FINAL
Site Inspection Report
Army Aviation Support Facility #1
Lincoln, Nebraska

Site Inspection for Perfluorooctanoic Acid (PFOA), Perfluorooctanesulfonic Acid (PFOS), Perfluorohexanesulfonic Acid (PFHxS), Perfluorononanoic Acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic Acid (PFBS)
ARNG Installations, Nationwide

October 2023

Prepared for

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

UNCLASSIFIED

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
°F	Degrees Fahrenheit
%	Percent
µg/kg	Microgram(s) per kilogram
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	Aqueous film-forming foam
amsl	Above mean sea level
ANG	Air National Guard
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	Below ground surface
btoc	Below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-custody
CSM	Conceptual site model
DA	Department of the Army
DoD	Department of Defense
DPT	Direct-push technology
DQO	Data quality objective
DUA	Data usability assessment
EA	EA Engineering, Science, and Technology, Inc., PBC
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
ft	Foot (feet)
FTA	Fire Training Area
HA	Health Advisory
HDPE	High-density polyethylene
HFPO-DA	Hexafluoropropylene oxide-dimer acid
IDW	Investigation-derived waste
ITRC	Interstate Technology Regulatory Council
K_{oc}	Organic carbon normalized distribution coefficient
LC/MS/MS	Liquid chromatography/tandem mass spectrometry

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

MIL-SPEC	Military Specification
MS	Matrix spike
MSD	Matrix spike duplicate
NEARNG	Nebraska Army National Guard
NELAP	National Environmental Laboratory Accreditation Program
ng/L	Nanogram(s) per liter
No.	Number
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexane sulfonate
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PID	Photoionization detector
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA	Quality assurance
QC	Quality control
QSM	Quality Systems Manual
RI	Remedial investigation
RSL	Regional Screening Level
SI	Site Inspection
SL	Screening level
TOC	Total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

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

The PA identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI description/location). The objective of the SI is to identify whether there has been a release to the environment from the AOI identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for the relevant compounds. This SI was completed at the Lincoln Army Aviation Support Facility (AAFS) #1 in Lincoln, Nebraska, and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1. Lincoln AAFS#1 will be referred to as the "Facility" throughout this document.

The Facility, operated by Nebraska ARNG (NEARNG), is in Lancaster County, Lincoln, Nebraska, just to the north of Oak Creek. At present, Lincoln AASF #1 is comprised of approximately 65.29 acres, and the Facility is constructed on a parcel of land owned by the City of Lincoln. The Facility is accessible from the north via Northwest 24th Street and is adjacent to the Lincoln Municipal Airport and is located directly south of a parcel of land occupied by the Nebraska Air National Guard (NEANG) (AECOM Technical Services, Inc. [AECOM] 2020).

The PA identified one AOI for investigation during the SI phase. SI sampling results from the AOI were compared to OSD SLs for the relevant compounds. **Table ES-2** summarizes the SI results for the AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation (RI) for AOI 1.

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

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

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

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

bgs = Below ground surface
µg/kg = Microgram(s) per kilogram
ng/L = Nanogram(s) per liter

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

AOI	Potential Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary	Future Action
1	West Lawn Former Fire Training Area	●	●	●	Proceed to RI

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

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense 2022). The six components listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide-dimer acid (HFPO-DA)[2] at ARNG facilities nationwide. The ARNG performed this SI at the Lincoln Army Aviation Support Facility (AASF) #1 located in Lincoln, Nebraska. The Lincoln AASF #1 will be referred to as the "Facility" throughout this document.

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

1.2 SITE INSPECTION PURPOSE

A PA was performed at the Lincoln AASF #1 (AECOM Technical Services, Inc. [AECOM] 2020) that identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, or historically released. The objective of the SI is to identify whether there has been a release to the environment from the AOI identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

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

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2. FACILITY BACKGROUND

2.1 FACILITY LOCATION AND DESCRIPTION

The Lincoln AASF #1 is in Lancaster County, Lincoln, Nebraska, just to the north of Oak Creek. At present, Lincoln AASF #1 is comprised of approximately 65.29 acres, and the Facility is constructed on a parcel of land owned by the City of Lincoln; this parcel was leased in 2006 to the State of Nebraska for the use by the NEARNG for an indefinite term. The Facility is accessible from the north via Northwest 24th Street and it is adjacent to the Lincoln Municipal Airport and located directly south of a parcel of land occupied by the Nebraska Air National Guard (NEANG) (**Figure 2-1**). The Facility is a maintenance and repair facility, and it includes a Main Hangar, Cold Storage Building, NEARNG Headquarters building, a parking apron, flight ramp, wash rack, fueling point, and taxiway connecting to the airport runway (AECOM 2020).

2.2 FACILITY ENVIRONMENTAL SETTING

The Lincoln AASF #1 is located in Lancaster County which is in the Great Plains of eastern Nebraska, a province characterized by a variety of landscapes created by a multitude of geological processes. The diversity of the landscape is varied by different subregions created by fluvial, eolian, volcanic, or glacial landforms that lead to the creation of the low relief part of central North America. The Facility resides in a division of the Great Plains region known as the High Plains, which is geographically defined by west to east flowing rivers that cut through Tertiary cover (AECOM 2020).

The following sections include information on geology, hydrogeology, hydrology, climate, and current and future land use. The topography at Lincoln AASF #1 is shown on **Figure 2-2**. The regional geology and groundwater features are shown on **Figure 2-3**. The regional surface water features and drainage basins are shown on **Figure 2-4**. Groundwater elevations and contours are presented on **Figure 2-5**.

2.2.1 Geology

Lincoln AASF #1 lies within the eastern edge of the Great Plains. In the City of Lincoln, the bedrock comes from a Cretaceous-aged sandstone and shale, but in lower primary bedrock, the lower Cretaceous Dakota Group includes Lakota Formation and Fusion Shale. The bedrock in Nebraska stretches from 350 to 400 feet (ft) and has been covered by an unconsolidated sediment from the Quaternary period that is viewed as two lithostratigraphic units. In the upper levels of the unconsolidated soil comes 10 to 22 ft of eolian silt and clay deposits. Lower unconsolidated units have roughly 15 ft of well-sorted fluvial sand and gravel and can be found thickest in the paleostream channels in the underlying Cretaceous bedrock (AECOM 2020).

During the SI, the soil underling the Facility was found to be generally composed of organic silt, sandy silt, clayey silt, fine to coarse sand, and some clayey sand. The borings were completed at depths ranging from 0 to 21 ft below ground surface (bgs). Samples for grain size analyses were collected at one location (AOI01-02) and analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil samples are comprised

primarily of silt and clay (99.5 percent [%]) and sand (0.5%). Boring logs are presented in **Appendix D** and grain size results are presented in **Appendix E**.

2.2.2 Hydrogeology

Two aquifers exist near the Facility, a shallow unconfined aquifer, and a deep confined aquifer. The shallow aquifer has a depth that extends down to 90 ft bgs and consists of unconsolidated sands and clayey soil formed from the Quaternary age. Between the shallow and deep aquifer, there is a thick, silty clay layer. This deep aquifer is the principal aquifer of the region and is found in the Cretaceous Dakota Formation, which is comprised of fine- to coarse-grained sandstone that is poorly consolidated with lenses of shale and Murdock; the deep aquifer begins at a depth of 125–150 ft bgs and can be found nearly 350 ft thick (AECOM 2020).

As indicated in the 2019 EDR™ report (EDR 2019), there are several monitoring/observation wells located on the facility. There are additional commercial/industrial, irrigation, livestock, domestic, other/unknown, and monitoring/observation wells located within a 4-mile radius (**Figure 2-2**). Drinking water for the Facility is supplied by the City of Lincoln Water System, which uses nearby river aquifers as its drinking water sources (AECOM 2020).

Depths to water in December 2021 ranged from approximately 5 to 13 ft bgs during synoptic water level measurements. Total boring completion depths, to accommodate temporary well installation, ranged from 20 to 21 ft bgs. Groundwater elevation contours from the SI are presented on **Figure 2-5** and indicate the groundwater flow direction at Lincoln AASF #1 is primarily to the south based on calculated groundwater elevations (**Figure 2-5**).

2.2.3 Hydrology

Lincoln AASF #1 is located in the Salt Creek drainage area. Stormwater drains to the north into the Old Oak Creek Channel, which eventually discharges to Oak Creek (**Figure 2-3**). The Old Oak Channel was rerouted and is typically empty except during periods of precipitation. Oak Creek flows eastward until it conjoins with the Salt Creek, approximately 3 miles east of the Facility (AECOM 2020). An additional drainage ditch is present in the southern portion of the Facility (i.e., south of AOI 1), which eventually discharges into the Old Oak Creek Channel east of the Facility boundary.

2.2.4 Climate

The climate at the Facility has four defined seasons in which summers are warm and humid, winters are typically dry with light snow, and spring months tend to produce high amounts of thunderstorms and even tornadoes. Temperatures at the Facility vary from average highs of 63.1 degrees Fahrenheit (°F) to average lows of 39.9°F. The average annual temperature is 51.5°F, and the average annual precipitation is 28.94 inches of rain (AECOM 2020).

2.2.5 Current and Future Land Use

The Lincoln AASF #1 is not fenced; it is within a larger fenced area of the controlled access facility that includes the ANG Airbase and Lincoln Municipal Airport. Reasonably anticipated

future land use is not expected to change from the current land use; however, future infrastructure improvements, land acquisitions, and land use controls at the Lincoln Municipal Airport and surrounding areas are unknown (AECOM 2020).

2.2.6 Sensitive Habitat and Threatened/Endangered Species

A wildlife survey has not occurred at the facility, and the facility does not have any significant areas of habitat. The following species have not been identified at the facility but may be present in the surrounding area.

The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Lancaster County, Nebraska (U.S. Fish and Wildlife Service 2022):

- Birds: Piping Plover (*Charadrius melodus*) – Federally Threatened; Whooping Crane (*Grus americana*) – Federally Endangered
- Fishes: Pallid Sturgeon (*Scaphirhynchus albus*) – Federally Endangered
- Flowering Plants: Western Prairie Fringed Orchid (*Platanthera praeclara*) – Federally Threatened
- Insects: Monarch Butterfly (*Danaus plexippus*) – Federal Candidate; Salt Creek Tiger Beetle (*Cicindela nevadica lincolniana*) – Federally Endangered
- Mammal: Northern Long-eared Bat (*Myotis septentrionalis*) – Federally Threatened.

2.3 HISTORY OF PFAS USE

One potential PFAS release area was identified at the Facility during the PA (AECOM 2020). Interviews and records obtained during the PA indicate that fire training exercises occurred on the West Lawn where NEARNG dispensed “foam” sometime in the 1990s during familiarization training; however, whether the foam released was PFAS-containing was unknown at the time of the PA. A description of the AOI is presented in **Section 3**.

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Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

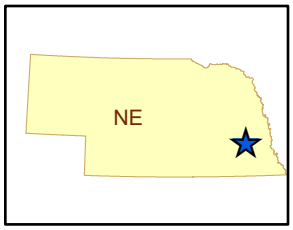
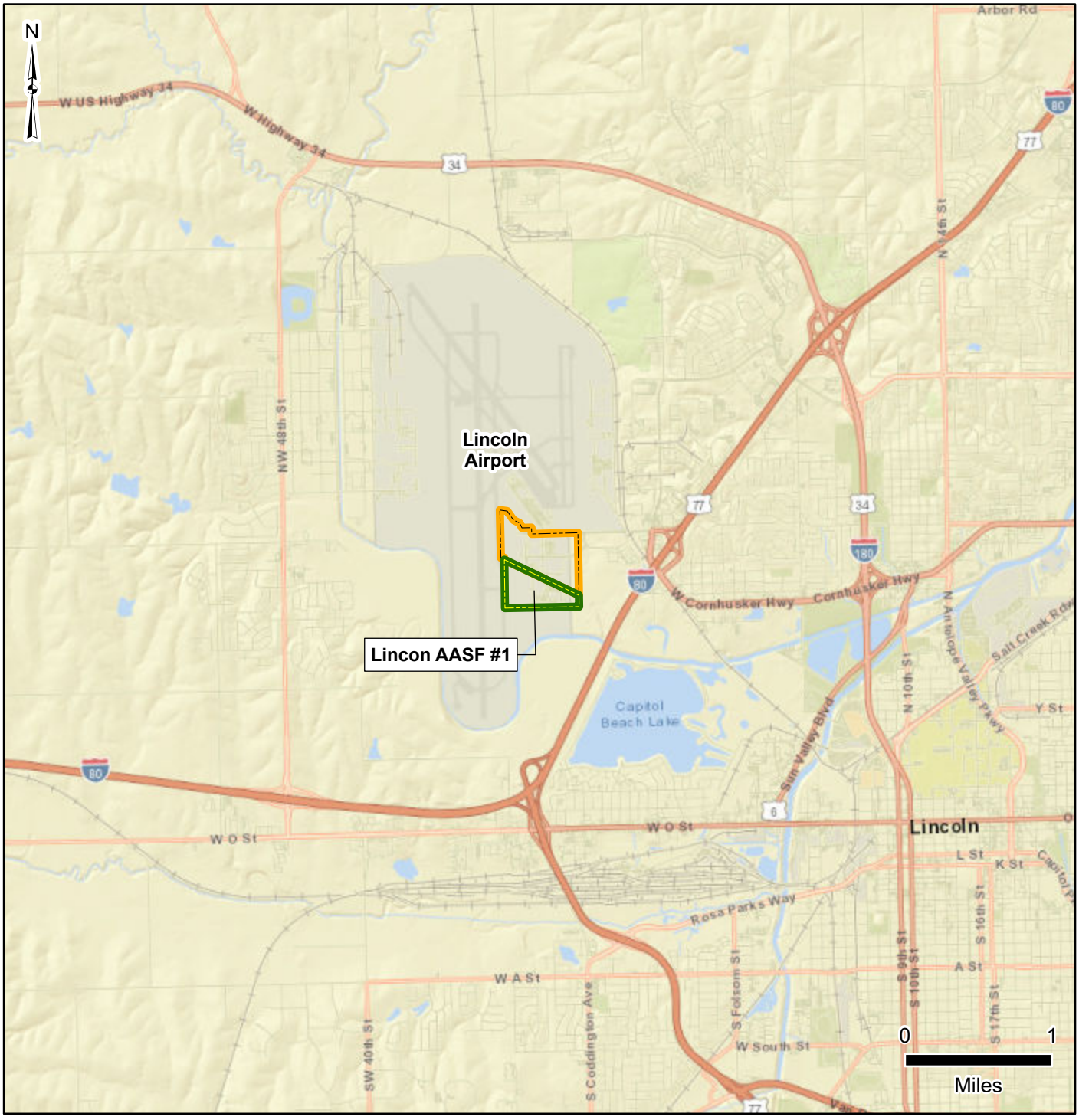


Figure 2-1
Facility Location



Facility Data

- Facility Boundary
- ANG Airbase Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

