FINAL
Site Inspection Report Army Aviation Support Facility, Davenport, Iowa

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

January 2022

Prepared for:

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

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Acronyms and Abbreviations

6:2 FTS	6:2 Fluorotelomer sulfonate
8:2 FTS	8:2 Fluorotelomer sulfonate
µg/Kg	micrograms per Kilogram
°F	degrees Fahrenheit
°C	degrees Celsius
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
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
FedEx	Federal Express
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
FTA	Fire Training Area
HDPE	high-density polyethylene
IAARNG	Iowa Army National Guard
IDNR	Iowa Department of Natural Resources
IDW	investigation-derived waste
IGS	Iowa Geological Survey
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
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	poly-vinyl 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
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

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Executive Summary

The Army National Guard (ARNG) 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 (AASF) in Davenport, Iowa, also called “Davenport AASF” (or referred to as the “facility” throughout this document).

Davenport AASF is on Davenport Municipal Airport property in Scott County, located at 9650 North Harrison Street, Davenport, Iowa. During the PA, one potential PFAS release area, the Wash Rack, was identified as an AOI at the facility (AECOM, 2019). Aqueous film forming foam (AFFF) was released to the wash rack drain at AOI 1 by the Iowa ARNG (IAARNG) every five years from 1998 to present day, when the contents of the Tri-Max™ 3, Tri-Max™ 30, and Tri-Max™ 60 fire extinguishers were emptied at the wash rack prior to hydrostatic testing. Additionally, prior to the 2000s, a firetruck was housed at the AASF. The firetruck was taken annually to Peoria, Illinois airport for training and nozzle testing by the IAARNG and then washed at the wash rack upon its return to the AASF. AOI 1, upgradient of AOI 1 (referenced in the report as ‘Upgradient Facility Area), and downgradient of AOI 1 (referenced in the report as the Downgradient Facility Area) were investigated during the SI. SI field activities included soil and groundwater grab sampling from temporary monitoring wells on 6 August and 7 August 2020.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2020b), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.1 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 Comprehensive Environmental Response, Compensation, and Liability Act (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 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, when the maximum site concentration for sampled media exceed the SLs, the AOI will proceed to a Remedial Investigation (RI), the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table ES-1**. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

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

- PFOA and PFOS in groundwater at AOI 1: Wash Rack exceeded the individual SLs of 40 nanograms per liter (ng/L), with detected concentrations of 375 ng/L and 4,250 ng/L, respectively, at location AOI01-01. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOS in groundwater at DVP-01: Upgradient Facility Area exceeded the SL of 40 ng/L, with a concentration of 73.9 J ng/L at location DVP-01. Based on the results of the SI, further evaluation of this area is warranted in the RI.
- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs.

Table ES-2 summarizes the SI results for soil and groundwater. Drinking water for Davenport AASF is supplied by the City of Davenport via the Iowa American Water Company, which uses surface water from the Mississippi River as the water source (Iowa American Water, 2017). Surficial groundwater at the facility is not a proxy for drinking water, given that rural, public, and industrial wells tapping the Silurian-Devonian bedrock aquifers are 100 to 700 feet deep (Iowa Geological Survey [IGS], 2017a). However, geological research indicates that glacial till thickness at the facility may not be thick enough to be considered a confining layer that would prevent surficial groundwater from migrating into the Silurian-Devonian aquifer utilized by potential downgradient receptors for drinking water. Based on the conceptual site models (CSMs) developed and revised in light of the SI findings, there is a potential for exposure to residential 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, further evaluation is warranted in the RI for AOI 1: Wash Rack and the Upgradient Facility Area.

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]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

Notes:
a.) Assistant Secretary of Defense, 2019. 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 October 2019.
bgs = below ground surface
ng/L = nanogram per Liter
µg/kg = micrograms per kilogram

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Wash Rack	◐	●	●
Upgradient Facility Area	Unknown	◐	●	●
Downgradient Facility Area	Unknown	○	◐	◐

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

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Wash Rack	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
Upgradient Facility Area	Northwest Facility Boundary	Exceedance of SL in groundwater. No exceedances of SLs in soil.	Proceed to RI
Downgradient Facility Area	Southeast Facility Boundary	Detections in groundwater but no exceedances of SLs. No detections 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 the Army Aviation Support Facility (AASF) in Davenport, Iowa. The Davenport AASF is 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 Army 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 poly-fluoroalkyl 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 Davenport AASF (AECOM, 2019) that identified one potential PFAS release area at the facility, which was designated as Area of Interest (AOI) 1. 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. Site Background

2.1 Facility Location and Description

The facility is on Davenport Municipal Airport property in Scott County, Davenport, Iowa (**Figure 2-1**). Davenport AASF is north of Interstate 80, west of North Harrison Street, south of Slopertown Road, and east of 155th Avenue. The communities of Davenport, Iowa, Bettendorf, Iowa, Moline, Illinois, and Rock Island, Illinois lie within 15 miles of the current AASF. The facility is constructed on a 10.4-acre parcel of land owned by the State of Iowa. An additional 5.5 acres of adjacent land to the south of the facility are leased from the City of Davenport. The AASF provides multiple unit support for heavy lift rotary-winged aircraft. The former AASF occupied buildings leased from the City of Davenport from approximately 1962 to 1974. The current AASF, which was constructed in 1974, is located north of the former AASF.

2.2 Facility Environmental Setting

Davenport is in the Southern Iowa Drift Plain, a region characterized by loess-capped hills overlying glacial drift sediments. The terrain of the area has been subjected to repeated periods of Quaternary-age glaciations and erosion, creating gently rolling hills which slope toward nearby drainage features and integrated drainage networks. The elevation of the facility is approximately 750 feet above mean sea level. The elevation in the area decreases to the southeast toward the Mississippi River (Iowa Geological Survey [IGS], 2017c). The facility topography is shown on **Figure 2-2**. Groundwater features, including off-facility wells, are displayed on **Figure 2-3**, and groundwater flow contours are shown on **Figure 2-4**. Surface water features are depicted on **Figure 2-5.**

2.2.1 Geology

Davenport AASF is situated on Quaternary-age loess and eolian sand facies of the Peoria Formation, which range in thickness from 16 to 49 meters. The deposits are characterized as yellowish brown to gray, massive, noncalcaeroues-grading to calcareous silt loam and intercalated fine to medium, well-sorted, sand. The loess and sand deposits overlie fractured, loamy, glacial till of the Illinoian Glasford Formation. The Glasford Formation generally ranges in thickness from 33 to 115 feet and overlies the dense, fractured, loamy, glacial till of the Wolf Creek or Alburnett formations. Silurian, Devonian, and Pennsylvanian sedimentary bedrock (shale, dolomite, and limestone) underlie the Quaternary glacial deposits. The uppermost bedrock at the facility is the Silurian-aged Gower Formation and is composed of porous dolomite (IGS, 2009; McKay et al., 2011).

2.2.2 Hydrogeology

The facility is in the Northeast Iowa Groundwater Province and is underlain by the Silurian-Devonian and the Cambrian-Ordovician bedrock aquifers. At the facility, groundwater is first encountered within the surficial water table aquifer that resides within the unconsolidated sedimentary deposits. Groundwater flow is generally to the southeast, toward the Mississippi River (**Figure 2-3**).

The first bedrock aquifer encountered beneath the facility is the Silurian-Devonian aquifer, which comprises a sequence of carbonate rocks of Devonian and Silurian age. At the AASF, the uppermost unit within the aquifer is the Gower Formation. The aquifer is not confined by the upper Devonian shales; however, glacial drift may act as a local upper confining unit if it is thick and impermeable (Horick, 1984). Borehole logs taken near the facility show the Gower Formation is encountered between 100 to 189 feet below ground surface (bgs). Borehole logs completed by

Iowa Department of Natural Resources (IDNR) near the facility suggest clay layers exceed 50 feet in thickness, although other borehole logs interpret the till to be thinner (IGS, 2020). Due to the thin glacial till confinement (i.e., <100 feet thick), a study of groundwater vulnerability in Iowa suggested that the regional bedrock aquifers have a high potential for contamination (Hoyer and Hallberg, 1991). This suggests the Silurian-Devonian aquifer may not be confined at the facility location. The Silurian-Devonian aquifer serves rural, public, and industrial uses in eastern and northern Iowa (IGS, 2017a). Wells tapping the Silurian-Devonian aquifer are typically 100 to 700 feet deep.

The Cambrian-Ordovician aquifer underlies the Silurian-Devonian aquifer, is a widespread source of water for high capacity wells and is extensively used by municipalities and industries in eastern Iowa. Wells tapping the Cambrian-Ordovician aquifer are typically 300 to 2,000 feet deep (IGS, 2017b). The Cambrian-Ordovician aquifer is confined at the AASF due to the presence of thick shales beneath the Silurian-Devonian aquifer (Horick, 1984).

No potable water wells are located within the current AASF; however, private and public supply wells exist within 4 miles of the facility (**Figure 2-4**). Drinking water for the AASF is supplied by the City of Davenport via the Iowa American Water Company, which uses surface water from the Mississippi River as the water source (Iowa American Water, 2017).

2.2.3 Hydrology

The Davenport AASF is in the Crow Creek watershed, and tributaries leading to Crow Creek are located less than 0.5 miles east of the AASF (**Figure 2-5**).

Regional surface water features include the Mississippi River. Water diverted from the Mississippi River is used for irrigation and is processed by the East River Station treatment facility for domestic use in the area near the AASF (Iowa American Water, 2017).

2.2.4 Climate

The climate at Davenport AASF is humid continental, with warm summers, cold winters, and wet springs. The average high temperature is 74 degrees Fahrenheit (°F), and average low temperature is 42 °F. Seasonally, temperatures vary from summer highs of 85 °F to winter lows of 16 °F. Average annual precipitation is 36 inches. The prevailing wind is southerly, averaging 9 miles per hour (National Weather Service Forecast Office, 2020).

2.2.5 Current and Future Land Use

The AASF is a controlled access facility and is adjacent to the Davenport Municipal Airport. The Davenport Municipal Airport is owned and operated by the City of Davenport and provides commercial and general air service to the Davenport area and southeast Iowa. Future land use is not anticipated to change.

2.2.6 Critical Habitat and Threatened/ Endangered Species

The following clams, insects, plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Scott County, Iowa (US Fish and Wildlife Service [USFWS], 2020).

