FINAL
Site Inspection Report
Silverbell Army Heliport
Marana, Arizona

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

July 2022

Prepared for:

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Acronyms and Abbreviations

%	percent
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
AASF	Army Aviation Support Facility
acre-ft	acres per foot
ADEMA	Arizona Department of Emergency and Military Affairs
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AFRC	Armed Forces Reserve Center
AMA	Active Management Area
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASLD	Arizona State Land Department
ASTM	American Society for Testing and Materials
AZARNG	Arizona National Guard
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DO	dissolved oxygen
DoD	Department of Defense
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EDR™	Environmental Data Resources, Inc.™
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FEMA	Federal Emergency Management Agency
FRB	field reagent blank
FTA	Fire Training Area
GPS	Global Positioning System
HA	Health Advisory

HDPE	high-density polyethylene
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
JLUS	Joint Land Use Study
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
mph	miles per hour
MS	matrix spike
MSD	matrix spike duplicate
NCRS	Natural Resources Conservation Service
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NOAA	National Oceanic and Atmospheric Association
NRCD	Natural Resource Conservation District
NRCS	National Resource Conservation Service
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
OWS	oil-water separator
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFCs	perfluorinated compounds
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance

QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent differences
SBAH	Silverbell Army Heliport
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
TCRA	Time Critical Removal Action
TOC	total organic carbon
TPP	Technical Project Planning
UCMR3	Unregulated Contaminant Monitoring Rule 3
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAATS	Western Army National Guard Aviation Training Site
WWTP	wastewater treatment plant

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Executive Summary

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

SBAH occupies approximately 170 acres of land located approximately 2.85 miles west of Interstate 10 and northeast of East Pinal Air Park Road, which is north of the city of Marana in Pinal County, Arizona. The facility primarily operates as "Airport Reserve" with industrial/military functions. The facility includes over 300,000 square feet of office space, hangars, and storage facilities. During the PA, numerous potential release areas were identified, including fire-training areas (FTAs), non-FTAs, and emergency response areas. PFAS-containing aqueous film forming foam (AFFF) may have been released from fire training activities, fire suppression system releases, washing of vehicles covered in AFFF, Tri-Max™ unit maintenance and recharge, AFFF storage, and emergency response related to fuel spills. The potential PFAS release areas were grouped into four AOIs, AOI 1 through AOI 4, which were investigated during the SI. The SI field activities were conducted from 4 to 23 October 2021 and included the collection of soil and groundwater samples.

To fulfill the project Data Quality Objectives set forth in the approved SI Quality Assurance Project Plan Addendum (AECOM, 2021a), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry compliant with Quality Systems Manual 5.3 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

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

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

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

- At AOI 1, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.

- At AOI 2, PFOA, PFOS, and PFBS were detected in soil, and PFOS detections exceeded the SL of 130 micrograms per kilogram (µg/kg) at two locations. Based on the results of the SI, further evaluation of AOI 2 is warranted in a Remedial Investigation (RI).
- At AOI 3, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.
- At AOI 4, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.
- Two monitoring wells were installed at the facility boundary to assess groundwater impacts for the entire facility from the identified AOIs. PFOA, PFOS, and PFBS were detected in groundwater at both monitoring wells, but were below SLs.
- Several potential up-gradient release areas exist which could contribute to the concentrations of PFAS in groundwater detected in the facility boundary monitoring wells and on-facility water supply wells. The SI did not perform a comprehensive evaluation of the aquifer and hydraulic connectivity between the on-facility wells (monitoring and water supply) and off-facility monitoring wells.

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

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for all four AOIs (AOI 1 through AOI 4).

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

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

Notes:

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

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Building L4320 and surrounding area	◐	NA	◐
2	Building L4300 and surrounding area	●	NA	◐
3	Northeastern Boundary Release Locations	◐	NA	◐
4	Alpha, Charlie, and Bravo Rows	◐	NA	◐

Legend:
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Building L4320	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI
2	Building L4300 and surrounding area	Exceedances of SLs in soil at source area. No exceedances of soil or groundwater at the facility boundary.	Proceed to RI
3	Northeastern Boundary Release Locations	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI
4	Alpha, Charlie, and Bravo Rows	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI

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1. Introduction

1.1 Project Authorization

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

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

1.2 SI Purpose

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

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

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

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

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2. Facility Background

2.1 Facility Location and Description

SBAH is approximately 170 acres of land located approximately 2.85 miles west of Interstate 10 and northeast of East Pinal Air Park Road, which is north of the city of Marana in Pinal County, Arizona (**Figure 2-1**). According to the Pinal County Assessor's Office, SBAH is located in Sections 28 and 29, Township 10 South, Range 10 East of Gila and Salt River Base and Meridian in Pinal County, Arizona (Pinal County, 2015).

SBAH is located north of Pinal Airpark (**Figure 2-1**), which was constructed as the Marana Army Airfield in 1942. After World War II, the Airfield was deeded to Pinal County. The Airfield was a flying school and a base for covert Central Intelligence Agency air operations. Later, the Airfield became known as the Pinal Airpark. Since 1979, tenants at the Pinal Airpark have provided passenger and cargo services along with aircraft maintenance, storage, reconfiguration, and reclamation services. Today, the primary occupant of the Airpark is Evergreen Air Center, which serves as a "boneyard" for civilian commercial aircraft, as well as airliner storage, reconfiguration, and reclamation. Undeveloped desert landscape bounds SBAH to the west, north, and east. SBAH is largely developed with buildings, roads, and an airfield.

The land occupied by SBAH was conveyed by the US to the State of Arizona in 1913. In 1983, 161 acres of land were patented by the Arizona State Land Department (ASLD) to the Arizona Department of Emergency and Military Affairs (ADEMA) for SBAH. By 1987, an armory and an Army Aviation Support Facility (AASF) (L4600) had been constructed on SBAH property. In 2005, ADEMA leased 565 acres of land surrounding SBAH from ASLD (GEC – SA&B, 2005; Arizona ARNG [AZARNG], 2010). By 2010, SBAH had over 300,000 square feet of office space, hangars, and storage facilities (AZARNG, 2010). Documentation regarding historical land use at SBAH supports the conclusion that the area is free from munitions, explosives of concern, and unexploded ordinance.

2.2 Facility Environmental Setting

SBAH is located in the central Tucson Basin, within the Basin and Range physiographic province, a landscape of the interior western US that is dominated by mountain ranges separated by broad alluvial valleys (Thornbury, 1965). The facility lies within the Yuma Desert portion of the Sonoran Desert region of Arizona at an elevation of about 1,893 feet above mean sea level (amsl). The Tortolita Mountains to the east, Tucson Mountains to the west, and the Picacho Mountains to the north of the facility rise to elevations of about 4,000 to 4,500 feet amsl. Local, unnamed, intermittent washes drain west to the Santa Cruz River, which is about 2 miles southwest of the facility. The Santa Cruz River flows intermittently, except in short stretches fed by reclaimed effluent from wastewater treatment plants (WWTPs). During prehistoric times, and as late as the beginning of the twentieth century, the Santa Cruz River was a much more reliable source of surface water or shallow groundwater (URS, 2008).

Topographic variability in the region creates environmental zones with varying resources (Fish et. al, 1985; Goodyear, 1975; Minckley and Brown, 1982). In the valley bottom, the Santa Cruz River was once a reliable source of water, and the floodplain and adjacent terraces had arable land. A variety of grasses and cacti covered the lower bajadas (alluvial fans), and paloverde-mixed cacti communities rich in saguaro and other edible cacti, grew on the upper bajadas and around mountain bases. Washes radiating out of the mountains had distinctive xeroriparian vegetation communities that crossed the bajadas. The mountains had diverse woodland and grassland environments that supported deer and other large mammals. These environments were a source of rocks for flaked and ground stone tools and had springs that provided water. Natural vegetation has been eliminated from the adjacent developed areas of SBAH and Pinal Air Park (URS, 2008). The topography of the facility is generally level, sloping slightly to the northwest (**Figure 2-2**).

2.2.1 Geology

Soil information was obtained from the Web Soil Survey website maintained by the Natural Resources Conservation Service (NCRS) of the US Department of Agriculture (NRCS, 2015). Using this tool, soil on the facility was identified as “Denure sandy loam, 1 to 3 percent slopes” (NRCS, 2015). Denure sandy loams are deep, somewhat excessively drained soil found on fan terraces. The Denure sandy loams formed in fan alluvium derived from mixed sources. This soil unit is used as rangeland agriculture (Natural Resource Conservation District [NRCD], 1991).

SBAH is located within the Upper Santa Cruz Sub-Basin of the Tucson Basin. The sub-basin contains undivided Quaternary surficial deposits consisting of valley fill or alluvium varying up to 12,000 feet in thickness (**Figure 2-3**). The alluvium varies in constitution from dense sand, gravel, and cobble deposits to silts and clays. In many areas, deposits of heavily cemented sandy clay and clayey sand (caliche) are encountered (GEC – SA&B, 2005).

The alluvium and rock of the Tucson Basin include three major units: Fort Lowell Formation, Tinaja Beds, and Pantano Formation; these units contain a single, unconfined aquifer. The Fort Lowell Formation, which comprises the upper 300 to 400 feet, provides most of the groundwater that is withdrawn from the basin. This Formation includes interbedded silt, sand, and gravel. The Tinaja Beds underlie the Fort Lowell Formation and are separated from the Fort Lowell Formation by an aquitard. The Tinaja Beds are comprised of a layer of sand and gravel underlain by gypsiferous clayey silt and mudstones. The Pantano Formation underlies the Tinaja Beds at depths of several thousand feet in the central portion of the Basin. The Pantano Formation is a reddish-brown silty sandstone that overlies bedrock (GEC – SA&B, 2005).

Soil borings completed during the SI found alternating layers of well-graded silty sand and gravel and semi-confining layers of silty clay to clay. The borings were completed at depths between 15 and 250 feet bgs. Isolated layers of clay to silty sand were also observed in the boring logs at thicknesses ranging from a few inches to several feet thick. Many of the logs also reported varying percentages of gravel and cobbles. These observations are consistent with the understood land fill material and depositional environment (see boring logs in **Appendix E**).

2.2.2 Hydrogeology

SBAH is located within the Tucson Active Management Area (AMA). The main aquifer in this area is the Fort Lowell Formation. Groundwater flow in the region around SBAH is generally to the northwest. Depth to groundwater ranged from 200 to 300 feet below ground surface (bgs) during 1994-1995 and is suspected to be influenced by surface water infiltration from nearby irrigated fields (Hammet, 1995). The area is characterized by very little direct recharge to groundwater due to very low annual rainfall.

Beginning in the 1970s, many municipalities required stormwater to be retained and disposed onsite at newly developed commercial or industrial properties. Depending upon specific development and drainage conditions, dry wells were a common method used to dispose of stormwater. Dry wells are regulated under the Safe Drinking Water Act. The Arizona Department of Environmental Quality (ADEQ) maintains a searchable database of dry wells (ADEQ, 2019).

The following registration numbers and names are associated with dry wells at SBAH (ADEQ, 2019):

- 52217 (6 wells) – Silver Bell Flood Mitigation
- 45031 (4 wells) – Silver Bell WWTP Upgrade
- 44460 (1 well) – Silver Bell Airfield at Armed Forces Reserve Center (AFRC)
- 45659 (1 well) – AZARNG – AFRC
- 8563 (1 well) – Silver Bell Armory HO 1st BN 285th

Six dry wells are located within the stormwater drainage ditches along the northeastern property line and were installed as flood mitigation. Four dry wells are located within the northwestern cell of the wastewater retention basin and were installed as part of the WWTP upgrade. Three other registered dry wells exist on-facility, two associated with the AFRC, and one associated with the Armory, for a total of 13 dry wells registered with ADEQ at SBAH.

According to the Arizona Department of Water Resources (ADWR) well registry and the Environmental Data Resources, Inc.™ (EDR™) report, there are five groundwater wells within 1 mile of SBAH (ADWR, 2019) and more within 4 miles. Two wells are on-facility, and the remaining three are off-facility, as described in **Table 2-1** below:

Table 2-1: Groundwater Wells within 1 Mile of SBAH

Registration Number	Owner	Location/Direction from SBAH Geographical Center	Well Depth (ft bgs)	Screen Interval (ft bgs)	Water Level (ft bgs)	Use	Pump Rate (gpm)	On-Facility/Off-Facility
55-213034	Arizona Emergency & Military Affairs Department	~0.49 miles SE	610	275-550	200	Mixed	Unknown	On-facility
55-507748	Div Military AFF-AZ	~0.20 miles E	610	275-550	230	Mixed	80	On-facility
55-577144	Evergreen Air Center	~0.70 miles WSW	250	190-240	220	Monitor	N/A	Off-facility
55-615698 (co-located with 55-618728)	Arizona State Land Department	~0.60 miles N	400	N/A	219	Mixed	5	Off-facility
55-618728 (co-located with 55-615698)	Arizona Board of Regents	~0.60 miles N	400	N/A	300	Mixed	Unknown	Off-facility

Notes:
E = east
gpm = gallons per minute
N = north
N/A = not applicable
SE = southeast
WSW = west-southwest

SBAH has two groundwater extraction wells: 55-213034 and 55-507748. The first well is located in the eastern corner of SBAH, adjacent to L4583, and the second well is located adjacent to the FMO, L4501 (**Figure 2-3**). Groundwater from these wells is used for potable drinking water, fire suppression, irrigation, and activities related to SBAH's mission. Groundwater extraction rates provided by ADWR are available from 1984 to 2015 for well 55-507748. The average annual extracted groundwater between 2011 and 2015 was 16.6 acres per foot (acre-ft) (5,409,126 gallons). There are 157 wells (domestic, commercial, and industrial), 50 of which are downgradient, within a 4-mile radius of the facility.

Based on the USEPA's Unregulated Contaminant Monitoring Rule 3 (UCMR3) data, no PFAS were detected in a public water system above the HA within 20 miles of the facility (USEPA, 2017a). The USEPA lifetime Health Advisory (HA) is 70 nanograms per liter (ng/L) for PFOA and PFOS, individually or combined. PFAS analyses performed in 2016 had method detection limits (MDLs) that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today. PFOA and PFOS were detected in groundwater sampled from several public supply wells in the Town of Marana from 2016-2017. In response, two treatment systems were designed and constructed to treat PFAS (and other contaminants) in groundwater. The two plants were operational as of March 2021 (Town of Marana, 2022). Depths to water gauged from the monitoring wells installed during the SI ranged from 157.29 to 166.17 feet bgs. Groundwater elevations have been calculated; however, given the limited number of monitoring wells at the facility, groundwater contours were not mapped. The calculated groundwater elevation from the two monitoring wells and the inferred groundwater flow direction are shown in **Figure 2-4**.

2.2.3 Hydrology

SBAH is within the city of Marana-Santa Cruz River watershed, which consists of approximately 58 square miles of the Lower Santa Cruz watershed in Pinal and Pima Counties. The watershed lies within a flat plain and includes a drainage area that is mostly undisturbed desert. The facility is located on a broad, flat, alluvial fan east of the Santa Cruz River. The area is characterized by a low-energy erosional environment stabilized by large creosote bushes and mesquite trees (Harris Group Inc, 2004).