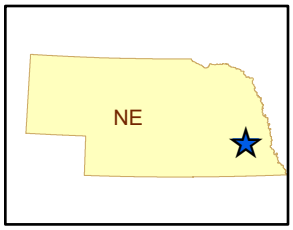
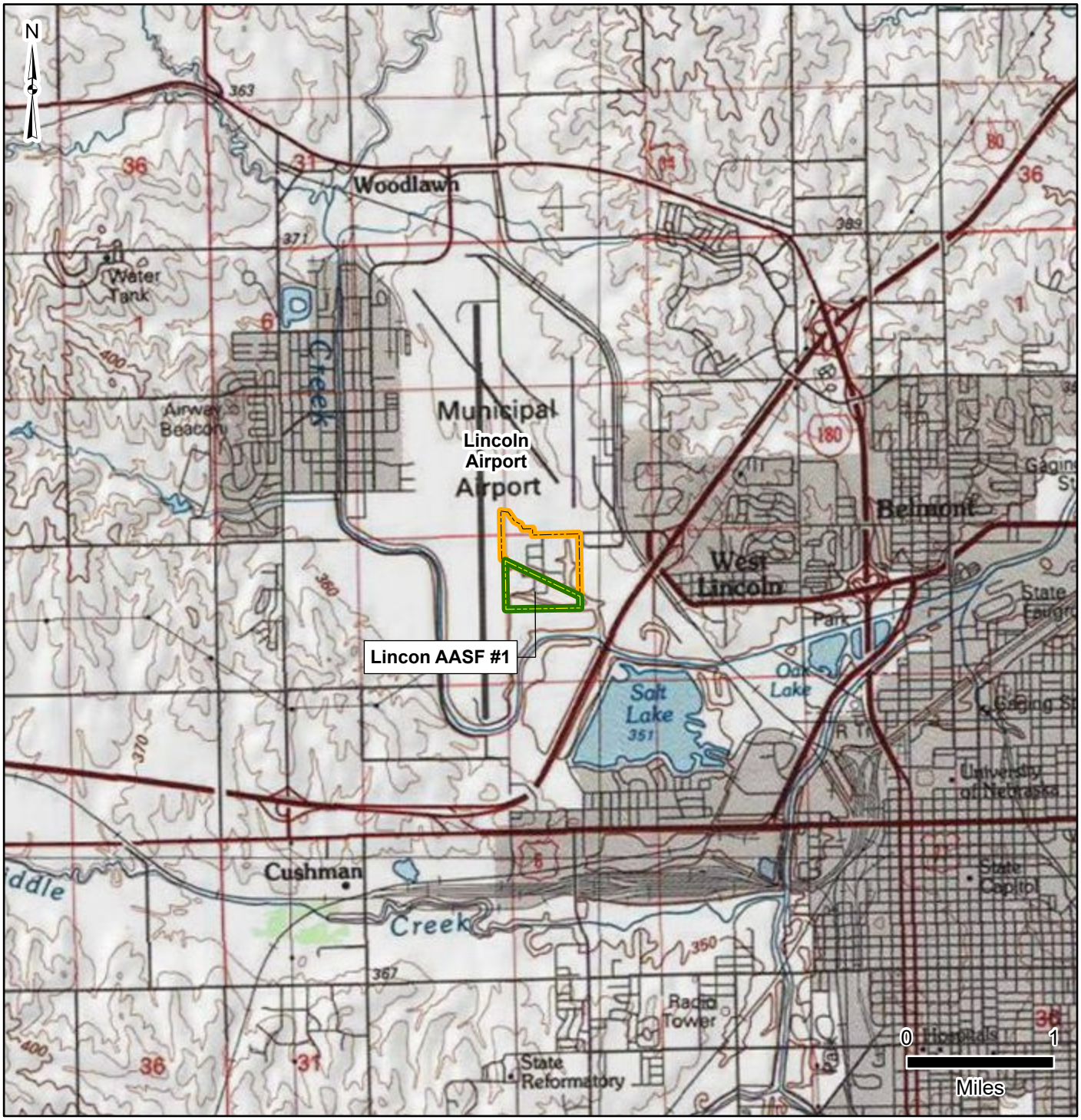


Figure 2-2
Topography



Facility Data

- Facility Boundary
- ANG Airbase Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

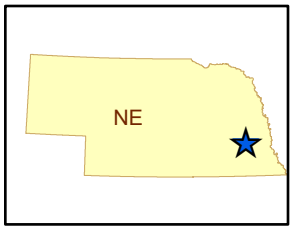
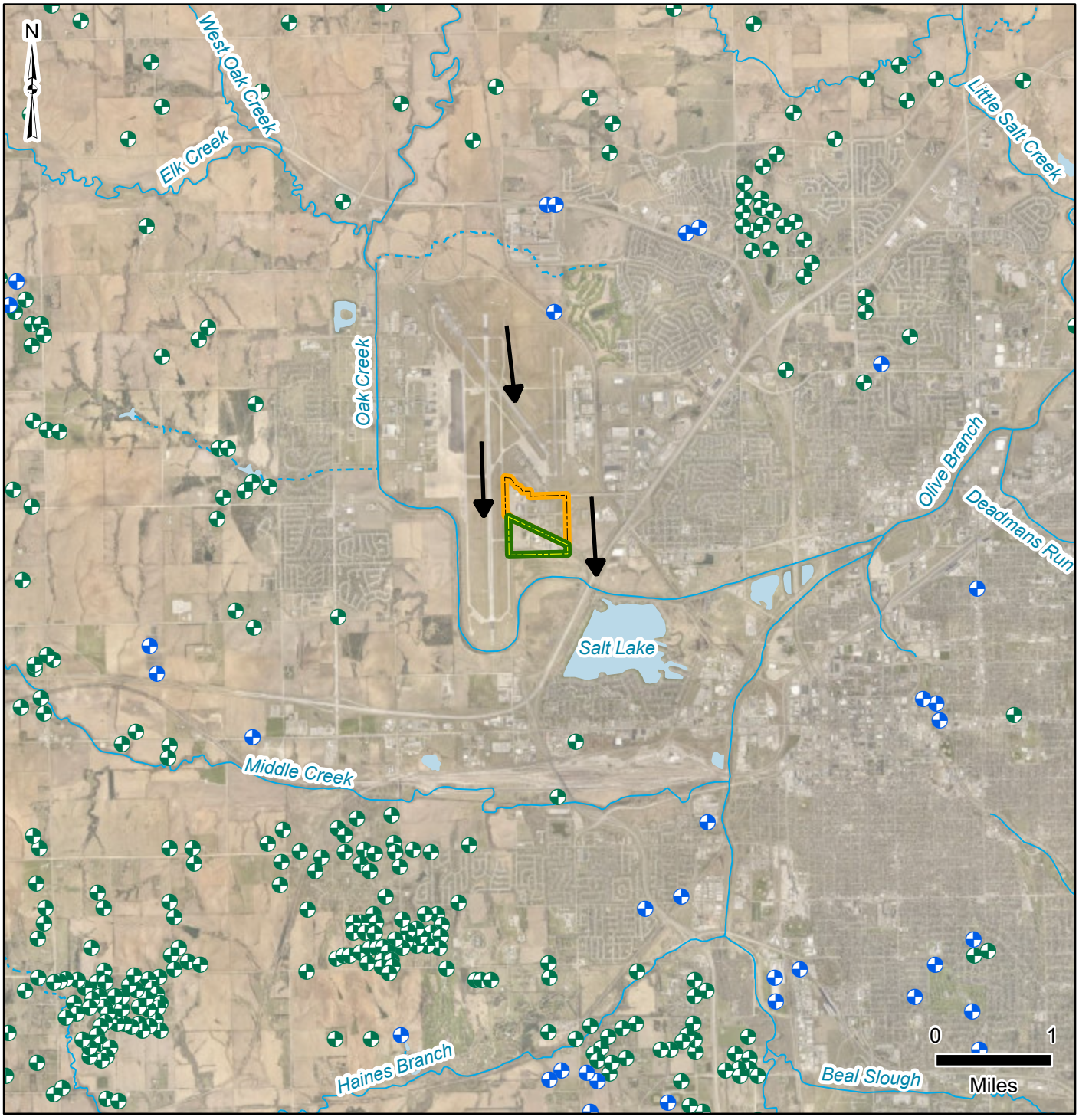


Figure 2-3
Groundwater Features



Facility Data
- Facility Boundary
- ANG Airbase Boundary

Well Type
- Domestic
- Irrigation

Hydrology/Hydrogeology
- Inferred Groundwater Flow Direction
- Intermittent Creek/Stream
- Perennial Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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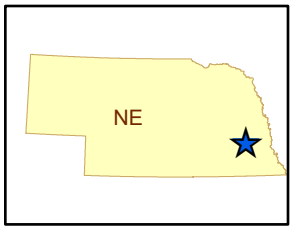
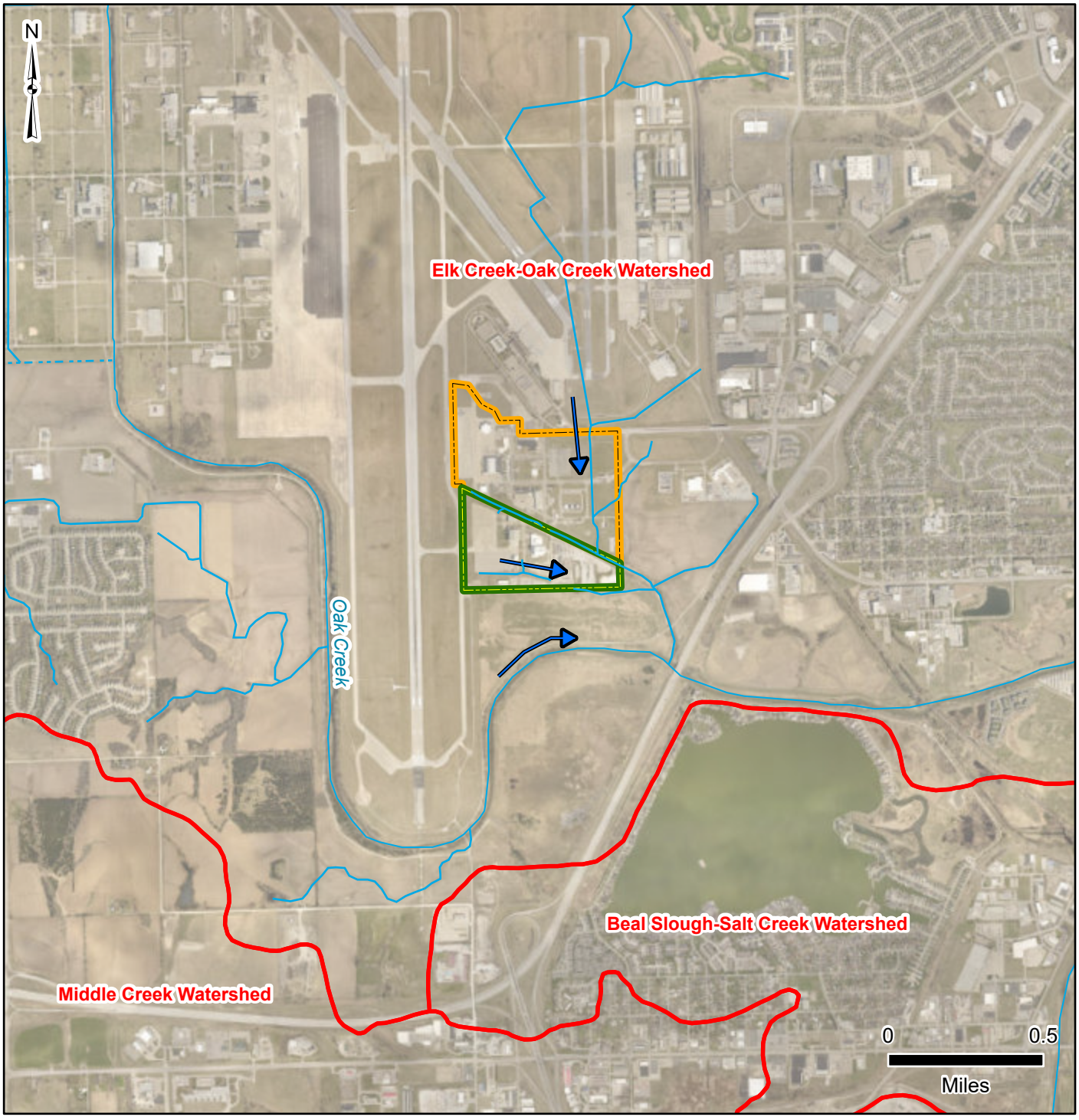
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 2-4
Surface Water Features





Facility Data
- Facility Boundary
- ANG Airbase Boundary

Hydrology
- Surface Water Flow Direction
- Perennial Creek/Stream
- Intermittent Creek/Stream
- Waterbody
- Watershed Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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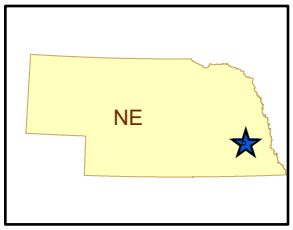
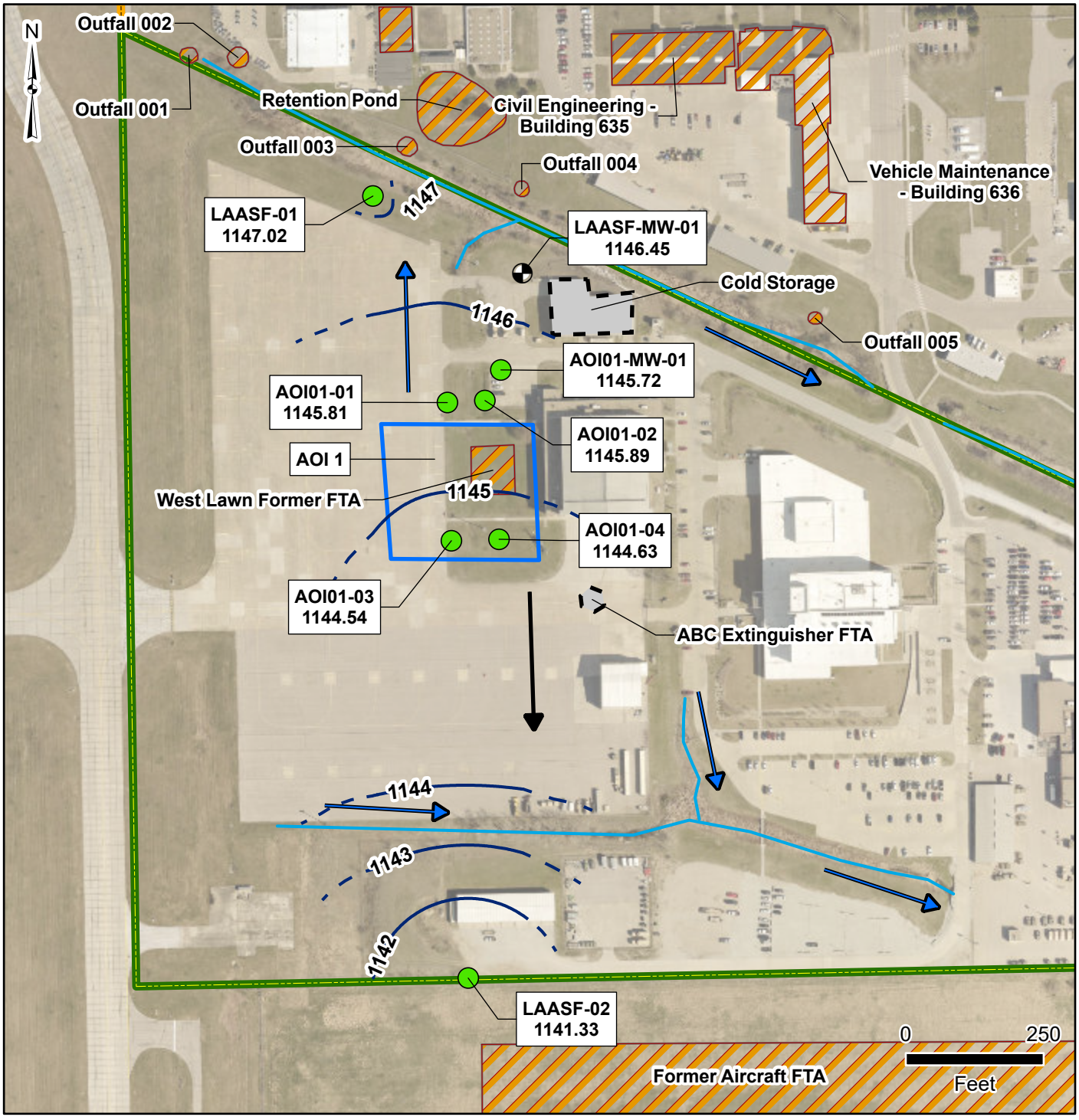
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 2-5
Groundwater Elevations, December 2021