- **Clams**: Higgins eye pearlymussel, *Lampsilis higginsii* (endangered); Spectaclecase mussel, *Cumberlandia monodonta* (endangered); Sheepnose mussel, *Plethobasus cyphyus* (endangered)
- **Insects**: Rusty patched bumble bee, *Bombus affinis* (endangered)

- **Plants**: Prairie bush-clover, *Lespedeza leptostachya* (threatened); Western prairie fringed orchid, *Platanthera praeclara* (threatened)
- **Mammals**: Indiana bat, *Myotis sodalis* (endangered); Northern long-eared bat, *Myotis septentrionalis* (threatened)
- **Reptiles**: Eastern massasauga rattlesnake, *Sistrurus catenatus* (threatened)

There are no critical habitats listed at the facility (USFWS, 2020).

2.3 History of PFAS Use

One potential PFAS release area was identified at the Davenport AASF during the PA, where aqueous film forming foam (AFFF) may have been used or released historically (AECOM, 2019). PFOA and PFOS were potentially released to soil and groundwater within the boundary of Davenport AASF at the Wash Rack via Tri-Max™ fire extinguishers that were emptied every five years prior to hydrostatic testing, as well as firetruck washing that occurred after annual off-facility AFFF training. Additionally, prior to the 2000s, a firetruck was housed at the AASF. The firetruck was taken annually to Peoria, Illinois airport for training and nozzle testing by the IAARNG and then washed at the wash rack upon its return to the AASF.

One AOI was identified based on preliminary data and inferred surficial groundwater flow direction. A description of the AOI is presented in **Section 3**.

2.4 Potable Water Sampling

Potable water for the Davenport AASF is supplied by the City of Davenport via the Iowa American Water Company, which uses surface water from the Mississippi River as the water source (Iowa American Water, 2017).

Due to historical releases of AFFF at Davenport AASF, the potential exists for exposure to off-facility drinking water receptors immediately southeast of the facility boundary. Though not included in the original SI scope, programmatic contingencies are in place to conduct off-facility sampling if SI results warrant. Based on the magnitude and location of the PFAS exceedances in groundwater near the Davenport AASF facility boundary, the project team agreed that off-facility sampling was necessary to evaluate the potential impact to off-facility drinking water receptors. Prior to sampling, approval was obtained from the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health. On 25 August 2021 groundwater samples were collected from two potable wells located downgradient of the facility boundary (**Figure 2-6**). Sample results are summarized below and provided in **Appendix G**:

- PFOA, PFOS, and PFBS were non-detect at both potable well locations.

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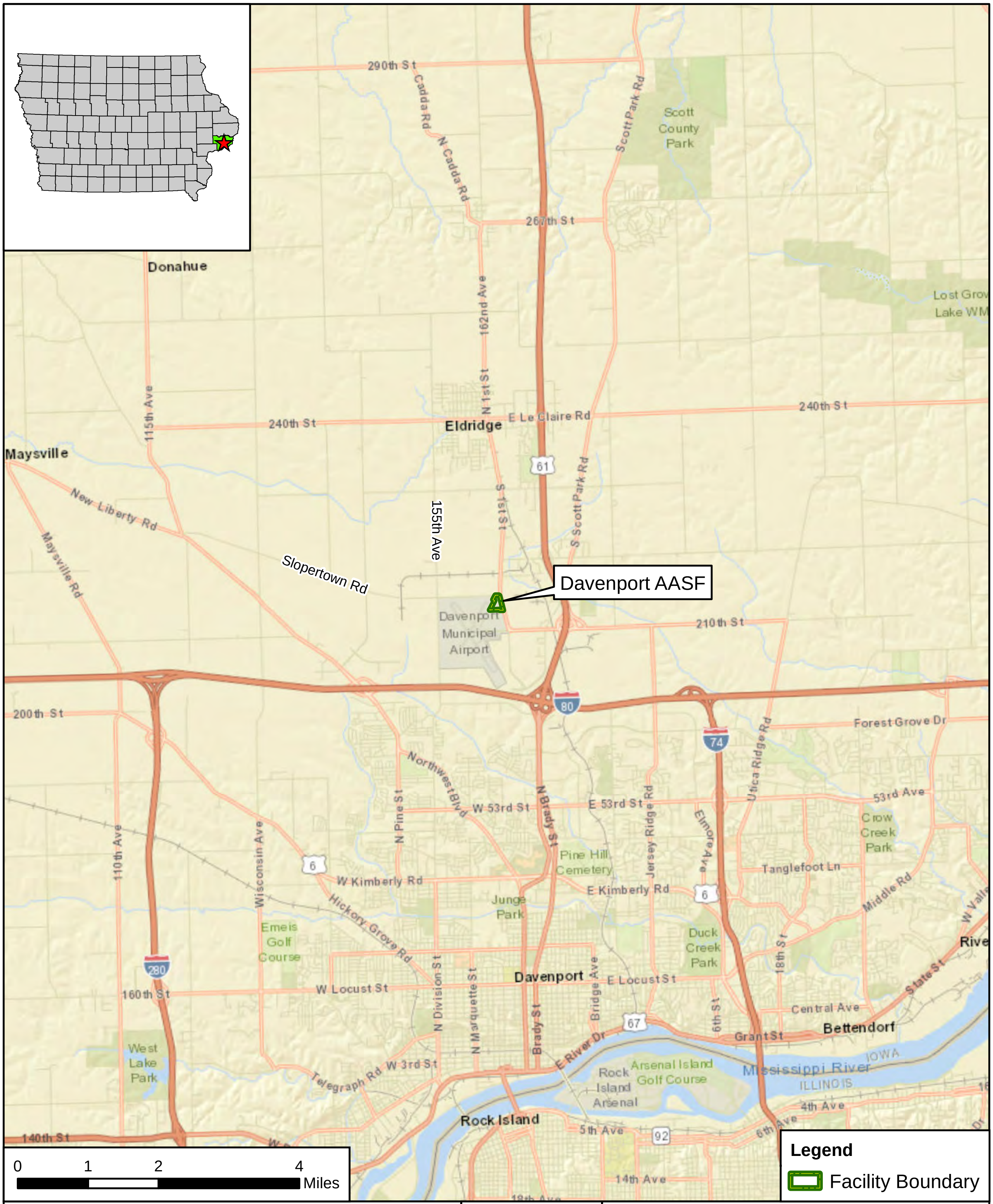

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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	10/23/2020

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Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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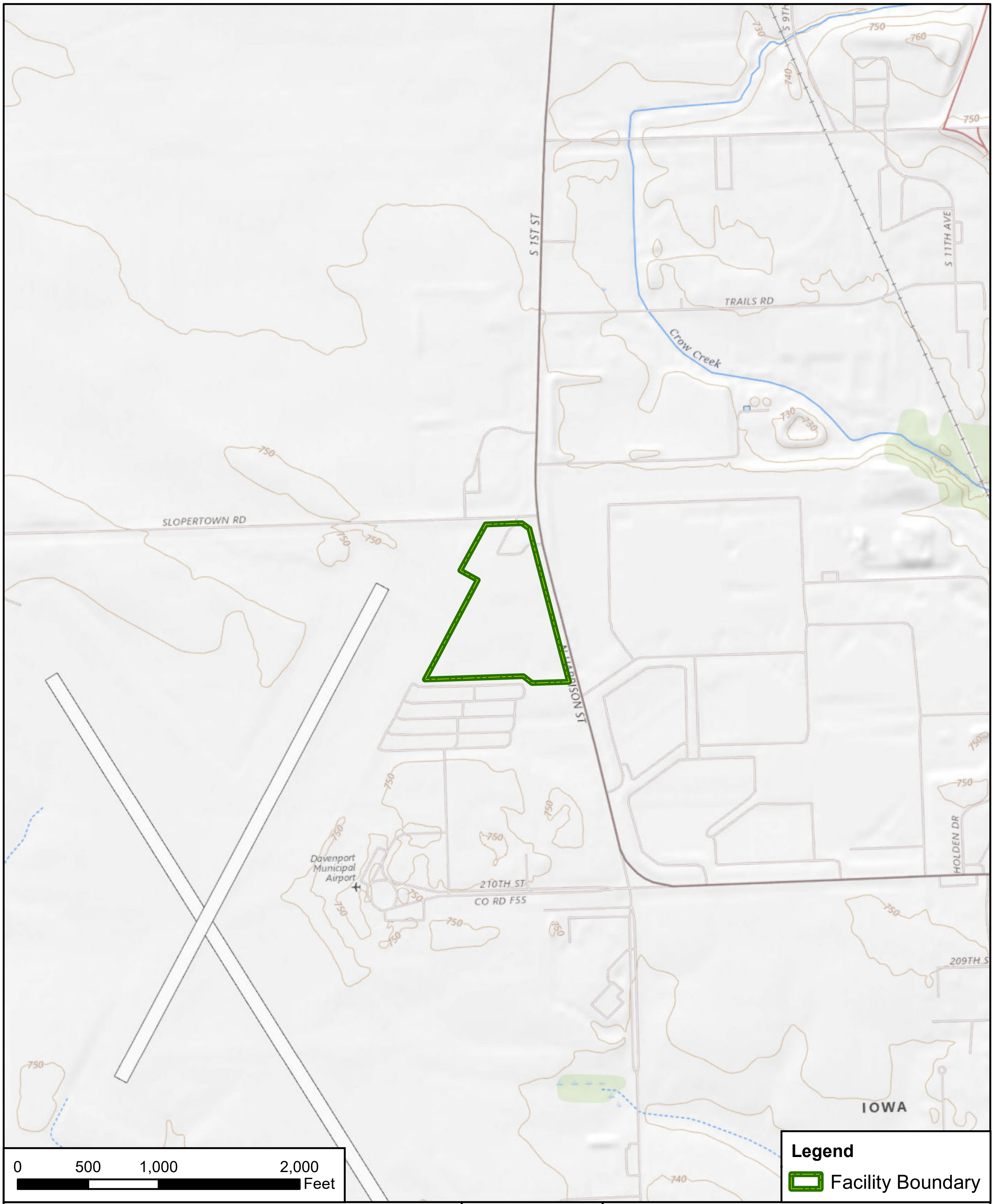

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Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	RG	11/10/2020