The surface topographic gradient near the facility is less than 15 feet per mile to the west-northwest. The nearest significant natural drainage feature, the Santa Cruz River, is located approximately 2 miles west of SBAH (US Geological Survey [USGS], 1996). The nearest wetland is located 1.75 miles west-southwest of SBAH. This wetland is categorized as a "freshwater forested/shrub wetland" (US Fish and Wildlife Service [USFWS], 2015).

SBAH is located in Zone X, according to data from the Federal Emergency Management Agency's (FEMA) Flood Map Service Center. Zone X is defined as "areas of 0.2 percent (%) annual chance flood; areas of 1% chance annual flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." (FEMA, 2015). A floodplain is located approximately 0.75 mile west of SBAH. This floodplain is characterized as a "special flood hazard areas subject to inundation by the 1% annual chance flood" (FEMA, 2015).

There are no naturally occurring surface water features at SBAH (**Figure 2-5**). Surface water collecting features at SBAH include the following:

- A two-celled wastewater retention basin located in the northwestern corner of SBAH; and
- A stormwater retention basin located in the northwestern corner of SBAH, adjacent to the west of the wastewater retention basin.

SBAH contains several locations where surface runoff and stormwater are collected and ultimately diverted to the stormwater retention basin in the northwestern corner of the facility. These features generally run along the northeastern, northwestern, southwestern, and southeastern perimeter of SBAH. The stormwater collection system is closed, and collected water does not cross SBAH property boundaries. Collected water is removed from SBAH by a combination of evaporation and infiltration.

SBAH has a WWTP (L4710) capable of treating approximately 100,000 gallons per day, located in the southern point of the base, as seen in **Figure 2-5** (Versar, 2010). The WWTP (L4710) was built in 2008 and came online in 2010. The WWTP (L4710) discharges to a two-celled wastewater retention basin located in the northwestern corner of SBAH, adjacent and to the east of the stormwater retention basin. Effluent from the WWTP (L4710) is discharged to the northwestern-most cell, which contains five dry wells that transport the water to the subsurface for infiltration. Wastewater flow is contained within the bounds of SBAH property; however, waste sludge produced by the WWTP (L4710) has historically been disposed of offsite.

The stormwater and wastewater retention basins are located in the northwestern corner of SBAH (**Figure 2-5**). The geographic coordinates at the approximate center of the stormwater basin are 32°31’25.0” N; 111°20’18.8” W. The geographic coordinates at the approximate center of the wastewater retention basins are 32°31’29.3” N; 111°20’17.3” W and 32°31’27.7” N; 111°20’15.4” W for the northern and southern cells, respectively. According to aerial photographs, the stormwater retention basin has existed at SBAH since approximately June 1996. The wastewater retention basins were constructed between August 2006 and June 2007.

The stormwater retention basin is approximately 286,625 square feet and does not have an outlet; therefore, captured stormwater remains within SBAH property boundaries. The northern and southern wastewater retention basin cells are each approximately 47,000 square feet. The dry wells located within the wastewater retention basins direct reclaimed WWTP effluent into the shallow subsurface.

The stormwater retention basin and drainage network receive all of the stormwater and run-off generated from within the SBAH boundary. The water is removed from the network via surface infiltration and evaporation. According to the 2018 EDR™ report, SBAH site topography has an elevational change of approximately 12 feet across the facility from north to south (1865 to 1877 feet amsl) and an elevational change of approximately 32 feet across the facility from west to east (1856 to 1888 feet amsl) (EDR™, 2018). The facility’s topological features suggest surface water would flow to the northwest, towards the stormwater retention basin located in the northwestern corner of the facility.

2.2.4 Climate

SBAH is located within the Sonoran Desert, which has a warm steppe climate characterized by low precipitation and high evapotranspiration rates. Precipitation varies depending on location over the course of a year, but the region is generally arid, and the Tucson Basin receives only about 12 inches of precipitation annually. Summer rainfall (June through August) accounts for 30 to 60 percent of the yearly precipitation, while winter rains and occasional snow account for 10 to 40 percent of the annual total (Sellers and Hill, 1974; URS, 2008). The maximum average monthly temperature in nearby Eloy, Arizona occurs in July (105.7 degrees Fahrenheit [°F]), with an average maximum annual temperature of 87.7 °F. The minimum average monthly temperature occurs in December (35.2 °F), with an average minimum annual temperature of 53.5 °F (National Oceanic and Atmospheric Association [NOAA], 2019). The average annual precipitation in Eloy, Arizona from 1971-2000 was 10.60 inches (NOAA, 2019).

2.2.5 Current and Future Land Use

At the time of the PA report, Pinal County, in conjunction with the AZARNG, are conducting a Joint Land Use Study (JLUS). The Pinal County JLUS is a collaborative effort between the military and surrounding communities working to promote compatible and sustainable growth within Pinal County, while simultaneously preserving the mission of the AZARNG (Pinal County, 2019). The current land use of SBAH is specifically designated by Pinal County as “Airport Reserve”, with the functions being industrial/military. The Pinal Airpark and SBAH lie within Pinal County’s Red Rock Growth Area, as outlined in the County’s Comprehensive Plan, with the objective of facilitating mixed use development and a diverse economic center in southern Pinal County (Pinal County, 2015). The future land use of SBAH is not proposed for change.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

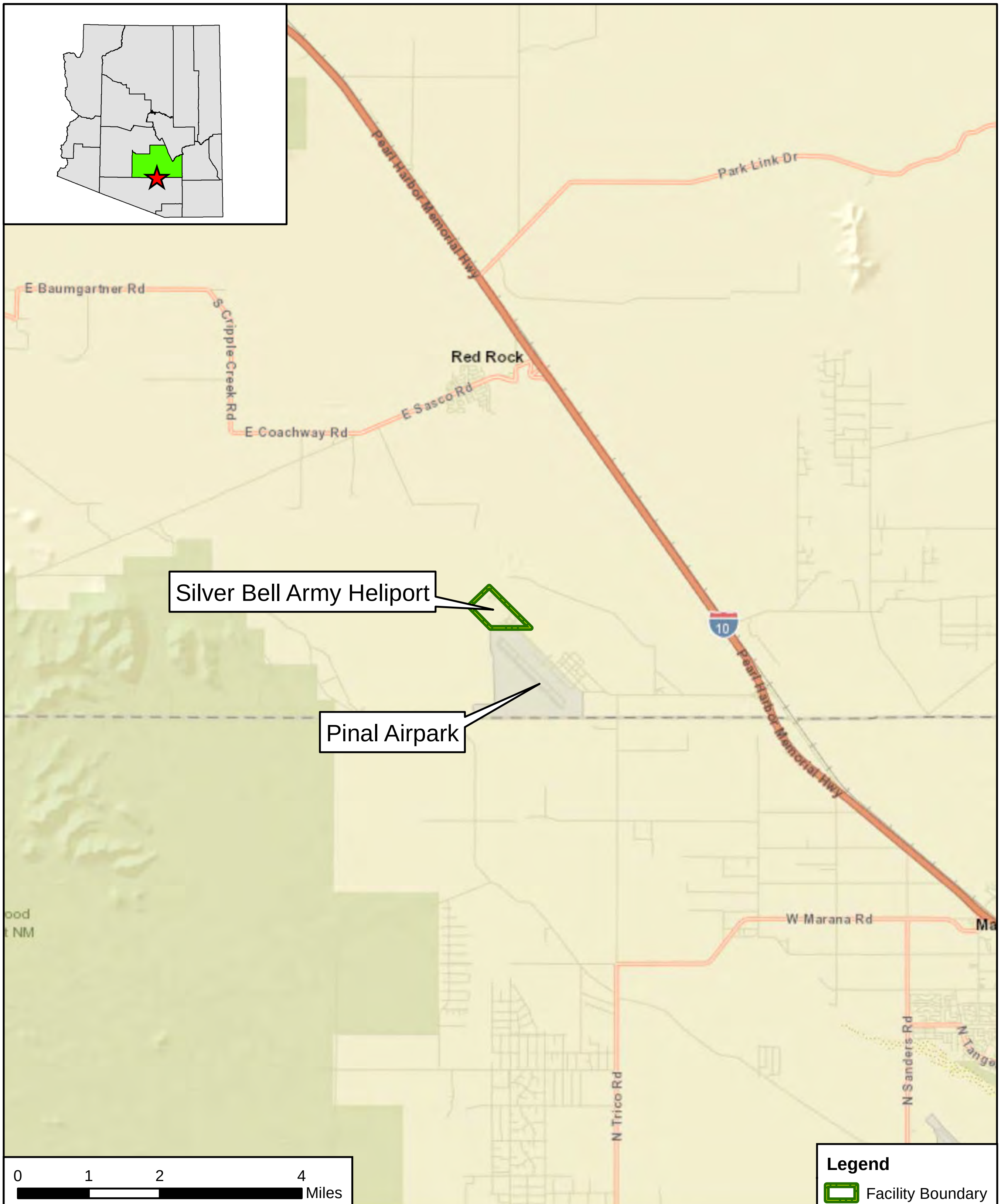
The following birds, plants, mammals, and reptiles are federally endangered, threatened, proposed, and/ or are listed as candidate species in Pinal County, Arizona (USFWS, 2021).

- **Amphibians:** Chiricahua leopard frog, *Rana chiricahuensis* (threatened)
- **Birds:** Bald eagle, *Haliaeetus leucocephalus* (resolved taxon); Southwestern willow flycatcher, *Empidonax traillii extimus* (endangered); Mexican spotted owl, *Strix occidentalis lucida* (threatened); Brown pelican, *Pelecanus occidentalis* (recovery); American peregrine falcon, *Falco peregrinus anatum* (recovery); Yuma Ridgways (clapper) rail, *Rallus obsoletus [longirostris] yumanensis* (endangered); Yellow-billed Cuckoo, *Coccyzus americanus* (threatened)
- **Fishes:** Spikedace, *Meda fulgida* (endangered); Loach minnow, *Tiaroga cobitis* (endangered); Gila topminnow (incl. Yaqui), *Poeciliopsis occidentalis* (endangered); Gila chub, *Gila intermedia* (endangered); Roundtail chub, *Gila robusta* (candidate); Razorback sucker, *Xyrauchen texanus* (endangered)
- **Flowering Plants:** Huachuca water-umbel, *Lilaeopsis schaffneriana var. recurve* (endangered); Nichol's Turk's head cactus, *Echinocactus horizonthalonius var. nicholii* (endangered); Arizona hedgehog cactus, *Echinocereus triglochidiatus var. arizonicus* (endangered); Acuna Cactus, *Echinomastus erectocentrus var. acunensis* (endangered)
- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate)
- **Mammals**: Sonoran pronghorn, *Antilocapra americana sonoriensis* (experimental population, non-essential); Ocelot, *Leopardus (Felis) pardalis* (endangered);
- **Reptiles**: Sonoran Desert tortoise, *Gopherus morafkai* (candidate); Tucson shovel-nosed Snake, *Chionactis occipitalis klauberi* (resolved taxon); Northern Mexican gartersnake, *Thamnophis eques megalops* (threatened)

2.3 History of PFAS Use

Thirteen potential PFAS release areas were identified at SBAH during the PA where aqueous film forming foam (AFFF) may have been used or released historically (AECOM, 2020). SBAH includes four hangars: Peace Vanguard Hangar (L4650), AC Maintenance Hangar (L4300), AASF #2 Hangar (L4600), and WAATS Hangar (L4605), which are equipped with fire suppression systems that use AFFF. AFFF was discharged from the fire suppression systems during several documented releases: testing of the Peace Vanguard Hangar system in 2009, unintentional triggering of the AASF #2 Hangar system in 2004 and 2007, and unintentional releases of the WAATS Hangar system four times between 2011 and 2018. Additionally, AFFF may have been released during fire training activities, washing of vehicles covered in AFFF, Tri-Max™ unit maintenance and recharge, AFFF storage, and emergency response related to fuel spills.

The potential PFAS release areas were grouped into four AOIs based on proximity to one another and presumed groundwater flow. A description of each AOI is presented in **Section 3**.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Silver Bell Army Heliport, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:126,720	CHK BY	AB	5/31/2022
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	5/31/2022

N

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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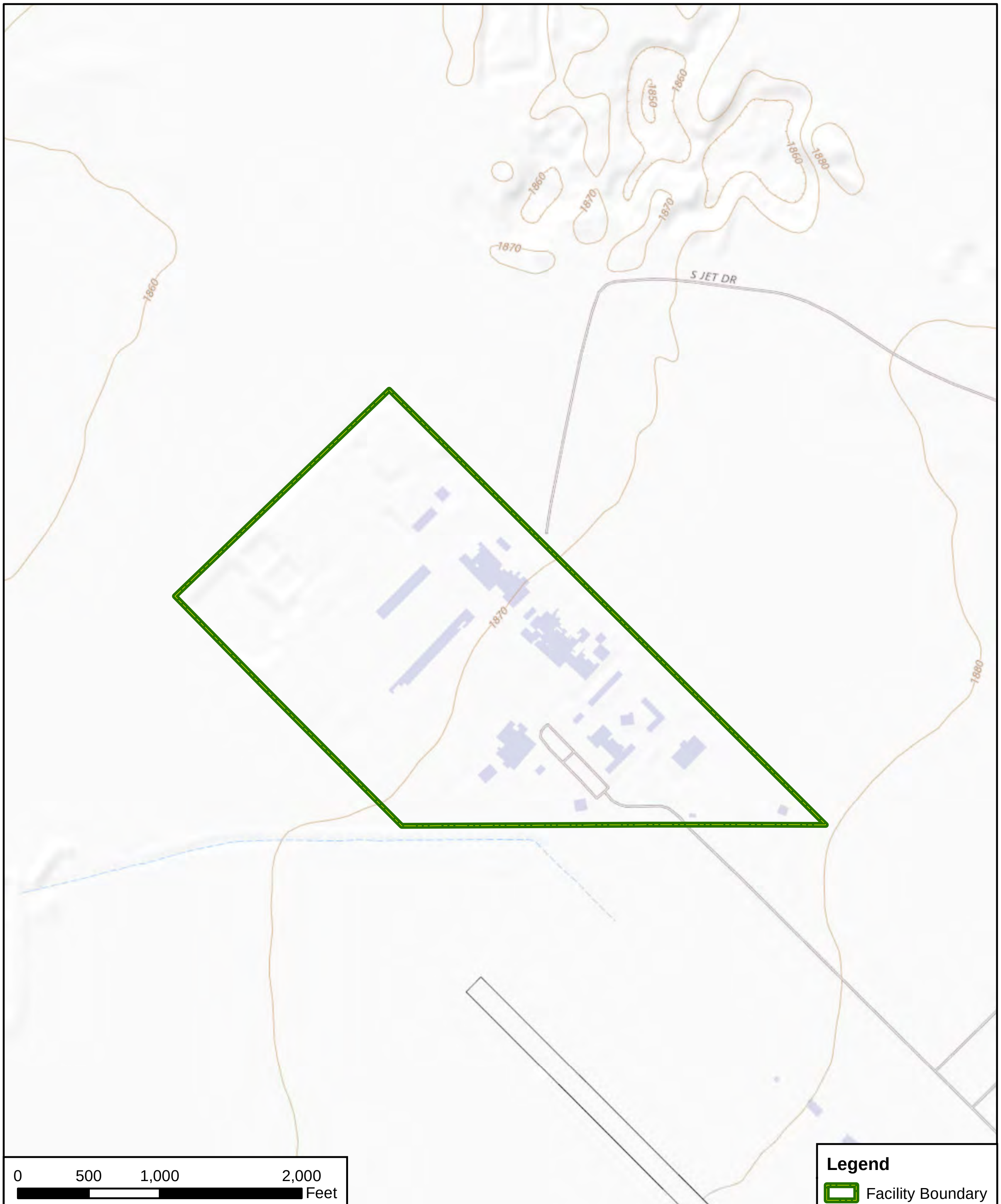

