FINAL
Site Inspection Report
Topeka Army Aviation Support Facility #1
Topeka, Kansas

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

December 2021

Prepared for:

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

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Table of Contents

Appendices

Figures

Tables

Acronyms and Abbreviations

6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
µg/kg	micrograms per kilogram
°C	degrees Celsius
°F	degrees Fahrenheit
%	percent
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineering Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FRB	Field Reagent Blank
FTA	Fire Training Area
GPR	ground-penetrating radar
HDPE	high-density polyethylene
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
KDHE	Kansas Department of Health and Environment
KSANG	Kansas Air National Guard
KSARNG	Kansas Army National Guard
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOD	limit of detection
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
PFCs	perfluorinated compounds
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
PPE	personal protective equipment
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

Executive Summary

The Army National Guard (ARNG) G9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Area of Interest (AOI) 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). A SI was completed at the Army Aviation Support Facility (AASF) #1, Topeka, Kansas. Topeka AASF #1 will be referred to as the "facility" throughout this document.

Topeka AASF #1 is in Shawnee County, Kansas, approximately 7 miles south of the city center of Topeka, 24 miles west of Lawrence, and 100 miles east of Salina. The facility is accessible from Southwest Topeka Boulevard by Southeast Gary Ormsby Drive. The facility is southwest of the Topeka Regional Airport and south of Forbes Field, which is under control of the Kansas Air National Guard (KSANG). The facility occupies approximately 30 acres of land that have been licensed from the United States (US) Air Force since 1980 for an indefinite term. The facility includes hangars for the operation, maintenance, and repair of KSARNG rotary-winged aircraft.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan 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 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.8** 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 dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, should 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 and groundwater contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

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

- PFOS in groundwater at AOI 1: Aqueous Film Forming Foam (AFFF) Fire Extinguisher Release area exceeded the SL of 40 nanograms per liter (ng/L) in three of the well locations with concentrations ranging from 89.0 J ng/L to 475 J+ ng/L, with the highest concentration occurring at the source area. The detected concentrations of PFOA and PFBS in groundwater were below their respective SLs. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

- The detected concentrations of PFOA and PFOS in soil samples were below the SLs. PFBS was not detected in soil at AOI 1.

Table ES-2 summarizes the SI results for soil and groundwater. Based on the conceptual site models 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. However, based on the Kansas Department of Health and Environment Water Well Program database, there are no drinking water wells downgradient (within 4 miles) of the facility boundary.

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 AFFF Fire Extinguisher Release 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 = 0.1. 15 October 2019.

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	AFFF Fire Extinguisher Release	◐	●	●

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	AFFF Fire Extinguisher Release	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

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) #1, Topeka, Kansas . The Topeka AASF #1 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 US Department of the Army (DA) requirements and guidance for field investigations including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and 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 the Topeka AASF #1, Kansas (AECOM, 2019) that identified one potential PFAS release area, which was grouped into one Area of Interest (AOI). The objective of the SI is to identify whether there has been a release to the environment from the AOI and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

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

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

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

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2. Facility Background

2.1 Facility Location and Description

Topeka AASF #1 is in Shawnee County, Kansas (**Figure 2-1**), approximately 7 miles south of the city center of Topeka, 24 miles west of Lawrence, and 100 miles east of Salina. The facility is accessible from Southwest Topeka Boulevard by Southeast Gary Ormsby Drive.

Topeka AASF #1 is on the Topeka Regional Airport and is south of Forbes Field, which is under control of the Kansas Air National Guard (KSANG). Topeka AASF #1 occupies approximately 30 acres of land that have been licensed from the US Air Force since 1980 for an indefinite term. The current Topeka AASF #1 facilities include hangars for the operation, maintenance, and repair of KSARNG rotary-winged aircraft.

2.2 Facility Environmental Setting

Shawnee County is situated along the Kansas River. The region is characterized by east-facing ridges and gently rolling plains. The topography consists of nearly level to gently sloping surfaces, and the elevation in the area ranges from 1,070 to 1,080 feet above mean sea level (**Figure 2-2**) (Leidos, 2014). The facility geology and groundwater features are presented on **Figure 2-3**, groundwater elevations and contours are presented on **Figure 2-4**, and surface water features are presented on **Figure 2-5**.

2.2.1 Geology

Topeka AASF #1 is situated in the southeastern part of Shawnee County on the eastern edge of the Great Plains. At the surface, the facility is underlain by glacial drift composed of clays, sand, and silts deposited during the last glacial maximum. Most glacial landforms, such as moraines, have been reworked due to erosion and resulted in the thin layer of glacial drift observed near the facility (Lyle and Layzell, 2020). Additionally, more recent deposits of loess and colluvium are present. These depositional processes have created a thin layer of unconsolidated material at Topeka AASF #1 that range from 5 to 20 feet in thickness. More specifically, the unconsolidated material has been classified into multiple alluvial soil types: Alluvial, Breaks-Alluvial Complex, Labette, Ladysmith, Pawnee, eroded Pawnee, and Sogn-Vinland Complex (Leidos, 2014).

The bedrock geology at Topeka AASF #1 is made up of two major geologic groups of Pennsylvanian age, the Wabaunsee, and Shawnee Group. Formations within both of these Groups were deposited during marine and non-marine environments, resulting in the alternating stratigraphic sequences of sandy shales, sandstones, marine shales, and limestone hundreds of feet in thickness (Johnson Jr. and Wagner, 1967). There is no evidence in literature indicating significant regional fracturing, but locally, certain limestone units have been described as vertically jointed (Leidos, 2014).

2.2.2 Hydrogeology

Groundwater is present in two aquifers underlying Topeka AASF #1. A shallow, unconfined aquifer exists within the unconsolidated material and a confined aquifer exists within the Nodaway Coal Bed (within the Howard Limestone Formation of the Wabaunsee Group) (Johnson Jr. and Wagner, 1967).

The unconfined aquifer is found within the unconsolidated soil and weathered bedrock. Usually, the water-bearing portion of the unconsolidated aquifer is found within the weathered bedrock. Depth to water is relatively shallow, approximately 10 feet below ground surface (bgs), but can occur anywhere from 2 to 24 feet bgs. Groundwater flow in this aquifer is generally to the northwest; however, flow is limited at the Topeka AASF #1 because of a lack of hydraulic connectivity. Recharge occurs from precipitation in areas free of asphalt and concrete at the surface and from vertical discharge from the confined aquifer of the Nodaway Coal Bed. The unconfined aquifer discharges to an unnamed tributary of the South Branch of Shunganunga Creek and, ultimately, to the Kansas River.

The confined aquifer, within the Nodaway Coal Bed, is located in the upper 50 feet of bedrock. The Nodaway Coal Bed runs at a slightly different angle than surrounding bedrock. As a result, the aquifer is confined by impermeable surrounding bedrock and discharges water upward to the unconfined aquifer through vertical fractures and joints (Leidos, 2014).

There are two abandoned monitoring wells located within the boundary of the Topeka AASF #1 and approximately 13 domestic wells that exist within 3 miles of the facility (**Figure 2-3**). These wells are side gradient of Topeka AASF #1 and are not likely to be impacted by potential PFAS releases. There are geothermal wells in addition to US Geological Survey wells, and they exist in the area surrounding Topeka AASF #1; however, they are not drinking water wells. Drinking water for Topeka AASF #1 is supplied by the City of Topeka, which obtains water from the Kansas River as its drinking water source (City of Topeka, 2018). Observed groundwater elevations from the December 2020 synoptic gauging event and corresponding contours are displayed on **Figure 2-4**.

2.2.3 Hydrology

Topeka AASF #1 is between two creeks, Lynn Creek and the south branch of Shunganunga Creek, where there is a drainage divide that runs along the main runway (**Figure 2-5**). Lynn Creek drains southeast to the Wakarusa River, while Shunganunga Creek drains into the Kansas River to the north. At the facility, surface runoff is primarily in the form of sheet flow but discharges into the Wakarusa River via direct discharge or through the storm sewer (Leidos, 2014).

2.2.4 Climate

The climate in Topeka is defined as humid continental and is characterized by highly variable seasonal temperatures governed by strong frontal air masses. The winter temperature low is 16.3 degrees Fahrenheit (ºF) and, in summer, the temperature reaches 89.2 ºF. The average annual precipitation is 35.2 inches and is more prevalent in the warmer months, when thunderstorms commonly produce tornadoes (World Climate, 2020).