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Site Topography

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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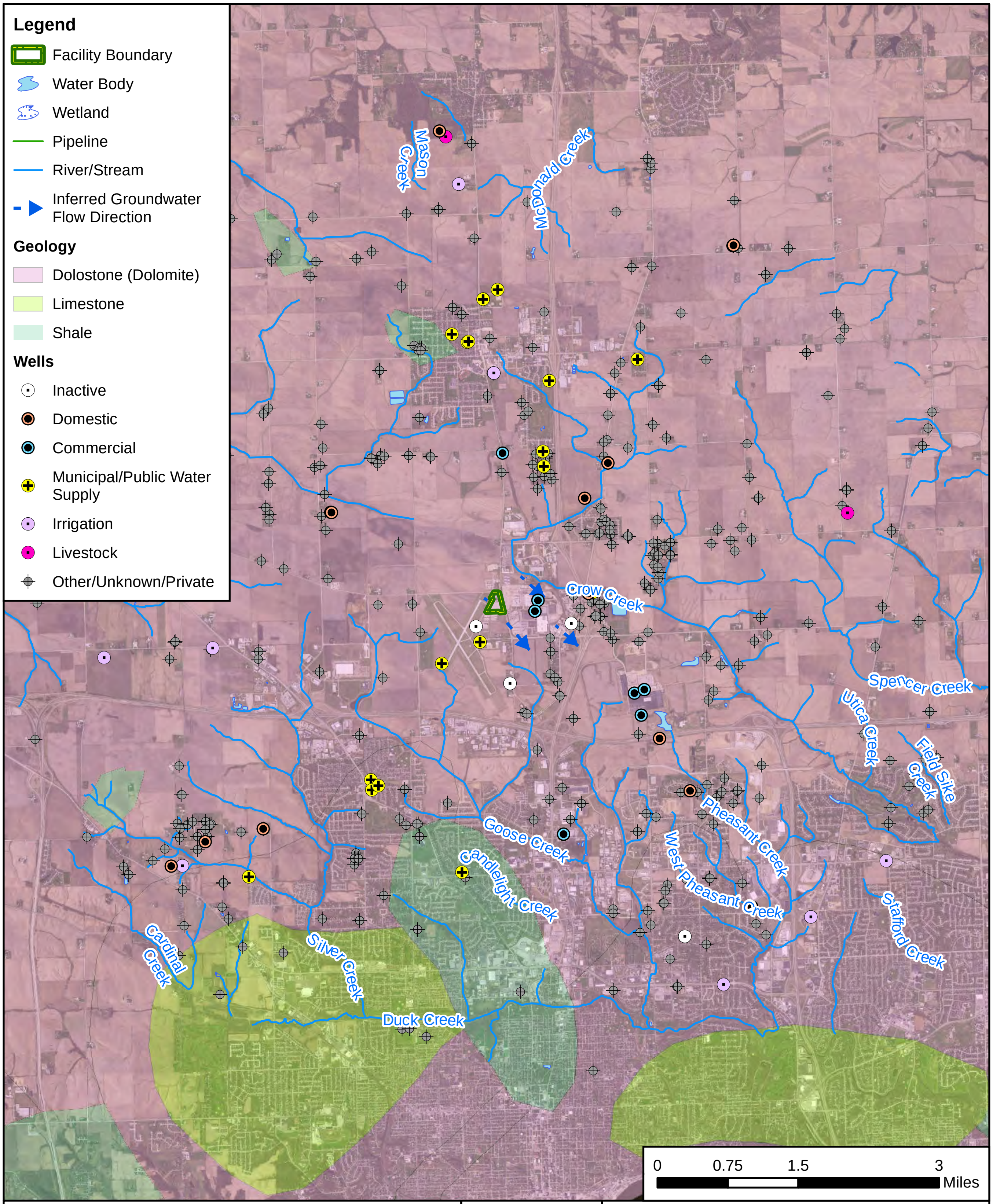

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Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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Groundwater Contours

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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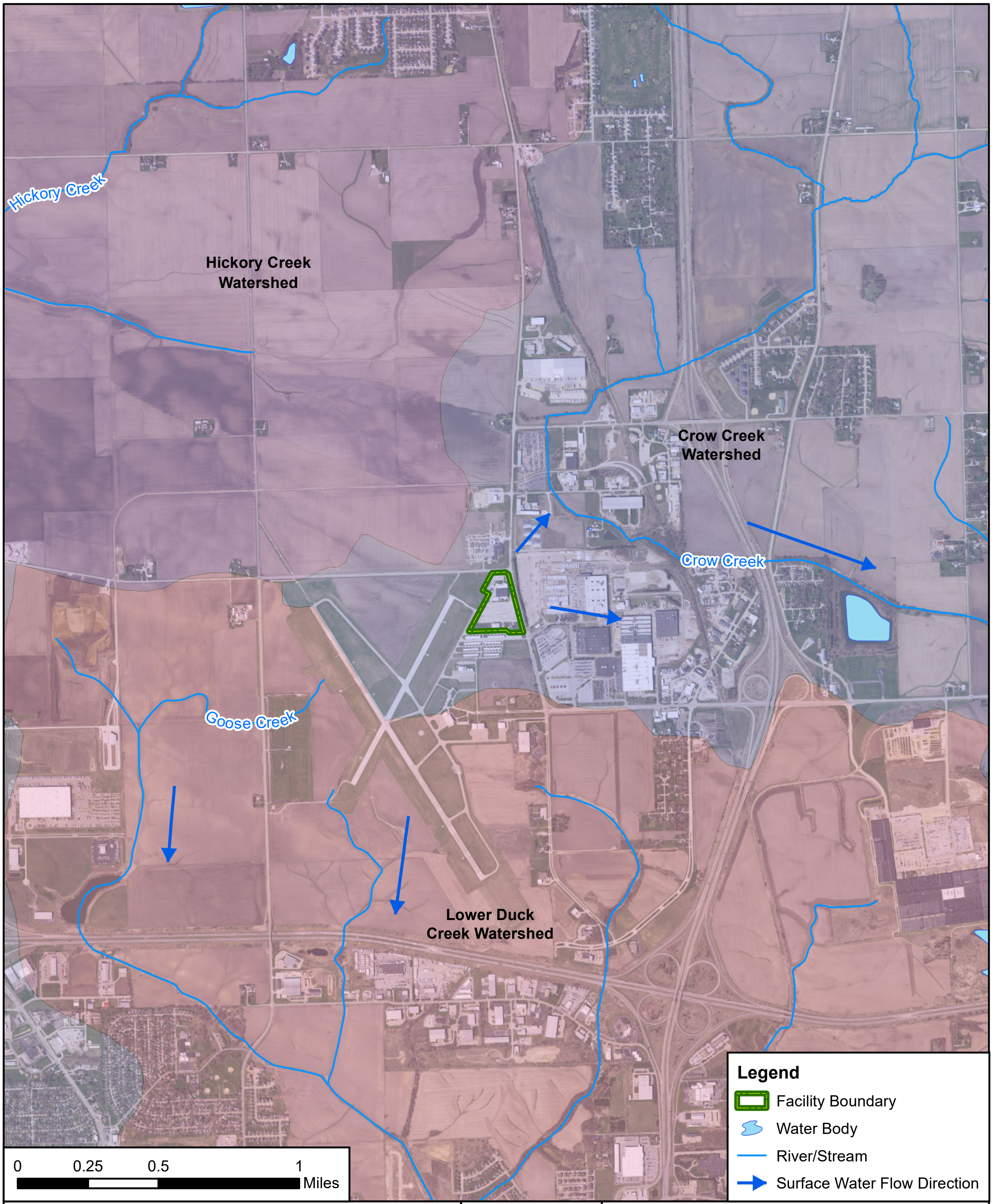

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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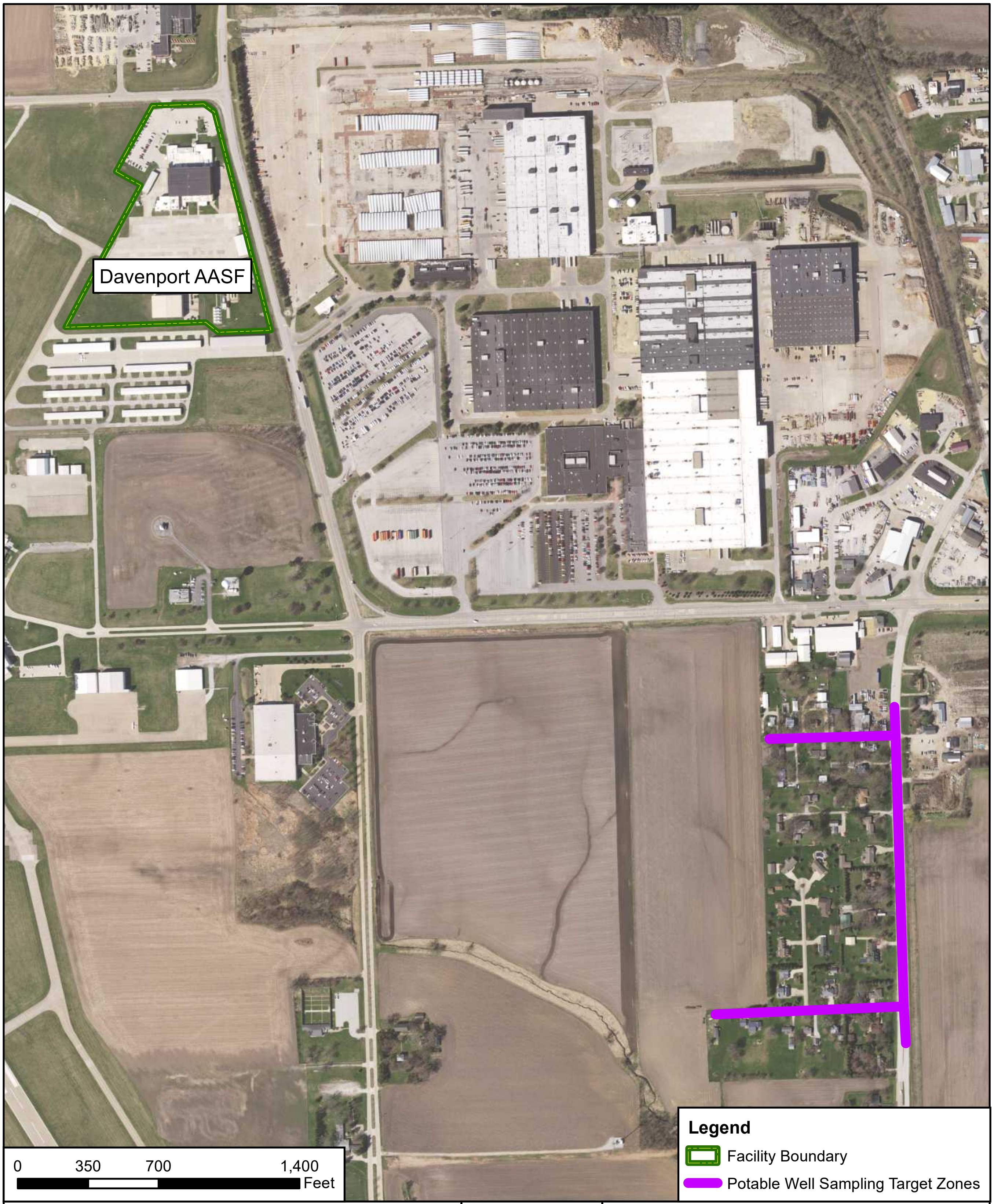

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Potable Well Sampling Area

AECOM
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Germantown, MD 20876

Figure 2-6

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3. Summary of Areas of Interest

This section presents a summary of the potential PFAS release area by AOI. One potential PFAS release area was identified as an AOI based on preliminary data and inferred groundwater flow direction (**Figure 3-1**).