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT
- Monitoring Well

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Groundwater Contour Interval (1 Foot)
- Inferred Groundwater Contour Interval (1 foot)
- Perennial Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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3. SUMMARY OF AREAS OF INTEREST

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, one potential release area was identified at Lincoln AASF #1 and identified as AOI 1. The potential release area is shown on **Figure 3-1**.

3.1 AOI 1 – WEST LAWN FORMER FIRE TRAINING AREA

The West Lawn Former Fire Training Area (FTA) is located west of the Main Hangar, southwest of the Cold Storage Building, and northwest of the ABC Fire Extinguisher FTA; the geographic coordinates are 40°50'17.7"N and 96°45'23.1"W. A written statement from a former NEARNG employee indicated that fire training exercises occurred on the west lawn, and NEARNG dispensed "foam" on the grassy area sometime in the 1990s during familiarization training. NEARNG personnel, at the time of the PA, could not verify whether the fire training exercises were conducted; however, it was believed unlikely that the type of fire extinguishers used during the training were aqueous film-forming foam (AFFF) fire extinguishers because Tri-Max^{TM} 30 containers, which contain AFFF, were not stored at Lincoln AASF #1 until 2005. In September 2019, half of the Tri-Max 30^{TM} were emptied and contents were containerized in a 275-gallon polyethylene tote in the Cold Storage Building. The emptied Tri-Max 30^{TM} fire extinguishers were sent offsite for hydrostatic testing. The 275-gallon tote was disposed by the Defense Logistics Agency. Based on the uncertainty of which extinguishers were used during the training exercises, the West Lawn Former FTA is considered an AOI (AECOM 2020).

3.2 ADJACENT SOURCES

Fifteen potential off-facility sources of PFAS were identified in the PA adjacent to the Facility and not under the control of the NEARNG. A description of each off-facility source is presented below and shown on **Figure 3-1**.

3.2.1 Lincoln Air National Guard Site

The ANG completed an SI at the adjacent Lincoln ANG facility, which is located to the north generally upgradient of the Facility, to determine where PFAS were used (Leidos 2019). The following sections summarize the findings of the SI. All of the adjacent source areas identified in the SI are upgradient of AOI 1. During the SI, combined PFOS and PFOA concentrations in groundwater were compared to the USEPA Lifetime Health Advisory (HA) (70 nanograms per liter [ng/L]) (USEPA 2016a, USEPA 2016b) and PFBS concentrations in groundwater were compared to the USEPA Regional Screening Level (RSL) for Tap Water (400,000 ng/L) (USEPA 2018). PFOS, PFOA, and PFBS concentrations in soil were compared to the USEPA RSLs (1,260 µg/kg, 1,260 µg/kg, and 1,260,000 µg/kg, respectively) (USEPA 2018). It should be noted that there were no soil or groundwater SLs for PFHxS when the previous SI was conducted at the Lincoln ANG facility. However, PFHxS was detected above the current groundwater SL (39 ng/L) in nine upgradient groundwater samples collected during the previous SI with a maximum detected concentration of 15,000 ng/L. Therefore, the Lincoln ANG is a potential upgradient source of PFHxS in groundwater at the Lincoln AASF #1. The following section discuss individual areas and specific PFOA and PFOS findings summarized in the ANG SI report (Leidos 2019).

3.2.1.1 Aircraft Parking Ramp

The Aircraft Parking Ramp was identified due to the fueling and de-fueling, de-icing, maintenance, and parking of aircraft on the ramp. PFAS contamination levels in surface soil and groundwater did not exceed the USEPA RSL (USEPA 2018) or HA of 70 ng/L; however, the SI recommended further investigation at this site to determine if a previously undetected source area exists that is contributing to the PFAS groundwater concentrations, and to determine the nature and extent of PFAS in groundwater through sampling of additional new monitoring wells located upgradient of and downgradient from the Aircraft Parking Ramp.

3.2.1.2 Fuel Systems Maintenance Hangar

The fuel systems maintenance hangar has a 2,000-gallon AFFF tank fire suppression system. There are documented releases from annual testing and spills. When the system was discharged, the contents entered the floor drains and discharged into the retention pond. PFAS contamination levels in groundwater exceeded the USEPA HA of 70 ng/L. Groundwater results for PFOS and PFOA (combined) was reported as 4,380 ng/L. The SI recommended further investigation at the Fuel Systems Maintenance Hangar.

3.2.1.3 Current Fire Station

The Current Fire Station since 1999 stores AFFF and had vehicles filled with AFFF that were washed at the location. The floor drains discharge to an oil/water separator and then to a sanitary sewer system. Nozzle testing occurred on the ramp located west of the station and stormwater flowed to Outfall 005. PFAS contamination levels in groundwater exceeded the USEPA HA (70 ng/L). Groundwater results for PFOS and PFOA (combined) was reported as 14,300 ng/L. The SI recommended further investigation at the Current Fire Station.

3.2.1.4 Main Aircraft Maintenance Hangar

The Main Aircraft Maintenance Hangar had a 2,000-gallon AFFF tank fire suppression system from 1997 to 2009. There are documented releases of AFFF from annual testing of the system and spills. When the system was discharged prior to 1999, the contents entered the floor drains and discharged into the storm sewer. After 1999, system discharges entered floor drains and flowed into the retention pond. In 2009, the hangar was retrofitted to have a high expansion foam fire suppression system. No AFFF is currently stored or used at the hangar. PFAS contamination levels in groundwater exceeded the USEPA HA (70 ng/L). Groundwater results for PFOS and PFOA were reported as 14,700 ng/L and 2,630 ng/L, respectively. The SI recommended further investigation at The Main Aircraft Maintenance Hangar.

3.2.1.5 Outfall 001

Surface water runoff from the Aircraft Parking Ramp area and the area southwest of the Fuel Systems Maintenance Hangar collects in Outfall 001. PFAS contamination levels in surface soil and groundwater were not determined due to a lack of water flow.

3.2.1.6 Outfall 002

Surface water runoff from the Main Aircraft Maintenance Hangar on the west and south sides of the ramp area collects in Outfall 002. PFAS contamination was detected in sediment, but it did not exceed the USEPA RSL (USEPA 2018). PFAS contamination levels in surface water exceeded the USEPA HA. The surface water result for PFOS and PFOA (combined) was reported as 130 ng/L. Recommended to proceed to further investigations. The SI recommended further investigation at Outfall 002.

3.2.1.7 Former Fire Station

The Former Fire Station (used from 1978 to 1995) stored AFFF in vehicles and AFFF was used to wash vehicles. PFAS contamination levels in groundwater exceeded the USEPA HA (70 ng/L). Groundwater results for PFOS and PFOA (combined) were reported as 1,630 ng/L. The SI recommended further investigation at the Former Fire Station.

3.2.1.8 Retention Pond

There is a known release of AFFF that occurred in the Retention Pond based on disposal of AFFF and releases from all the hangars. PFAS contamination levels in surface soil and groundwater did not exceed the USEPA RSL (USEPA 2018) or USEPA HA (70 ng/L). However, the SI recommended further investigation at this site to determine if a previously undetected source area exists that is contributing to the PFAS groundwater concentrations, and to determine the nature and extent of PFAS in groundwater through sampling of additional new monitoring wells located upgradient of and downgradient from the Retention Pond.

3.2.1.9 Outfall 003

All surface water runoff from the former fire station collects in Outfall 003. However, no surface soil/sediment and groundwater samples were collected and PFAS contamination levels were not determined due to a lack of water flow.

3.2.1.10 Outfall 004

All surface water runoff from the main aircraft maintenance hangar and the north and south portion of the ramp area for the Main Hangar collect in Outfall 004. PFAS contamination levels in surface water exceeded the USEPA HA (70 ng/L). Surface water results for PFOS and PFOA (combined) was reported as 34,800 ng/L. PFAS contamination was detected in sediment but did not exceed the project action levels. The SI recommended further investigation at Outfall 004.

3.2.1.11 Civil Engineering Building

There was a vehicle maintenance facility on the east end of the Civil Engineering Building from 1979 to 1999. The building had a pit that discharged PFAS-containing materials to a sanitary sewer on the north side of the building. PFAS contamination levels in groundwater exceeded the USEPA HA (70 ng/L). Groundwater results for PFOS and PFOA (combined) was reported as 1,290 ng/L. The SI recommended further investigation at Civil Engineering Building.

3.2.1.12 Vehicle Maintenance Building

This building has been the Vehicle Maintenance Building since 1999 and has been specifically used for vehicles that store AFFF. Floor drains discharge to a pit that is pumped to a sanitary sewer. Any spills or leaks were wiped up with rags and disposed of in the rag waste bin. PFAS contamination levels in groundwater exceeded the USEPA HA (70 ng/L). Groundwater results for PFOS and PFOA (combined) was reported as 780 ng/L. The SI recommended further investigation at the Vehicle Maintenance Building.

3.2.1.13 Outfall 005

All surface water runoff from the fuel systems maintenance hangar and a small portion of the ramp area on the south side of the fuel systems maintenance hangar collects in Outfall 005. Runoff from areas surrounding the Former Fire Station, Civil Engineering Building, and Vehicle Maintenance Building also collects in Outfall 005. PFAS contamination levels in surface water exceeded the project action levels. Surface water results for PFOS and PFOA (combined) was reported as 1,080 ng/L. PFAS contamination was detected in sediment but did not exceed the project action levels. The SI recommended further investigation at Outfall 005.

3.2.2 Former Aircraft Fire Training Area

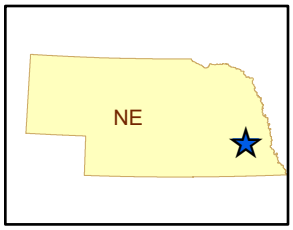
Personnel from the Lincoln ANG recalled seeing pictures of an old aircraft that was used for fire training activities and located south of the NEARNG boundary. Historically, the Lincoln ANG would light a plane on fire, and fire training exercises were conducted to extinguish the fire. These exercises reportedly occurred in the 1960s and 1970s. It is not confirmed that AFFF was used at the Former Aircraft FTA; however, AFFF is considered likely since the Lincoln ANG started using AFFF in the 1970s. The Former Aircraft FTA is located on property owned by the City of Lincoln and is downgradient of the Facility.

3.2.3 Runway Emergency Response

The Lincoln ANG responded to an emergency on the main runway located north of the Lincoln ANG facility. Details to the extent of the emergency are unknown; however, Lincoln ANG personnel reported 1,500 gallons of 3% AFFF were released onto the runway. The runway was then flushed with water, which then flowed to the west along a swale. The swale subsequently drains to the Old Oak Creek Channel and then to Oak Creek, which ultimately discharges to Salt Creek. This potential source area is located upgradient of AOI 1.

Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 3-1
Areas of Interest



Facility Data

- Facility Boundary
- ANG Airbase Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Hydrology

- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream
- Intermittent Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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4. PROJECT DATA QUALITY OBJECTIVES

As identified during the data quality objective (DQO) process and outlined in the SI Uniform Federal Policy (UFP) – Quality Assurance Project Plan (QAPP) Addendum (EA 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOI identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at the AOI.

4.1 PROBLEM STATEMENT

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

4.2 INFORMATION INPUTS

Primary information inputs for the SI include the following:

- The PA Report for the Lincoln AASF #1 (AECOM 2020)
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific UFP-QAPP Addendum (EA 2021a)
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 STUDY BOUNDARIES

The scope of the SI was bounded horizontally by the property limits of the facility (**Figure 2-1**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights-of-entry will be obtained by ARNG with property owner(s). Temporal boundaries were limited to the earliest available time field resources were available to complete the study.

4.4 ANALYTICAL APPROACH

Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP); Accreditation No. 0001.01 and the National Environmental Laboratory Accreditation Program (NELAP) (Commonwealth of Pennsylvania Department of Environmental Protection, Accreditation No. 36-00037). PFAS data underwent 100% Stage 2B validation in accordance with the DoD General Data Validation Guidelines (2019b) and DoD Data Validation Guidelines Module 3: Data Validation Procedure of Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual (QSM) Table B-15 (2020).

4.5 DATA USABILITY ASSESSMENT

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

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

5. SITE INSPECTION ACTIVITIES

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

- *Final Preliminary Assessment Report, Lincoln Army Aviation Support Facility #1, Lincoln, Nebraska*, dated September 2020 (AECOM 2020)

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

- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Lincoln Army Aviation Support Facility #1, Lincoln, Nebraska*, dated October 2021 (EA 2021a)

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

- *Accident Prevention Plan/Site Safety and Health Plan Addendum, Site Inspections for Per- and Polyfluoroalkyl Substances Impacted Sites, ARNG Installations, Nationwide, Lincoln AASF #1, Nebraska, Revision 1*, dated May 2021 (EA 2021b).

The SI field activities were conducted from 6 to 8 December, and on 16 December 2021, and consisted of direct-push technology (DPT) borings, soil sample collection, temporary monitoring well installation, grab groundwater sample collection, and existing monitoring well sampling. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021a), except as noted in **Section 5.10**. Field Change Request Forms can be found in **Appendix B4**.