2.2.5 Current and Future Land Use

The facility is a controlled access facility with public roads and is adjacent to the Topeka Regional Airport. The facility consists of a split-level administrative office building and three hangars used for maintenance repair and storage, with partial second floor office areas in two of the hangars. The Topeka Regional Airport is owned and operated by the Metropolitan Topeka Airport Authority and provides private, commercial, and military air service. Future infrastructure improvements, land acquisitions, and land use controls are not anticipated to change.

2.2.6 Critical Habitat and Threatened/ Endangered Species

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

- **Birds**: Sprague’s pipit, *Anthus spragueii* (resolved taxon); Least tern, *Sterna antillarum* (recovery)

- **Fishes**: Topeka shiner, *Notropis topeka (=tristis)* (endangered)
- **Mammals**: Northern Long-Eared Bat, *Myotis septentrionalis* (threatened)

2.3 History of PFAS Use

Since 1992, the facility housed six TriMax-30™ fire extinguishers that were placed on the ramp area. In 2008, the TriMax-30™ fire extinguishers were removed from the facility, and five Ansul Alcohol-Resistant aqueous film forming foam (AFFF) fire extinguishers (Ansul AR-33-D) with a 15 percent (%) AFFF solution concentration were placed on the ramp area. In 2014, there was a one-time release of AFFF, when four Ansul AFFF fire extinguishers were emptied on gravel behind building 682 (**Figure 3-1**). The estimated total amount emptied onto the gravel area was 132 gallons of 15% AFFF solution; no bulk AFFF solution has been stored on the facility. The TriMax-30™ and Ansul fire extinguishers were tested annually by a contractor, and any release was containerized then removed by the contractor. Since 2014, the facility has housed six Purple K fire extinguishers that are placed on the ramp area.

2.4 Other PFAS Investigations

This SI is the first PFAS investigation completed at the Topeka AASF #1.

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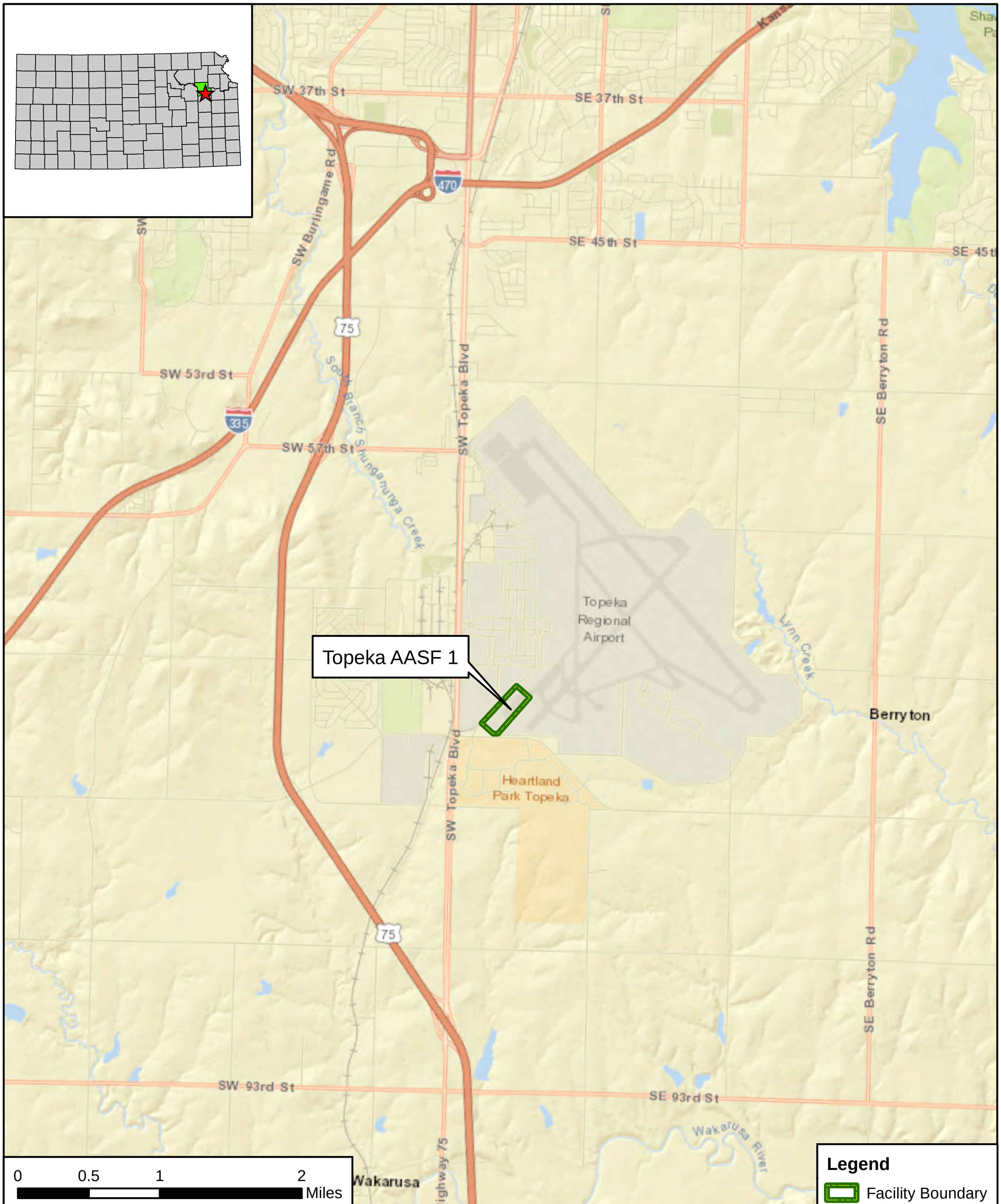

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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	2/19/2021	

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Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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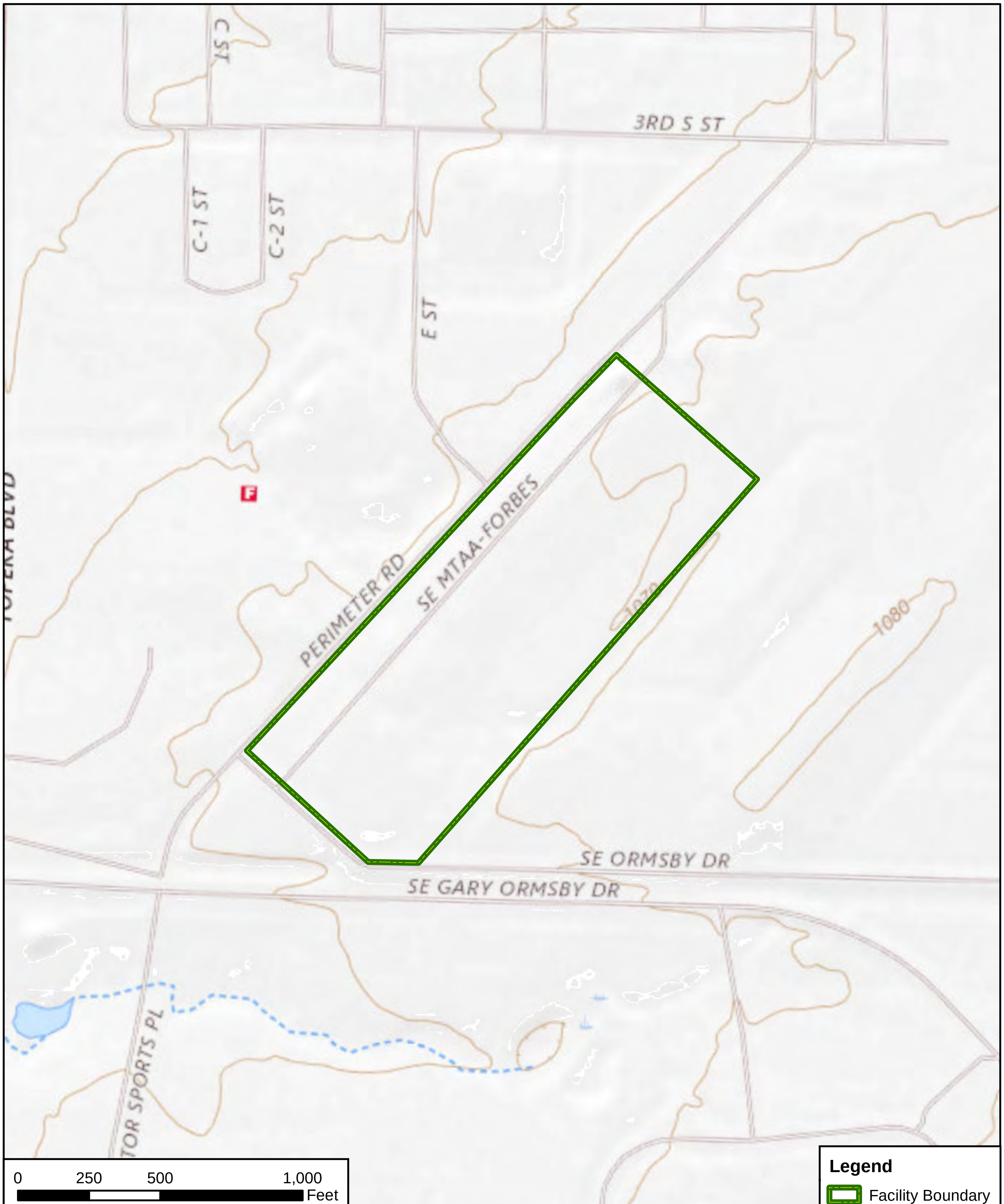