3.1 AOI 1

AOI 1 consists of one potential PFAS release area, as described below.

3.1.1 Wash Rack

AOI 1 is the wash rack located on the Davenport AASF ramp. PFOA and PFOS were released to the wash rack drain at AOI 1 by the IAARNG every five years from 1998 to present day, when the contents of the Tri-Max™ 3, Tri-Max™30, and Tri-Max™ 60 fire extinguishers were emptied at the wash rack prior to hydrostatic testing. Additionally, prior to the 2000s, a firetruck was housed at the AASF. The firetruck was taken annually to Peoria, Illinois airport for training and nozzle testing by the IAARNG and then washed at the wash rack upon its return to the AASF. The concrete surrounding the wash rack drain is sloped downward toward the drain in all directions, directing flow into the drain. Currently, the wash rack drains to the sanitary sewer; however, before 1994, the wash rack effluent flowed through an oil-water separator prior to being discharged to an adjacent ditch outside the facility’s eastern boundary.

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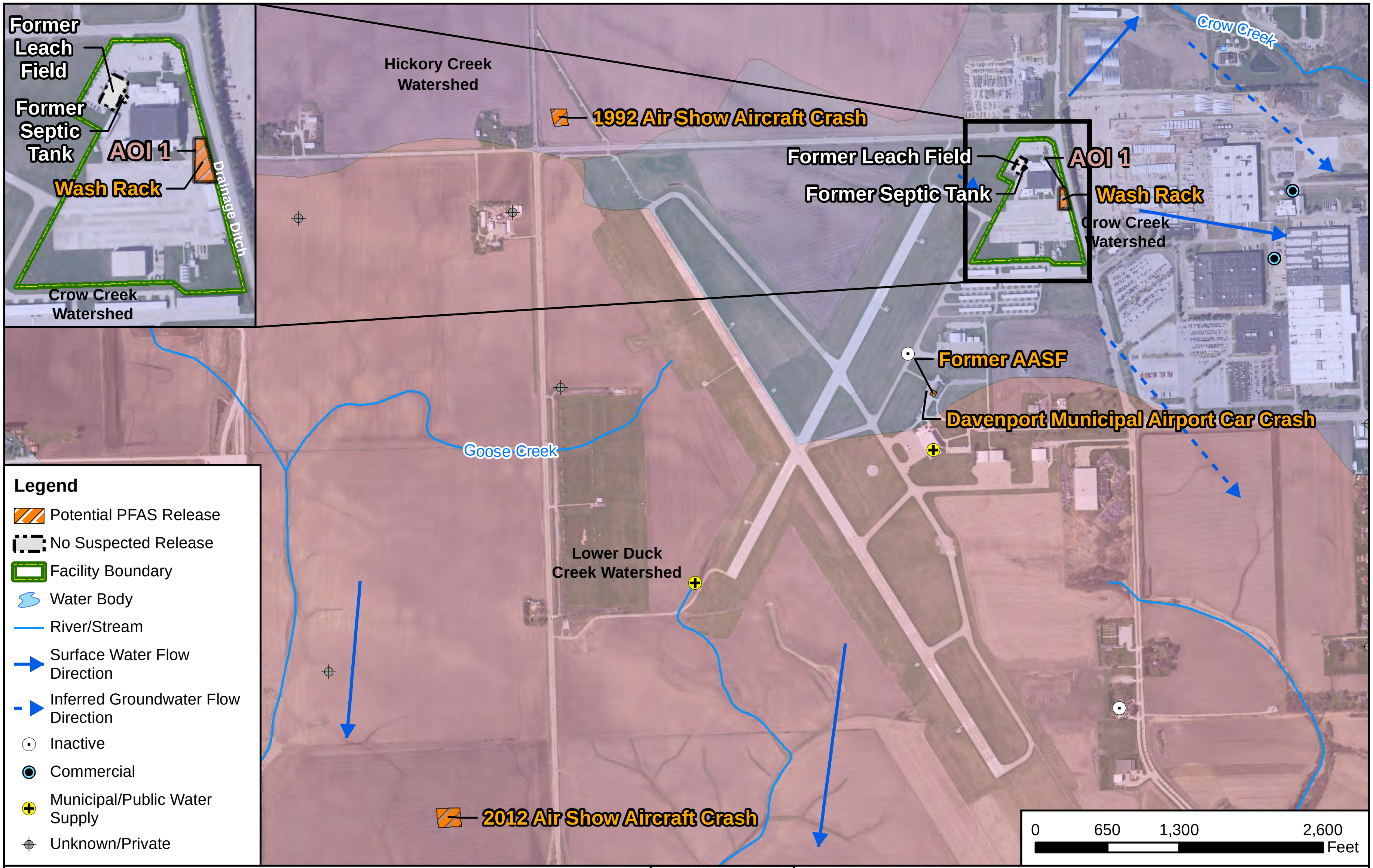

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Area of Interest

AECOM

12420 Milestone Center Drive
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 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 October 2019 (Assistant Secretary of Defense, 2019). 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 US Department of the Army (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 fire training areas (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 goals of this SI are to:

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 removal action.

4. Collect data to better characterize the release areas for more effective and rapid initiation of an RI.
5. Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).
6. Determine whether a 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 Davenport AASF, Iowa (AECOM, 2019);
- 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, 2020b); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.
- Analytical data from potable water samples collected from two potable wells in close proximity to the facility boundary downgradient of AOI 1.

4.4 Study Boundaries

The scope of the SI is horizontally bounded by the property limits of Davenport AASF (**Figure 2-2**). Off-facility sampling was performed at potable wells within 0.5 miles of the facility boundary.

4.5 Analytical Approach

Samples were analyzed by Pace Analytical (formerly Gulf Coast Analytical Laboratory, LLC), 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, 2020b). 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 (AECOM, 2020b) identify actions based on the following:

Groundwater:

- Is there a human receptor within 4 miles of the site?
- 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., 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 within the shallow perched aquifer no deeper than 6 feet bgs. The Cambrian Ordovician and the Silurian-Devonian bedrock aquifers are significantly deeper, at 300 to 2,000 feet bgs and 100 to 700 feet bgs, respectively, and were not within the scope of this investigation.

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, 2018a; DoD, 2018b; USEPA, 2017).

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.

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 field sample results associated with EIS area counts less than the lower quality control (QC) limit were non-detect and were qualified “UJ”. The qualified field sample results should be considered usable as estimated values with a negative bias.

LCS/LCS duplicate (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/LCSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2020b).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested with one exception. The MS/MSD performed on parent sample DVP-01-GW displayed an RPD greater than the QC limit of 30% for PFOS, at 47%. The parent sample results associated with the MS/MSD imprecision was previously qualified due to an MS/MSD percent recovery anomaly; therefore, no further impact on data quality is anticipated.

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, 2019b), with one exception. The field duplicate pair performed on field sample DVP-AOI01-GW displayed an RPD greater than the QC limit of 35% for perfluorohexanoic acid (PFHxA), at 77.6%. The field duplicate pair results associated with the field duplicate imprecision were qualified “J”. The qualified field duplicate 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/LCSD samples were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2019b).

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, with one exception. The MS/MSD performed on field sample DVP-01-GW displayed percent recoveries outside the QC limits for perfluorobutyrate (PFBA) and PFOS. The field sample results associated with the negative biases were positive, were qualified “J-“, and should be considered usable as estimated values with a negative bias.

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. The calibration verifications were within the project established precision limits presented in the QAPP Addendum (AECOM, 2019b).

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) 5.1 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 branch 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.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. All associated instrument blanks and method blanks were non-detect for all target analytes.

Equipment blanks and field 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 drill rig decontamination sample, CAMP DODGE DECON, displayed a concentration above the detection limit of 1.78 nanograms per liter (ng/L) for PFBA at 10.8 ng/L. The associated field sample results displayed concentrations greater than five times the concentration found in the blank; no impact on the data is anticipated.

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. Field samples DVP-AOI01-01-SB-3-5 and DVP-01-SB-10-12 were re-extracted outside hold time due to EIS anomalies. The associated field sample results were non-detect and were qualified “UJ” and should be considered usable as estimated values. The holding time for pH analysis is “immediate”, all field samples analyzed for pH were qualified “J” and should be considered usable as estimated values.

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 and to complete the risk assessment.

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 meeting 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 USEPA Method 537 Modified at 100%
- PFAS in soil by USEPA Method 537 Modified at 100%
- pH in soil by USEPA Method 9045D at 100%
- Total organic carbon (TOC) by USEPA Method 9060 at 100%

Certain soil samples were unable to be collected due to groundwater elevation being higher than anticipated at multiple soil boring locations; this is described further in **Section 5.8**.

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, a method detection limit (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, 2019b). 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, 2019b), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the MDL 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 Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan dated March 2018* (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan dated July 2018* (AECOM, 2018b);
- *Final Preliminary Assessment Report, Army Aviation Support Facility, Davenport, Iowa, dated June 2019* (AECOM, 2019);
- *Final Site Safety and Health Plan, Army Aviation Support Facility, Davenport, Iowa, dated July 2020* (AECOM, 2020a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Army Aviation Support Facility, Davenport, Iowa, dated July 2020* (AECOM, 2020b).

SI field activities included soil and groundwater grab sampling on 6 August to 7 August 2020. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2020b).

The following samples were collected during the SI and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

- 9 soil grab samples from 4 boring locations; and
- 4 groundwater grab samples from 4 temporary well locations.

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**. Groundwater sampling forms are provided in **Appendix B2**. Survey data containing latitude, longitude, and elevations of sampling locations are provided in **Appendix B3**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

The USACE TPP Process, Engineers 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 remotely via teleconference on 28 April 2020, prior to SI field activities. Meeting minutes are provided in **Appendix D**. TPP meetings 1 and 2 were conducted in general accordance with EM 200-1-2.

The stakeholders for this SI include the ARNG, Iowa ARNG (IAARNG), USACE, IDNR, 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, 2020b). Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

Utility clearance was conducted by the AECOM field team. AECOM's drilling subcontractor, Cascade Technical Services, LLC, contacted "Iowa 811," the one-call utility clearance contractor to notify them of intrusive work. Additionally, the first 5 feet of each boring were advanced using hand augering methods to confirm no subsurface utility lines were present at each drilling location.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be PFAS-free prior to the start of field activities. A sample from the Camp Dodge, Johnston, Iowa potable water supply was collected from a water hose at Camp Dodge on 18 September 2019, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15. Additionally, the Camp Dodge potable water supply was sampled as part of a triannual PFAS sampling program in March 2020. The results of the Camp Dodge potable well samples from 2019 and 2020 are provided in **Appendix G**. 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 QAPP Addendum (AECOM, 2020b). 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 QAPP Addendum (AECOM, 2020b). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth.