The following samples were collected during the SI and analyzed for a subset of 24 PFAS via Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) compliant with QSM Version 5.3 Table B-15 to fulfill the project DQOs:

- Eighteen (18) soil samples from six locations (DPT boring locations)
- Five (5) surface soil samples from five locations (hand auger locations)
- Seven (7) grab groundwater samples from temporary well locations
- One (1) groundwater sample from an existing facility monitoring well
- Nine (9) quality assurance (QA)/quality control (QC) samples

Figure 5-1 provides the sample locations for all media across the Facility. **Table 5-1** presents the list of samples collected for each medium. Field documentation is provided in **Appendix B**. A log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**. Land survey data is provided in **Appendix B3**. Photographs were not collected during this field effort.

5.1 PRE-INVESTIGATION ACTIVITIES

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

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 21 September 2021, prior to SI field activities with stakeholders. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include ARNG G-9, NEARNG, USACE, and the Nebraska Department of Environment and Energy representatives familiar with the Facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the UFP-QAPP Addendum (EA 2022).

A TPP Meeting 3 was held on 15 August 2023 to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix C** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

The 811 Nebraska Dig line was contacted to notify them of intrusive work at the Facility. Utility clearance was performed at each of the proposed boring locations on 2 December 2021 with input from the EA field team. Additionally, the first 5 ft of each boring were pre-cleared by EA's drilling subcontractor, Plains Environmental Services, Inc., using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS sampling Equipment Acceptability

A sample from a potable water source at EA's office in Lincoln, Nebraska, was collected on 10 November 2021, prior to mobilization. Results of the sample confirmed this source to be acceptable for use in this investigation; therefore, it was used throughout the field activities. Specifically, the same was analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15. These results can be found in **Appendix E**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling

environment was provided in the Standard Operating Procedures appendix to the Programmatic UFP-QAPP (EA 2020a).

5.2 HAND AUGER SOIL SAMPLING

Soil samples were collected from 11 locations for chemical analysis from 0 to 2 ft bgs using a hand auger (i.e., five samples were from hand auger only locations and six samples were from soil boring locations). All soil sample locations are shown on **Figure 5-1**. The hand auger locations were selected based on the AOI information provided in the PA (AECOM 2020) and as agreed upon by stakeholders during the TPP and review of the UFP-QAPP Addendum (EA 2021a). Non-dedicated sampling equipment (i.e., hand auger) was decontaminated between sampling locations.

Each sample was collected into a laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottle and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard chain-of-custody (COC) procedures to the laboratory and analyzed for PFAS (LC/MS/MS compliant with QSM Version 5.3 Table B-15) in accordance with the UFP-QAPP Addendum. QC samples and analysis were performed as described in the UFP-QAPP Addendum (EA 2021a).

5.3 SOIL BORINGS AND SOIL SAMPLING

Soil samples were collected via DPT drilling methods in accordance with Standard Operating Procedure 047 *Direct-Push Technology Sampling* (EA 2021a). A 5410 truck-mounted GeoProbe® dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to remove soil from the top 5 ft of the boring in compliance with utility clearance procedures.

Three discrete soil samples were collected for chemical analysis from each soil boring (with the exception of boring locations LAASF-MW-01 and AOI01-MW-01 as noted in **Section 5.10**): one sample at the surface (0 to 2 ft bgs) and two subsurface soil samples. One subsurface soil sample was collected approximately 1 ft above the groundwater table, and one collected at the mid-point between the surface and the groundwater table (not to exceed 15 ft bgs). Groundwater was encountered at depths ranging from 13 to 15 ft bgs during drilling. Total boring completion depths, to accommodate temporary well installation, ranged from 20 to 21 ft bgs.

All soil sample locations are shown on **Figure 5-1**, and boring sample depths are provided in **Table 5-1**. The soil boring locations were selected based on the AOI information provided in the PA (AECOM 2020) and as agreed upon by stakeholders during the TPP and review of the UFP-QAPP Addendum (EA 2021a).

During the drilling, the soil cores were continuously logged for lithological descriptions by a field geologist using the Unified Soil Classification System. A photoionization detector (PID) was used to screen the breathing zone during boring activities as a part of personal safety requirements. Observations and measurements were recorded on sampling forms (**Appendix B2**) and in a non-treated field logbook. Depth interval, recovery thickness, PID concentrations,

moisture, relative density, Munsell color, and Unified Soil Classification System texture were recorded. The boring logs are provided in **Appendix D**.

Each sample was collected into a laboratory-supplied PFAS-free HDPE bottle 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 (LC/MS/MS compliant with QSM Version 5.3 Table B-15). One sample per AOI was additionally analyzed for total organic compound (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM D422) in accordance with the UFP-QAPP Addendum (EA 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/matrix spike duplicates (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, one equipment blank was collected per day and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler 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 after sampling and surveying in accordance with the UFP-QAPP Addendum (EA 2021a). After removal of the casings, boreholes were abandoned using bentonite chips. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.4 TEMPORARY WELL INSTALLATION AND GROUNDWATER GRAB SAMPLING

Temporary wells were installed using a 5410 truck-mounted GeoProbe® dual-tube sampling system. Once the borehole was advanced to the desired depth, a temporary well was constructed of a 5-ft section of 1-inch Schedule 40 polyvinyl chloride (PVC) screen with sufficient casing to reach the ground surface. New PVC pipe and screen were used at each location to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected, after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well intervals, using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected in 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, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) before each grab sample was collected in a separate container. 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 Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. Three field blanks were collected in accordance with the UFP-QAPP Addendum (EA 2021a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

5.5 EXISTING MONITORING WELL GROUNDWATER SAMPLING

Three existing monitoring wells were proposed for sampling in the UFP-QAPP Addendum (EA 2021a); however, only one existing monitoring well was sampled as part of the SI as described in **Section 5.10** and documented using a Field Change Request Form (**Appendix B4**). Non-dedicated sampling materials were decontaminated between well locations.

Groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected in laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. The well was purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after each grab sample was collected in a separate container. 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 Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA 2021a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

5.6 SYNOPTIC WATER LEVEL MEASUREMENTS

Groundwater levels were used to monitor facility-wide groundwater elevations and assess groundwater flow. Synoptic water level elevation measurements were collected on 8 December 2021 from the newly installed temporary monitoring wells and one existing monitoring well, taken from the survey mark on the northern side of the well casing. Groundwater elevation data are provided in **Table 5-3**.

5.7 SURVEYING

The northern side of each new temporary well casing was surveyed by a Nebraska-licensed professional land surveyor. Positions were collected in the applicable Universal Transverse Mercator zone projection with World Geodetic System 1984 datum (horizontal) and North American Vertical Datum of 1988 (vertical). Surveying data were collected on 8 December 2021 and are provided in **Appendix B3**.

5.8 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 UFP-QAPP Addendum (EA 2021a).

Soil IDW (i.e., soil cuttings) were left in place at the point of source. The soil cuttings were distributed on the downgradient side of the borehole. Liquid IDW (i.e., purge water, development water, and decontamination fluids) generated during the SI activities were containerized in one properly labeled 55-gallon drum, which was labeled and secured in a gravel parking area along the southern boundary of the Facility. The liquid IDW container remains at the Facility awaiting off-site disposal following USACE and ARNG approval of a Letter Work Plan for IDW Disposal. The Letter Work Plan will be submitted for review and approval upon issuance of the Draft Final SI Report.

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.

5.9 LABORATORY ANALYTICAL METHODS

Samples were analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 at Eurofins Lancaster Laboratories Environmental, LLC, in Lancaster, Pennsylvania, a DoD ELAP and National Environmental Laboratory Accreditation Program-certified laboratory.

A select number of soil samples were also analyzed for TOC using USEPA Method 9060A, pH by USEPA Method 9045D, and grain size by ASTM D422.

5.10 DEVIATIONS FROM UFP-QAPP ADDENDUM

Deviations from the UFP-QAPP Addendum occurred based on field conditions. These deviations were discussed between EA, ARNG, and USACE. The deviations from the UFP-QAPP Addendum are noted below:

- Hand auger soil boring location AOI01-HA-02 was moved north (downgradient of surface drainage flow) in order to avoid infrastructure associated with the geothermal well field located in the area. This change was noted in a Field Change Request (provided in **Appendix B4**).

- Soil boring/temporary well locations AOI01-01 and AOI01-02 were moved north of the sidewalk due to the underlying footprint of the geothermal well field. Additionally, soil boring/temporary well location LAASF-02 was relocated east due to access restrictions presented by the surrounding topography. This change was noted in a Field Change Request (provided in **Appendix B4**).

- Sampling was planned for three existing facility monitoring wells (LAASF-MW-01, AOI01-MW-01, and LAASF-MW-02}; however, they were unable to be located during initial site reconnaissance. Therefore, groundwater samples representative of these locations were planned to be collected from temporary monitoring wells installed using DPT (Field Change Request provided in **Appendix B4**). However, monitoring well LAASF-MW-01 was found at the time of sampling and a groundwater sample was collected per the UFP-QAPP Addendum (EA 2021a). Additionally, refusal was

encountered when relocating boring location LAASF-MW-02. Due to the presence of multiple high-profile utilities; therefore, LAASF-MW-02 was removed from the scope of this SI (see Field Change Request in **Appendix B4**). The replacement temporary well for location AOI01-MW-01 was drilled as planned.

- Boring location LAASF-02 was only hand augered to 1 ft bgs due to encountering rocky subsurface materials.

- Additional deviations occurred that were not documented on a Field Change Request Form. Photographs of field activities were not collected during the SI; therefore, no photographic log is presented in this SI report.

Table 5-1. Samples by Medium
Lincoln AASF #1, Lincoln, Nebraska
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (QSM Version 5.3 Table B-15)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D0	Grain Size (ASTM D422)	Comments
Soil Samples							
AOI01-HA-01	12/8/2021	0-2	X				
AOI01-HA-02	12/7/2021	0-2	X				
AOI01-HA-03	12/7/2021	0-2	X				
AOI01-HA-13	12/7/2021	0-2	X				Field Duplicate
LAASF-HA-01	12/8/2021	0-2	X				
LAASF-HA-02	12/8/2021	0-2	X				
AOI01-01-SB-0-2	12/6/2021	0-2	X				
AOI01-01-SB-6-7	12/6/2021	6-7	X				
AOI01-01-SB-12-13	12/6/2021	12-13	X				
AOI01-02-SB-0-2	12/7/2021	0-2	X				
AOI01-02-SB-6-7	12/7/2021	6-7	X				
AOI01-02-SB-12-13	12/7/2021	12-13	X				
AOI01-02-SB-14-16	12/7/2021	14-16		X	X	X	pH/TOC and grainsize
AOI01-03-SB-0-2	12/6/2021	0-2	X				
AOI01-13-SB-0-2	12/6/2021	0-2	X				Field Duplicate
AOI01-03-SB-6-7	12/6/2021	6-7	X				
AOI01-03-SB-13-14	12/6/2021	13-14	X				
AOI01-04-SB-0-2	12/6/2021	0-2	X				
AOI01-04-SB-8-9	12/6/2021	8-9	X				
AOI01-04-SB-12-13	12/6/2021	12-13	X				
LAASF01-SB-0-2	12/7/2021	0-2	X				
LAASF01-SB-8-9	12/7/2021	8-9	X				
LAASF01-SB-13-14	12/7/2021	13-14	X				
LAASF-02-SB-0-2	12/7/2021	0-2	X				
LAASF-02-SB-8-9	12/7/2021	8-9	X				
LAASF-02-SB-13-14	12/7/2021	13-14	X				
Groundwater Samples							
AOI01-01-GW	12/7/2021	-	X				

Table 5-1. Samples by Medium
Lincoln AASF #1, Lincoln, Nebraska
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (QSM Version 5.3 Table B-15)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D0	Grain Size (ASTM D422)	Comments
AOI01-02-GW	12/7/2021	-	X				
AOI01-03-GW	12/7/2021	-	X				
AOI01-04-GW	12/7/2021	-	X				
AOI01-13-GW	12/7/2021	-	X				Field Duplicate
AOI01-MW-01-GW	12/8/2021	-	X				
LAASF-MW-01-GW	12/8/2021	-	X				
LAASF-01-GW	12/8/2021	-	X				
LAASF-02-GW	12/8/2021	-	X				
Blank Samples/Source Water							
LAASF-FB-12062021	12/6/2021	-	X				Field Blank
LAASF-EB-12062021	12/6/2021	-	X				Equipment Blank
LAASF-FB-12072021	12/7/2021	-	X				Field Blank
LAASF-EB-12072021	12/7/2021	-	X				Equipment Blank
LAASF-FB-12082021	12/8/2021	-	X				Field Blank
LAASF-EB-12082021	12/8/2021	-	X				Equipment Blank
DECON_TEST_111021	11/10/2021	-	X				Source Water

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

Area of Interest	Boring ID	Soil Boring Depth (ft bgs)	Temporary Well Screen Interval (ft bgs)
1	AOI01-01	20	15-20
	AOI01-02	20	14-19
	AOI01-03	21	14-19
	AOI01-04	20	15-20
	AOI01-MW-01	20	14-19
Facility Boundary	LAASF-01	20	15-20
	LAASF-02	20	15-20
	LAASF-MW-01*	9.65	—

Notes:
*LAASF-MW-01 is an existing facility monitoring well that was sampled as part of the SI. The screen interval is unknown but is assumed to be 5–10 ft bgs.