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SCALE	1:6,000	CHK BY	SI	2/19/2021
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	2/19/2021

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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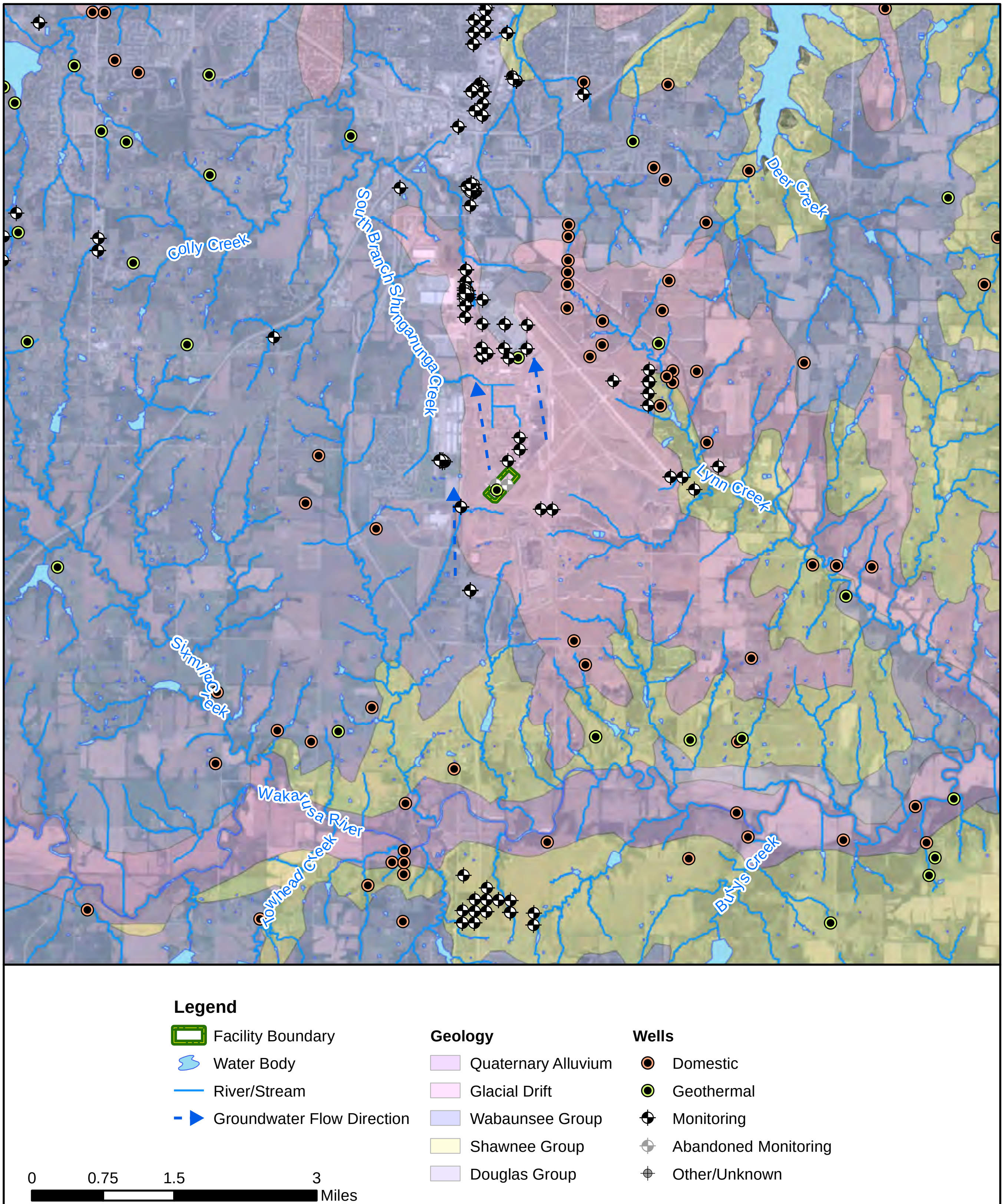

CLIENT	ARNG				**Groundwater Features**
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SCALE	1:95,040	CHK BY	SI	4/23/2021	
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	4/23/2021	

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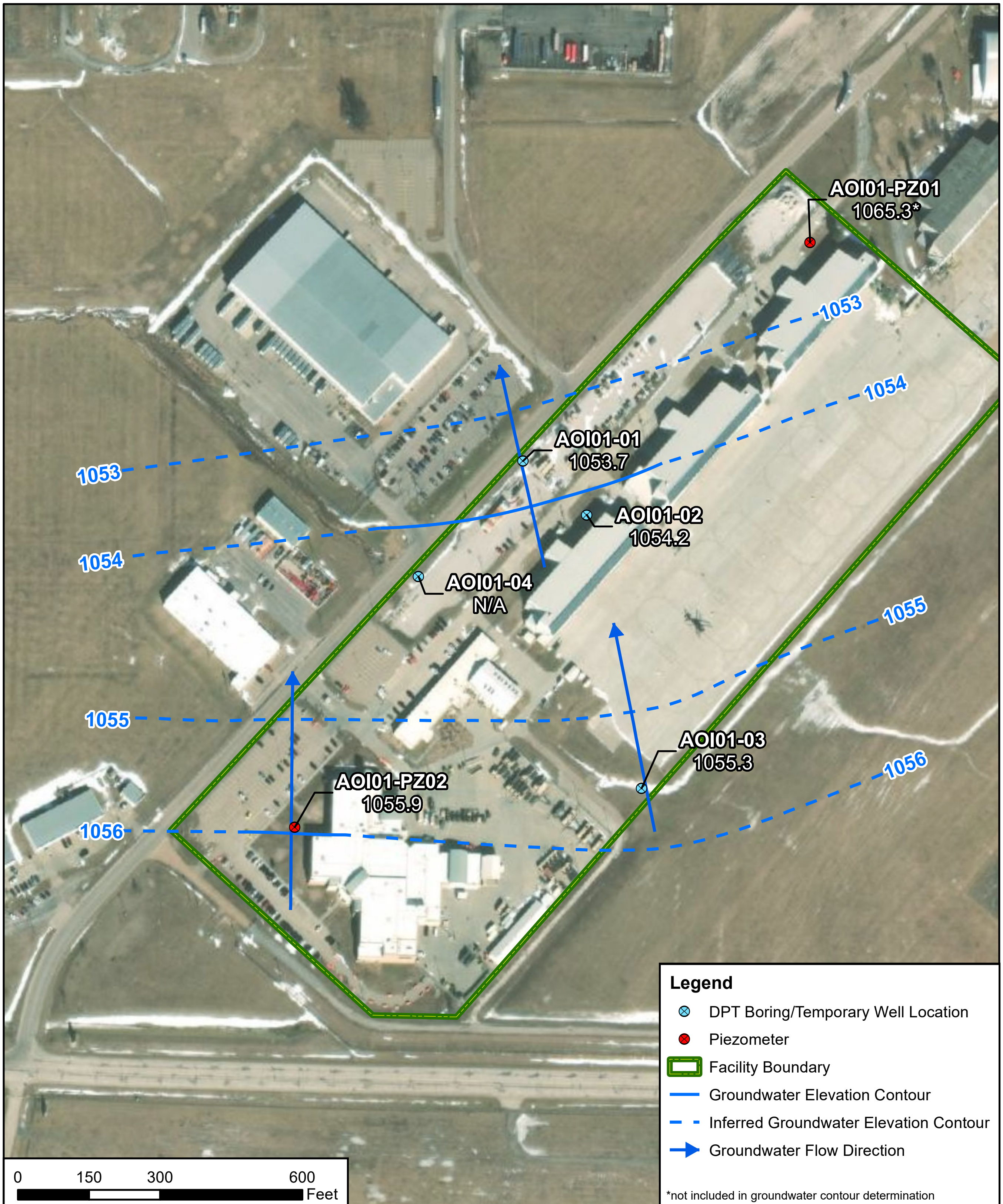