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Silver Bell Army Heliport, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:12,000	CHK BY	MB	5/31/2022
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	5/31/2022

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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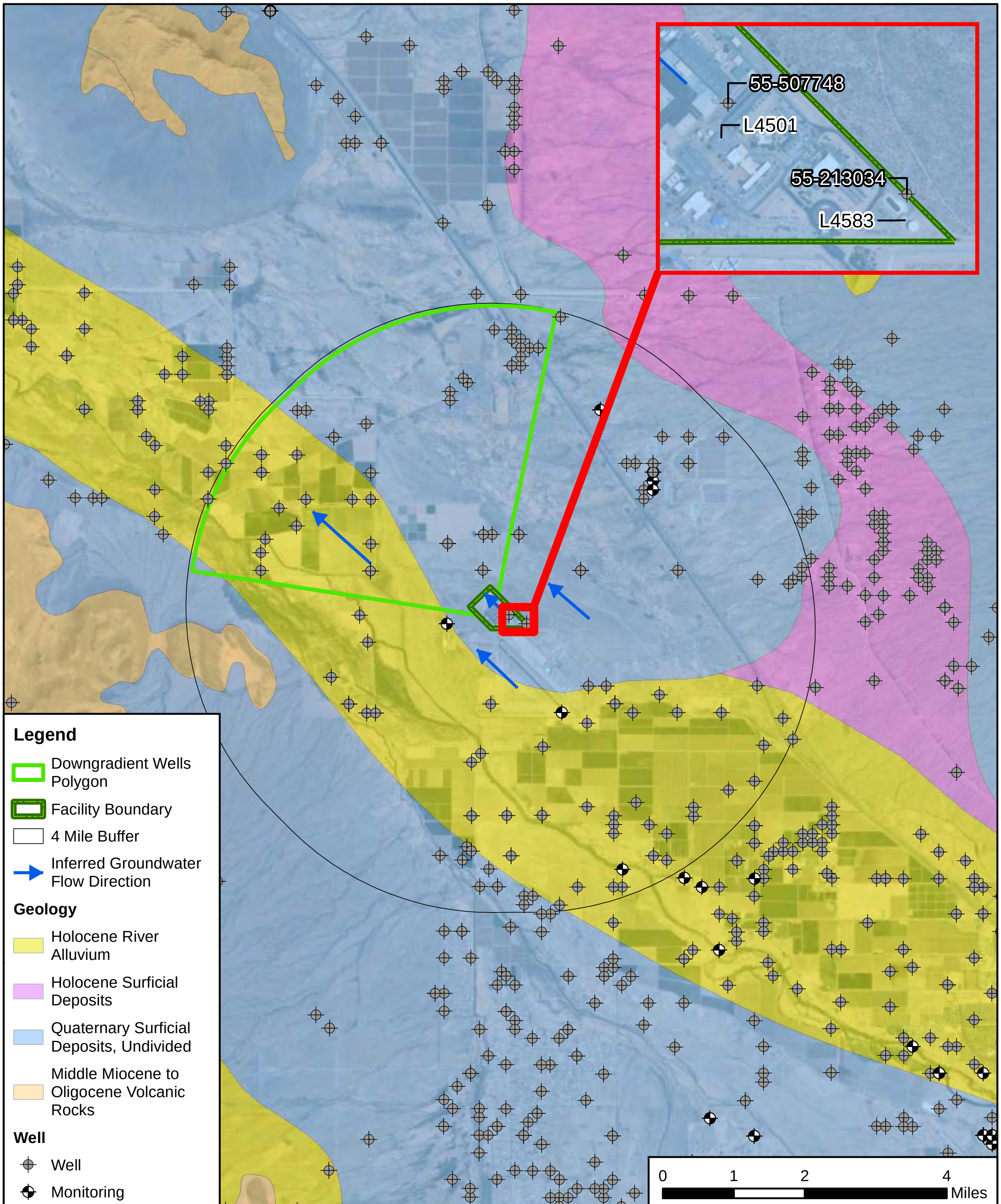

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at Silver Bell Army Heliport, AZ			
REVISED	6/3/2022	GIS BY	MS	6/3/2022
SCALE	1:126,720	CHK BY	MB	6/3/2022
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/3/2022

N

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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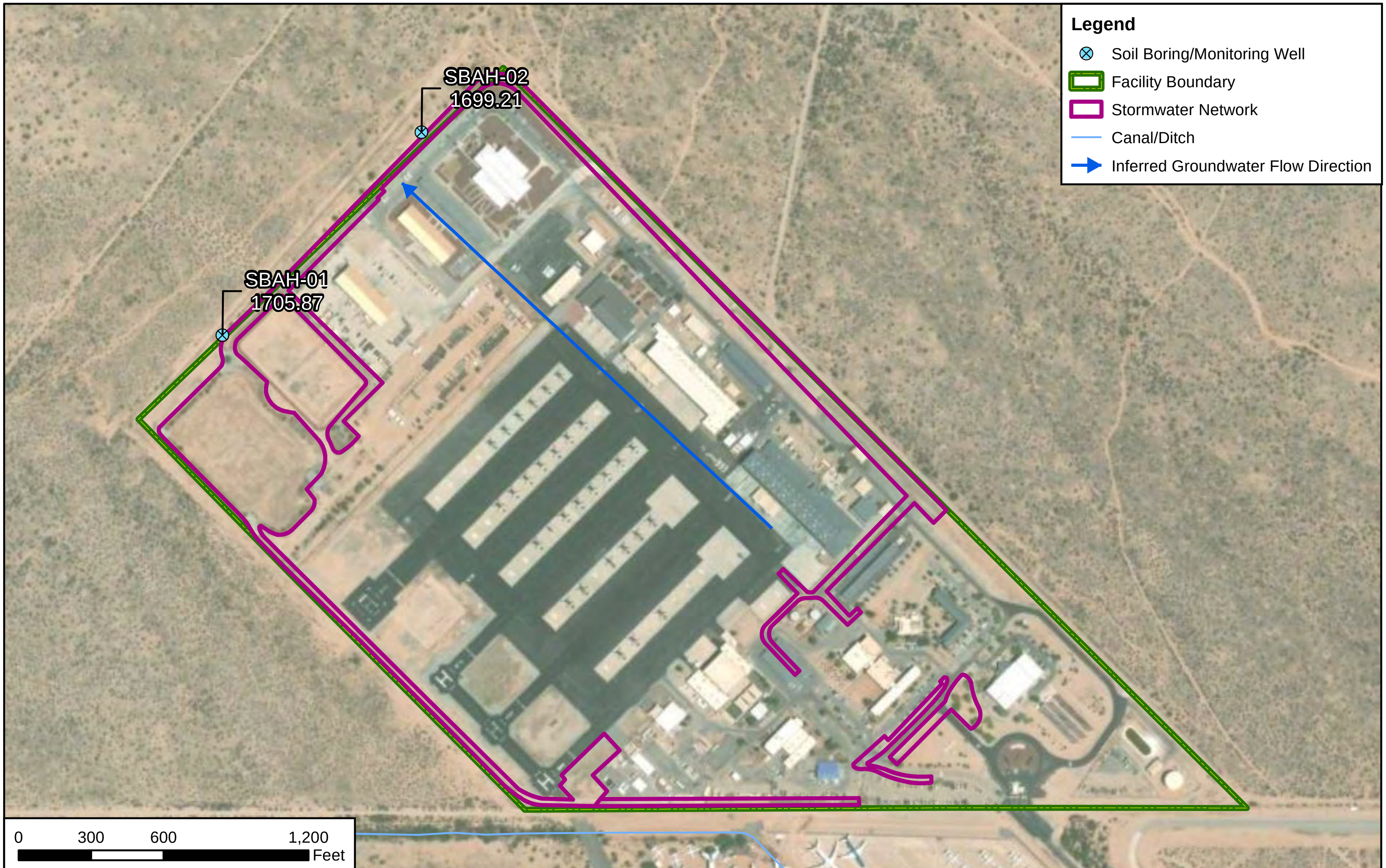

CLIENT	ARNG			
PROJECT	Site Investigation for PFOA, PFOS, and PFBS at Silver Bell, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:7,200	CHK BY	AB	5/31/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/31/2022

Groundwater Elevations, October 2021

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4

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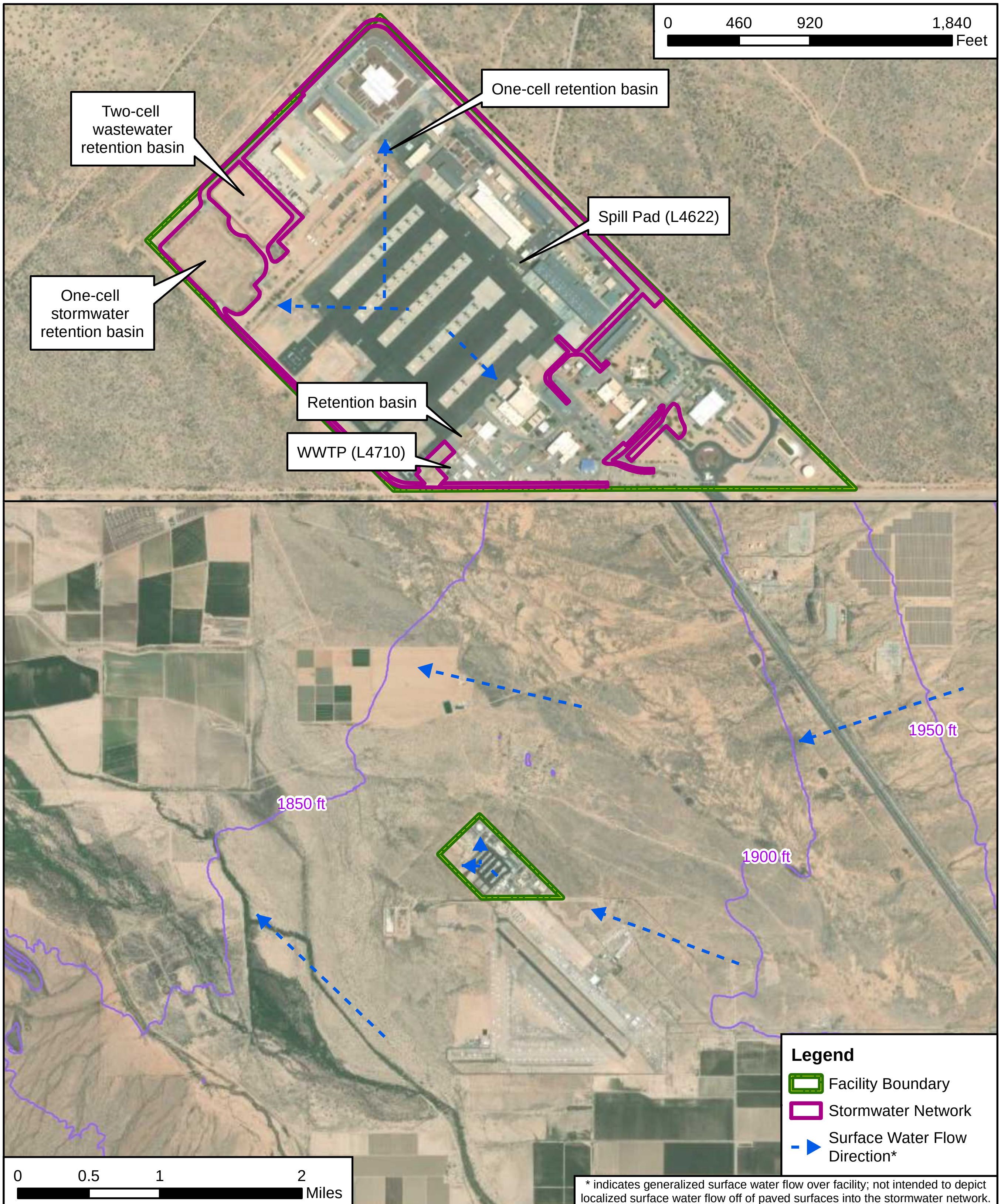

CLIENT	ARNG				Surface Water Features
NOTES	Site Inspection for PFAS at Silver Bell Army Heliport, AZ				
REVISED	6/2/2022	GIS BY	MS	6/2/2022	AECOM 12420 Milestone Center Drive Germantown, MD 20876
SCALE	1:63,360	CHK BY	AB	6/2/2022	Figure 2-5
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/2/2022	

N

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. Based on the PA findings, thirteen potential PFAS release areas were identified at SBAH and grouped into four AOIs (AECOM, 2020). The potential PFAS release areas are shown on **Figure 3-1**.

3.1 AOI 1

Building L4320 and the surrounding area comprise AOI 1. This AOI consists of two potential PFAS release areas, as described below.

The current fire station (Building L4320) is located approximately 350 feet southwest of the AC Maintenance Hangar (L4300), along the southeastern border of the tarmac. The current fire station (L4320) consists of a large building, an asphalt and gravel driveway, and surrounding bare earth and landscaping gravel planters. The driveway is approximately 90 feet long, 60 feet wide, and the geographic coordinates of the approximate center are 32°31’14.6” N; 111°19’59.6” W. The building is equipped with a fire suppression system and has three drains in each one of its three bays (nine drains in total). The SBAH utility map indicates these drains connect to the WWTP (L4710).

The first potential PFAS release area is associated with fire training which occurred outside and in front of the current fire station (L4320). The former Fire Chief at Marana Army Airfield stated during interviews that one to two Tri-Max™ units were used monthly for fire training purposes. Fire training activities at the current fire station (L4320) began when the station became operational in 2009 until late in 2018.

The second potential PFAS release area is associated with fire equipment storage, Tri-Max™ storage, and equipment maintenance. Fire equipment inspections were performed on the driveway and within the surrounding gravel and sparsely vegetated areas at the current fire station (L4320). Additionally, Tri-Max™ mobile fire extinguishers and other AFFF equipment are currently stored along the western edge of the driveway. Further, the current fire station (L4320) maintains six firefighting vehicles as well as equipment designed to suppress aircraft fires. In addition, firefighting equipment and materials are stored on unpaved areas adjacent to a CONEX box approximately 90 feet south of the geographic center of the current fire station (L4320) driveway. The approximate geographic coordinates of the storage area are 32°31’13.6” N; 111°19’59.7” W. The 500 square feet storage area is unsheltered. Firefighting materials have been stored in this area since 2009. Several Tri-Max™ units, ladders, fire extinguisher canisters, compressed gases, and hoses are stored in this area. Materials are stored on the ground between a chain-link fence and the metal CONEX box. Potential AFFF releases to the environment are suspected to have occurred in this area due to leaks from Tri-Max™ units, fire extinguishers, and material canisters located in the storage area. The total volume of stored AFFF materials at the fire station (L4320) is generally between three to five 55-gallon drums at any one time.