Two to three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring, dependent on depth to surficial groundwater. Where possible, one subsurface soil sample was collected approximately 1 foot above the groundwater table, one subsurface soil sample at the mid-point between the ground surface and the groundwater table, and one surface soil sample at the 0 to 2 foot bgs depth interval were collected at each boring using DPT. Deviations from the QAPP Addendum (AECOM, 2020b) are discussed in **Section 5.8**.

The soil boring locations are shown on **Figure 5-1**, and sample depths are provided **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and SI UFP-QAPP Addendum review.

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; **Appendix B5**). 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**.

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 5.1 Table B-15), TOC (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the QAPP Addendum (AECOM, 2020b).

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

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the QAPP Addendum (AECOM, 2020b) using wetted bentonite chips at completion of sampling activities. All borings were installed in grassy areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using 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 at each borehole to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

The temporary wells were purged for five to ten minutes 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**) before 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 5.1 Table B-15 in accordance with the QAPP Addendum (AECOM, 2020b).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the 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 QAPP Addendum (AECOM, 2020b) by removing the PVC and backfilling the hole with wetted bentonite chips. All temporary wells were installed in grassy areas to avoid disturbing concrete or asphalt surfaces.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 6 to 7 August 2020. Groundwater elevation measurements were collected from the four temporary monitoring wells installed during the SI. 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 is provided in **Table 5-3**.

5.5 Surveying

The northern side of each well casing was surveyed by an Iowa-Licensed land surveyor following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2020b). Survey data from the newly installed wells on the facility were collected on 7 August 2020 in the Universal Transverse Mercator Zone 15 North projection with World Geodetic System 84 datum. 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 investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the QAPP Addendum (AECOM, 2020b) and with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) generated during the SI activities were left in place at the point of the source. The soil cuttings were distributed on the ground surface on the downgradient side of the boring. The soil IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

Liquid IDW generated during SI activities (i.e. purge water, development water, and decontamination fluids) were discharged directly to the ground surface slightly downgradient of the source. The liquid IDW was not sampled and assumes the PFAS characteristics of the associated groundwater samples collected from that source location.

Geographic coordinates were collected using a global positioning system around each location where IDW was placed (i.e., an IDW polygon). The IDW polygons are displayed on the figure in **Appendix F**.

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 5.1 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 sulfonate (6:2 FTS)
- 8:2 fluorotelomer sulfonate (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)

- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- 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 QAPP Addendum

Deviations from the QAPP Addendum occurred based on field conditions and discussion between AECOM, ARNG, and USACE. Deviations from the QAPP Addendum are noted below and are documented in the Nonconformance and Corrective Action Report (**Appendix B4**):

The QAPP Addendum stated that three soil samples were to be collected from each direct-push boring location at representative depths of the surface soil, vadose soil, and intermediate soil. However, three out of four direct-push locations (AOI01-01, DVP-02, and DVP-03) had depth-to-water ranging from approximately 4 to 5 feet bgs. Therefore, soil samples at these borings could only be collected from two depth intervals (0-2 feet bgs and 3-5 feet bgs) instead of three depth intervals. This action was documented in a nonconformance and corrective action report provided in **Appendix B4**.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Davenport AASF, Iowa

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (LC/MS/MS compliant with QSM 5.1 Table B-15)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Comments
Soil Samples						
DVP-AOI01-01-SB-0-2	8/6/2020	0 - 2	x	x	x	
DVP-AOI01-01-SB-0-2-FD	8/6/2020	0 - 2		x	x	Field Duplicate
DVP-AOI01-01-SB-0-2-MS	8/6/2020	0 - 2		x	x	MS/MSD
DVP-AOI01-01-SB-0-2-MSD	8/6/2020	0 - 2		x	x	MS/MSD
DVP-AOI01-01-SB-3-5	8/6/2020	3 - 5	x			
DVP-AOI01-01-SB-3-5-FD	8/6/2020	3 - 5	x			Field Duplicate
DVP-01-SB-0-2	8/6/2020	0 - 2	x			
DVP-01-SB-0-2-MS	8/6/2020	0 - 2	x			MS/MSD
DVP-01-SB-0-2-MSD	8/6/2020	0 - 2	x			MS/MSD
DVP-01-SB-3-5	8/6/2020	3 - 5	x			
DVP-01-SB-10-12	8/6/2020	10 - 12	x			
DVP-02-SB-0-2	8/6/2020	0 - 2	x			
DVP-02-SB-3-5	8/6/2020	3 - 5	x			
DVP-03-SB-0-2	8/6/2020	0 - 2	x			
DVP-03-SB-3-5	8/6/2020	3 - 5	x			
DVP-03-SB-3-5-FD	8/6/2020	3 - 5	x			Field Duplicate
Groundwater Samples						
DVP-AOI01-01-GW	8/7/2020	5 - 10	x			
DVP-AOI01-01-GW-FD	8/7/2020	5 - 10	x			Field Duplicate
DVP-01-GW	8/7/2020	10 - 15	x			
DVP-01-GW-MS	8/7/2020	10 - 15	x			MS/MSD
DVP-01-GW-MSD	8/7/2020	10 - 15	x			MS/MSD
DVP-02-GW	8/6/2020	5 - 10	x			
DVP-03-GW	8/7/2020	5 - 10	x			
Blank Samples						
CAMP DODGE DECON	9/18/2019	---	x			Decontamination Water Blank
FRB-072919	9/18/2019	---	x			Field Reagent Blank
DVP-ERB-01	8/6/2020	---	x			Equipment Rinsate Blank
DVP-FRB-01	8/6/2020	---	x			Field Reagent Blank

Notes:
ft = feet
MS/MSD = matrix spike/ matrix spike duplicate
PFAS = per- and polyfluoroalkyl substances
pH = potential for hydrogen
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals
Site Inspection Report, Davenport AASF, Iowa

Area of Interest	Soil Boring ID	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)
AOI 1	AOI01-01-SB	10	5 - 10
Upgradient Facility Boundary	DVP-01-SB	20	10 - 15
	DVP-02-SB	15	5 - 10
Downgradient Facility Boundary	DVP-03-SB	15	5 - 10

Notes:

bgs = below ground surface

AOI = area of interest

Table 5-3
Groundwater Elevations at Temporary Groundwater Monitoring Wells
Site Inspection Report, Davenport AASF, Iowa

Temporary Groundwater Monitoring Well ID	Ground Surface Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
AOI01-01	746.15	5.0	741.15
DVP-01	747.18	5.5	741.68
DVP-02	747.58	4.7	742.88
DVP-03	743.46	3.8	739.66

Notes:

amsl = above mean sea level

bgs = below ground surface

ft = feet

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CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Davenport AASF, IA			
REVISED	10/23/2020	GIS BY	MS	10/23/2020
SCALE	1:2,520	CHK BY	JW	10/23/2020
Base Map: State of Iowa Homeland Security and Emergency Management, Iowa State University GIS		PM	RG	10/23/2020

N

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI for each AOI. 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 G**, and the laboratory reports are provided in **Appendix H**.

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 October 2019 (Assistant Secretary of Defense, 2019). 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 an RI, the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table 6-1**.

All other results presented in this report are considered informational in nature and serve as an indication as to whether soil, groundwater, sediment, and surface water contain or do not contain PFAS within the boundaries of the Site.

Table 6-1: 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]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

Notes:
a.) Assistant Secretary of Defense, 2019. 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 October 2019.
bgs = below ground surface
ng/L = nanogram per Liter
µg/kg = micrograms per kilogram

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 G** 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 they 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 (Koc 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: Wash Rack. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled at AOI 1 from two depth intervals at boring location AOI01-01 during the SI: shallow (0 to 2 feet bgs) and shallow subsurface (3 to 5 feet bgs). Soil was not collected from a deeper interval due to shallow surficial groundwater, which was encountered at 5.5 feet bgs during drilling (see **Section 5.8**). PFOS was detected in the shallow and shallow subsurface soil samples, at concentrations of 43.6 micrograms per kilogram (µg/Kg) and 18.5 µg/Kg, respectively. PFOA was also detected in the shallow and shallow subsurface soil samples at concentrations of 0.656 J µg/Kg and 0.327 J µg/Kg, respectively. PFBS was not detected in either soil sample at AOI 1.

6.3.2 AOI 1 Groundwater Analytical Results

One groundwater sample was collected from a temporary monitoring well installed at AOI01-01 during the SI (DVP-AOI01-01-GW). Detected concentrations PFOS and PFOA in groundwater exceeded the individual SLs of 40 ng/L for each compound, with concentrations of 4,250 ng/L and 375 ng/L, respectively. PFBS was detected below the SL of 40,000, at a concentration of 26.9 ng/L.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOS and PFOA were detected in soil at AOI 1; however, the detected concentrations were lower than the soil SLs of 130 ng/L. PFOS and PFOA were detected in groundwater at concentrations exceeding the individual SLs of 40 ng/L. The detected concentrations of PFBS in soil and groundwater were below the individual SLs. Based on exceedances of the SLs for PFOS and PFOA in groundwater, further evaluation at AOI 1 is warranted.

6.4 Upgradient Facility Boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the Upgradient Facility Boundary, which was sampled to examine potential off-facility sources of PFAS located upgradient of Davenport AASF. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.4.1 Upgradient Facility Boundary Soil Analytical Results

Soil was sampled at the Upgradient Facility Boundary from three depth intervals at boring location DVP-01 and two depth intervals at boring location DVP-02. At DVP-01, soil was collected from shallow (0 to 2 feet bgs), shallow subsurface (3 to 5 feet bgs), and deep (10 to 12 feet bgs) intervals. At DVP-02, soil was collected from shallow (0 to 2 feet bgs) and shallow subsurface (3 to 5 feet bgs) intervals. Soil was not collected from a deeper interval at DVP-02 due to shallow surficial groundwater, which was encountered at 5.0 feet bgs during drilling (see **Section 5.8**).

PFOS was detected in soil at DVP-01 at each depth interval, with concentrations ranging from 0.370 J µg/Kg to 1.84 µg/Kg. PFOA and PFBS were not detected at DVP-01. PFOS, PFOA, and PFBS was not detected in soil at DVP-02.

6.4.2 Upgradient Facility Boundary Groundwater Analytical Results

Two groundwater samples were collected from two temporary monitoring wells installed at DVP-01 and DVP-02 during the SI (DVP-01-GW and DVP-02-GW). The detected concentration of PFOS in groundwater at DVP-01 exceeded the SL of 40 ng/L, with a concentration of 73.9 J ng/L. PFOA was detected at DVP-01 below the SL of 40 ng/L, at a concentration of 12.2 ng/L. PFBS was also detected at DVP-01 below the SL of 40,000, with a concentration of 36.2 J- ng/L. PFOS, PFOA, and PFBS were not detected in groundwater collected at DVP-02.