Table 5-3. Groundwater Elevations
Lincoln AASF #1, Lincoln, Nebraska
Site Inspection Report

Monitoring Well ID	Top of Casing Elevation (ft amsl)	Depth to Water (ft btoc)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
AOI01-01	1153.47	7.66	6.58	1145.81
AOI01-02	1153.71	7.82	6.93	1145.89
AOI01-03	1153.76	9.22	8.05	1144.54
AOI01-04	1153.51	8.88	7.98	1144.63
AOI01-MW-01	1153.48	7.76	6.07	1145.72
LAASF-01	1152.33	5.31	4.59	1147.02
LAASF-02	1154.14	12.81	12.25	1141.33
LAASF-MW-01	1152.72	6.27	6.35	1146.45

Notes:
amsl = Above mean sea level
bgs = Below ground surface
btoc = Below top of casing
ft = feet
ID = Identification

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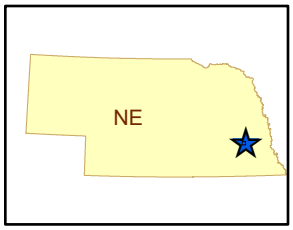
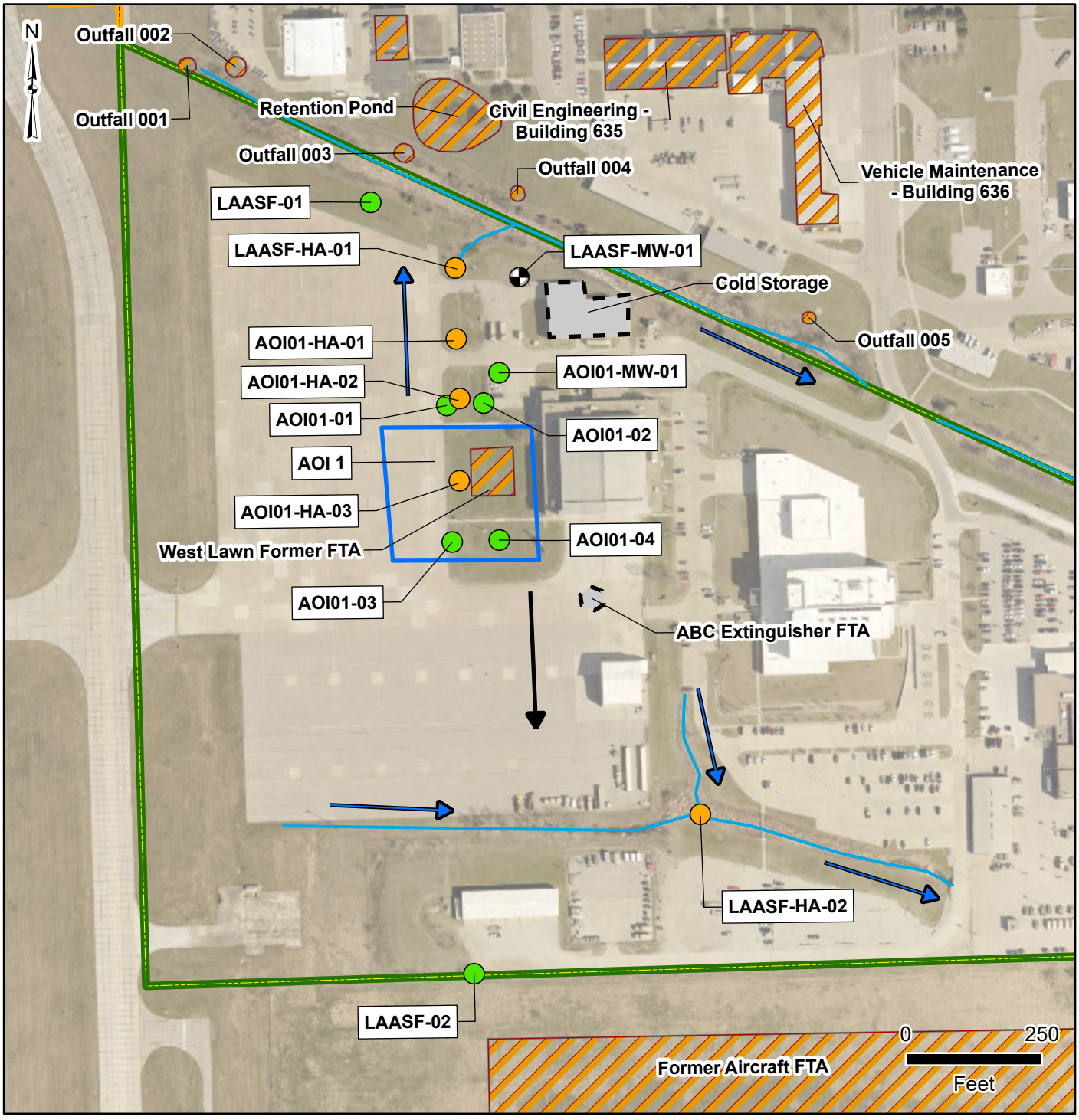
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 5-1
Site Inspection Sample Locations





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Area of Interest
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT
- Monitoring Well
- Hand Auger

Hydrology
- Surface Water Flow Direction
- Inferred Groundwater Flow Direction
- Perennial Creek/Stream
- Intermittent Creek/Stream
- Waterbody

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 14N

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6. SITE INSPECTION RESULTS

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for the AOI and boundary areas is provided in **Sections 6.3 and 6.4**. **Tables 6-2 through 6-5** present results for the relevant compounds in soil or groundwater. Tables that contain all results are provided in **Appendix E**, and the laboratory reports are provided in **Appendix F**.

6.1 SCREENING LEVELS

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

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

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

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

µg/kg = Microgram(s) per kilogram
ng/L = Nanogram(s) per liter

The data in the subsequent sections are compared against the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the Facility; the residential scenario is applied to surface soil results (0 to 2 ft bgs) and the industrial/commercial worker scenario is applied to shallow and deep subsurface soil results (2 to 15 ft bgs). The SLs are not applied to deep subsurface soil results (greater than 15 ft bgs) because 15 ft is the anticipated limit of construction activities.

6.2 SOIL PHYSICOCHEMICAL ANALYSES

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions; and are therefore, relatively mobile in groundwater (Xiao et al. 2015) but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (e.g., 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 the West Lawn Former FTA. The detected compounds are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.3.1 AOI 1 – Soil Analytical Results

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

Soil was sampled at four boring locations/temporary monitoring well locations associated with the potential release area at AOI 1. Soil was sampled from three intervals at each of the boring locations: surface (0–2 ft bgs), shallow subsurface soil (less than 9 ft bgs), and deep subsurface soil (up to 14 ft bgs). Additionally, surface soil samples (0–2 ft bgs) were collected from three hand auger boring locations associated with AOI 1.

PFOS was detected above the SL (13 micrograms per kilogram [µg/kg]) in two of the seven surface soils samples at AOI01-02 (14 µg/kg) and AOI01-HA-02 (15 µg/kg). Three other relevant compounds (PFHxS, PFNA, and PFOA) were detected at concentrations below the applicable SLs. The maximum detected concentrations of PFHxS, PFNA, and PFOA were 1.5 µg/kg, 0.6 J µg/kg, and 1.2 µg/kg, respectively. PFBS was not detected in surface soil samples.

A total of eight subsurface soil samples were collected from AOI 1 (four shallow subsurface and four deep subsurface samples). Three relevant compounds (PFHxS, PFOS, and PFOA) were detected in shallow subsurface soil at concentrations below the applicable SLs. The maximum detected concentrations of PFHxS, PFOS, and PFOA were 1.1 µg/kg, 2.7 µg/kg, and 0.47 J

µg/kg, respectively. PFBS and PFNA were not detected in shallow subsurface soil samples. No relevant compounds were detected in the deep subsurface soil samples.

6.3.2 AOI 1 – Groundwater Analytical Results

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

Groundwater samples were collected from five temporary wells associated with AOI 1 during the SI. PFHxS, PFOS, and PFOA were detected at concentrations above the applicable SLs in four of the five temporary wells. PFHxS detections ranged from 7.6 ng/L (AOI01-03) to 1,800 J- ng/L (AOI01-MW-01). PFOS detections ranged from 0.56 J ng/L (AOI01-03) to 2,800 J- ng/L (AOI01-MW-01). PFOA detections ranged from 4.1 ng/L (AOI01-03) to 150 ng/L (AOI01-MW-01). Additionally, PFBS detections were below the SL of 600 ng/L, with concentrations ranging from 4.8 ng/L (AOI01-03) to 310 J- ng/L (AOI01-MW-01). PFNA detections were below the SL of 6 ng/L, with concentrations ranging from non-detect (AOI01-03) to 5.9 ng/L (AOI01-MW-01).

6.3.3 AOI 1 – Conclusions

Based on the results of the SI, PFOS was detected in surface soil above the SL. Additionally, PFHxS, PFOS, and PFOA were detected in groundwater samples above their respective SLs. Therefore, further evaluation of AOI 1 is warranted.

6.4 BOUNDARY SAMPLE LOCATIONS

This section presents the analytical results for soil and groundwater in comparison to SLs for samples collected at Facility boundary. The detected compounds are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.4.1 Boundary Locations – Soil Analytical Results

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

Soil boundary sample locations were comprised of two boring locations (LAASF-01 and LAASF-02) along the Facility boundary. Boring location LAASF-01 was along the northern/upgradient boundary of the Facility (adjacent to the downgradient NEANG facility boundary). Boring location LAASF-02 was along the southern/downgradient boundary of the NEARNG Facility. Soil was sampled from three intervals in the two borings; surface (0–2ft bgs), shallow subsurface soil (less than 9 ft bgs), and deep subsurface soil (up to 14 ft bgs). Additionally, surface soil samples (0–2 ft bgs) were collected from two hand auger boring locations. The two hand auger boring locations were associated with surface drainage features along the upgradient and downgradient facility boundaries.

PFOS was detected above the SL (13 µg/kg) in two of the four boundary surface soil samples. PFOS was detected at a concentration of 84 µg/kg, the maximum PFOS soil concentration

detected on-site, at hand auger boring location LAASF-HA-01. This sample was collected at the northernmost (downgradient of the AOI) point of the swale that drains surface flow from the West Lawn into Old Oak Channel Creek, which separates the Lincoln AASF #1 property from the adjacent ANG property. PFOS was detected at a concentration of 43 µg/kg at hand auger boring location LAASF-HA-02. This sample was collected from a surface drainage feature located toward the southern, downgradient facility boundary that drains the portion of the facility south of the West Lawn. Three other relevant compounds (PFHxS, PFNA, and PFOA) were detected at concentrations below the applicable SLs. The maximum detected concentrations of PFHxS, PFNA, and PFOA were 5.6 µg/kg, 0.4 J µg/kg, and 1.1 µg/kg, respectively. PFBS was not detected in surface soil samples.

A total of four subsurface soil samples were collected from the Facility boundary (two shallow subsurface and two deep subsurface samples). No relevant compounds were detected in the shallow or deep subsurface soil samples.

6.4.2 Boundary Locations – Groundwater Analytical Results

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

Groundwater samples were collected from two temporary wells and one existing monitoring well associated with the Facility boundaries during the SI. PFHxS, PFNA, PFOS, and PFOA were detected in groundwater collected from one temporary well assessing the upgradient Facility boundary (LAASF-01-GW) at concentrations exceeding the SLs of 39 ng/L, 6 ng/L, 4 ng/L, and 6 ng/L, respectively. The maximum concentrations of PFHxS, PFNA, PFOS, and PFOA in the upgradient well (LAASF-01) were 2,200 ng/L, 9.3 ng/L, 4,700 ng/L, and 250 ng/L, respectively. PFBS detections ranged from 1.4 J ng/L (LAASF-02) to 440 ng/L (LAASF-01); however, no concentrations of PFBS exceeded the SL of 600 ng/L. There were no exceedances of SLs in LAASF-02-GW (downgradient boundary) and LAASF-MW-01-GW (upgradient and to the east of LAASF-01).

6.4.3 Conclusions

Based on the results of the SI, PFOS was detected in surface soil above the SL (13 µg/kg) from hand auger borings located within surface drainage features at the northern (downgradient of the AOI) and southern (downgradient of the AOI) Facility boundaries. The presence of PFAS in the hand auger soil samples may indicate a potential release occurred on-site. PFHxS, PFNA, PFOS, and PFOA were detected in groundwater at an upgradient temporary well location (LAASF-01) at concentrations exceeding the associated SLs. Therefore, further evaluation of the Facility boundary to determine contribution from potential upgradient sources is warranted.

Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Lincoln AASF #1

		Location ID	AOI01-01		AOI01-02		AOI01-03		AOI01-03		AOI01-04		AOI01-HA		AOI01-HA	
		Sample Name	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI01-13-SB-0-2		AOI01-04-SB-0-2		AOI01-HA-01		AOI01-HA-02	
		Parent Sample ID							AOI01-03-SB-0-2							
		Sample Date	12/6/2021		12/7/2021		12/6/2021		12/6/2021		12/6/2021		12/8/2021		12/7/2021	
		Depth (ft bgs)	0-2		0-2		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Unit**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)																
Perfluorobutanesulfonic acid (PFBS)	1,900	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	130	µg/kg	0.45	J	1.1		0.24	J	0.44	J	ND	U	0.89		0.59	J
Perfluorononanoic acid (PFNA)	19	µg/kg	0.6	J	0.37	J	ND	U	ND	U	ND	U	0.52	J	0.3	J
Perfluorooctanesulfonic acid (PFOS)	13	µg/kg	7.7		14		1.1	J+	1.1	J+	1.8	J+	12		15	
Perfluorooctanoic acid (PFOA)	19	µg/kg	1		0.57	J	ND	U	0.68	J	0.24	J	1.2		0.4	J

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. July
2. The Screening Levels for soil are based on a residential scenario for incidental ingestion of contaminated soil.
Values exceeding the Screening Level are shaded gray.
J = Estimated concentration.
J+ = Estimated concentration, biased high.
U = The analyte was not detected at a level greater than or equal to the adjusted detection level.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Lincoln AASF #1

		Location ID	AOI01-HA		AOI01-HA		LAASF-01		LAASF-02		LAASF-HA		LAASF-HA	
		Sample Name	AOI01-HA-03		AOI01-HA-13		LAASF-01-SB-0-2		LAASF-02-SB-0-2		LAASF-HA-01		LAASF-HA-02	
		Parent Sample ID			AOI01-HA-03									
		Sample Date	12/7/2021		12/7/2021		12/7/2021		12/7/2021		12/8/2021		12/8/2021	
		Depth (ft bgs)	0-2		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Unit**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)														
Perfluorobutanesulfonic acid (PFBS)	1,900	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	130	µg/kg	1.5		1.1		0.55	J	ND	U	5.6		2.8	
Perfluorononanoic acid (PFNA)	19	µg/kg	ND	U	ND	U	ND	U	ND	U	0.4	J	ND	U
Perfluorooctanesulfonic acid (PFOS)	13	µg/kg	2.4		1.7		2.1		ND	U	84		43	
Perfluorooctanoic acid (PFOA)	19	µg/kg	0.53	J	0.39	J	0.26	J	ND	U	1.1		0.88	

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. July
2. The Screening Levels for soil are based on a residential scenario for incidental ingestion of contaminated soil.
Values exceeding the Screening Level are shaded gray.
J = Estimated concentration.
J+ = Estimated concentration, biased high.
U = The analyte was not detected at a level greater than or equal to the adjusted detection level.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

Table 6-3. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Lincoln AASF #1

		Location ID	AOI01-01		AOI01-02		AOI01-03		AOI01-04		LAASF-01		LAASF-02	
		Sample Name	AOI01-01-SB-6-7		AOI01-02-SB-6-7		AOI01-03-SB-6-7		AOI01-04-SB-8-9		LAASF-01-SB-8-9		LAASF-02-SB-8-9	
		Parent Sample ID												
		Sample Date	12/6/2021		12/7/2021		12/6/2021		12/6/2021		12/7/2021		12/7/2021	
		Depth (ft bgs)	6-7		6-7		6-7		8-9		8-9		8-9	
Analyte	**Screening Level[1,2]**	**Unit**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)														
Perfluorobutanesulfonic acid (PFBS)	25,000	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1,600	µg/kg	0.92		1.1		ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	µg/kg	ND	U	2.7		ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	µg/kg	0.47	J	0.29	J	0.26	J	ND	U	ND	U	ND	U

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. July 2022.
2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.
J = Estimated concentration.
U = The analyte was not detected at a level greater than or equal to the adjusted detection level.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

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Table 6-4. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Lincoln AASF #1

		Location ID	AOI01-01		AOI01-02		AOI01-03		AOI01-04		LAASF-01		LAASF-02	
		Sample Name	AOI01-01-SB-12-13		AOI01-02-SB-12-13		AOI01-03-SB-13-14		AOI01-04-SB-12-13		LAASF-01-SB-13-14		LAASF-02-SB-13-14	
		Parent Sample ID												
		Sample Date	12/6/2021		12/7/2021		12/6/2021		12/6/2021		12/7/2021		12/7/2021	
		Depth (ft bgs)	12-13		12-13		13-14		12-13		13-14		13-14	
Analyte	**Screening Level[1,2]**	**Unit**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)														
Perfluorobutanesulfonic acid (PFBS)	25,000	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1,600	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	µg/kg	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. July 2022.