Maintenance and storage activities at the current fire station (L4320) began when it became operational in 2009 until late in 2018. Tri-Max™ maintenance and recharge are performed along the driveway and on the landscaping gravel on the side of the driveway. These activities included discharging the contents of the Tri-Max™ onto the ground surface and replacing the Tri-Max™ solution via a 5-gallon bucket. According to SBAH personnel, for more than 12 years, the contractor changed the solution in the Tri-Max™ units every 6 months. Tri-Max™ decommissioning occurred outside Building L4320. This process included drilling holes in the old units and dumping the solution in the unpaved area southwest of the fire station driveway and surrounding area (L4320). SBAH personnel estimate that about 100 units per year were dumped in this area.

Vehicles containing AFFF are also maintained and stored within the bays at the current fire station (L4320). Maintenance activities of these vehicles consist of nozzle testing and spraying, purging and refilling AFFF storage on vehicles along with washing and servicing of fire trucks and other similar activities. Vehicles are refilled with AFFF using a pump. According to SBAH personnel, AFFF leaked from a firetruck within the fire house and drained through the bay floor drain. The date of this leak and volume of AFFF released are unknown.

3.2 AOI 2

Building L4300 and the surrounding area comprise AOI 2. This AOI consists of two potential PFAS release areas, as described below.

The former fire station driveway, AC Maintenance Hangar (Building L4300), and surrounding area are located along the southeastern border of the tarmac and consist of a long asphalt driveway with gravel planters on either side of the driveway. The former fire house occupies a small space in the northern most portion of the AC Maintenance Hangar (L4300). There is a shade canopy directly in front of the former fire house, along the driveway. The driveway is approximately 100 feet long, 35 feet wide, and the approximate geographic coordinates of the center are 32°31’17.8” N; 111°19’56.3” W. This portion of the building is currently used as classrooms for SBAH personnel. The building was not equipped with a fire suppression system and did not have floor drains.

The first potential PFAS release area is associated with fire training, which occurred outside and in front of the AC Maintenance Hangar (Building L4300). This portion of the AC Maintenance Hangar (L4300) previously operated as a fire station between 1985 to 1994, then again from 2006 to 2009. Fire training activities and equipment inspection were performed on the driveway and within the surrounding gravel areas. SBAH personnel stated that foaming occurs in surface water runoff near the former fire training area (FTA) during significant rainfall. Tri-Max™ mobile fire extinguishers were discharged and refilled semi-annually at the former fire station (L4300) during its use as an FTA, but the exact timeframe of fire training is unknown, although it likely coincides with the operation of the fire station (1985 -1994; 2006 – 2009). Fire training and maintenance activities ceased at the FTA when the fire station was relocated to the current fire station (L4320). Training at the former fire station driveway, AC Maintenance Hangar (L4300), and surrounding area involved using one to two mobile Tri-Max™ units, per event, to extinguish small fires. Training is believed to have occurred on the building driveway.

The second potential PFAS release area is associated with fire equipment storage, Tri-Max™ storage, and equipment maintenance. Tri-Max™ maintenance and recharge were performed along the driveway and in the landscaping gravel adjacent to the driveway. This maintenance included discharging the contents of the Tri-Max™ units onto the ground surface and replacing the Tri-Max™ solution via a 5-gallon bucket. Based on the description of these activities, the Tri-Max™ maintenance area is considered to be the entire length of the asphalt driveway and the immediate areas of landscaping gravel on either side of the driveway.

3.3 AOI 3

AOI 3 consists of five specific areas were numerous potential PFAS release areas occurred. In total, this AOI consists of eight potential PFAS release areas, as described in the subsections below.

3.3.1 Peace Vanguard Hangar (L4650)

The Peace Vanguard Hangar (Building L4650) is located in the northern corner of SBAH and directly south of the fuel farm. The geographic coordinates at the approximate center of the hangar structure are 32°31’31.1” N; 111°20’01.5” W. The Peace Vanguard Hangar (L4650) was constructed in 2009 and supports joint operations between US forces and visiting international forces. During the PA, two potential PFAS release areas were identified at the Peace Vanguard Hangar (L4650).

The first potential PFAS release area is associated with fire training which occurred outside and in front of the Peace Vanguard hangar (L4650). SBAH personnel stated that fire training activities occurred in front of the building. According to interviewees, the last training in this area was in October 2018. The area used for fire training is assumed to be along the concrete apron on the south-side of the Peace Vanguard Hangar (L4650). Fire training performed annually at this FTA consisted of discharging AFFF from one to two Tri-Max™ mobile fire extinguishers, per event, at small objects set ablaze. Tri-Max™ solution was directly sprayed onto the concrete apron and was not contained using booms or similar products. After training, the Tri-Max™ solution was washed away using water. AFFF sprayed during training may have potentially travelled to the stormwater retention basin, the landscaping gravel planter adjacent to the concrete apron, and/or the wash rack drain located approximately 75 feet southeast of the Peace Vanguard Hangar (L4650) apron.

The second potential PFAS release area is associated with the fire suppression system within the Peace Vanguard Hangar (Building L4650). The system was initially tested following the hangar’s construction in 2009. The foam filled about 6 feet high within the hangar bays and was pushed out the door, towards the tarmac, and allowed to evaporate. According to SBAH personnel, the Peace Vanguard Hangar (L4650) fire suppression system has been tested annually since the 2009 release by a contractor, though no releases have occurred beyond the interior of the hangar.

3.3.2 Wash Rack

The geographic coordinates at the approximate center of the Wash Rack and Drain (L4603) structure are 32°31’38.8” N; 111°20’00.8” W. Aerial photographs indicate the Wash Rack and Drain (L4603) has been in operation since 2003. Though the intended purpose of the Wash Rack and Drain (L4603) is for daily use of vehicle cleaning operations, the Aviation Life Support Equipment Supervisor stated during interviews that the Wash Rack and Drain (L4603) may have occasionally been used for fire training with Tri-Max™ mobile fire extinguishers. During the PA, two potential PFAS release areas were identified at the Wash Rack. .

The first potential PFAS release area is associated with fire training that occurred at the Wash Rack. Fire training is believed to have occurred on the tarmac near the Wash Rack and Drain (L4603), which allowed discharged AFFF to be washed down the drain. The type of training performed on the tarmac near the Wash Rack and Drain (L4603) is similar to that performed at the Peace Vanguard Hangar (L4650), where one to two Tri-Max™ mobile fire extinguishers, per event, were used to extinguish small fires.

The second potential PFAS release area is associated with vehicle and aircraft washing and maintenance. Various types of helicopters, wheeled vehicles, and large aircraft parts are washed at the Wash Rack and Drain (Building L4603). SBAH personnel stated with confidence during interviews that helicopters covered with AFFF were washed at the Wash Rack and Drain (L4603) during a release of the fire suppression system at AASF #2 (L4600).

3.3.3 AASF#2 (L4600)

AASF #2 (Building L4600) is located along the northeastern boundary of SBAH and directly southeast of the Peace Vanguard Hangar (L4650) and Wash Rack and Drain (L4603). The geographic coordinates at the approximate center of AASF #2 (L4600) are 32°31’26.4” N; 111°19’56.3” W. Aerial photographs indicate that AASF #2 (L4600), which supports SBAH

AZARNG operations, was constructed in 1995. There are three fire suppression systems among eight bays within AASF #2 (L4600). Two potential PFAS release areas were identified.

The first potential PFAS release area is associated with fire training which occurred at AASF #2 (L4600). SBAH personnel stated during interviews that annual fire training with one to two Tri-Max™ training mobile fire extinguishers, per event, occurred annually on the asphalt southwest of the concrete apron at AASF #2 (L4600) until several years ago; the timeframe in which annual training occurred is unknown. Depending on the exact location of fire training at AASF #2 (L4600), AFFF may have discharged southeast towards a stormwater drainage ditch located southeast of the apron.

The second potential PFAS release area is associated with the fire suppression system within the Peace Vanguard Hangar (Building L4650). The fire suppression system at AASF #2 (Building L4600) has been triggered on multiple occasions and resulted in releases of AFFF. SBAH personnel indicated that the automatic fire suppression system was unintentionally triggered in 2004 and 2007. The fire suppression system pipes leaked AFFF to the floor of the AASF #2 (L4600) in 2004. The AFFF was mopped up using a Zamboni and pushed towards a trench drain that extends the entire length of building L4600. The spill pad drain and the hangar trench drain transported fluids to a former retention pond where Peace Vanguard Hangar (L4650) is located. In 2007, AFFF solution filled the fire riser room due to a malfunction; the solution was directed to the asphalt roads and unpaved areas northeast of AASF #2 (L4600), and it leaked out of the Paint Room and Machine Room. It is unclear if the solution reached the stormwater drainage ditch. Additionally, the volume of AFFF released during both unintentional fire suppression system trigger events is unknown.

3.3.4 Former Fire Station (L4601)

The SBAH former fire station (Building L4601) is located between the AASF #2 Hangar (L4600) and WAATS Hangar (L4605). The geographic coordinates at the approximate center of the former fire station (L4601) are 32°31'25.3" N; 111°19'55.3" W. Historical aerial imagery suggests that the former fire station (L4601) was constructed in 1994 and was used as a fire station until 2006. Activities associated with the maintenance and storage of firefighting equipment were conducted within this facility while it operated as a fire station. One potential PFAS release area was identified.

According to SBAH personnel, the former fire station (L4601) did not have a fire suppression system or drains. Although unverified, AFFF releases may have occurred at the former fire station (L4601) during its operational years as a fire station based on common activities performed at other SBAH fire stations, such as the maintenance and storage of firetrucks. It is therefore assumed that potential AFFF releases at the former fire station (L4601) would have entered the environment through the spill pad drain and the building's surrounding areas.

3.3.5 WAATS Hangar (L4605)

The WAATS Hangar (Building L4605) is located along the northeastern boundary of SBAH and directly southeast of AASF #2 (L4600) and the former fire station (L4601). The geographic coordinates at the approximate center of the WAATS Hangar (L4605) are 32°31'23.3" N; 111°19'52.3" W. Historical aerial photographs indicate the WAATS Hangar (L4605) was constructed between 2004 and 2005. The WAATS Hangar (L4605) has 10 bays and is equipped with a multi-zone fire suppression system. During the PA, one potential PFAS release area was identified at the WAATS Hangar (L4605).

SBAH personnel stated during interviews that the automatic fire suppression system at the WAATS Hangar (L4605) unintentionally released AFFF in 2011, April 2017, May 2018, and July

2018. The release in 2011 occurred in the back (northeast) portion of the WAATS Hangar (L4605). The volume of AFFF released from these events is unknown. The released AFFF likely migrated northeast along the asphalt towards bare earth behind the WAATS Hangar (L4605).

The April 2017 and July 2018 releases occurred in the fire riser room at the rear (northeast) of the WAATS Hangar (L4605). A seal within the fire suppression system failed and caused the fire riser room to fill with AFFF. The volumes of AFFF released during the April 2017 and July 2018 releases are unknown.

The May 2018 release occurred during a fire system check conducted at the WAATS Hangars (L4605). The fire suppression system was deactivated; however, one riser remained activated due to improper labeling. When the system was tested, the “old paint booth” riser activated and filled the room with AFFF, though it was no longer the paint booth at that moment, as it was used as the sheet metal shop. The volume of AFFF released is unknown. According to SBAH personnel, the release was squeegeed out, washed out, and pushed out to the gravel area northeast of the building.

3.4 AOI 4

The Alpha, Charlie, and Bravo Rows comprise AOI 4. This AOI consists of one potential PFAS release area, as described below.

Emergency response locations are often considered potential PFAS release areas because AFFF is commonly used to extinguish crash flames. According to SBAH staff, no crashes or unplanned fires that resulted in AFFF use have occurred at SBAH during their tenure; however, two crashes at the adjacent Marana Army Airfield were described during interviews.

AFFF is commonly used to extinguish aviation fuel-related fires. Several fuel spills have occurred on the tarmac at SBAH. AFFF was used to control a fire or fire-potential at spills in the Alpha, Bravo, and Charlie rows of the tarmac southwest of the AASF #2/WAATS Hangar. The Charlie row spill was speculated by staff to have occurred in 2003 or 2004. The timeframe of the Alpha/Bravo row spill is unknown, though SBAH personnel stated that the asphalt had to be replaced due to the extent of the spill. The volume of AFFF used in response to both events is unknown, and spill records were unavailable during the site visit.

Tri-Max™ units are stored on the facility between each aircraft on the ramp for use during emergency response. At the time of the visual site inspection, 58 Tri-Max™ units were on the ramp, with a historical maximum total of up to 100 units. The Tri-Max™ units have been used at SBAH since 2002 or 2003. Prior to this time, large carbon dioxide containers were used for fire suppression on the ramp, though they were not stored on the ramp.

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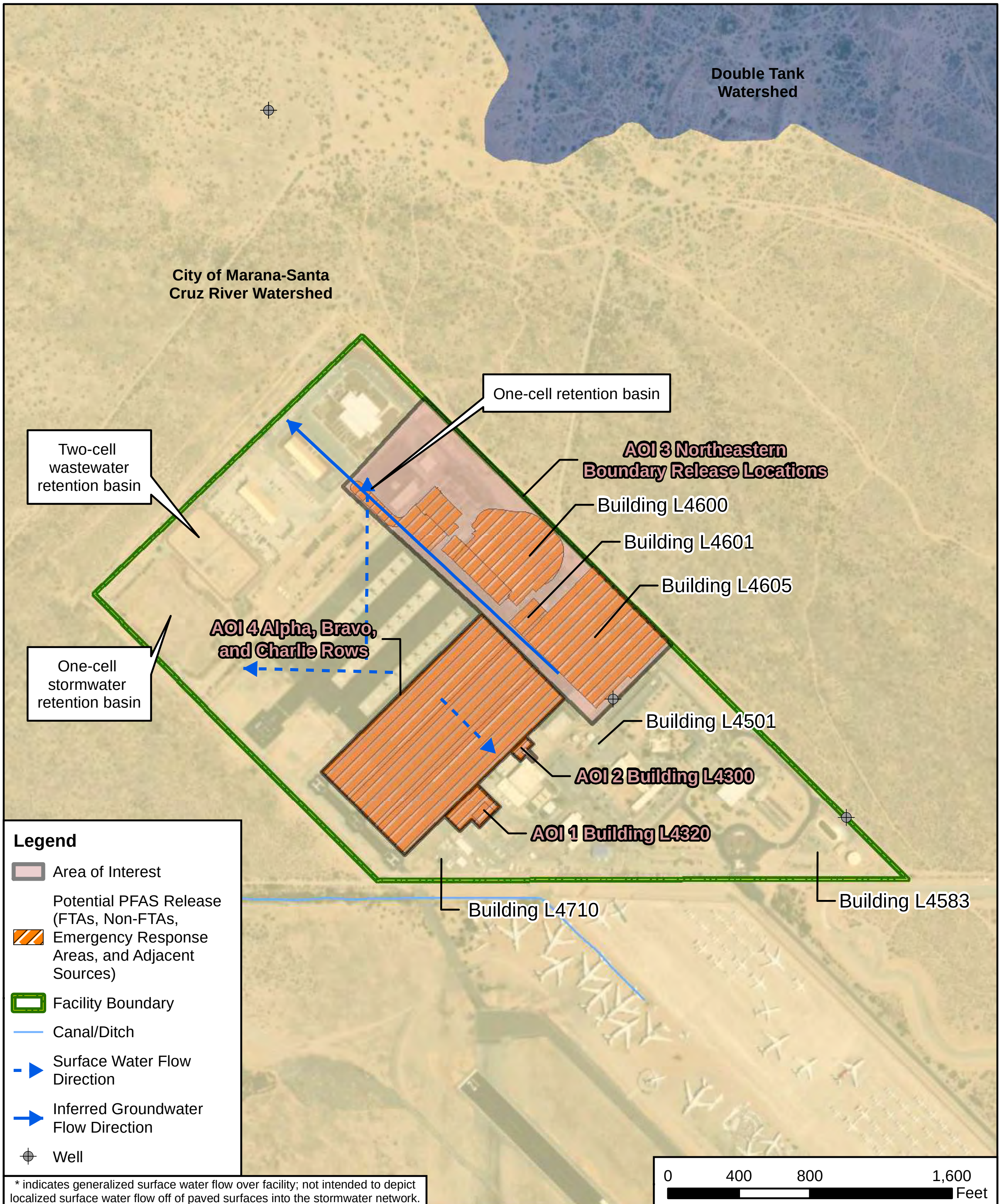

CLIENT	ARNG				
NOTES	Site Inspection for PFAS at Silver Bell Army Heliport, AZ				
REVISED	6/3/2022	GIS BY	MS	6/3/2022	
SCALE	1:9,600	CHK BY	AB	6/3/2022	
Base Map: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community		PM	CM	6/3/2022	

Areas of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

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

4.1 Problem Statement

The following problem statement was developed during project planning:

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

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

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

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

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

4.2 Goals of the Study

The following goals were established for this SI:

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

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

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

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

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

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

4.3 Information Inputs

Primary information inputs included:

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

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-1**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s).