CLIENT	ARNG			
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Groundwater Elevation Contours

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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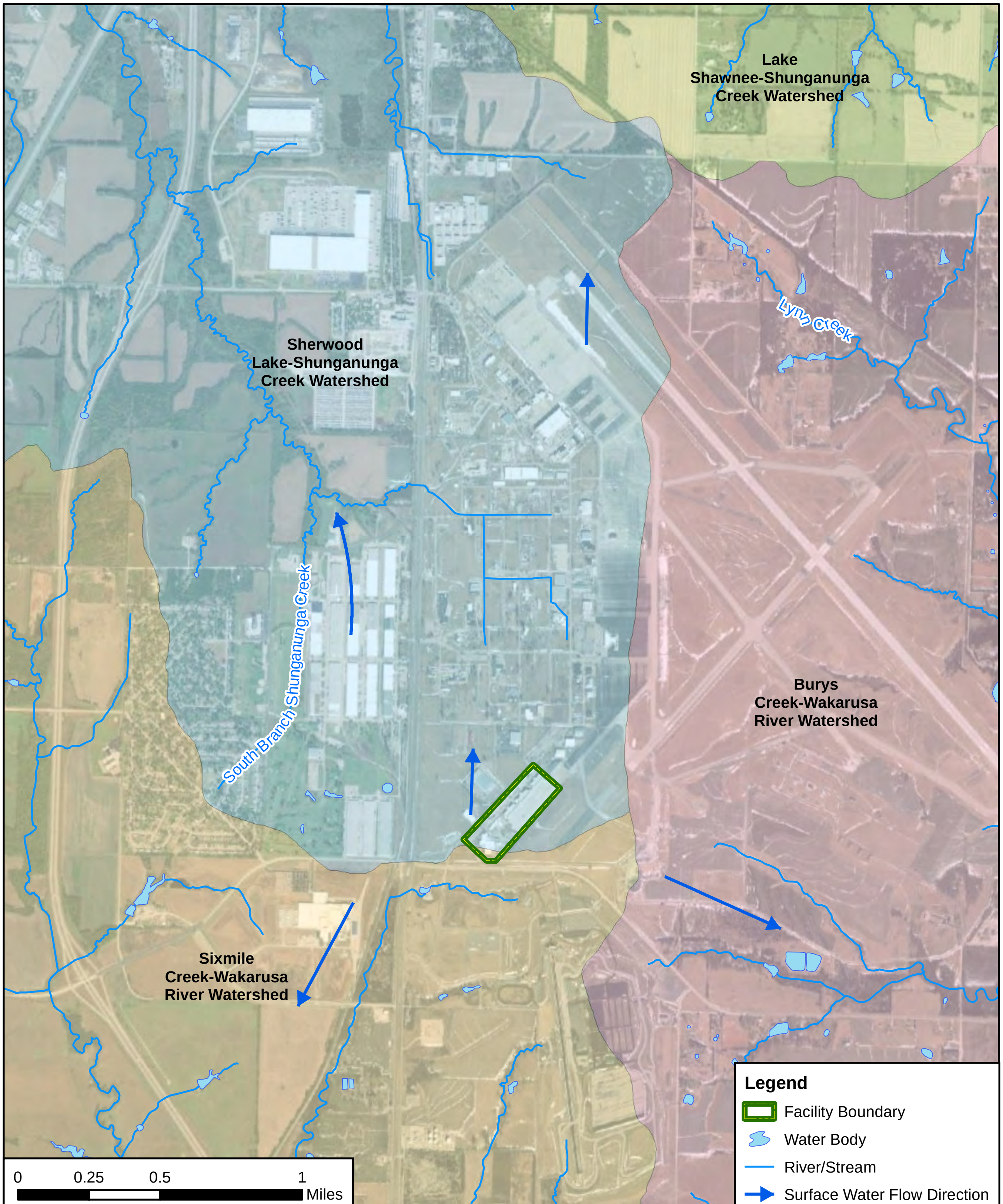

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Surface Water Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, one AOI was identified at the Topeka AASF #1, the AFFF Fire Extinguisher Release (**Figure 3-1**).

3.1 AOI 1 AFFF Fire Extinguisher Release

Since 1992, the facility housed six TriMax-30™ fire extinguishers that were placed on the ramp area. In 2008, the TriMax-30™ TM fire extinguishers were removed from the facility, and five Ansul Alcohol-Resistant AFFF fire extinguishers (Ansul AR-33-D) with a 15% AFFF solution concentration were placed on the ramp area. In 2014, there was a one-time release of AFFF, when four Ansul AFFF fire extinguishers were emptied on gravel behind building 682 (**Figure 3-1**). The estimated total amount emptied onto the gravel area was 132 gallons of 15% AFFF solution. One of the Ansul AFFF fire extinguishers was containerized in a 55-drums, and ultimately disposed of through the Defense Logistics Agency contract in August 2019. No bulk AFFF solution has been stored on the facility. The TriMax-30™ and Ansul fire extinguishers were tested annually by a contractor, and any release was containerized then removed by the contractor. Since 2014, the facility has housed six Purple K fire extinguishers that are currently placed on the ramp area.

There are two stormwater drains in the proximity of the release area. The closest stormwater drain is approximately 65 feet to the north, and the second is approximately 140 feet to the south. Both of the stormwater drains are elevated above the gravel release area; therefore, it is unlikely the release impacted the stormwater system. The two stormwater drains lead to two outfalls on the west boundary of the facility and ultimately discharge north to the South Branch Shunganunga Creek.

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CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Topeka AASF 1, KS			
REVISED	8/30/2021	GIS BY	MS	8/30/2021
SCALE	1:7,200	CHK BY	SI	8/30/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	8/30/2021

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 following problem statement was developed during project planning:

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

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 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 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 following goals were established for this SI:

1. Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.
2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.

3. Determine the potential need for a removal action.
4. Collect data to better characterize the release areas for more effective and rapid initiation of a 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 potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.

4.3 Information Inputs:

Primary information inputs included:

- The PA for the Topeka AASF #1, Kansas (AECOM, 2019);
- Analytical data from soil and groundwater 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.

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s).

4.5 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the DoD Environmental Laboratory Accreditation Program (DoD 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 identify actions based on the following:

Groundwater:

- Is there a human receptor within 4 miles of the facility?
- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?
- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the conceptual site model (CSM) suggest in terms of source, pathway and receptor?

Soil:

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

Soil and groundwater samples were collected from the potential release area in AOI 1. Groundwater was encountered at approximately 4 to 12 feet bgs.

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 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. Several field samples displayed EIS area counts greater than the upper quality control (QC) limit of 150%. The positive field sample results associated with EIS area counts greater than the upper QC limit were qualified “J-“.The qualified field sample results were 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 demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The

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

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, with one exception. The field duplicate pair displayed an RPD greater than the QC limit of 50% at 74.3% for total organic carbon (TOC). The field duplicate pair were both positive and were qualified “J”, the qualified sample 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, with two exceptions. Two LCS/LCSDs performed displayed a percent recovery greater than the upper QC limit for PFOS. The associated field sample results were positive and were qualified “J+”. The qualified field sample results should be considered usable as estimated values with a positive bias.

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. The MS/MSD samples were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2020b).

