOIs were below the SLs.

Table 8-1 summarizes the SI results for soil and groundwater. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to off-facility drinking water receptors caused by DoD activities at or adjacent to the facility, though exposure is likely insignificant.

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, no further evaluation is warranted for AOI 1: Storage and Ramp Area, AOI 2: Green AASF1 Hangar, and AOI 3: Helicopter Ramp Area.

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Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Storage and Ramp Area	◐	◐	◐
2	Green AASF1 Hangar	◐	◐	N/A
3	Wetland	◐	◐	◐

Legend:
N/A = Not applicable
● = PFOA, PFOS, and/or PFBS detected; exceedance of the screening levels
◐ = PFOA, PFOS, and/or PFBS detected; no exceedance of the screening levels
○ = PFOA, PFOS, and PFBS not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Storage and Ramp Area	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action
2	Green AASF1 Hangar	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action
3	Wetland	Detections in groundwater but no exceedances of SLs. No exceedances of SLs in soil.	No further action

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