4.5 Analytical Approach

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

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

Groundwater:

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

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

Soil:

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

Soil and groundwater samples were collected from each of the identified AOIs. Groundwater was encountered within two downgradient boundary monitoring wells installed during the SI, and depths to water ranged from 157.29 to 166.17 feet bgs. Any PFAS detected in groundwater from either boundary well may be attributable to any AOI on the facility.

4.6 Data Usability Assessment

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

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

Precision

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

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established quality control (QC) criteria. No associated calibration verifications displayed results outside the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

LCS/LCS duplicate (LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a).

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2021a) with limited exceptions. Two field duplicate pairs displayed one non-detect result for a compound, while the associated field duplicate sample displayed a positive result. The non-detect result was qualified UJ, fd, while the positive result was qualified J,fd. The qualified field duplicate pair results should be considered usable as estimated values. The duplicate performed during the total organic carbon (TOC) analysis displayed an RPD greater than the established precision limits presented in the QAPP addendum. However, these duplicate RPDs were not applicable for qualification because the sample and/or duplicate concentrations were less than five times the reporting limit. The associated field sample results should be considered usable as reported.

Accuracy

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

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

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. The MS/MSD samples were within the project established control limits presented in the QAPP Addendum (AECOM, 2021a) with minor exceptions. The MS/MSD performed on parent sample AOI04-03-SB-13-15 displayed percent recoveries less than the lower QC limit for PFOS. The associated field sample result was positive and was qualified as estimate with a negative bias. The qualified field sample result should be considered usable as an estimated value.

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. Field samples SBAH-ERB-03, AOI01-03-SB-0-2, and AOI02-03-SB-0-2 displayed EIS area counts outside the project established precision limits presented in the QAPP Addendum (AECOM, 2021a). In the case of parent sample AOI01-03-SB-0-2, the sample was diluted by a factor of ten. Therefore, the EIS area count recovery was not applicable for qualification, and the associated field sample result should be considered usable as reported. The non-detect field sample result associated with a high EIS recovery should be considered usable as reported, while the positive field sample result was qualified as estimate with a negative bias. The qualified field sample result should be considered usable as qualified.

Injection internal standards (IIS) were added by the laboratory after sample extraction and prior to analysis as a legacy requirement of DoD Quality Systems Manual (QSM) 5.1 to measure relative responses of target analytes. Even though not required under the current DoD QSM 5.3 analysis, the IIS are still added to the sample after extraction as an additional QC measure. The IIS percent recoveries were outside the established precision limits presented in the QAPP Addendum (AECOM, 2021a) for one field sample. The impact on data usability was not assessed, and the field samples were re-analyzed by the laboratory to confirm the initial results.

Representativeness

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

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) Compliant with QSM 5.1 Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branched and linear isomers when available were used, and isotopically labeled standards were used for quantitation.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2021a) for all analyses. All technical and analytical holding times were met by the laboratory, with limited exceptions. The holding time for pH analysis is considered 'immediate', so all pH sample results have been qualified as estimate. Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control.

One instrument blank displayed a concentration of N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) greater than the detection limit (DL). The associated field sample results were non-detect or displayed positive results greater than five times the blank detection.

Field blanks and equipment blanks were also collected for groundwater and soil samples. The equipment blanks SBAH-ERB-01 and SBAH-ERB-02 displayed concentrations greater than the DL for multiple target analytes. The associated field sample results were non-detect or displayed positive results greater than five times the blank detections.

A sample of the water used for decontamination of the drill rig was collected in advance of the field effort. The blank samples L4501-01 and L4580-02 displayed concentrations greater than the DL for multiple target analytes. The associated field sample results were non-detect or displayed positive results greater than five times the blank detections.

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

Comparability

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

Completeness

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

- PFAS in aqueous media by DoD QSM 5.3 Table B-15 at 100%
- PFAS in solid media by DoD QSM 5.3 Table B-15 at 100%
- pH in soil by USEPA Method 9045D at 100%
- TOC by USEPA Method 9060 at 100%

Sensitivity

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

5. Site Inspection Activities

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

- *Final Preliminary Assessment Report, Silver Bell Army Heliport, Marana, Arizona* dated September 2020 (AECOM, 2020);
- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan* dated March 2018 (AECOM, 2018a);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Silverbell Army Heliport, Marana, Arizona* dated July 2021 (AECOM, 2021a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b); and
- *Final Site Safety and Health Plan, Silverbell Army Heliport, Marana, Arizona* dated September 2021 (AECOM, 2021b).

The SI field activities were conducted from 4 to 23 October 2021 and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a), except as noted in **Section 5.8**.

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

- Thirty (30) soil samples from 19 boring locations;
- Two low-flow groundwater samples from two newly installed permanent monitoring well locations; and
- Seventeen (17) quality assurance (QA) samples.

Figure 5-1 shows the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity was completed throughout the SI field activities and is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, Field Change Request Forms are provided in **Appendix B3**, and land survey data are provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

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

5.1.1 Technical Project Planning

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

A combined TPP Meeting 1 and 2 was held on 27 January 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, AZARNG, USACE, ADEQ, and representatives familiar with the facility, regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2021a).

The TPP Meeting 3 has not yet been scheduled. Its purpose is to discuss the results of the SI. Meeting minutes for TPP 3 will be included in **Appendix D** 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

AECOM's drilling subcontractor, Cascade Technical Services, LLC. placed a ticket with the Arizona 811 utility clearance provider to notify them of intrusive work on 15 September 2021. However, because the facility is a private facility, the participating "Call Before You Dig" locators did not clear utilities within the boundaries of the facility. Therefore, AECOM contracted Ground Penetrating Radar Systems Inc. (GPRS), a private utility location service, to perform utility clearance. GPRS performed utility clearance of the proposed boring locations on 4 October 2021 with input from the AECOM field team and SBAH facility staff. Ground-penetrating radar were used to complete the clearance. Additionally, the first 5 feet of each boring were pre-cleared using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

The potable water source used for decontamination of drilling equipment was confirmed to be acceptable for use in a PFAS investigation prior to the start of field activities. Samples from the two water supply wells at SBAH were collected on 22 February 2021, prior to mobilization, and analyzed for PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15. The results of the decontamination water sample are provided in **Appendix F**. A discussion of the results is presented in **Section 4.6 Representativeness**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2021a). Prior to the start of field work each day, a PFAS Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via rotary sonic (rotosonic) drilling technology, in accordance with the SI QAPP Addendum (AECOM, 2021a). A TSi 155CC sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on **Figure 5-1** and depths are provided **Table 5-2**.

At the permanent monitoring well locations, one surface soil sample (0 to 2 feet bgs), one subsurface soil sample (13-15 feet bgs), and one soil sample approximately 2 feet above the groundwater table were collected. At the shallow subsurface soil boring locations, one surface soil (0-2 feet bgs) and one subsurface soil sample (13-15 feet bgs) was collected. At hand auger locations, one surface soil sample (0-2 feet bgs) was collected.

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

Soil borings completed during the SI found alternating layers of well-graded silty sand and gravel and semi-confining layers of silty clay to clay. The borings were completed at depths between 15 and 250 feet bgs. Isolated layers of clay to silty sand were also observed in the boring logs at thicknesses ranging from a few inches to several feet thick. Many of the logs also reported varying percentages of gravel and cobbles. These observations are consistent with the understood fill material from development of the facility and natural material as a result of depositional environment.

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

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

Soil borings not converted into permanent monitoring wells were subsequently abandoned in accordance with the SI QAPP Addendum (AECOM, 2021a) using bentonite chips at completion of sampling activities. Borings were installed in grass or dirt areas to avoid disturbing concrete or asphalt surfaces.

5.3 Permanent Well Installation, Development, and Groundwater Sampling

During the SI, two permanent monitoring wells were installed within or downgradient of potential source areas. The locations of the wells are shown on **Figure 5-1**.

A truck-mounted rotosonic drill rig was used to install two 4-inch diameter monitoring wells. The monitoring wells were constructed with Schedule 80 poly-vinyl chloride (PVC), flush threaded 10-foot sections of riser, 0.020-inch slotted well screen (50 foot screen), and a threaded bottom cap. A filter pack of 12/20 silica sand was installed in the annulus around the well screen to 2 feet above the well screen. A 5-foot-thick bentonite seal was placed above the filter sand and hydrated with potable water. A bentonite grout was placed in the well annulus from the top of the bentonite seal to ground surface. The bentonite grout was allowed to set for 24 hours prior to well completion in accordance with the SI QAPP Addendum (AECOM, 2021a). Both monitoring wells were completed with flush mount well vaults and circular well pads 2 feet in diameter. The screen interval of each of the groundwater monitoring wells is provided in **Table 5-3**.

Monitoring well development was completed in accordance with the SI QAPP Addendum (AECOM, 2021a). The newly installed monitoring wells were developed no sooner than 24 hours following installation. Development was performed by Cascade. A pump hoist truck was used to raise and lower an air lift pump for development. The wells were surged and purged at a rate determined in the field to reduce drawdown, but also remove bulk sediment from the bottom of the monitoring well and suspended solids in the filter pack. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], and turbidity) were measured using a water quality meter and recorded on the well development form (**Appendix B2**).

Groundwater samples were collected in accordance with the SI QAPP Addendum using low-flow sampling methods using a Geotech submersible pump (AECOM, 2021a). New tubing was used at each well and the pumps were decontaminated between each well. The wells were purged at a rate determined in the field to reduce drawdown during sampling. Water quality parameters (e.g., temperature, specific conductance, pH, DO, and ORP) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in either groundwater samples.

Each sample was collected into 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 by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2021a).

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

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 23 October 2021. Groundwater elevation measurements were collected from the two new temporary monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater elevation map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

The northern side of each well casing was surveyed by Arizona-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021a). Survey data from the newly installed wells on the facility were collected on 22 October 2021 in the applicable Universal Transverse Mercator zone projection with World Geodetic System 84 datum (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed well data are provided in **Appendix B4**.

5.6 Investigation-Derived Waste

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

Soil generated from the shallow soil borings (0-15 feet bgs) and the top 10 feet (0 to 10 feet bgs) and 10 feet above watertable from each of the monitoring well locations was containerized in properly labeled 55-gallon drums. The containerized IDW is being temporarily stored onsite at a location designated by AZARNG. ARNG will coordinate waste profiling, transportation, and disposal of the solid IDW.

Liquid IDW (i.e., purge water and decontamination fluids) generated during SI activities was containerized in properly labeled 55-gallon drums. The liquid IDW was not sampled and assumes the PFAS characteristics of the associated groundwater samples collected from the source locations. The containerized IDW is being temporarily stored onsite at a location designated by AZARNG. ARNG may use the groundwater analytical data to l manage and dispose of the liquid IDW, which will occur under a separate contract in accordance with SOP No. 042A for Treating Liquid Investigation-Derived Material (Purge water, drilling water, and decontamination fluids) (EA Engineering, Science, and Technology, Inc., 2021). ARNG will further coordinate with the ADEQ to ensure proper disposal is in accordance with state requirements and the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Geographic coordinates were collected using a Global Positioning System (GPS) around each location where IDW was placed (i.e., an IDW polygon). The IDW polygons are displayed on the figure in **Appendix B5**.

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

5.7 Laboratory Analytical Methods

Samples were analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. The 18 PFAS analyzed as part of the ARNG SI program include the following:

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

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

5.8 Deviations from SI QAPP Addendum

Three deviations from the SI QAPP Addendum occurred when staking sampling locations. These deviations are noted below and they are documented in Field Change Request Forms (**Appendix B3**):

- During the site walk, ARNG recalled an additional area in AOI 1 where Tri-Max™ units were emptied/rinsed, and AFFF was otherwise released to the ground surface. A request was made for an additional 15-foot boring to be advanced in the release area (AOI01-03). This action was documented in a Field Change Request Form in **Appendix B3**.
- During the site walk, two boring locations in AOI 2 were shifted to be closer to the locations of historic release. AOI02-01 was moved approximately 200 feet northwest, closer to Building L4300. AOI02-04 was moved approximately 20 to 30 feet south-southeast. These actions were documented in a Field Change Request Form in **Appendix B3**.
- During the site walk, several boring locations in AOI 3 were shifted for varying reasons. AOI03-01, AOI03-02, and AOI03-03 were shifted no more than 100 feet to be in closer proximity to dry wells. This was the intended purpose of the borings and is consistent with sampling rationale. SBAH-02 was initially shifted approximately 100 feet out of the stormwater drainage ditch and into the parking lot because the full-size sonic rig could not safely traverse the ditch. This action did not change the intended purpose/rationale for the location and was documented in a Field Change Request Form in **Appendix B3**. However, after approval of this Field Change Request, the field team found a gate along an interior fence line that allowed access to the original SBAH-02 location. As a result, SBAH-02 was not installed in the parking lot, but rather in closer proximity to the original location near the stormwater drainage ditch.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Silverbell Army Heliport, Marana, Arizona