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. One calibration verification recovered higher than the upper QC limit for N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) and 8:2 fluorotelomer sulfonate (8:2 FTS). The associated field sample results were non-detect and were qualified “UJ”. The qualified field sample results should be considered usable as estimated values. One calibration verification performed also recovered higher than the QC limit; however, there were no associated target analytes in this batch. Therefore, no impact on data quality is anticipated and the associated results should be considered usable as reported.

4.6.3 Representativeness

Representativeness qualitatively expresses the degree to which data accurately reflect facility 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. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2020b) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. Several PFAS method blanks displayed concentrations for target analytes greater than the detection limit. The positive field sample results that were less than five times the concentrations detected in the method blanks were qualified "U" and the associated numerical results were elevated to be equal to the detection limit; the limit of detection (LOD) was elevated to the concentration of the blank detection in instances where the blank concentration was greater than the LOD. The results are usable as qualified but should be considered false positives and treated as non-detect.

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, with few exceptions. Field blanks TP-equipment rinsate blank (ERB)-01 and TP-field regeant blank (FRB)-01 displayed concentrations greater than the detection limit for several target analytes. The associated field sample results were either non-detect or the concentration exceeded five times that displayed in the blank samples and required no data qualifying action. The associated field sample results should be considered usable as reported.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The drill rig decontamination samples, TK-DECON-01 and TP-DECON-02, displayed detections for several target analytes. The associated field sample results were either non-detect or the concentration exceeded five times that displayed in the blank samples and required no data qualifying action. The associated field sample results should be considered usable as reported. Based on the sample results, the potable water source was deemed acceptable for use during the investigation for decontamination of drilling equipment and during well installation.

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 several exceptions. When field samples were analyzed outside of holding time due to a method blank contamination, the positive associated field sample results qualified "J", while non-detects were qualified "UJ". Both sets of data were reported by the laboratory. The data reviewer recommends the re-analyzed results for use due to the fact that the associated method blank was within QC limits for the reanalysis. The holding time for pH analysis is "immediate", all field samples analyzed for pH were qualified "J". The qualified field sample results 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.

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/UX" flagged data, although the project team has retained these results in the data set:

- PFAS in groundwater by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%.
- PFAS in soil by LC/MS/MS compliant with QSM 5.1 Table B-15 at 100%.
- pH in soil by USEPA Method 9045D at 100%.
- TOC by USEPA Method 9060 at 100%.

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 SI QAPP Addendum (AECOM, 2020b). 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 SI QAPP Addendum (AECOM, 2020b), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the DL were reported and qualified "J" as estimated values by the laboratory.

5. Site Inspection Activities

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

- *Final Preliminary Assessment Report, Topeka AASF, Kansas dated January 2019* (AECOM, 2019);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan dated March 2018* (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Topeka AASF #1, Kansas dated November 2020* (AECOM, 2020b);
- *Final Programmatic Accident Prevention Plan dated July 2018* (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Topeka AASF #1, Kansas dated November 2020* (AECOM, 2020a).

The SI field activities were conducted from 2 to 3 December 2020 and consisted of direct push boring and soil sample collection, temporary monitoring well installation, and grab groundwater sample collection. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2020b), except as noted in **Section 5.8**.

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:

- Thirteen (13) soil grab samples from four (4) boring locations;
- Three (3) groundwater grab samples from four (4) temporary well locations;
- Ten (10) Quality Assurance (QA) samples collected; and
- Two (2) piezometer locations for water level measurements.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2** and a Field Change Request Form is 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, Engineering Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including quantitative and qualitative DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 1 October 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 G9, Kansas ARNG (KSARNG), USACE, Kansas Department of Health and Environment (KDHE), 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 Baker Utility Partners, LLC., with input from the AECOM field team on 1 December 2020. AECOM's drilling subcontractor, Dakota Technologies, LLC, contacted "Kansas811" one-call utility clearance contractor to notify them of intrusive work. General locating services and ground-penetrating radar (GPR) were used to complete the clearance. Additionally, the first 5 feet of each boring were advanced using hand augering methods to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be PFAS-free prior to the start of field activities. A sample of the City of Topeka Municipal Water Supply was collected from a spigot at the facility on 2 December 2020 and analyzed for PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15. The results of the potable well sample are provided in **Appendix F**. A discussion of the results is presented in **Section 4.6.3**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 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 SI QAPP Addendum (AECOM, 2020b). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth.

Three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring. 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 depths are provided **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and SI QAPP Addendum review.

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

Clay layers exceeding 3 feet in thickness were encountered in two of the four boreholes, AOI01-02 and AOI01-03. The clay layer observed at AOI01-02 measured a thickness of 10.2 feet beginning at 5.0 feet bgs, and the layer at AOI01-03 measured 9.5 feet thick beginning at 2.3 feet bgs. Thinner clay layers were observed at AOI01-01 as beds up to 2.5 feet thick. The clay layers at all three of these boreholes were overlain by lean clay with sand, beginning at depths ranging from 0.2 to 0.3 feet bgs. At the fourth borehole, AOI01-04, drillers encountered a 7.7-foot thick clay-rich layer containing minor amounts of sand at 2.4 feet bgs. A grain size analysis sample collected at AOI01-04 at a depth of 8 to 10 feet had 70.58% silt, 26.60% clay, and 2.82% sand. Bedrock was encountered during drilling at all boreholes except AOI01-04, with refusal depths ranging from 9.2 to 16 feet bgs.

The clay intervals are described as dark gray to brownish gray to dark grayish brown, stiff, with medium to high plasticity, and containing trace amounts of fine-to-medium-grained sand disseminated throughout the clay interval or concentrated in thin laminations within the lower portions of the observed clay intervals. Beds of well-graded sand with minor gravel components and/or clay clasts typically overlie the clay intervals, which fits with the model of channel abandonment that was overridden by later high-energy flow conditions, as the braided channel network migrated and aggraded within its channel belt.

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 SI 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, ERBs were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4 degrees Celsius (°C) during shipment.

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

5.3 Temporary Well Installation and Groundwater Grab Sampling

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

At the temporary well location within AOI01-04, refusal was encountered prior to ground water. Due to the high clay content in the soil, there was difficulty advancing the soil boring via DPT, therefore an off-set location would likely result in the same result and was not advised by the AECOM geologist.

The temporary wells were allowed to recharge for a minimum of 24 hours after installation before collection of groundwater samples. After the recharge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for PFAS by LC/MS/MS Compliant with QSM 5.1 Table B-15 in accordance with the SI 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 FRB was collected in accordance with the Programmatic UFP-QAPP (PQAPP) (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 4°C during shipment.

Temporary wells and piezometers were abandoned in accordance with the SI QAPP Addendum (AECOM, 2020b) by removing the PVC and backfilling the hole with bentonite chips. Temporary wells were installed in grass areas to avoid disturbing concrete or asphalt.

5.4 Water Level Measurements

Groundwater level measurements were taken prior to sampling. Groundwater elevation measurements were collected from each of the installed temporary wells. Additionally, two boring locations, AOI01-PZ01 and AOI01-PZ02, were converted to piezometers to determine the water level and establish groundwater direction. After reviewing the field data, the AECOM team determined that the water level measurement from AOI01-PZ01 likely reflected a perched water-bearing unit which was not in direct hydraulic connection with the other borings/temporary wells installed across the facility. As a result, AOI01-PZ01 was excluded from the groundwater contours. See **Section 5.8** for further details. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

Each well casing was surveyed by Kansas-Licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2020b). Survey data from the newly installed temporary wells on the facility were collected on 3 December 2020 in the Universal Transverse Mercator Zone 16 North projection with World Geodetic System 84 datum. The surveyed well data are provided in **Appendix B4**.

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 SI QAPP Addendum (AECOM, 2020b) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) and liquid IDW (purge and decontamination water) generated during the SI activities were containerized in one, 55-gallon drums for soil IDW and one, 55-gallon drum of liquid IDW and were stored inside the hangar. The soil and liquid IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

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

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

5.8 Deviations from SI QAPP Addendum

Derivations from the SI QAPP Addendum occurred based on field conditions and discussion between AECOM, ARNG, and USACE. Deviations from the SI QAPP Addendum are noted below and are documented in the following appendices:

- Sample location AOI01-04 was relocated approximately 75 feet northeast of the sampling location presented in the Final SI QAPP Addendum (AECOM, 2020b). During the utility locate at AOI01-04, the sewer and water lines were within 5 feet of the sample location. The revised sample location is immediately upgradient of an outfall that leads off the facility and still downgradient of the potential source area. This action was documented in the Field Change Request Form provided in **Appendix B3**.