6.4.3 Upgradient Facility Boundary Conclusions

Based on the results of the SI, PFOS was detected in soil at the Upgradient Facility Boundary; however, the detected concentrations were lower than the soil SLs. PFOS was detected in groundwater at a concentration exceeding the SL of 40 ng/L at DVP-01. The detected concentrations of PFOA and PFBS in groundwater were below the individual SLs. Based on the exceedance of the SL for PFOS in groundwater, further evaluation at the Upgradient Facility Area is warranted.

6.5 Downgradient Facility Boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the Downgradient Facility Boundary. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.5.1 Downgradient Facility Boundary Soil Analytical Results

Soil was sampled at the Downgradient Facility Boundary from two depth intervals at boring location DVP-03: shallow (0 to 2 feet bgs) and shallow subsurface (3 to 5 feet bgs). Soil was not collected from a deeper interval at DVP-03 due to shallow surficial groundwater, which was encountered at 5.0 feet bgs during drilling (see **Section 5.8**). PFOS, PFOA, and PFBS were not detected in either depth interval.

6.5.2 Downgradient Facility Boundary Groundwater Analytical Results

One groundwater sample was collected from a temporary monitoring well installed at DVP-03 during the SI (DVP-03-GW). Detected concentrations PFOS and PFBS in groundwater were below the SLs of 40 ng/L and 40,000 ng/L, respectively, with concentrations of 7.63 ng/L for PFOS and 6.61 ng/L for PFBS. PFOA was not detected in groundwater at DVP-03.

6.5.3 Downgradient Facility Boundary Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil at the Downgradient Facility Boundary. PFOS and PFBS were detected in groundwater at concentrations below the individual SLs. Based on the detected concentrations of PFOS and PFBS in groundwater, no further action is warranted at the Downgradient Facility Boundary.

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Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Davenport AASF, Iowa

Area of Interest		AOI 1		Upgradient Facility Boundary				Downgradient Facility Boundary	
Sample ID		DVP-AOI01-01-SB-0-2		DVP-01-SB-0-2		DVP-02-SB-0-2		DVP-03-SB-0-2	
Sample Date		08/06/2020		08/06/2020		08/06/2020		08/06/2020	
Depth		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**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)									
PFBA	-	0.833	J	0.902	J	0.901	J	1.45	
PFDA	-	0.391	J	ND		ND		ND	
PFHpA	-	0.485	J	ND		ND		ND	
PFHxA	-	0.523	J	ND		ND		ND	
PFHxS	-	0.730	J	0.163	J	ND		ND	
PFNA	-	0.937	J	ND		ND		ND	
PFOA	130	0.656	J	ND		ND		ND	
PFOS	130	43.6		0.382	J	ND		ND	
PFPeA	-	0.595	J	ND		ND		ND	
PFUnDA	-	0.413	J	ND		ND		ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DVP	Davenport
ft	feet
HQ	Hazard quotient
ID	Identifier
LCMSMS	Liquid Chromatography 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 Shallow Subsurface Soil
Site Inspection Report, Davenport AASF, Iowa

	Area of Interest	AOI 1				Upgradient Facility Boundary						Downgradient Facility Boundary			
	Sample ID	DVP-AOI01-01-SB-3-5		DVP-AOI01-01-SB-3-5-FD		DVP-01-SB-3-5		DVP-01-SB-10-12		DVP-02-SB-3-5		DVP-03-SB-3-5		DVP-03-SB-3-5-FD	
	Sample Date	08/06/2020		08/06/2020		08/06/2020		08/06/2020		08/06/2020		08/06/2020		08/06/2020	
	Depth	3 - 5 ft		3 - 5 ft		3 - 5 ft		10 - 12 ft		3 - 5 ft		3 - 5 ft		3 - 5 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)															
6:2 FTS	-	0.247	J	ND		ND		ND		ND		ND		ND	
8:2 FTS	-	0.334	J	ND		ND		ND		ND		ND		ND	
PFBA	-	0.264	J	0.290	J	0.289	J	0.241	J	ND		0.258	J	0.225	J
PFHpA	-	0.237	J	0.271	J	ND		ND		ND		ND		ND	
PFHxA	-	0.192	J	0.251	J	ND		ND		ND		ND		ND	
PFHxS	-	0.276	J	0.233	J	1.53		ND		ND		ND		ND	
PFNA	-	0.523	J	0.804	J	ND		ND		ND		ND		ND	
PFOA	1600	0.244	J	0.327	J	ND		ND		ND		ND		ND	
PFOS	1600	11.4		18.5		1.84		0.370	J	ND		ND		ND	
PFPeA	-	0.394	J	0.548	J	ND		ND		ND		ND		ND	

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic 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

AOI	Area of Interest
DVP	Davenport
FD	Duplicate
ft	feet
HQ	Hazard quotient
ID	Identifier
LCMSMS	Liquid Chromatography 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, Davenport AASF, Iowa

	Area of Interest	AOI 1				Upgradient Facility Boundary				Downgradient Facility Boundary	
	Sample ID	DVP-AOI01-01-GW		DVP-AOI01-01-GW-FD		DVP-01-GW		DVP-02-GW		DVP-03-GW	
	Sample Date	08/07/2020		08/07/2020		08/07/2020		08/06/2020		08/07/2020	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)											
6:2 FTS	-	1140		1020		ND		ND		ND	
8:2 FTS	-	950		808		ND		ND		ND	
PFBA	-	200		186		48.6	J-	27.6		44.7	
PFBS	40000	26.9		22.6		36.2	J-	ND		6.61	J
PFDA	-	10.7		8.67	J	ND		ND		ND	
PFHpA	-	536		501		18.3		ND		ND	
PFHxA	-	479		456		48.1		ND		4.16	J
PFHxS	-	509	J	474	J	532		ND		47.5	
PFNA	-	221		205		ND		ND		ND	
PFOA	40	375		363		12.2		ND		ND	
PFOS	40	4250		3720		73.9	J	ND		7.63	J
PFPeA	-	589		539		34.4		ND		3.27	J

Grey Fill	Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic 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

AOI	Area of Interest
DVP	Davenport
FD	Duplicate
GW	Groundwater
HQ	Hazard quotient
ID	Identifier
LCMSMS	Liquid Chromatography 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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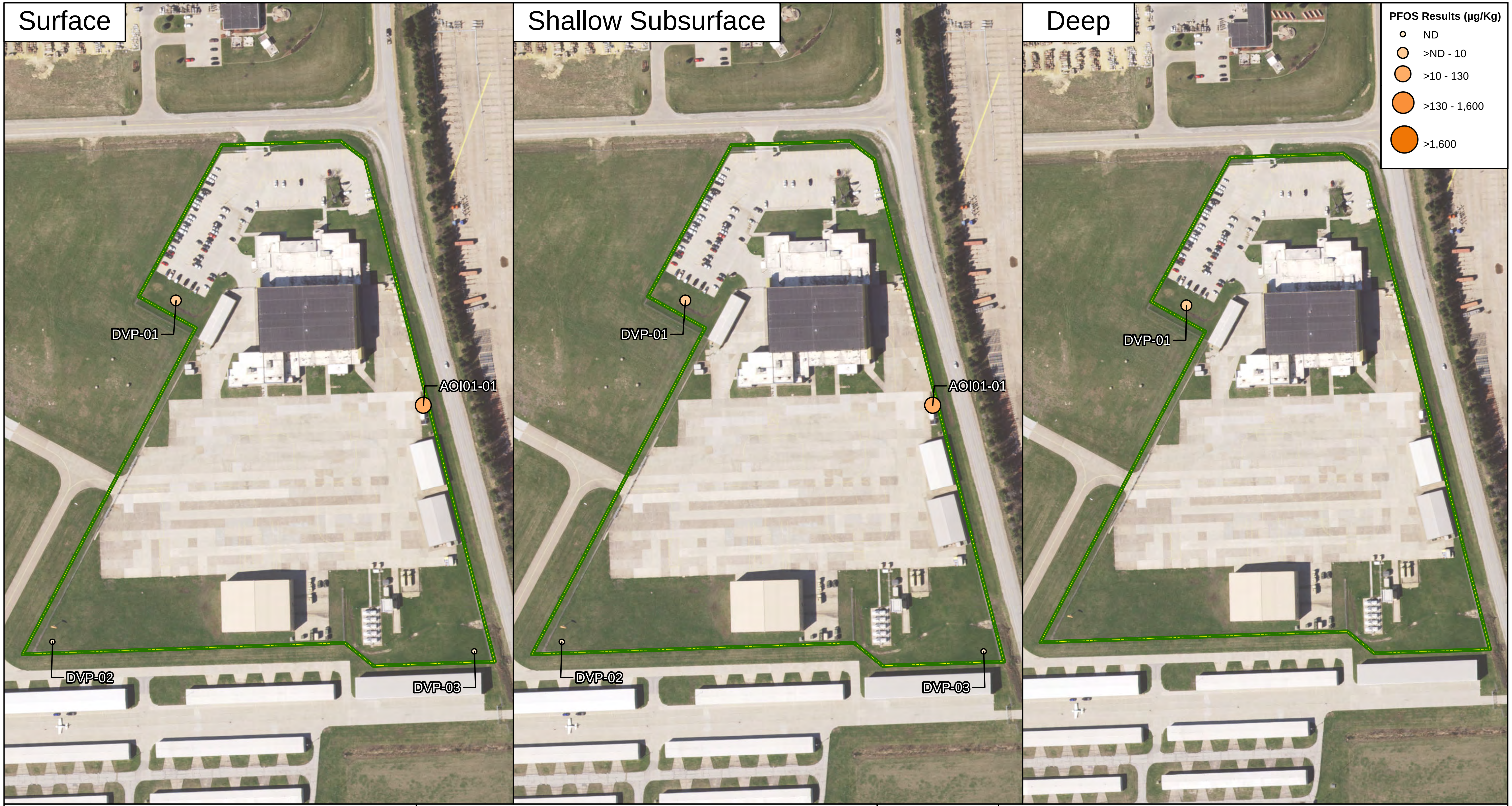

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Davenport AASF, IA			
REVISED	12/2/2020	GIS BY	MS	12/2/2020
SCALE	1:2,520	CHK BY	JW	12/2/2020
Base Map: State of Iowa Homeland Security and Emergency Management, Iowa State University GIS Facility		PM	RG	12/2/2020