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	10/5/2021 13:05	0-2	x				
AOI01-01-SB-13-15	10/5/2021 13:15	13-15	x				
AOI01-01-SB-13-15-D	10/5/2021 13:15	13-15	x				FD
AOI01-02-SB-0-2	10/6/2021 12:55	0-2	x				
AOI01-03-SB-0-2	10/5/2021 12:40	0-2	x	x	x		
AOI01-03-SB-13-15	10/5/2021 12:50	13-15	x				
SBAH-01-SB-0-2	10/6/2021 11:05	0-2	x				
SBAH-01-SB-13-15	10/11/2021 14:10	13-15	x				
SBAH-01-SB-153-155	10/14/2021 9:25	153-155	x				
AOI02-01-SB-0-2	10/5/2021 11:59	0-2	x				
AOI02-01-SB-13-15	10/5/2021 12:10	13-15	x	x	x		
AOI02-02-SB-0-2	10/6/2021 9:30	0-2	x				
AOI02-03-SB-0-2	10/6/2021 13:10	0-2	x				
AOI02-04-SB-0-2	10/6/2021 9:10	0-2	x				
AOI03-01-SB-0-2	10/5/2021 13:55	0-2	x				
AOI03-01-SB-13-15	10/5/2021 14:05	13-15	x				
AOI03-02-SB-0-2	10/5/2021 14:55	0-2	x				
AOI03-02-SB-13-15	10/5/2021 15:05	13-15	x				
AOI03-03-SB-0-2	10/5/2021 10:12	0-2	x	x	x		
AOI03-03-SB-0-2-D	10/5/2021 10:12	0-2	x				FD
AOI03-03-SB-0-2-MS	10/5/2021 10:12	0-2	x				MS
AOI03-03-SB-0-2-MSD	10/5/2021 10:12	0-2	x				MSD
AOI03-03-SB-13-15	10/5/2021 10:25	13-15	x				
AOI03-04-SB-0-2	10/6/2021 10:10	0-2	x				
AOI03-05-SB-0-1.7	10/6/2021 10:30	0-1.7	x				
AOI03-06-SB-0-2	10/6/2021 9:50	0-2	x				
SBAH-02-SB-0-2	10/6/2021 11:20	0-2	x				
SBAH-02-SB-13-15	10/16/2021 11:30	13-15	x				
SBAH-02-SB-198-200	10/19/2021 11:45	198-200	x				
AOI04-01-SB-0-0.75	10/6/2021 12:40	0-0.75	x				
AOI04-02-SB-0-2	10/6/2021 12:10	0-2	x				
AOI04-03-SB-0-2	10/5/2021 8:15	0-2	x				
AOI04-03-SB-0-2-D	10/5/2021 8:15	0-2	x				FD
AOI04-03-SB-13-15	10/5/2021 8:25	13-15	x	x	x		
AOI04-03-SB-13-15-D	10/5/2021 8:25	13-15		x	x		FD
AOI04-03-SB-13-15-MS	10/5/2021 8:25	13-15	x	x	x		MS
AOI04-03-SB-13-15-MSD	10/5/2021 8:25	13-15	x	x	x		MSD
AOI04-04-SB-0-2	10/6/2021 12:25	0-2	x				
Groundwater Samples							
SBAH-01	10/23/2021 9:20	168	x				
SBAH-01-D	10/23/2021 9:20	168	x				FD
SBAH-01-MS	10/23/2021 9:20	168	x				MS
SBAH-01-MSD	10/23/2021 9:20	168	x				MSD
SBAH-02	10/23/2021 13:10	200	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Silverbell Army Heliport, Marana, Arizona

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Quality Control Samples							
SBAH-ERB-01	10/6/2021 6:30	NA	x				
SBAH-ERB-02	10/6/2021 13:15	NA	x				
SBAH-ERB-03	10/20/2021 10:00	NA	x				
SBAH-ERB-04	10/23/2021 14:45	NA	x				
SBAH-ERB-05	10/23/2021 12:30	NA	x				
SBAH-FRB-01	10/19/2021 12:00	NA	x				

Notes:
AOI = Area of Interest
ASTM = American Society for Testing and Materials
bgs = below ground surface
ERB = equipment rinsate blank
FD = field duplicate
FRB = field reagent blank
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
NA = not applicable
PFAS = per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
SB = soil boring
SBAH = Silverbell Army Heliport
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 5-2
Soil Boring Depths
Site Inspection Report, Silverbell Army Heliport, Marana, Arizona

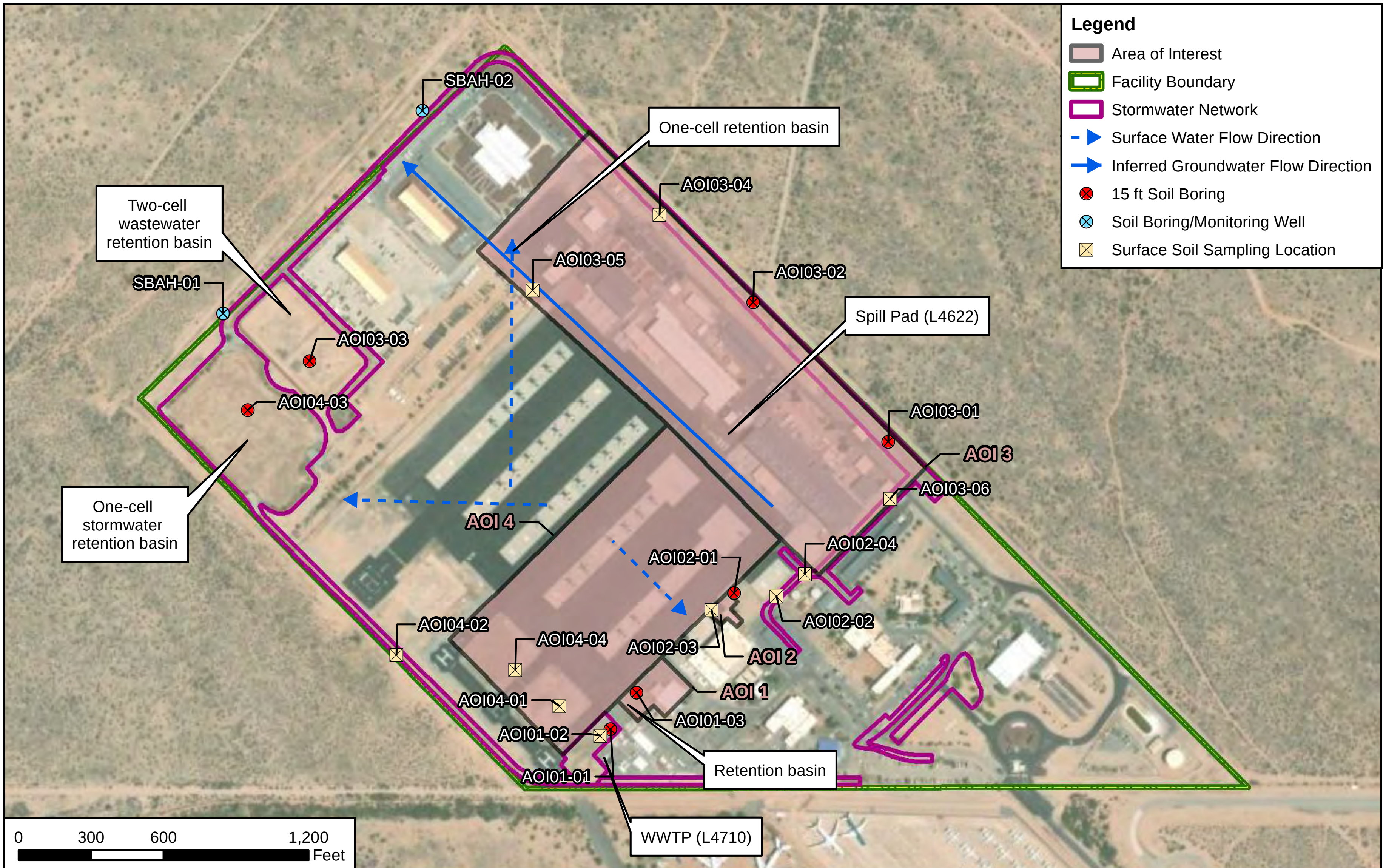
Area of Interest	Boring Location	Soil Boring Depth (feet bgs)
1	AOI01-01	15
	AOI01-02	2
	AOI01-03	15
	SBAH-01	155
2	AOI02-01	15
	AOI02-02	2
	AOI02-03	2
	AOI02-04	2
3	AOI03-01	15
	AOI03-02	15
	AOI03-03	15
	AOI03-04	2
	AOI03-05	1.7
	AOI03-06	2
	SBAH-02	200
4	AOI04-01	0.75
	AOI04-02	2
	AOI04-03	15
	AOI04-04	2

Notes:
AOI = Area of Interest
bgs = below ground surface
SBAH = Silverbell Army Heliport

Table 5-3
Permanent Monitoring Well Screen Intervals and Groundwater Elevations
Site Inspection Report, Silverbell Army Heliport, Marana, Arizona

Area of Interest	Well ID	Well Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	SBAH-01	150 - 170	1863.16	1863.43	157.29	157.56	1705.87
3	SBAH-02	199 - 249	1865.38	1865.81	166.17	166.60	1699.21

Notes:
bgs = below ground surface
btoc = below top of casing
ID = identification
NAVD88 = North American Vertical Datum 1988
SBAH = Silverbell Army Heliport



CLIENT	ARNG			
PROJECT	Site Investigation for PFOA, PFOS, and PFBS at Silver Bell, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:7,200	CHK BY	AB	5/31/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/31/2022

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\AZ\Silver_Bell_Figures\Silver_Bell_SI_Figures\SI_Report\Fig_5-1_Silver_Bell_SI_Sample_Locations.mxd

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6. Site Inspection Results

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** and **Section 6.4**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil or groundwater; only constituents detected in one or more samples are included. Tables that contain the analytical results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 Screening Levels

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

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

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

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

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

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

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI Analytical Data

This section presents the analytical results for soil in comparison to SLs at each AOI and for soil and groundwater at downgradient locations at the facility boundary. Soil samples were collected within each AOI, but given the depth of groundwater, monitoring wells were only installed at the facility boundary.

The discussion below presents the AOI specific soil data first with detected PFAS compounds in summarized for all AOIs in **Table 6-2** through **Table 6-3** and presented on **Figure 6-1** through **Figure 6-3.** This is followed by discussion of soil and groundwater results collected from the facility boundary monitoring wells that generally apply to all the AOIs.

6.3.1 AOI 1 Soil Analytical Results

AOI 1 includes two potential PFAS release areas at Building L4320. Soil was sampled from surface soil (0 to 2 feet bgs) and shallow subsurface soil (13 to 15 feet bgs) from boring locations AOI01-01 through AOI01-03. PFOA, PFOS, and PFBS were detected in soil, at concentrations approaching their SLs; however, none of the results exceeded their SLs. In the surface soil, PFOA was detected in all three locations with concentrations ranging from 2.35 micrograms per kilogram (µg/kg) to 5.51 µg/kg. PFOS was detected at all three locations, with concentrations ranging from 9.17 J µg/kg to 73 µg/kg. PFBS was detected at all three locations, with concentrations ranging from 0.028 J µg/kg to 0.315 J µg/kg.

In the shallow subsurface, PFOA was detected in both shallow locations (AOI01-01 and AOI01-03), with concentrations ranging from 0.116 J µg/kg to 1.27 µg/kg. PFOS and PFBS were non-detect in both locations..

6.3.2 AOI 2 Soil Analytical Results

AOI 2 includes two potential PFAS release areas at Building L4300 and the surrounding area. Soil was sampled from surface soil (0 to 2 feet bgs) and shallow subsurface soil (13 to 15 feet bgs) from boring locations AOI02-01 through AOI02-04. PFOA, PFOS, and PFBS were detected in soil and in several instances exceeded their SLs. In the surface soil, PFOA was detected at two of the four locations, with concentrations ranging from 2.46 J µg/kg to 2.89 µg/kg. PFOS was detected at all four locations, with concentrations ranging from 0.313 J µg/kg to 484 µg/kg. PFBS was detected at two of the four locations, with concentrations ranging from 0.022 J µg/kg to 0.114 J µg/kg.

In the shallow subsurface boring (AOI02-01), PFOA was detected at a concentration of 0.938 J µg/kg. PFOS was detected at a concentration of 28 µg/kg. PFBS was not detected.

Based on the results of the SI, PFOA, PFOS, and PFBS were detected in soil at AOI 2. All detections were below SLs except for PFOS in surface soil at two boring locations (AOI02-01 and AOI02-03). Based on the exceedances of the SL for PFOS in soil, further evaluation at AOI 2 is warranted.

6.3.3 AOI 3 Soil Analytical Results

AOI 3 includes eight potential PFAS release areas associated with a number of buildings along the northeast side of the facility. Soil was sampled from surface soil (0 to 2 feet bgs) and shallow subsurface soil (13 to 15 feet bgs) at six locations from boring locations AOI03-01 through AOI03-06. PFOA, PFOS, and PFBS were detected in soil at concentrations approaching their SLs; however, none of the results exceeded their SLs. In the surface soil, PFOA was detected at three of the six locations, with concentrations ranging from 0.089 J µg/kg to 2.26 µg/kg. PFOS was detected at all six locations, with concentrations ranging from 0.085 J µg/kg to 23.4 µg/kg. PFBS was detected at one location, with a concentration of 0.023 J µg/kg.

In the shallow subsurface borings, PFOA was non-detect at all three boring locations (AOI03-01, AOI03-02, AOI03-03, and AOI03-. PFOS was detected in two of the three locations, with concentrations ranging from 0.338 J µg/kg to 0.457 J µg/kg. PFBS was detected in one location at a concentration of 0.026 J µg/kg. No detection exceeded the SLs.

6.3.4 AOI 4 Soil Analytical Results

AOI 4 includes one potential PFAS release area at the Alpha, Charlie, and Bravo Rows. Soil was sampled from surface soil (0 to 2 feet bgs) and shallow subsurface boring locations (13 to 15 feet bgs). In the surface soil, PFOA was detected at two of the four locations, with concentrations ranging from 0.101 J µg/kg to 0.219 J µg/kg. PFOS was detected at three of the four locations, with concentrations ranging from 3.21 µg/kg to 9.21 µg/kg. PFBS was non-detect at all four locations.

In the shallow subsurface soil sample (AOI04-03), PFOA was detected at a concentration of 0.096 J µg/kg. PFOS was detected at a concentration of 0.966 J µg/kg. PFBS was detected at a concentration of 0.021 J µg/kg.

6.4 Facility Analytical Results

Due to the depth of water at SBAH monitoring well installation was limited to two wells on the downgradient side of the facility boundary based on the inferred groundwater flow direction. The objective of these monitoring wells was to evaluate PFAS in groundwater that could be affected by potential on-facility releases at the AOIs and to access potential PFAS groundwater concentrations at the facility boundary.

6.4.1 Facility Soil Analytical Results

During the borehole drilling for the two deep wells, soil was sampled at the downgradient facility boundary from surface soil (0 to 2 feet bgs), shallow subsurface soil (13 to 15 feet bgs), and deep subsurface (153-155 feet bgs at SBAH-01 and 198-200 feet bgs at SBAH-02). **Figure 6-1** through **Figure 6-3** present the ranges of detections of PFOA, PFOS, and PFBS in soil. **Tables 6-2** and **Table 6-3** summarize the detected compounds in soil.

PFOA, PFOS, and PFBS were detected in soil but were below their SLs. In the surface soil interval, PFOA was detected at SBAH-02 with a concentration of 0.093 µg/kg. PFOS was detected at both locations with concentrations ranging from 0.080 J µg/kg to 0.205 J µg/kg. PFBS was detected at SBAH-02 with a concentration of 0.022 J µg/kg. PFOA, PFOS, and PFBS were not detected in the shallow subsurface and deep soil sample.

6.4.2 Facility Groundwater Analytical Results

PFAS detections in groundwater from downgradient facility boundary monitoring wells SBAH-01 and SBAH-02 are summarized in **Table 6-4**. **Figure 6-4** presents the ranges of detections of PFOA, PFOS, and PFBS in groundwater. PFOA was detected in SBAH-01 at a concentration of 8.44 ng/L. PFOS was detected in SBAH-01 at a concentration of 5.80 ng/L (duplicate results). PFBS was detected in both wells with concentrations ranging from 2.21 ng/L to 11.5 ng/L.