- During DPT at sample location AOI01-04, refusal was encountered prior to groundwater. Due to the high clay content in the soil, there was difficulty advancing the soil boring via DPT. An off-set location would likely result in the same result of clay/bedrock and was not advised by the AECOM geologist. Groundwater downgradient of the source area was collected at AOI01-03. This action was documented in the Daily Log of Field Activities provided in **Appendix B1**.
- Two boring locations, AOI01-PZ01 and AOI01-PZ02, were converted to piezometers to determine the water level and establish groundwater direction. The water level for location AOI01-PZ01, which is on the northern side of the facility, was likely obtained from a perched water-bearing unit and was excluded from the groundwater contours. Typically, soil immediately below the depth at which water was encountered is wet. At location AOI01-PZ01, the soil below the groundwater was not wet, and consisted mostly of clays, which can allow for water to perch above the water table. As a result, the groundwater measurement was excluded in the groundwater contour map in **Figure 2-4**.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Topeka AASF #1

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	12/2/2020	0-2	x				
AOI01-01-SB-0-2-MS	12/2/2020	0-2	x				Matrix Spike
AOI01-01-SB-0-2-MSD	12/2/2020	0-2	x				Matrix Spike Duplicate
AOI01-01-SB-4-6	12/2/2020	4-6	x				
AOI01-01-SB-6-8	12/2/2020	6-8		x	x		
AOI01-01-SB-6-8-MS	12/2/2020	6-8		x	x		Matrix Spike
AOI01-01-SB-6-8-MSD	12/2/2020	6-8		x	x		Matrix Spike Duplicate
AOI01-01-SB-6-8-FD	12/2/2020	6-8		x	x		Field Duplicate
AOI01-01-SB-8-9.5	12/2/2020	8-9.5	x				
AOI01-02-SB-0-2	12/2/2020	0-2	x				
AOI01-02-SB-6-8	12/2/2020	6-8	x				
AOI01-02-SB-14-16	12/2/2020	14-16	x				
AOI01-DUP-01	12/2/2020	14-16	x				Field Duplicate
AOI01-03-SB-0-2	12/2/2020	0-2	x				
AOI01-03-SB-6-8	12/2/2020	6-8	x				
AOI01-03-SB-10-12	12/2/2020	10-12	x				
AOI01-04-SB-0-2	12/2/2020	0-2	x				
AOI01-04-SB-4-6	12/2/2020	4-6	x				
AOI01-DUP-02	12/2/2020	4-6	x				Field Duplicate
AOI01-04-SB-8-10	12/2/2020	8-10	x			x	
Groundwater Samples							
AOI01-01-GW	12/3/2020	4.2-9.2	x				
AOI01-02-GW	12/3/2020	10-15	x				
AOI01-03-GW	12/3/2020	6.8-11.8	x				
Blank Samples							
TP-Decon-02	12/2/2020	NA	x				Decontamination Water Blank
TP-ERB-01	12/2/2020	NA	x				Equipment Rinsate Blank
TP-FRB-01	12/2/2020	NA	x				Field Reagent Blank

Notes:
AASF = Army Aviation Support Facility
AOI = Area of Interest
ASTM = American Society for Testing Materials
bgs = below ground surface
Decon = decontamination water blank
DUP = field duplicate
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
GW = groundwater
LC/MS/MS = liquid chromatography tandem mass spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
pH = potential for hydrogen
QSM = Quality Systems Manual
SB = soil boring
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals
Site Inspection Report, Topeka AASF #1

Area of Interest	Soil Boring ID	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)	Groundwater Elevation (ft amsl)
AOI 1	AOI01-01	9.2	4.8-9.2	1053.7
	AOI01-02	16	10-15	1054.2
	AOI01-03	11.8	6.8-11.8	1055.3
	AOI01-04	10	5-10	NA
	AOI01-PZ01	15	10-15	1065.3
	AOI01-PZ02	20	15-20	1055.9

Notes:
AASF = Army Aviation Support Facility
AOI = Area of Interest
bgs = below ground surface
ID = identification

Table 5-3
Groundwater Elevations at Temporary Groundwater Monitoring Wells
Site Inspection Report, Topeka AASF #1

Monitoring Well ID	Ground Surface Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
AOI01-01	1062.039	8.3	1053.7
AOI01-02	1067.521	13.3	1054.2
AOI01-03	1066.067	10.8	1055.3
AOI01-04	1061.647	NA	NA
AOI01-PZ01	1069.241	3.9	1065.3*
AOI01-PZ02	1066.372	10.5	1055.9

Notes:

*excluded from groundwater contour determination. See **Section 5.4** for further information.

AASF = Army Aviation Support Facility

AOI = Area of Interest

amsl = above mean sea level

bgs = below ground surface

ft = feet

ID = identification

NA = not applicable

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CLIENT	ARNG				N
NOTES	Site Inspection for PFAS at Topeka AASF 1, KS				
REVISED	2/19/2021	GIS BY	MS	2/19/2021	
SCALE	1:3,600	CHK BY	SI	2/19/2021	
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	2/19/2021	

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 6.9**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil, or groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 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 facility.

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.

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (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: AFFF Fire Extinguisher Release area. 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 three depth intervals at boring locations AOI01-1, AOI01-02, AOI01-03, and AOI01-04 during the SI: shallow interval (0 to 2 feet bgs), intermediate interval (4 to 8 feet bgs), and deep interval (8 to 16 feet bgs). PFOS, PFOA, and PFBS were detected in soil at concentrations several orders of magnitude lower than the SLs.

PFOS was detected in the shallow soil interval at location AOI01-03 with a concentration of 2.52 J micrograms per kilogram (µg/kg). PFOS was detected at the deep soil interval at locations AOI01-02 and AOI01-04, with concentrations of 0.291 J µg/kg and 0.313 J µg/kg, respectfully; however, PFOS was not detected in the intermediate interval. PFOA was detected in the shallow soil interval at location AOI01-03, with a concentration of 0.542 J µg/kg. PFOA was not detected in the intermediate or deep soil intervals. PFBS was not detected in soil at AOI 1.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater samples were collected from three temporary monitoring well locations at AOI 1 during the SI (AOI01-01-GW, AOI01-02-GW, and AOI01-03-GW). PFOS was detected above the SL of 40 nanograms per liter (ng/L), with concentrations ranging from 89.0 J ng/L to 475 J+ ng/L, and with the maximum concentration occurring at AOI01-02-GW. PFOA was detected below the SL of 40 ng/L at all locations, with concentrations ranging from 14.7 ng/L to 31.1 ng/L, and with the maximum concentration occurring at AOI01-02-GW. PFBS was detected below the SL of 40,000 ng/L at all locations, with concentrations ranging from 6.16 J ng/L to 23.0 ng/L, with the maximum concentration occurring at AOI01-02-GW.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA and PFOS, were detected in soil, and PFOA, PFOS, and PFBS were detected in groundwater at AOI 1. The detected concentrations of PFOA, PFOS, and PFBS in soil were several orders of magnitude lower than the soil SLs. PFOS was detected in groundwater at a concentration exceeding the SL of 40 ng/L at the potential source area. The detected concentrations of PFOA and PFBS in groundwater were below their respective SLs. Based on the exceedances of the SL for PFOS in groundwater, further evaluation at AOI 1 is warranted.