Legend

🟩 Facility Boundary

0 105 210 420 Feet

N

PFOS Soil Results

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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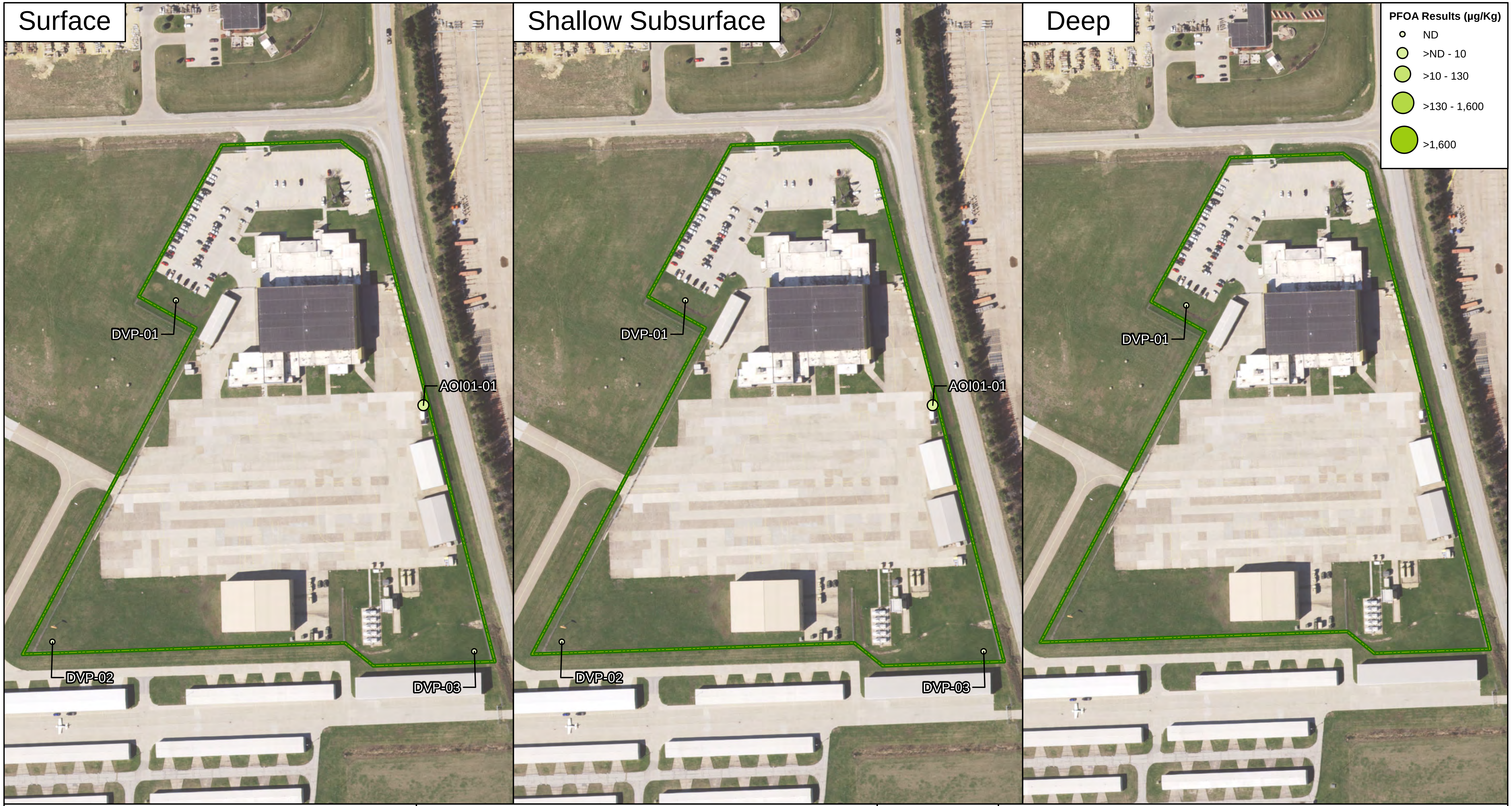

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Davenport AASF, IA			
REVISED	12/2/2020	GIS BY	MS	12/2/2020
SCALE	1:2,520	CHK BY	JW	12/2/2020
Base Map: State of Iowa Homeland Security and Emergency Management, Iowa State University GIS Facility		PM	RG	12/2/2020

Legend

🟩 Facility Boundary

0 105 210 420
Feet

N

PFOA Soil Results

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2

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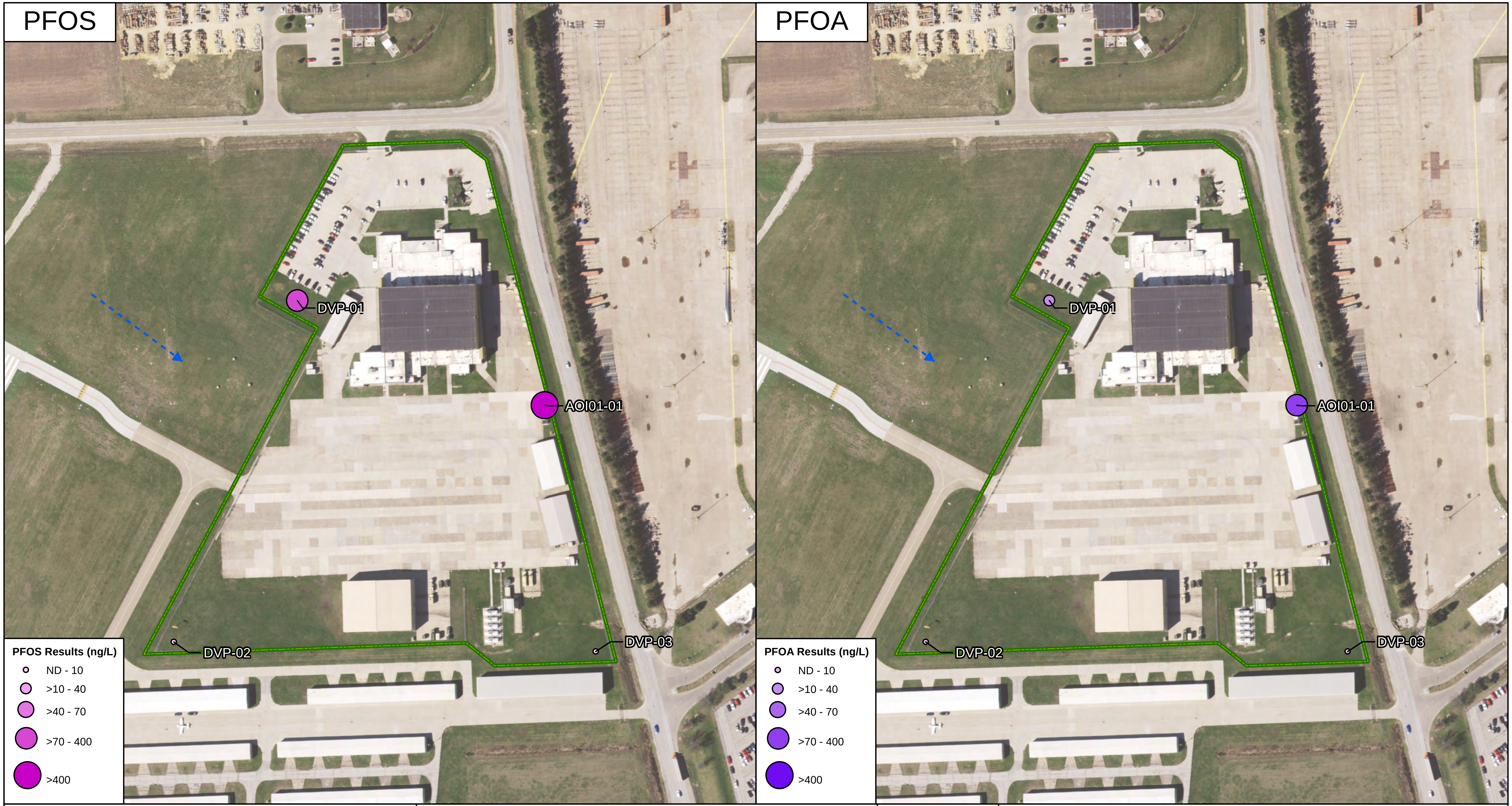

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Davenport AASF, IA			
REVISED	12/2/2020	GIS BY	MS	12/2/2020
SCALE	1:2,520	CHK BY	JW	12/2/2020
Base Map: State of Iowa Homeland Security and Emergency Management, Iowa State University GIS Facility		PM	RG	12/2/2020

🟩 Facility Boundary
→ Surface Water Flow Direction
- → Inferred Groundwater Flow Direction

PFOS and PFOA Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3

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7. Exposure Pathways

A human exposure pathway is considered complete when the following conditions are present:

1. Contaminant source above SLs;
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; however, the pathway is considered potentially complete if PFOA, PFOS, or PFBS are detected in media below the SLs or detected in media with no SL. Areas with an identified potentially complete pathway may warrant further investigation. Areas with no identified complete pathway generally warrant no further action unless there is an exceedance of the SLs.

In general, the potential PFAS exposure pathways 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 (thought unlikely due to restricted access), residents outside the facility boundary, and recreational users outside of the facility boundary. The CSM for AOI 1, revised based on the SI findings, is presented on **Figure 7-1**.

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 each AOI based on the individual soil SLs.

7.1.1 AOI 1

PFOA and PFOS were released to the wash rack drain at AOI 1 by the IAARNG every five years from 1998 to present day, when the contents of the Tri-Max™ 3, Tri-Max™ 30, and Tri-Max™ 60 fire extinguishers were emptied at the wash rack prior to hydrostatic testing. Additionally, prior to the 2000s, a firetruck was housed at the AASF. The firetruck was taken annually to Peoria, Illinois airport for training and nozzle testing by the IAARNG and then washed at the wash rack upon its return to the AASF.

PFOS and PFOA were detected in soil at AOI 1 and confirm the release of PFAS to soil in AOI 1. Based on the results of the SI in AOI 1, ground-disturbing activities could potentially result in site worker, future construction worker, and trespasser exposure to PFOS and PFOA via inhalation of dust or incidental ingestion of surface soil. Ground-disturbing activities could potentially result in future construction worker exposure to subsurface soil during trenching activities. No construction is occurring at AOI 1, and the CSM is presented on **Figure 7-1**.