While PFAS was detected in groundwater, all detections were below the SLs. However, due to the uncertainty in the groundwater flow direction and lack of AOI-specific groundwater data the detected concentrations of PFAS could be attributed to any one AOI or none of them.

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Silverbell Army Heliport

	Area of Interest	AOI01								AOI02								AOI03			
	Sample ID	AOI01-01-SB-0-2		AOI01-02-SB-0-2		AOI01-03-SB-0-2		SBAH-01-SB-0-02		AOI02-01-SB-0-2		AOI02-02-SB-0-2		AOI02-03-SB-0-2		AOI02-04-SB-0-2		AOI03-01-SB-0-2		AOI03-02-SB-0-2	
	Sample Date	10/05/2021		10/06/2021		10/05/2021		10/06/2021		10/05/2021		10/06/2021		10/06/2021		10/06/2021		10/05/2021		10/05/2021	
	Depth	0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
6:2 FTS	-	1.16		4.27		90.2		ND		22.2		ND		32.5		ND		ND		0.563	J
8:2 FTS	-	9.39		1.17		171		ND		106		0.073	J	123	J-	0.336	J	0.132	J	0.129	J
NMeFOSAA	-	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
PFBA	-	0.755	J	0.074	J	1.06		ND		ND		ND		0.127	J	ND		ND		ND	
PFBS	1900	0.079	J	0.028	J	0.315	J	ND		ND		0.114	J	ND		0.022	J	ND		ND	
PFDA	-	2.28		0.160	J	28.9		ND		4.06	J	0.312	J	37.5		0.263	J	0.133	J	ND	
PFDoA	-	0.058	J	ND		0.563	J	ND		ND		0.088	J	0.326	J	0.030	J	0.072	J	ND	
PFHpA	-	1.88		0.358	J	1.90		ND		ND		ND		0.188	J	ND		0.041	J	0.038	J
PFHxA	-	1.11		0.195	J	3.46		ND		0.176	J	0.028	J	0.356	J	ND		0.036	J	0.068	J
PFHxS	-	1.60		0.081	J	1.00	J	ND		0.189	J	ND		0.190	J	ND		ND		0.752	J
PFNA	-	3.86		1.24		5.41		ND		3.40	J	0.024	J	50.1		ND		0.043	J	0.050	J
PFOA	130	3.49		2.35		5.51		ND		2.46	J	ND		2.89		ND		ND		1.27	
PFOS	130	73.0		9.17		16.4		0.080	J	484		0.365	J	139		0.313	J	0.651	J	19.3	
PFPeA	-	2.24		0.276	J	4.35		ND		ND		0.028	J	0.399	J	ND		0.041	J	0.040	J
PFTeDA	-	ND		ND		0.084	J	ND		ND		ND		0.058	J	ND		ND		ND	
PFTrDA	-	ND		ND		0.110	J	ND		ND		ND		0.165	J	ND		ND		ND	
PFUnDA	-	0.220	J	0.039	J	1.07		ND		ND		0.419	J	1.41		0.117	J	0.067	J	ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

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

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Silverbell Army Heliport

	Area of Interest	AOI03												AOI04							
	Sample ID	AOI03-03-SB-0-2		AOI03-03-SB-0-2-D		AOI03-04-SB-0-2		AOI03-05-SB-0-1.7		AOI03-06-SB-0-2		SBAH-02-SB-0-02		AOI04-01-SB-0-0.75		AOI04-02-SB-0-2		AOI04-03-SB-0-2		AOI04-03-SB-0-2-D	
	Sample Date	10/05/2021		10/05/2021		10/06/2021		10/06/2021		10/06/2021		10/06/2021		10/06/2021		10/06/2021		10/05/2021		10/05/2021	
	Depth	0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 1.7 ft		0 - 2 ft		0 - 2 ft		0 - 0.75 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
6:2 FTS	-	ND		ND		10.8		0.649	J	ND		ND		ND		ND		ND		ND	
8:2 FTS	-	ND		ND		0.942	J	0.277	J	0.058	J	ND		0.108	J	ND		0.248	J	0.279	J
NMeFOSAA	-	ND		ND		0.028	J	ND		ND		ND		ND		ND		ND		ND	
PFBA	-	ND		ND		ND		0.066	J	ND		ND		0.123	J	0.051	J	0.155	J	0.146	J
PFBS	1900	ND		ND		0.023	J	ND		ND		0.022	J	ND		ND		ND		ND	
PFDA	-	ND		ND		0.085	J	0.179	J	0.096	J	ND		0.407	J	0.127	J	0.117	J	0.136	J
PFDoA	-	ND		ND		0.089	J	0.136	J	ND		ND		0.172	J	ND		0.064	J	0.069	J
PFHpA	-	0.109	J	0.107	J	0.116	J	0.098	J	ND		0.037	J	0.049	J	0.074	J	0.047	J	0.054	J
PFHxA	-	0.054	J	0.055	J	0.197	J	0.273	J	0.025	J	0.128	J	0.041	J	0.094	J	0.084	J	0.092	J
PFHxS	-	0.053	J	0.049	J	1.08		0.091	J	ND		0.406	J	0.032	J	ND		0.129	J	0.147	J
PFNA	-	0.024	J	0.024	J	0.065	J	0.068	J	ND		ND		0.462	J	0.831	J	0.124	J	0.130	J
PFOA	130	0.106	J	0.089	J	2.26		ND		ND		0.093	J	0.219	J	ND		0.101	J	0.112	J
PFOS	130	0.085	J	0.104	J	23.4		2.70		0.530	J	0.205	J	9.21		3.21		4.57		4.52	
PFPeA	-	0.037	J	0.046	J	0.127	J	0.356	J	ND		0.036	J	0.091	J	0.186	J	0.130	J	0.126	J
PFTeDA	-	ND		ND		0.022	J	0.042	J	ND		ND		0.026	J	ND		ND	UJ	0.020	J
PFTrDA	-	ND		ND		ND		0.046	J	ND		ND		0.056	J	ND		ND		ND	
PFUnDA	-	ND		ND		0.084	J	0.138	J	0.042	J	ND		0.311	J	ND		0.070	J	0.078	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

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

Interpreted Qualifiers

J = Estimated concentration

J- = Estimated concentration, biased low

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

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

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Silverbell Army Heliport

	Area of Interest	AOI04	
	Sample ID	AOI04-04-SB-0-2	
	Sample Date	10/06/2021	
	Depth	0 - 2 ft	
Analyte	OSD Screening Level [a]	Result	Qual
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)			
6:2 FTS	-	ND	
8:2 FTS	-	ND	
NMeFOSAA	-	ND	
PFBA	-	0.084	J
PFBS	1900	ND	
PFDA	-	ND	
PFDoA	-	ND	
PFHpA	-	0.226	J
PFHxA	-	0.290	J
PFHxS	-	0.044	J
PFNA	-	ND	
PFOA	130	ND	
PFOS	130	ND	
PFPeA	-	0.120	J
PFTeDA	-	ND	
PFTrDA	-	ND	
PFUnDA	-	ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

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

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

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

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

Table 6-3
PFAS Detections in Shallow Subsurface Soil
Site Inspection Report, Silverbell Army Heliport

	Area of Interest	AOI01								AOI02		AOI03								AOI04	
	Sample ID	AOI01-01-SB-13-15		AOI01-01-SB-13-15-D		AOI01-03-SB-13-15		SBAH-01-SB-13-15		AOI02-01-SB-13-15		AOI03-01-SB-13-15		AOI03-02-SB-13-15		AOI03-03-SB-13-15		SBAH-02-13-15		AOI04-03-SB-13-15	
	Sample Date	10/05/2021		10/05/2021		10/05/2021		10/11/2021		10/05/2021		10/05/2021		10/05/2021		10/05/2021		10/16/2021		10/05/2021	
	Depth	13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft		13 - 15 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
6:2 FTS	-	ND		ND		56.8		ND		45.2		ND		ND		ND		ND		0.254	J
8:2 FTS	-	0.078	J	ND		ND		ND		6.36		0.150	J	0.065	J	ND		ND		ND	
PFBA	-	0.937	J	0.974	J	ND		ND		0.065	J	ND		ND		ND		ND		0.044	J
PFBS	25000	ND		ND		ND		ND		ND		ND		0.026	J	ND		ND		0.021	J
PFDA	-	ND		ND		ND		ND		0.132	J	0.128	J	ND		ND		ND		ND	
PFDoA	-	ND		ND		ND		ND		0.031	J	0.094	J	0.059	J	ND		ND		ND	
PFHpA	-	1.37		0.656	J	0.031	J	ND		0.143	J	ND		0.035	J	ND		ND		0.143	J
PFHxA	-	10.4	J	5.84	J	0.115	J	ND		0.361	J	ND		0.104	J	ND		ND		0.356	J
PFHxS	-	1.28		0.617	J	0.383	J	ND		0.388	J	ND		0.096	J	ND		ND		0.677	J
PFNA	-	ND		ND		ND		ND		0.038	J	0.051	J	ND		ND		ND		ND	
PFOA	1600	0.116	J	ND		1.27		ND		0.983	J	ND		ND		ND		ND		0.096	J
PFOS	1600	ND		ND		ND		ND		28.0		0.457	J	0.338	J	ND		ND		0.966	J-
PFPeA	-	8.17		6.63		0.107	J	ND		0.165	J	ND		0.097	J	ND		ND		0.106	J
PFTeDA	-	ND		ND		ND		ND		0.023	J	ND		0.056	J	ND		ND		ND	
PFTrDA	-	ND		ND		ND		ND		ND		ND		0.041	J	ND		ND		ND	
PFUnDA	-	ND		ND		ND		ND		ND		0.052	J	0.022	J	ND		ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

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

Interpreted Qualifiers
J = Estimated concentration
J- = Estimated concentration, biased low

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnDA	perfluoro-n-undecanoic acid

Acronyms and Abbreviations

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

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Silverbell Army Heliport

		Area of Interest	AOI01				AOI03	
		Sample ID	SBAH-01		SBAH-01-D		SBAH-02	
		Sample Date	10/23/2021		10/23/2021		10/23/2021	
Analyte	OSD Screening Level [a]	USEPA HA [b]	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)								
6:2 FTS	-	-	325		309		8.68	
PFBA	-	-	45.1		43.9		2.00	J
PFBS	600	-	11.5		11.2		2.21	J
PFHpA	-	-	63.8		62.0		ND	
PFHxA	-	-	172		170		3.99	J
PFHxS	-	-	12.0		12.3		5.44	
PFOA	40	70	8.44		8.34		ND	
PFOS	40	70	5.38		5.80		ND	
PFPeA	-	-	316		308		3.57	J
Total PFOA+PFOS	-	70	13.8		14.1		ND	

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

References

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

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

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

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

Acronyms and Abbreviations

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

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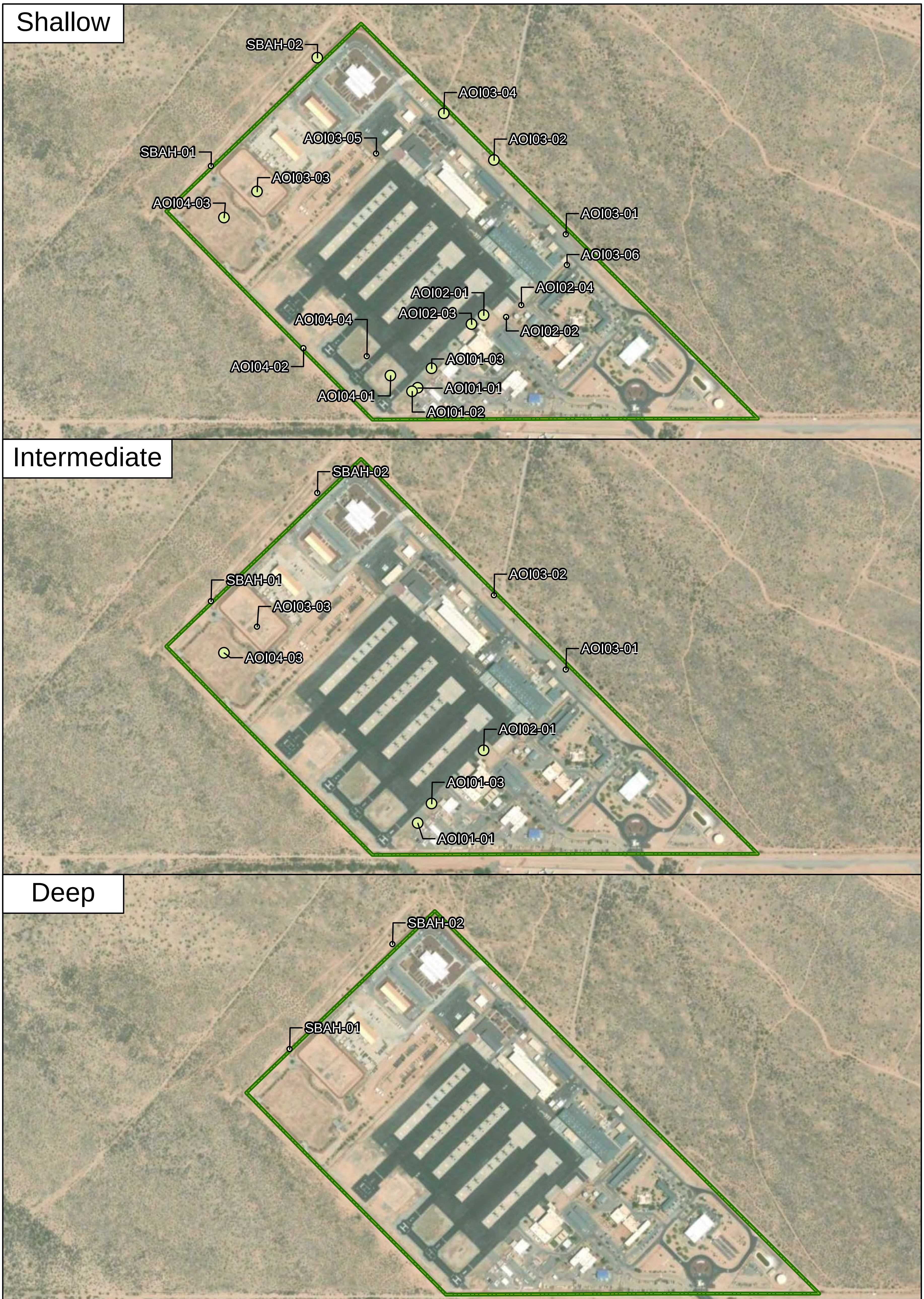

Legend

Facility Boundary

PFOA Results (µg/Kg)

- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

0 375 750 1,500 Feet

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation for PFAS at Silver Bell, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:9,000	CHK BY	AB	5/31/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/31/2022