2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.

U = The analyte was not detected at a level greater than or equal to the adjusted detection level.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
Qual = Qualifier.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).

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Table 6-5. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Lincoln AASF #1

		Location ID	AOI01-01		AOI01-02		AOI01-03		AOI01-03		AOI01-04		AOI01-MW		LAASF-01		LAASF-02		LAASF-MW-01	
		Sample Name	AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI01-13-GW		AOI01-04-GW		AOI01-MW-01-GW		LAASF-01-GW		LAASF-02-GW		LAASF-MW-01-GW	
		Parent Sample ID							AOI01-03-GW											
		Sample Date	12/7/2021		12/7/2021		12/7/2021		12/7/2021		12/7/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021	
Analyte	**Screening Level[1]**	**Unit**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (ng/L)																				
Perfluorobutanesulfonic acid (PFBS)	601	ng/L	87		43		4.3		4.8		230	J-	310	J-	440		1.4	J	55	
Perfluorohexanesulfonic acid (PFHxS)	39	ng/L	740	J-	230		7.6		7.9		1300	J-	1800	J-	2200		0.91	J	16	
Perfluorononanoic acid (PFNA)	6	ng/L	1.8		0.7	J	ND	U	ND	U	4.2		5.9		9.3		ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	4	ng/L	580	J-	100		0.56	J	0.57	J	1900		2800	J-	4700		1.1	J	2	
Perfluorooctanoic acid (PFOA)	6	ng/L	62		16		4.1		4.2		140		150		250		ND	U	ND	U

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using EPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. July 2022.

Values exceeding the Screening Level are shaded gray.
J = Estimated concentration.
J- = Estimated concentration, biased low.
U = The analyte was not detected at a level greater than or equal to the adjusted detection level.
ng/L = Nanogram(s) per liter.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.

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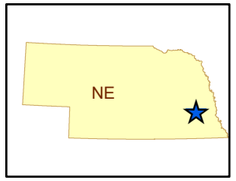
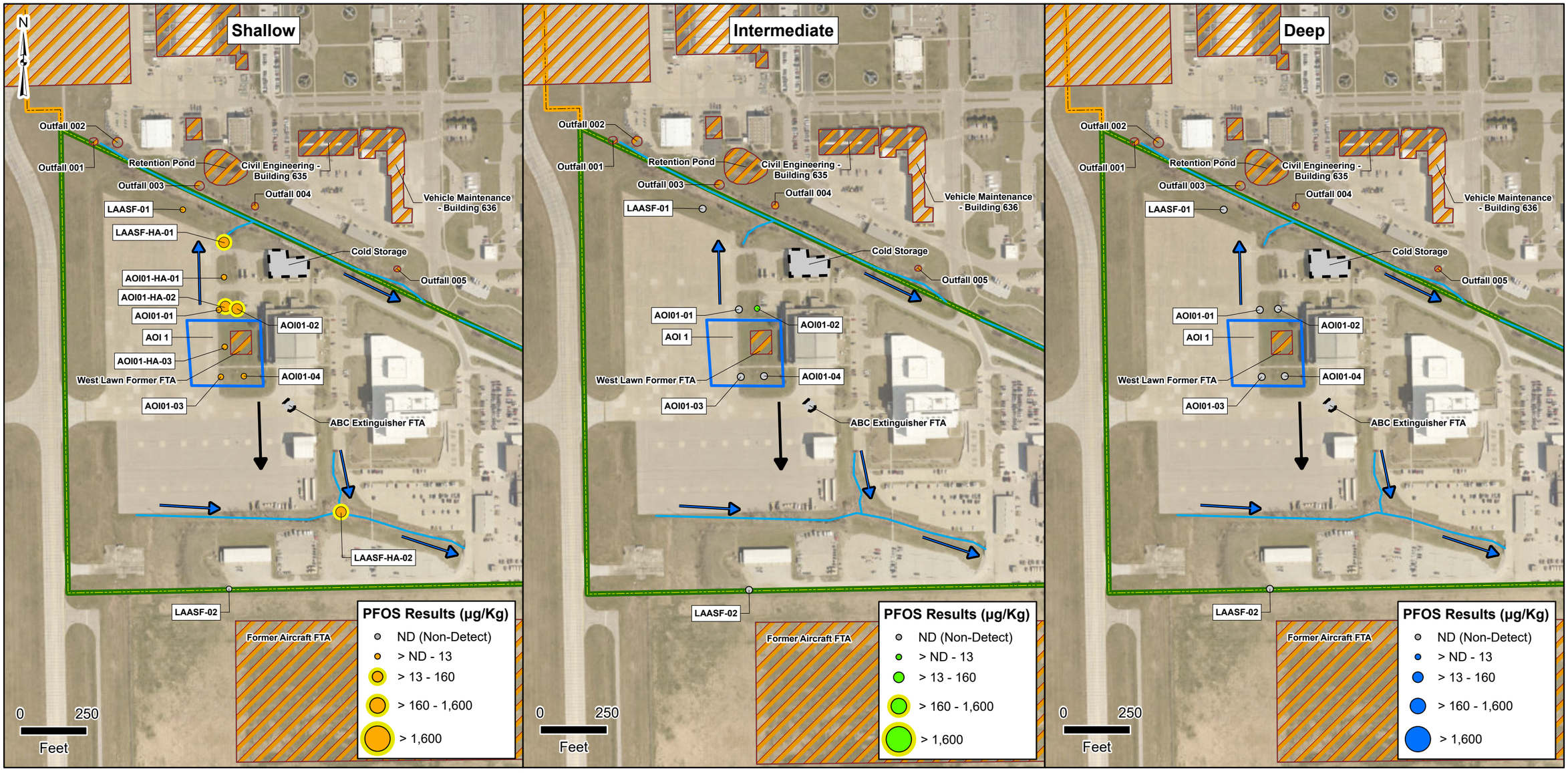
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-1
AOI 1
PFOS Detections in Soil





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFOS = Perfluorooctanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth Intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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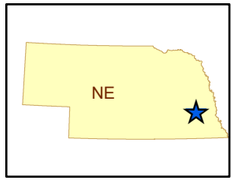
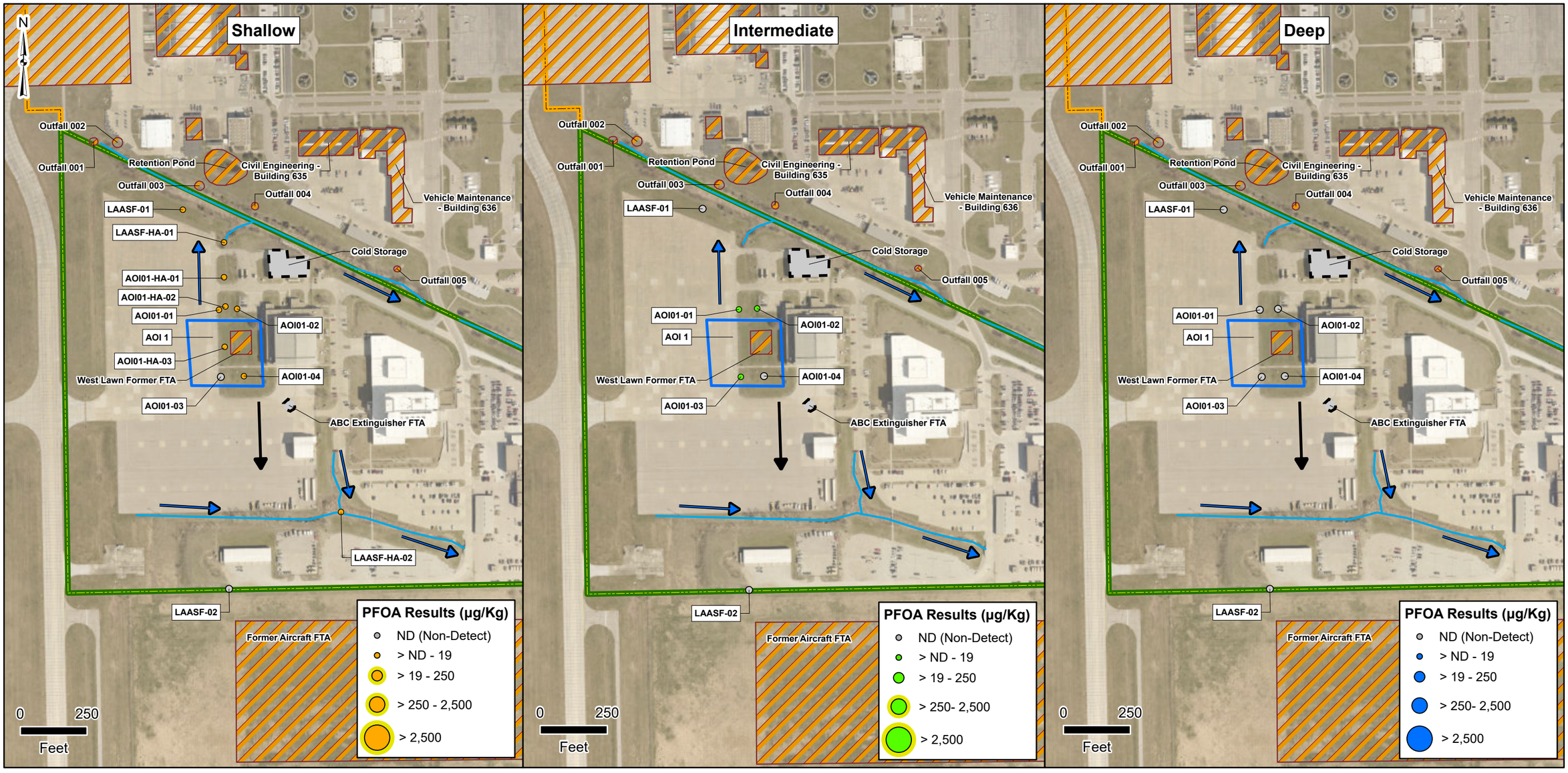
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-2
AOI 1
PFOA Detections in Soil





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFOA = Perfluorooctanoic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth Intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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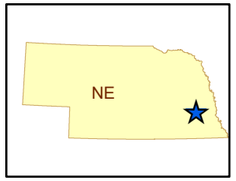
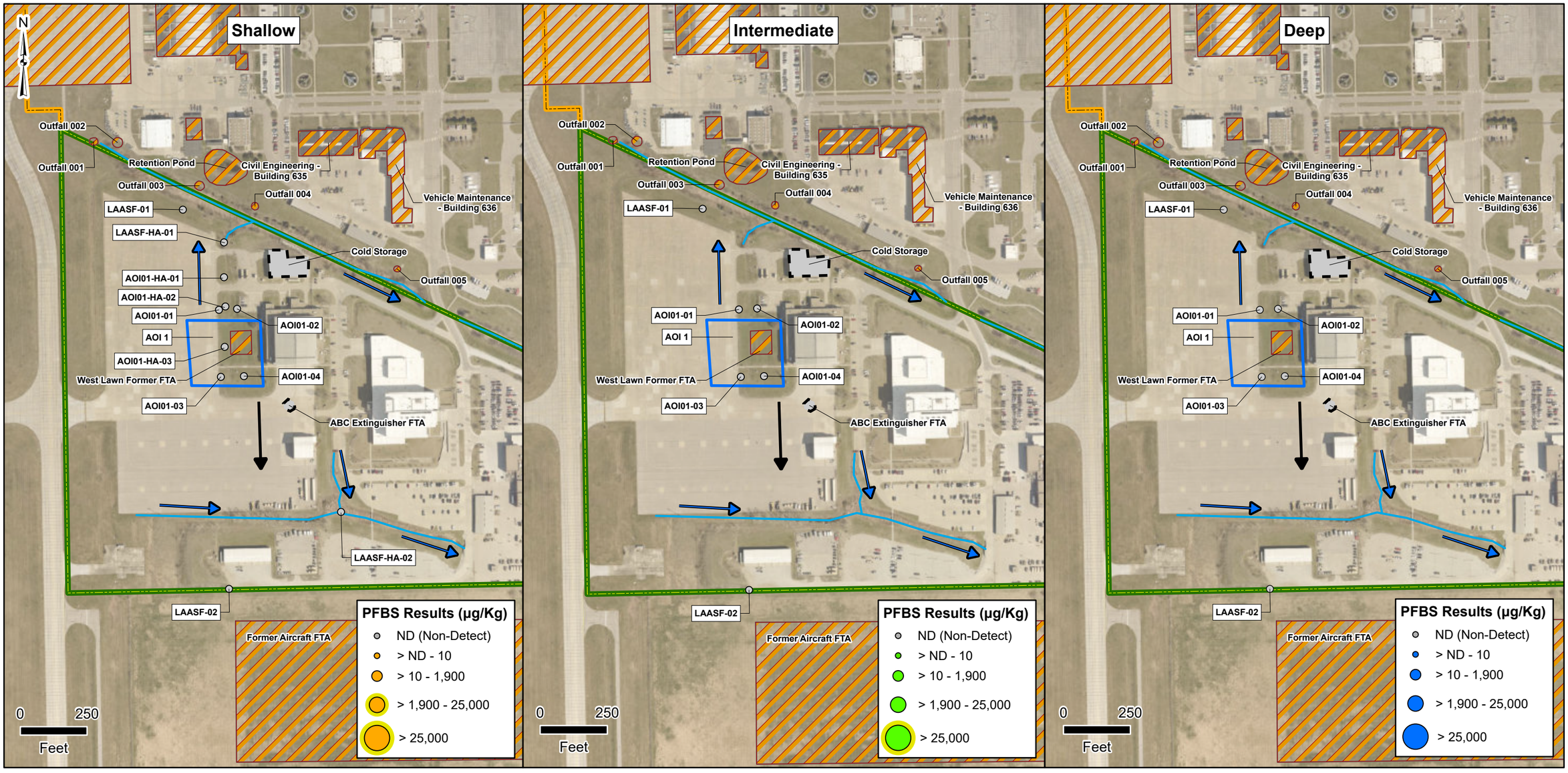
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-3
AOI 1
PFBS Detections in Soil