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Topeka Army Aviation Support Facility #1

	Area of Interest	AOI01							
	Sample ID	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-04-SB-0-2	
	Sample Date	12/02/2020		12/02/2020		12/02/2020		12/02/2020	
	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	-	ND		ND		0.213	J	ND	
PFHpA	-	ND		ND		0.442	J	ND	
PFHxA	-	ND		ND		0.590	J	ND	
PFNA	-	ND		ND		0.144	J	ND	
PFOA	130	ND		ND		0.542	J	ND	
PFOS	130	ND	UJ	ND	UJ	2.52	J	ND	UJ
PFPeA	-	ND		ND		0.436	J	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

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

Chemical Abbreviations

PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
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, Topeka Army Aviation Support Facility #1

	Area of Interest	AOI01																			
	Sample ID	AOI01-01-SB-4-6		AOI01-01-SB-8-9.5		AOI01-02-SB-6-8		AOI01-02-SB-14-16		AOI01-03-SB-6-8		AOI01-03-SB-10-12		AOI01-04-SB-4-6		AOI01-DUP-02		AOI01-04-SB-8-10		AOI01-DUP-01	
	Sample Date	12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020		12/02/2020	
	Depth	4 - 6 ft		8 - 9.5 ft		6 - 8 ft		14 - 16 ft		6 - 8 ft		10 - 12 ft		4 - 6 ft		4 - 6 ft		8 - 10 ft		14 - 16 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/Kg)																					
PFOS	1600	ND	UJ	ND	UJ	ND	UJ	0.291	J	ND	UJ	ND	UJ	ND	UJ	ND	UJ	0.313	J	ND	UJ

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

Chemical Abbreviations

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
DL	detection limit
DUP	Duplicate
ft	feet
HQ	Hazard quotient
ID	identification
LCMSMS	Liquid Chromatography Mass Spectrometry
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
SB	Soil boring
USEPA	United States Environmental Protection Agency
µg/Kg	micrograms per Kilogram

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Topeka Army Aviation Support Facility #1

	Area of Interest	AOI01					
	Sample ID	AOI01-01-GW		AOI01-02-GW		AOI01-03-GW	
	Sample Date	12/03/2020		12/03/2020		12/03/2020	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)							
6:2 FTS	-	6.43	J	45.5		313	
8:2 FTS	-	ND		2.94	J	ND	
PFBA	-	26.6		37.2		37.6	
PFBS	40000	12.4		23.0		6.16	J
PFHpA	-	9.42	J	26.4		15.9	
PFHxA	-	41.3		98.8		37.4	
PFHxS	-	89.8		325		54.2	
PFNA	-	ND		ND		2.86	J
PFOA	40	14.7		31.1		15.9	
PFOS	40	89.0	J	475	J+	109	J+
PFPeA	-	25.6		68.8		34.4	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

J+ = Estimated concentration, biased high

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
GW	Groundwater
HQ	Hazard quotient
ID	identification
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 Topeka AASF 1, KS				
REVISED 4/23/2021	GIS BY	MS	4/23/2021	
SCALE 1:4,560	CHK BY	SI	4/23/2021	
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	PM	CM	4/23/2021	

Legend

Facility Boundary

0 190 380 760 Feet

N

PFOS Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-1

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Topeka AASF 1, KS			
REVISED	4/23/2021	GIS BY	MS	4/23/2021
SCALE	1:4,560	CHK BY	SI	4/23/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	4/23/2021

Legend

Facility Boundary

0 190 380 760 Feet

N

PFOA Detections in Soil

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-2

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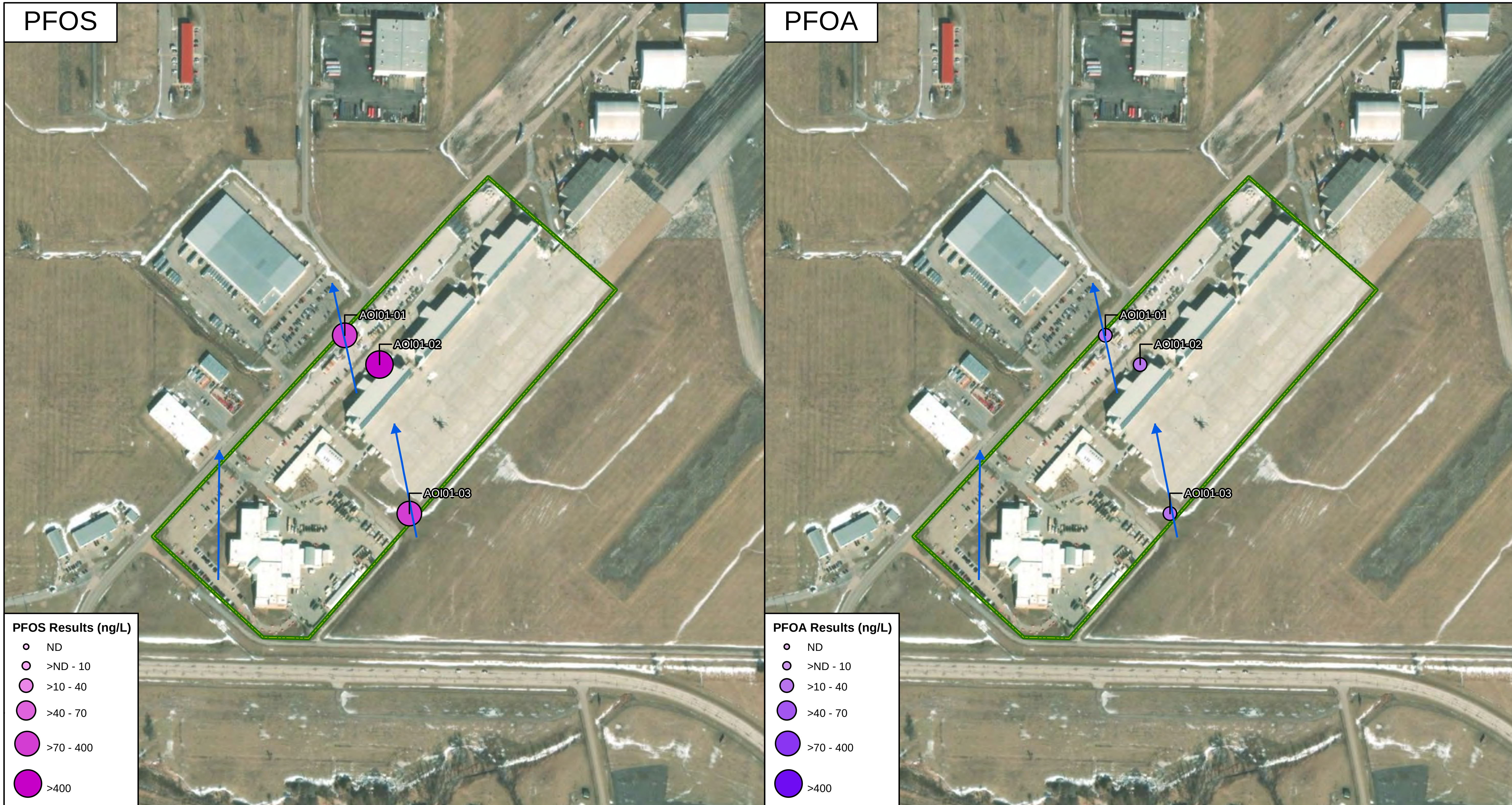

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at Topeka AASF 1, KS			
REVISED	4/23/2021	GIS BY	MS	4/23/2021
SCALE	1:4,560	CHK BY	SI	4/23/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	4/23/2021

Legend

Facility Boundary

Groundwater Flow Direction

0 190 380 760 Feet

N

PFOS and PFOA Detections in Groundwater

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 6-3

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7. Exposure Pathways

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

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

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if PFOA, PFOS, or PFBS are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of PFOA, PFOS, or PFBS above the SLs. Areas with an identified potentially complete pathway may warrant further investigation.