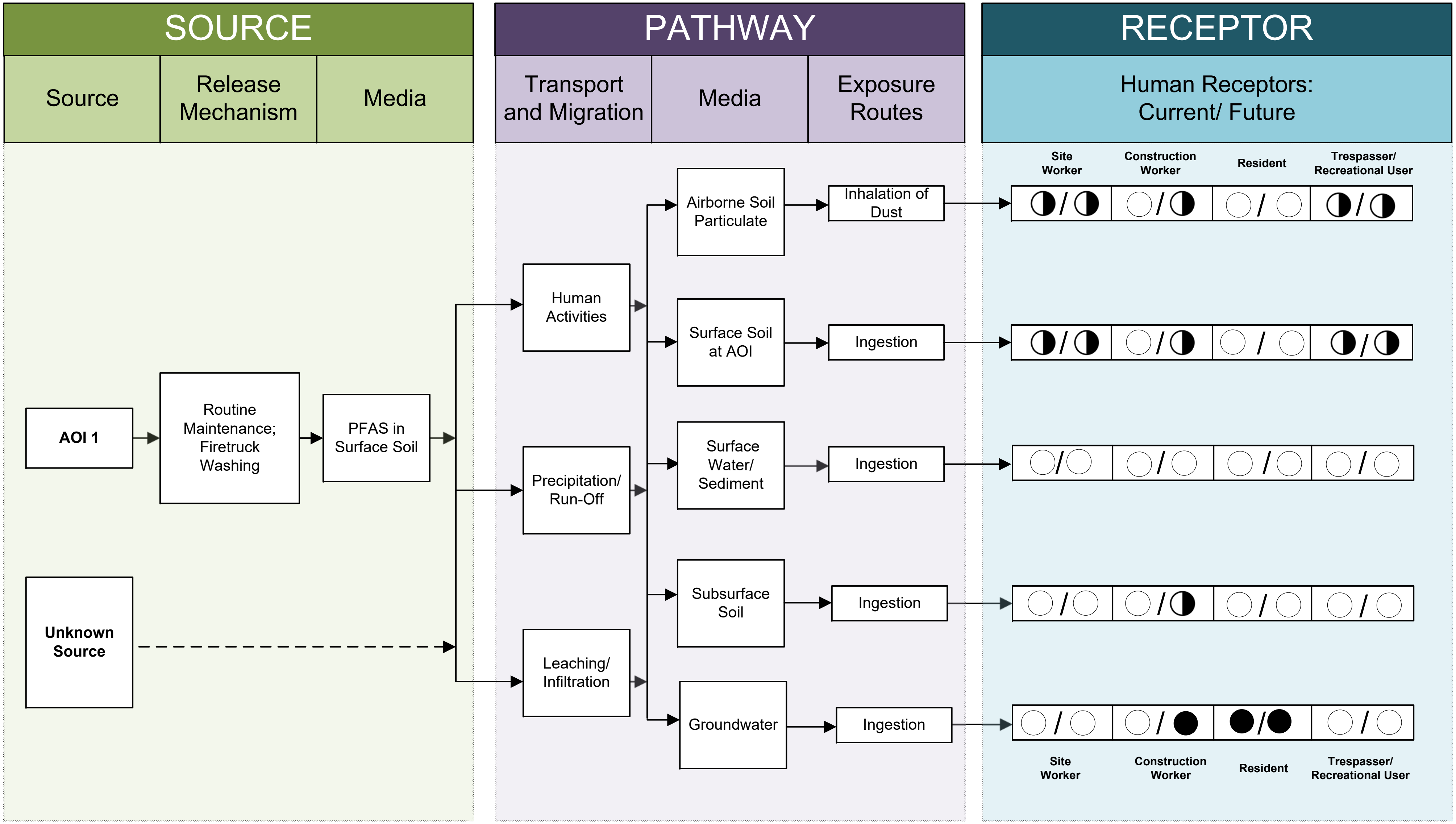
7.2 Groundwater Exposure Pathway

Drinking water for Davenport AASF is supplied by the City of Davenport via the Iowa American Water Company, which uses surface water as the water source (Iowa American Water, 2017). No potable water wells are located within the current AASF; however, private and public supply wells exist within 4 miles of the facility. Private and public supply wells downgradient of the facility draw groundwater from the Silurian-Devonian aquifer at depths ranging from 100 to 700 feet (IGS, 2017a); this aquifer was not included as part of this investigation. Surficial groundwater at the facility is very shallow, with depth to water at approximately 4 to 5 feet bgs and is therefore not considered a proxy for drinking water drawn from the Silurian-Devonian aquifer. However, geological research indicates that glacial till thickness at the facility may not be thick enough to be considered a confining layer that would prevent surficial groundwater from migrating into the Silurian-Devonian aquifer utilized by potential downgradient receptors for drinking water.

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete exposure pathway exists between the source and future construction workers at AOI 1, as well as off-facility residents, based on the individual groundwater SLs.

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from one temporary monitoring well at AOI 1, confirming the migration of PFAS to groundwater. PFOS and PFOA exceeded the individual SLs for each compound. The incidental groundwater exposure pathway is potentially complete for construction workers during trenching activities deep enough to encounter shallow groundwater. The exposure pathway is also potentially complete for off-facility residential drinking water receptors. The CSM is presented on **Figure 7-1**.



Media	Exposure Routes	Site Worker	Construction Worker	Resident	Trespasser/ Recreational User
Airborne Soil Particulate	Inhalation of Dust	◑ / ◑	○ / ◑	○ / ○	◑ / ◑
Surface Soil at AOI	Ingestion	◑ / ◑	○ / ◑	○ / ○	◑ / ◑
Surface Water/ Sediment	Ingestion	○ / ○	○ / ○	○ / ○	○ / ○
Subsurface Soil	Ingestion	○ / ○	○ / ◑	○ / ○	○ / ○
Groundwater	Ingestion	○ / ○	○ / ●	● / ●	○ / ○

LEGEND

—□ Flow-Chart Stops
→ Flow-Chart Continues
- - → Partial / Possible Flow
○ Incomplete Pathway
◑ Potentially Complete Pathway
● Potentially Complete Pathway with Exceedance of SL

Notes:
1. The resident and recreational user receptors refer to off-facility receptors.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-1
Conceptual Site Model
AOI 1 Wash Rack
Davenport AASF, Davenport, Iowa

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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

SI field activities included soil and groundwater grab sampling from 6 August to 7 August 2020. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2020b), except as previously noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2020b), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.9** of this Report.

- 9 soil grab samples from 4 boring locations;
- 4 groundwater grab samples from 4 temporary well locations; and
- 14 Quality Assurance (QA) samples collected.

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 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 both at the source area as well as at the upgradient and downgradient facility boundaries between source area and potential off-facility drinking water receptors. Detected concentrations of PFOA and PFOS in groundwater at AOI 1: Wash Rack each exceeded the individual SLs of 40 ng/L. PFOS in groundwater at DVP-01, located at the upgradient facility boundary, also exceeded the individual SL of 40 ng/L. The detected concentrations of PFOA, PFOS, and PFBS in all soil samples were below the SLs or non-detect.

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.*

   AOI 1: Wash Rack was the only potential PFAS release area identified during the PA and examined during the SI. PFOA and PFOS were detected in groundwater above the SLs at this AOI; therefore, this area may pose a threat to human health and the environment.

3. *Determine the potential need for a removal action.*

   Based on the data collected during this SI, there is not a complete pathway between source and on-facility drinking water receptors. Drinking water for Davenport AASF is supplied by the City of Davenport via the Iowa American Water Company, which uses surface water from the Mississippi River as the water source (Iowa American Water, 2017); therefore, the exposure pathway to on-facility drinking water receptors is considered incomplete.

As described in **Section 2.4**, off-facility private potable wells were sampled due to the exceedance of SLs observed in groundwater during the SI. Two private properties were selected for sampling due to their proximity to the facility. PFOA, PFOS, and PFBS were not detected in groundwater at these two potable wells. A removal action is not needed at this time because the potable water sample results were non-detect.

4. *Collect data to better characterize the release areas for more effective and rapid initiation of an RI.*

The geological data collected as part of the SI indicate an environment with low permeability and conductivity, with soils dominated by silts and clays. Sand was present in minor proportions in clay-dominated lenses. One thin lens of clayey sand was identified at DVP-03.

The silt observed at the top of the boreholes can be interpreted as loess (silt facies) of the Peoria Formation. The eolian sand facies of the Peoria Formation was not encountered during SI field activities. The lean clay and subsequent silt units identified during drilling may represent a continuation of the loess or the uppermost portion of the subglacial till of the underlying Glasford Formation. The Glasford Formation consists of dense, massive silt loam to silty clay loam and ranges from 33 to 115 feet thick and is underlain by additional tills from pre-Illinois-aged deposits that also range from 33 to 115 feet in thickness (IGS, 2009). These data suggest a thick stratigraphy with low permeability and conductivity underlying the facility and overlying the bedrock aquifers used for domestic and public use.

Depth to water at the facility ranges from approximately 4 to 5 feet bgs. Groundwater flow direction in at the facility is southeast towards the Mississippi River. These geologic and hydrogeologic observations inform development of the technical approach for the RI.

5. *Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).*

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. However, the detected concentration of PFOS at the upgradient facility boundary suggests an unknown source of PFAS may also be contributing to detected PFAS concentrations in surficial groundwater at the facility.

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

Detections of PFOA and PFOS in soil at the source area, as well as detections of PFOS at the upgradient facility boundary, indicate there is a potentially complete exposure pathway between source and site workers, future construction workers, and trespassers. The PFOS and PFOA SL exceedances in surficial groundwater indicate there is a potentially complete exposure pathway between source and future construction workers and off-facility residents.

8.3 Outcome

Based on the CSM developed and revised in light of the SI findings, there is potential for exposure to off-facility residential drinking water receptors resulting from historical DoD activities at the facility. There is potential for exposure to groundwater via incidental ingestion for the future construction worker receptor at AOI 1 from PFAS sources on-facility resulting from historical DoD activities. Sample chemical analytical concentrations collected during the SI were compared against the SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOA and PFOS in groundwater at AOI 1: Wash Rack exceeded the individual SLs of 40 ng/L, with detected concentrations of 375 ng/L and 4,250 ng/L, respectively, at location AOI01-01. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.
- PFOS in groundwater at DVP-01: Upgradient Facility Area exceeded the SL of 40 ng/L, with a concentration of 73.9 J ng/L at location DVP-01. Based on the results of the SI, further evaluation of this area is warranted in the RI.
- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from 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 residential drinking water receptors caused by DoD activities at or adjacent to the facility.

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, further evaluation is warranted in the RI for AOI 1: Wash Rack and the Upgradient Facility Area.

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Wash Rack	◐	●	●
Upgradient Facility Area	Unknown	◐	●	●
Downgradient Facility Area	On-Facility; Unknown	○	◐	◐

Legend:

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

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

○ = PFOS, PFOA, and PFBS not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Wash Rack	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI
Upgradient Facility Area	Northwest Facility Boundary	Exceedance of SL in groundwater. No exceedances of SLs in soil.	Proceed to RI
Downgradient Facility Area	Southeast Facility Boundary	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action

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