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth Intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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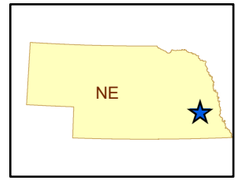
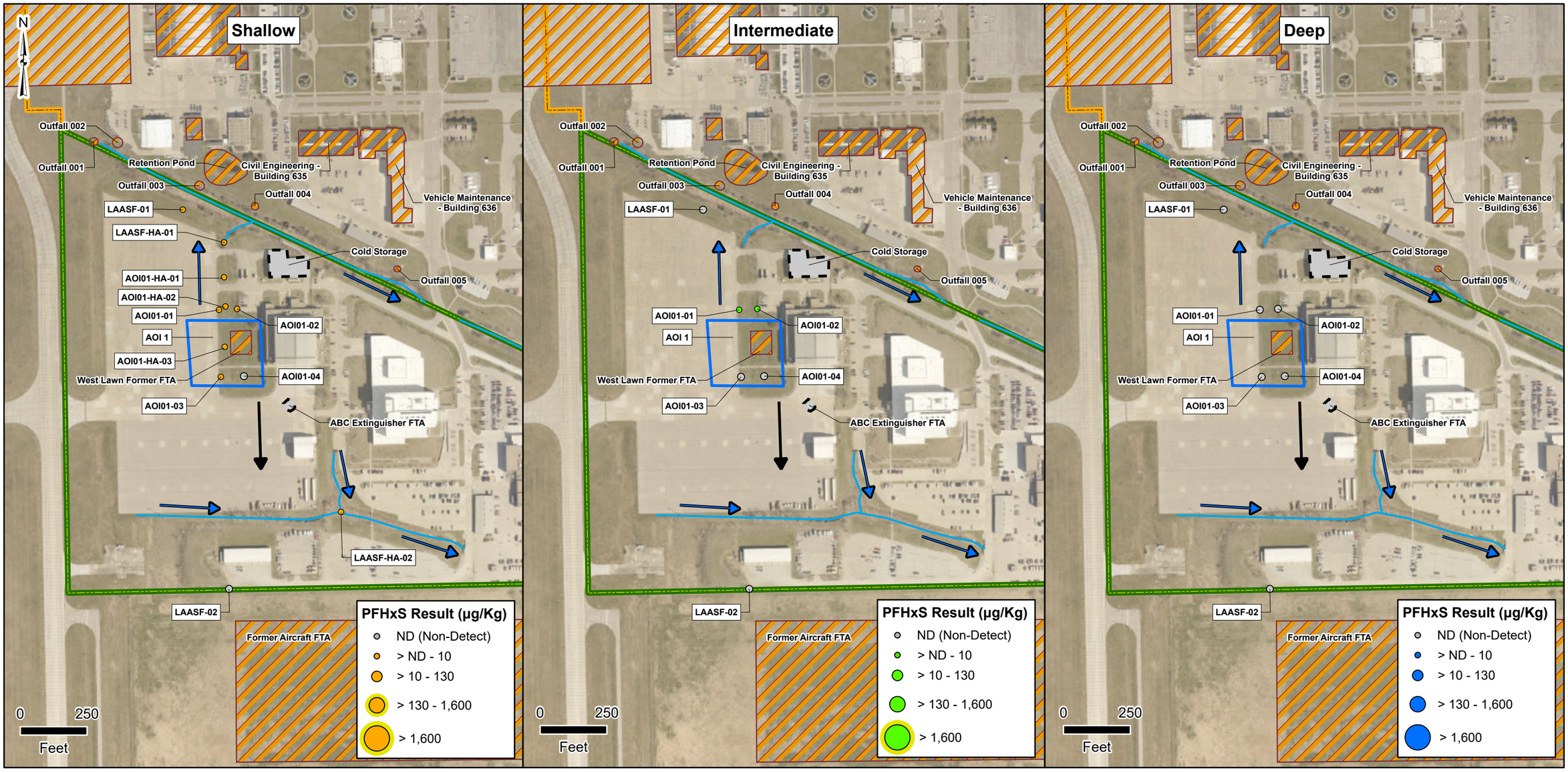
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-4
AOI 1
PFHxS Detections in Soil





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFHxS = Perfluorohexanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth Intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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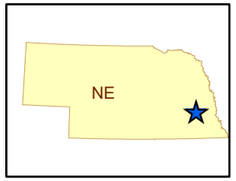
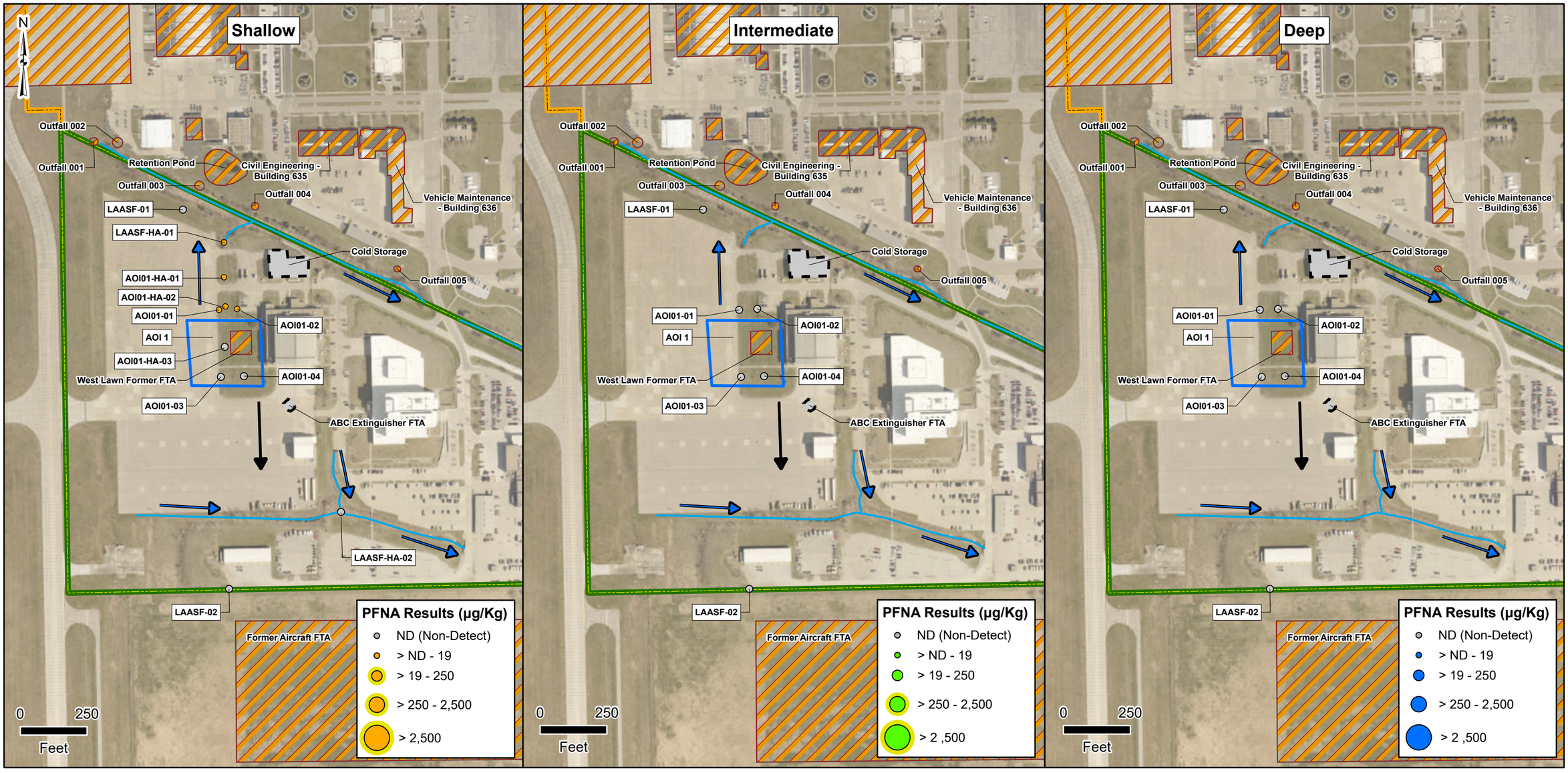
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-5
AOI 1
PFNA Detections in Soil





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth Intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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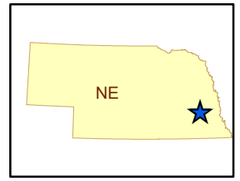
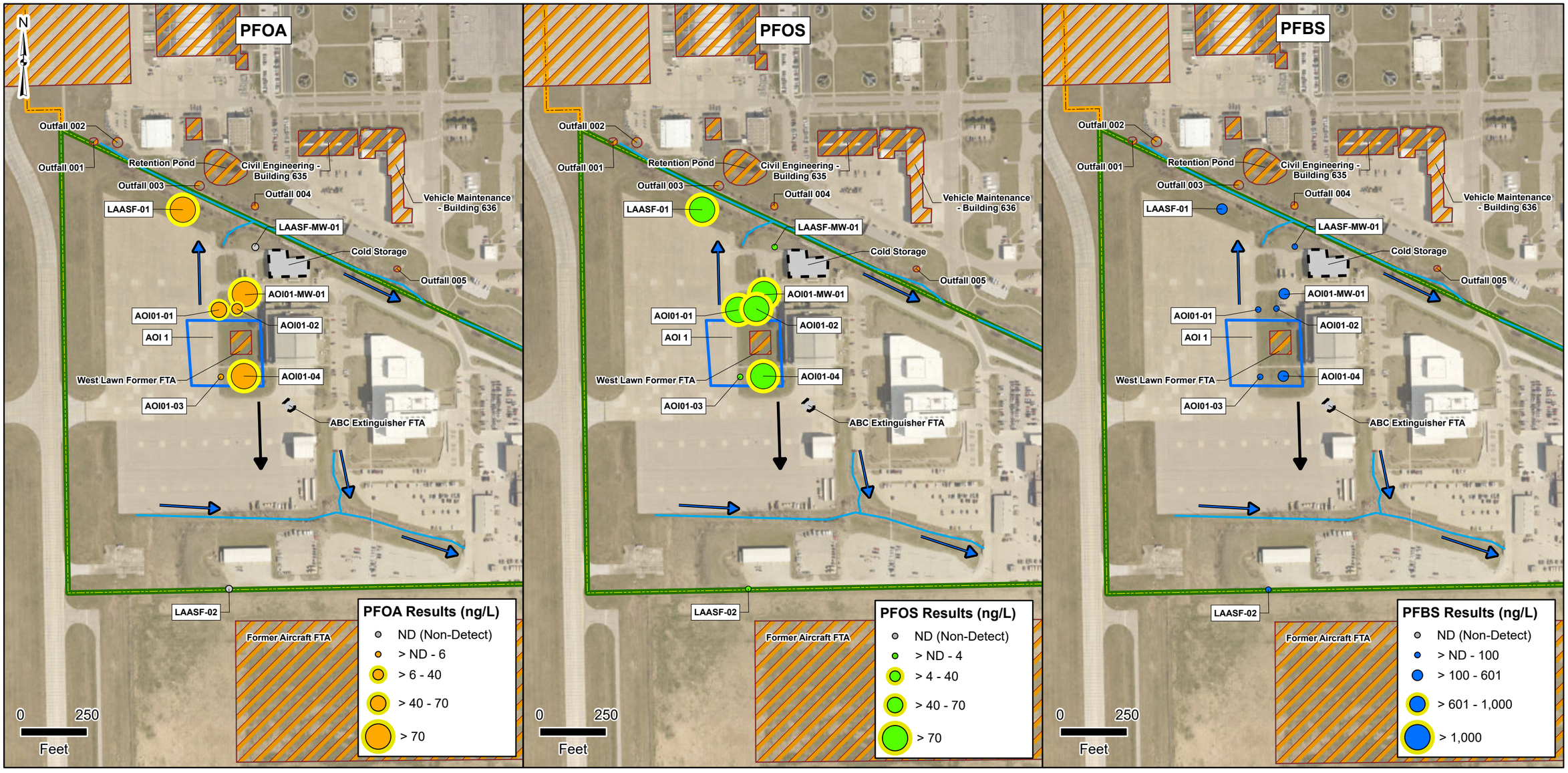
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-6
AOI 1
PFOA, PFOS and PFBS Detections in Groundwater





Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Note:
PFOA = Perfluorooctanesulfonic acid
PFOS = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