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

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1

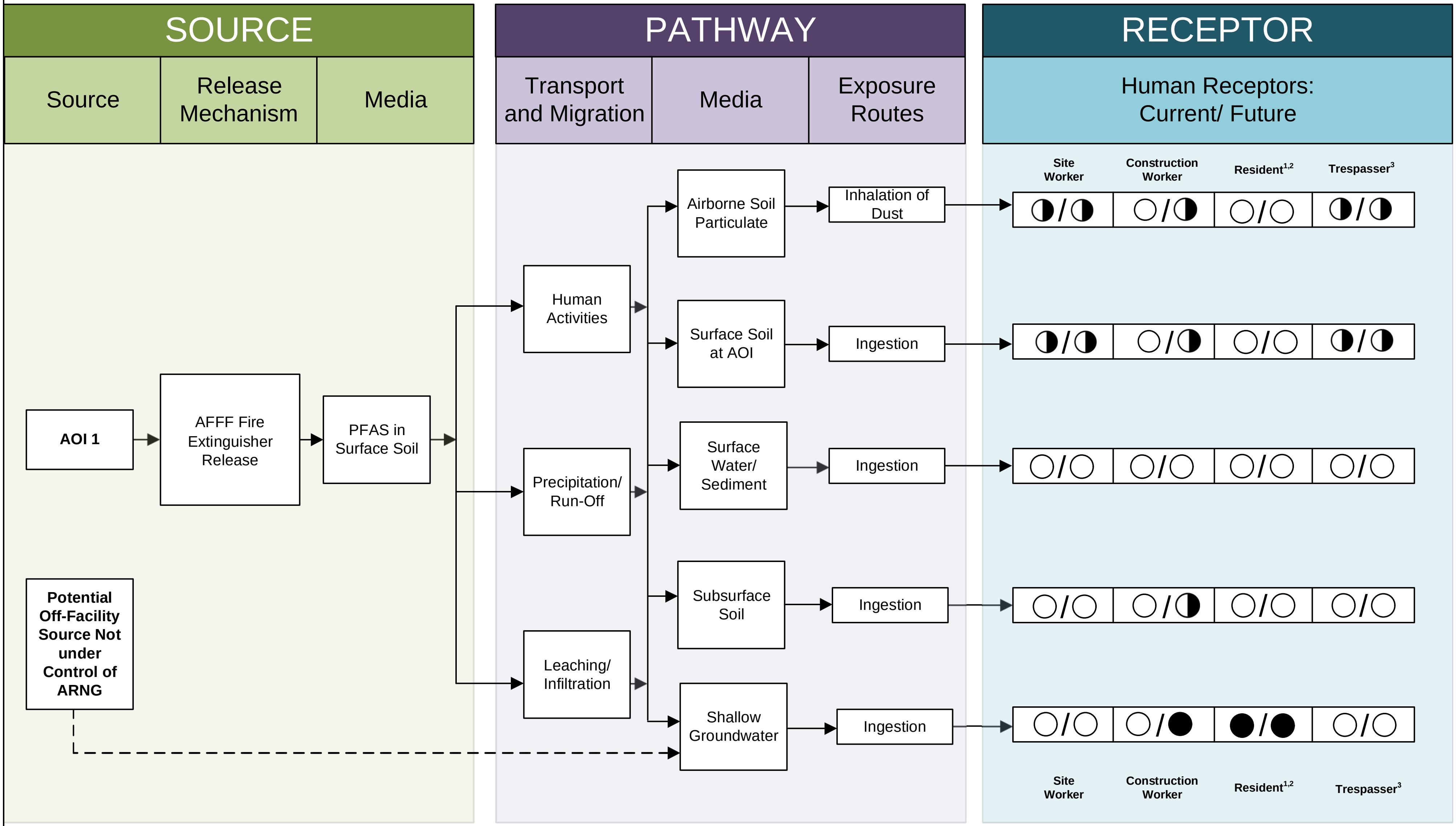
In 2014, there was a one-time release of AFFF, when four AFFF fire extinguishers were emptied on gravel behind building 682. The estimated total amount emptied onto the gravel area was 132 gallons of 15% AFFF solution. PFOS and PFOA, were detected in soil at AOI 1 and confirm the release of PFAS to soil 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, PFOA, and PFBS via inhalation of dust or ingestion of surface soil, and ground-disturbing activities could potentially result in future construction worker exposure to subsurface soil. No current construction is occurring at AOI 1. The CSM is presented on **Figure 7-1**.

7.2 Groundwater Exposure Pathway

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

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from three temporary monitoring wells at AOI 1, confirming the migration of PFAS to groundwater. PFOS exceeded the individual SL at three sample locations. The incidental groundwater exposure pathway is potentially complete for construction workers during trenching activities deep enough to encounter shallow groundwater. The exposure pathway is potentially complete for off-facility residential drinking water receptors. However, based on the KDHE Water Well Program database there are no drinking water wells downgradient (within 4 miles) of the facility boundary. The CSM is presented on **Figure 7-1**.



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 receptor refers to an off-site receptor.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Human consumption of fish potentially affected by PFAS is possible.

Figure 7-1
Conceptual Site Model
AOI 1 AFFF Fire Extinguisher Release

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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 sampling from 2 December to 3 December 2020. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2020b).

Field activities were conducted in accordance with the SI 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 5.7** of this Report.

- Thirteen (13) soil grab samples from four (4) boring locations;
- Three (3) groundwater grab samples from four (4) temporary well locations;
- Ten (10) QA samples collected; and
- Two (2) piezometer locations for water level measurements.

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

8.2 SI Goals Evaluation

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

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

   PFOA and PFOS were detected at the facility in soil. PFOA, PFOS, and PFBS were detected at the facility in groundwater. PFOA, PFOS, and PFBS were detected at the source area, as well as at the facility boundary between source areas and potential drinking water receptors. PFOS in groundwater at AOI 1 exceeded the SL of 40 ng/L. The detected concentrations of PFOA and PFOS in soil samples from all AOIs were below the 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.*

   AOI 1 was the only potential PFAS release area identified during the PA and examined during the SI. PFOS was detected in groundwater above the SL; therefore, these areas may pose a threat to human health and the environment.

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

There is a potentially complete pathway between source and off-facility residential drinking water receptors. Surficial groundwater at the facility is very shallow, with depth to water ranging from 4 to 10 feet bgs. It is unknown if the downgradient wells are screened within the shallow, unconfined aquifer or a deeper water bearing unit. Regardless, based on the KDHE Water Well Program database, there are no drinking water wells downgradient (within 4 miles) of the facility boundary. As a result, there is no immediate need for a removal action.

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 indicates a low permeability and conductive environment with soils dominated by lean clays and thin sand-gravel lenses.

The clay intervals are described as dark gray to brownish gray to dark grayish brown, stiff, with medium to high plasticity, and containing trace amounts of fine- to medium-grained sand disseminated throughout the clay interval or concentrated in thin laminations within the lower portions of the observed clay intervals. Beds of well-graded sand with minor gravel components and/or clay clasts typically overlie the clay intervals, which fits with the model of channel abandonment that was overridden by later high-energy flow conditions, as the braided channel network migrated and aggraded within its channel belt.

Depth to water at the facility ranged from approximately 8.3 to 13.3 feet bgs. Groundwater was not present in all the borings advanced, supporting the fact that within there is limited hydraulic connectivity within the unconsolidated material. Groundwater flow direction in the facility is to the northwest. These geologic and hydrogeologic observations inform development of 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 southeast side of facility boundary suggests an upgradient, off-facility source of PFAS may also be contributing to detected PFAS concentrations in surficial groundwater at the facility. KDHE completed a statewide inventory of facilities that potentially used, stored and/or produced PFAS in Kansas to identify other PFAS sources (Professional Environmental Engineers, Inc., 2019).

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

Detections of PFOA, PFOS, and PFBS in soil at the source area and facility boundary, indicate there is a potentially complete exposure pathway between source and site workers, future construction workers, and trespassers. The PFOS SL exceedances in surficial groundwater indicate there is a potentially complete exposure pathway between source and future construction workers and off-facility residents. However, based on the KDHE Water Well Program database there are no drinking water wells downgradient (within 4 miles) of the facility boundary.

8.3 Outcome

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 resulting from historical DoD activities at the facility. Sample chemical analytical concentrations collected during the SI were compared against the project SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOS in groundwater at AOI 1: AFFF Fire Extinguisher Release area exceeded the SL of 40 ng/L in three of the well locations with concentrations ranging from 89.0 J ng/L to 475 J+ ng/L, with the highest concentration occurring at the source area. The detected concentrations of PFOA and PFBS in groundwater were below their respective SLs. Based on the results of the SI, further evaluation of AOI 1 is warranted in the RI.

- The detected concentrations of PFOA and PFOS in soil samples from all AOIs were below the SLs. PFBS was not detected in soil at AOI 1.

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. However, based on the KDHE Water Well Program database there are no drinking water wells downgradient (within 4 miles) of the facility boundary.

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: AFFF Fire Extinguisher Release area.

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	AFFF Fire Extinguisher Release	◐	●	●

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

○ = not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	AFFF Fire Extinguisher Release	Exceedances of SLs in groundwater at source area. No exceedances of SLs in soil.	Proceed to RI

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