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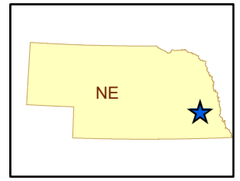
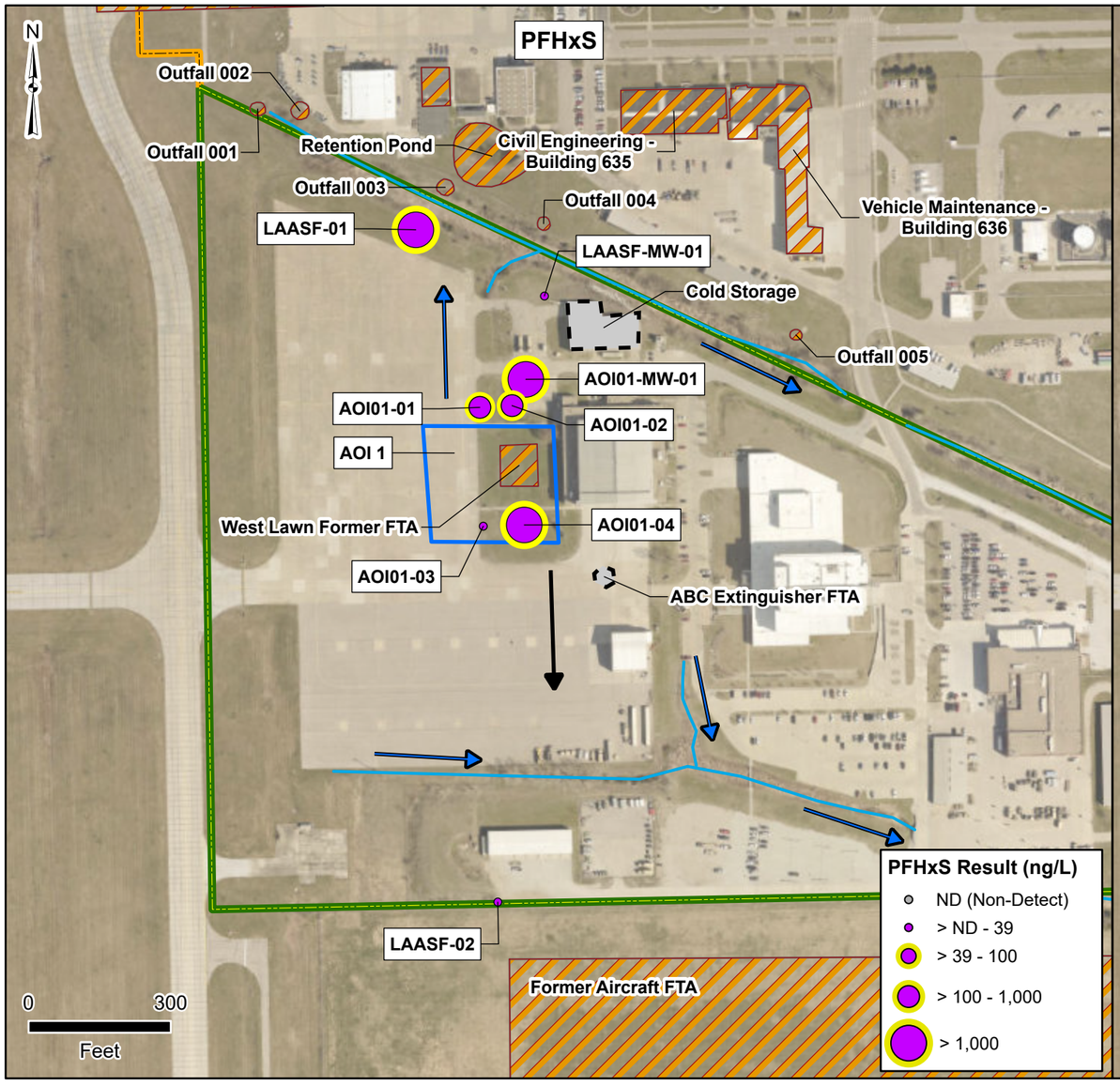
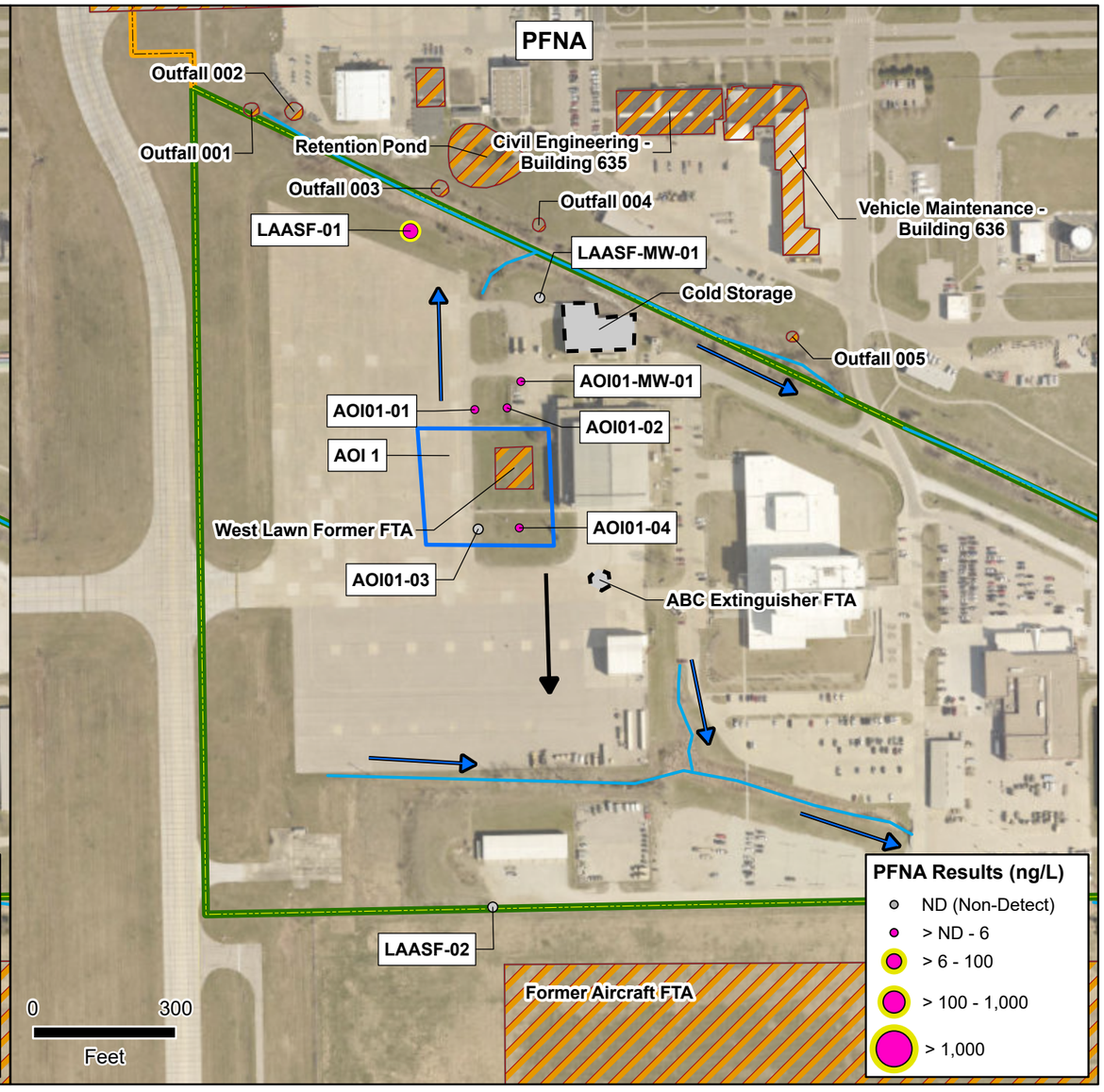
Army National Guard Site Inspections
Site Inspection Report
Lincoln AASF #1, Nebraska

Figure 6-7
AOI 1
PFHxS and PFNA Detections in Groundwater







Facility Data
- Facility Boundary
- ANG Airbase Boundary
- Potential PFAS Release
- No Suspected Release

Hydrology
- Surface Water Flow Direction
- Groundwater Flow Direction
- Perennial Creek/Stream

Notes:
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....January 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 13N

Path: G:\Federal\Nationwide\PFAS\MAES_G342501083\PROJECTS\SIReport\Lincoln\LincolnSIReport.aprx

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7. EXPOSURE PATHWAYS

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

1. Contaminant source
2. Environmental fate and transport
3. Exposure point
4. Exposure route
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 no identified complete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in a RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

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

7.1 SOIL EXPOSURE PATHWAY

The SI results for relevant compounds in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1 based on the aforementioned criteria.

7.1.1 AOI 1

Located west of the main hangar, the West Lawn Former FTA is considered a potential release area due to a written statement from a former NEARNG employee indicating that fire training exercises were conducted on the West Lawn, dispensing "foam" sometime in the 1990s.

PFOS was detected in surface soil at AOI 1 at concentrations above the SL. Additionally, PFAS was detected in surface soil samples collected from the downgradient drainage features (i.e., Facility boundary samples) at concentrations above the SL. Although the ground surface at AOI appears to be well vegetated making it less likely that exposure to surface soil would occur, ground-disturbing activities could result in site worker and construction worker exposure to PFAS compounds via ingestion or inhalation of dust. Therefore, the exposure pathway for inhalation and ingestion are considered to be potentially complete with an exceedance of the SL for these receptors.

PFHxS, PFOS, and PFOA were additionally detected in shallow subsurface soil at a concentration below the applicable SLs. Ground disturbing activities to subsurface soil could result in construction worker exposure to detectable concentrations of these relevant compounds via incidental ingestion. Therefore, the exposure pathway for subsurface soil is potentially complete for the construction worker. The site worker/trespasser activities are anticipated to be limited to surface or near surface soil; therefore, the exposure pathway for this receptor group to subsurface soil is considered incomplete.

7.2 GROUNDWATER EXPOSURE PATHWAY

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

7.2.1 AOI 1

PFHxS, PFOS, and PFOA were detected in groundwater at concentrations above applicable SLs collected from five temporary wells associated with AOI 1. Due to the depth to groundwater at AOI 1 (13 to 15 ft bgs), it is possible that construction workers would be exposed to PFAS through the groundwater via ingestion during trenching activities. Therefore, the exposure pathway for construction workers via the ingestion of groundwater is considered to be potentially complete with an exceedance of the SL. There are no known potable wells present at the Facility; therefore, the exposure pathways for the site workers/trespasser are considered to be incomplete. Downgradient potable wells were identified as shown in **Figure 2-3**. Due to the detections of relevant compounds in groundwater leaving the facility (facility Boundary) which are present below the SLs, the groundwater pathway is considered potentially complete to off-facility residents. The CSM is presented in **Figure 7-1**.

7.3 SURFACE WATER AND SEDIMENT EXPOSURE PATHWAY

7.3.1 AOI 1

PFOS was detected at concentrations above the SL in surface soils taken from perennial drainage pathways discharging to Oak Creek (drainages were dry at the time of sampling). PFAS constituents are highly water soluble, and, as a result, it is possible that PFAS migrated to Oak Creek. No surface water or sediment sampling was conducted at the Lincoln AASF #1; therefore, the exposure pathways for site workers, construction workers, and off-site recreational users of Oak Creek (and its on-site tributaries) via ingestion of surface water and sediment are considered potentially complete. Off-site residents receive drinking water from the City of Lincoln Water System; therefore, Oak Creek (and its tributaries) is not a source of drinking water and the resident receptor pathway is considered incomplete. The CSM is presented in **Figure 7-1**.

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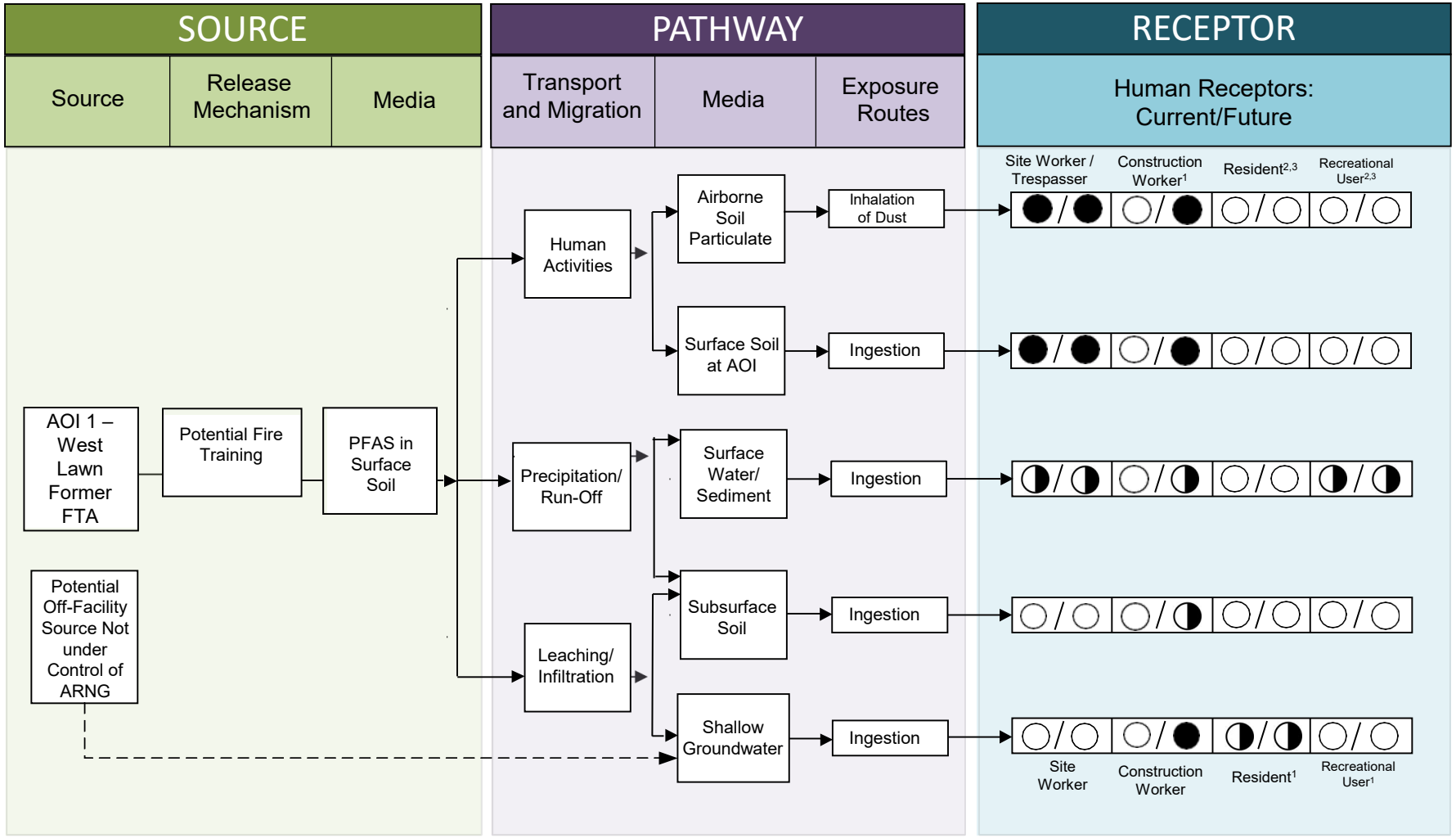

LEGEND

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

Notes:

1. No current active construction at the facility.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.

Figure 7-1
Conceptual Site Model
AOI 1

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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 SITE INSPECTION ACTIVITIES

The SI field activities at the facility were conducted from 6 to 8 December 2021, and on 16 December 2021. The SI field activities included soil sample collection (hand augers and borings), temporary monitoring well installation, grab groundwater sample collection, existing monitoring well sampling, and land surveying. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021a), except as previously noted in **Section 5.10**.

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

- Eighteen (18) soil samples from six locations (DPT boring locations)
- Five (5) soil samples from five locations (hand auger locations)
- Seven (7) grab groundwater samples from temporary well locations
- One (1) groundwater sample from an existing facility monitoring wells
- Nine (9) QA/QC samples

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at the AOI to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSM was refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, which are described in **Section 7**.

8.2 OUTCOME

Based on the results of this SI, further evaluation under CERCLA is warranted for AOI 1 including the Facility boundary (see **Table 8-1**). Based on the CSM developed and revised based on the SI findings, concentrations of relevant compounds were above applicable SLs in surface soil and groundwater at AOI 1 from sources potentially on the facility and at the facility boundary from potential upgradient off-facility sources. Sample chemical analytical concentrations collected during this SI were compared against the project SLs for soil and groundwater, as described in **Table 6-1**.

A summary of the results of the SI data relative to the SLs is as follows:

- AOI 1:
  - PFHxS, PFOS, and PFOA were detected above applicable SLs in groundwater collected from four temporary well locations associated with the AOI. PFOS was detected above the applicable SL in surface soil associated with AOI 1. Based on the results of the SI, further evaluation at AOI 1 is warranted.
- The Facility boundary:
  - PFHxS, PFOS, and PFOA were detected in groundwater at the upgradient boundary at concentrations exceeding the SLs. There were no exceedances in groundwater collected from the downgradient boundary location. PFOS was detected above the applicable SL in surface soil collected from at the upgradient and downgradient boundary boring locations. Based on the results of the SI, further evaluation of the Facility boundary to determine contribution from potential upgradient sources is warranted.

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

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

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

AOI	Potential Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary	Future Action
1	West Lawn Former Fire Training Area	●	●	●	Proceed to RI

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

9. REFERENCES

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