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Figure 6-1

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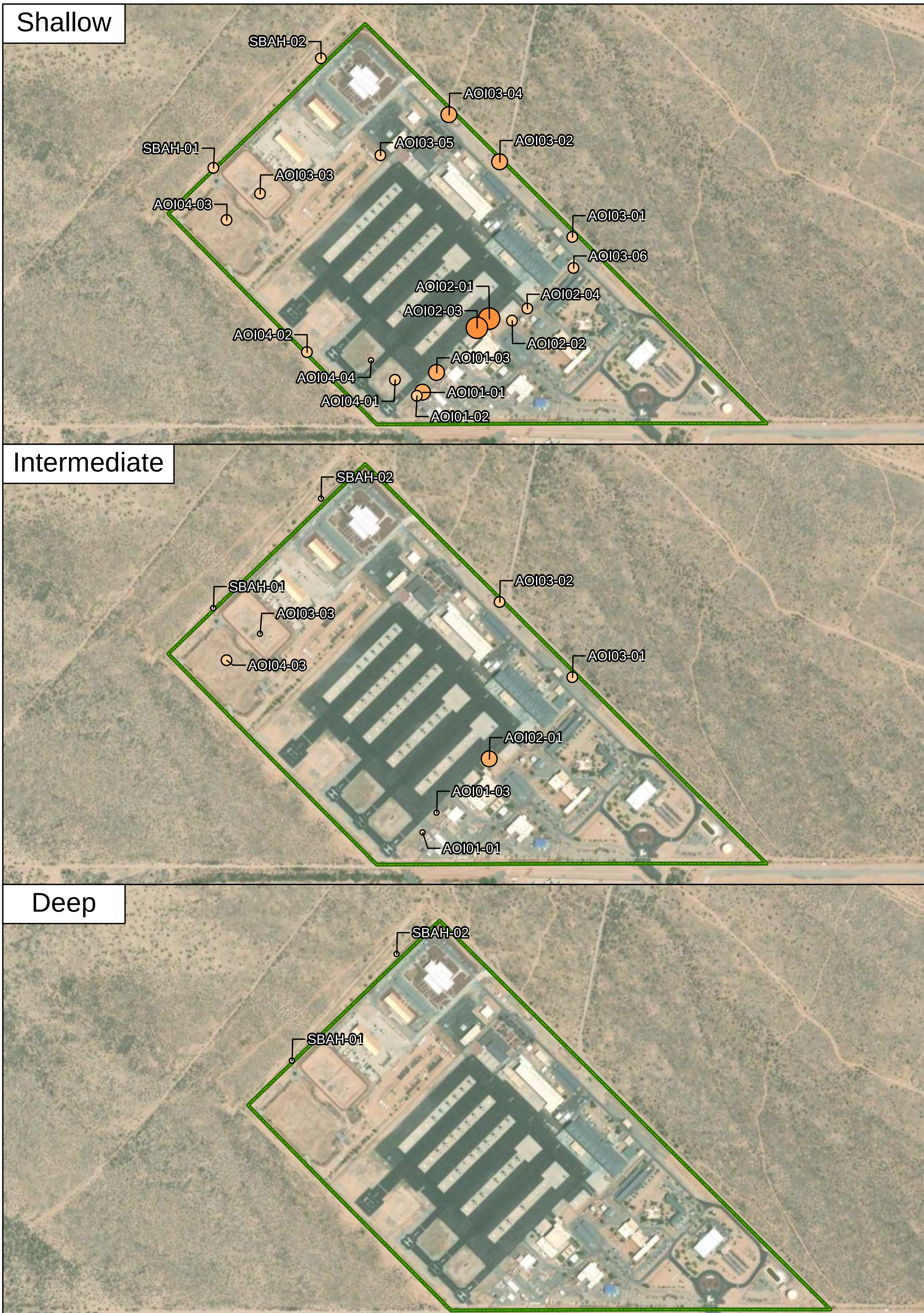

Legend

Facility Boundary

PFOS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

0 375 750 1,500 Feet

PFOS Detections in Soil

CLIENT	ARNG				
PROJECT	Site Investigation for PFAS at Silver Bell, AZ				
REVISED	5/31/2022	GIS BY	MS	5/31/2022	
SCALE	1:9,000	CHK BY	AB	5/31/2022	
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/31/2022	

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Figure 6-2

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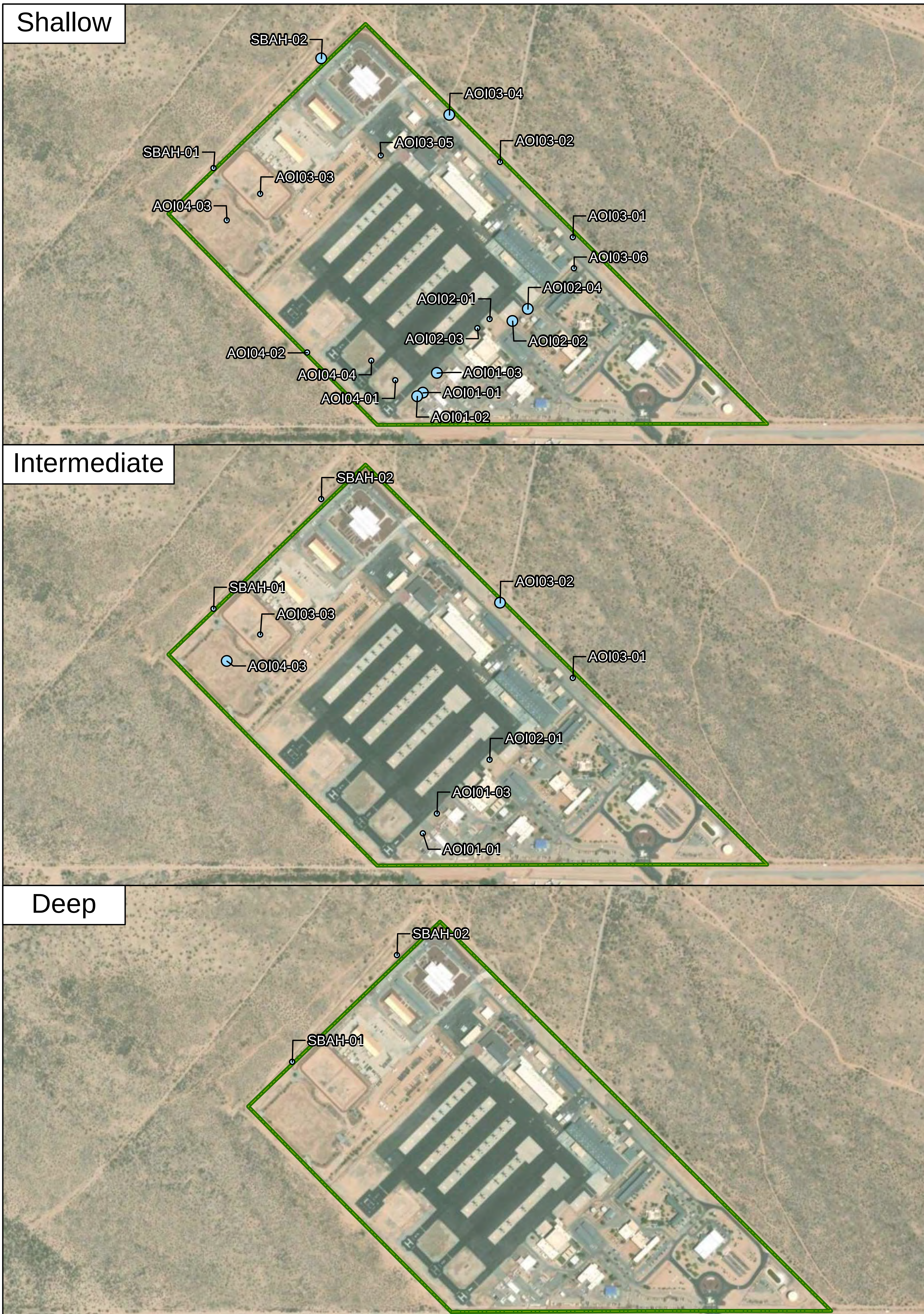

Legend

Facility Boundary

PFBS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

0 375 750 1,500 Feet

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Investigation for PFAS at Silver Bell, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:9,000	CHK BY	AB	5/31/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/31/2022

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Figure 6-3

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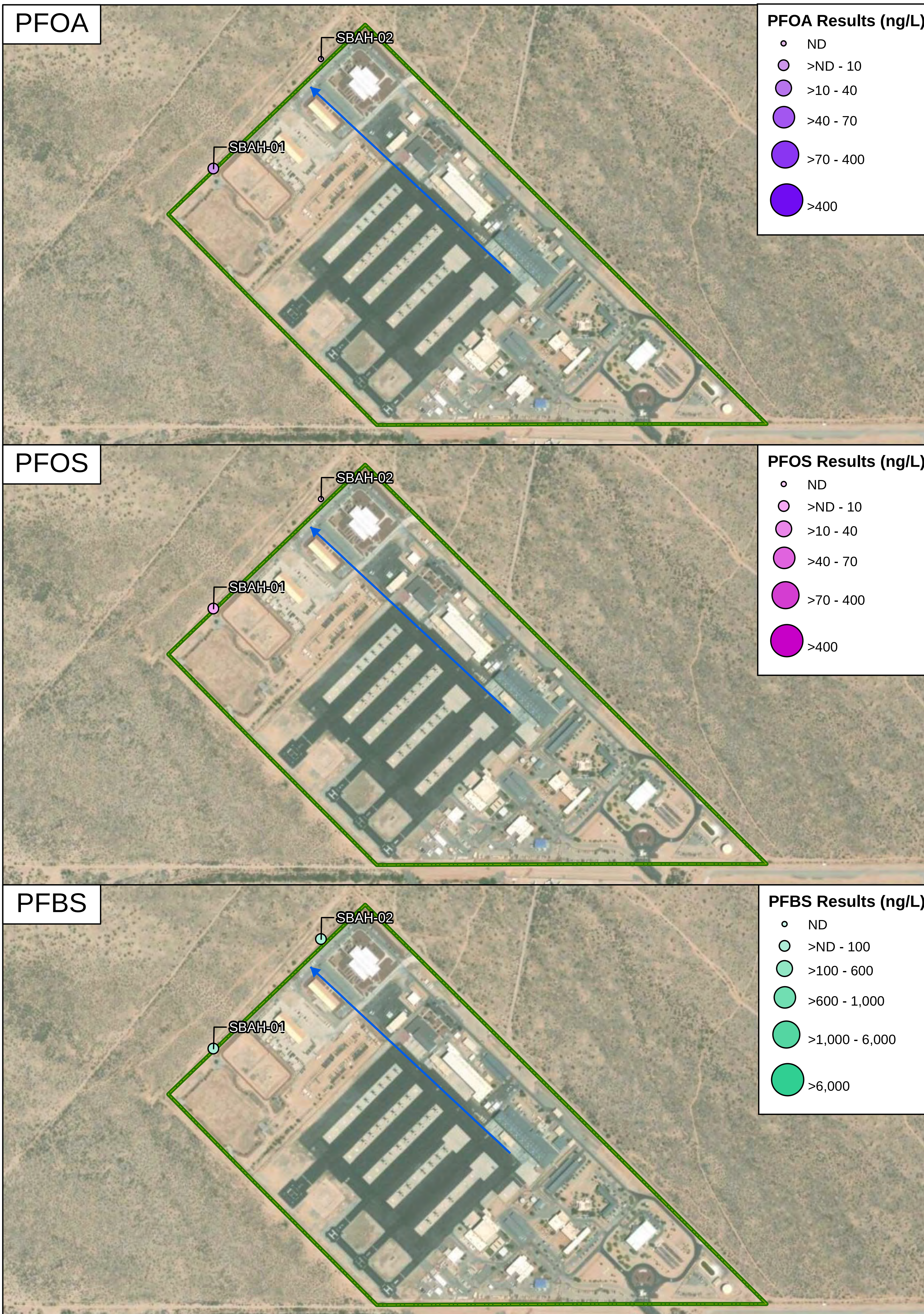

Legend
Facility Boundary
Inferred Groundwater Flow Direction

0 375 750 1,500 Feet

PFOA, PFOS, and PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Investigation for PFAS at Silver Bell, AZ			
REVISED	5/31/2022	GIS BY	MS	5/31/2022
SCALE	1:9,000	CHK BY	AB	5/31/2022
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,		PM	CM	5/31/2022
AECOM	12420 Milestone Center Drive Germantown, MD 20876	Figure 6-4		

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-4**. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

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

In general, the potential routes of exposure to PFAS are ingestion and inhalation. Based on research, ingestion appears to be the most significant pathway for human exposure; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers, residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

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

7.1.1 AOI 1

Several potential PFAS release areas are associated with AOI 1 related to fire training and fire equipment storage and maintenance. Fire training activities using AFFF at the current fire station (L4320) began when it became operational in 2009 until late in 2018. Additionally, fire equipment storage and maintenance (specifically of Tri-Max™ units) were performed on the driveway and within the surrounding gravel areas of the L4320.

Based on the results of the SI in AOI 1, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Additionally, off-facility recreational users and residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. Lasty, ground-disturbing activities could also potentially result in construction worker exposure to PFOA, PFOS, and PFBS in subsurface soil via ingestion. Construction activities were not observed at the time of the SI; however, construction activities could be planned in the future. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

Several potential PFAS release areas are associated with AOI 2 related to fire training and fire equipment storage and maintenance. Fire training activities using AFFF at the former fire station (L4300) occurred from 1985 to 1994 and then again from 2006 to 2009. Additionally, fire equipment storage and maintenance (specifically of Tri-Max™ units) were performed on the driveway and within the surrounding gravel areas of the L4300.

Based on the results of the SI in AOI 2, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Additionally, off-facility recreational users and residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. Lasty, ground-disturbing activities could also potentially result in construction worker exposure to PFOA, PFOS, and PFBS in subsurface soil via ingestion. Construction activities were not observed at the time of the SI; however, construction activities could be planned in the future. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

Multiple potential PFAS release areas are associated with AOI 3 from FTAs, fire suppression system releases, and fire equipment maintenance activities. Based on the results of the SI in AOI 3, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Additionally, off-facility recreational users and residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. Lasty, ground-disturbing activities could also potentially result in construction worker exposure to PFOA, PFOS, and PFBS in subsurface soil via ingestion. Construction activities were not observed at the time of the SI; however, construction activities could be planned in the future. The CSM for AOI 3 is presented on **Figure 7-3**.

7.1.4 AOI 4

One potential PFAS release area is associated with AOI 4 due to the use of AFFF on fuel spills along the Alpha, Bravo, and Charlie flight line. Based on the results of the SI in AOI 4, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Additionally, off-facility recreational users and residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. Lasty, ground-disturbing activities could also potentially result in construction worker exposure to PFOA, PFOS, and PFBS in subsurface soil via ingestion. Construction activities were not observed at the time of the SI; however, construction activities could be planned in the future. The CSM for AOI 4 is presented on **Figure 7-4**.

7.1.5 Facility Boundary

Soil samples were collected from the two boreholes for downgradient monitoring wells installed at the facility boundary. No potential PFAS release is known to have occurred at the boundary; however, soil samples were collected to assess possible secondary releases to these areas via wind deposition or stormwater transport from potential primary releases at the identified AOIs.

Based on the results of the SI, ground-disturbing activities could potentially result in site worker, construction worker, or trespasser exposure to PFOA, PFOS, and PFBS via inhalation of dust. Additionally, off-facility recreational users and residents may potentially be exposed to PFOA, PFOS, and PFBS via inhalation of dust caused by on-facility ground disturbing activities. Ground-disturbing activities could also potentially result in site worker, construction worker, or trespasser exposure via ingestion of surface soil. The CSM for the facility boundary is presented on **Figure 7-1** through **Figure 7-4**

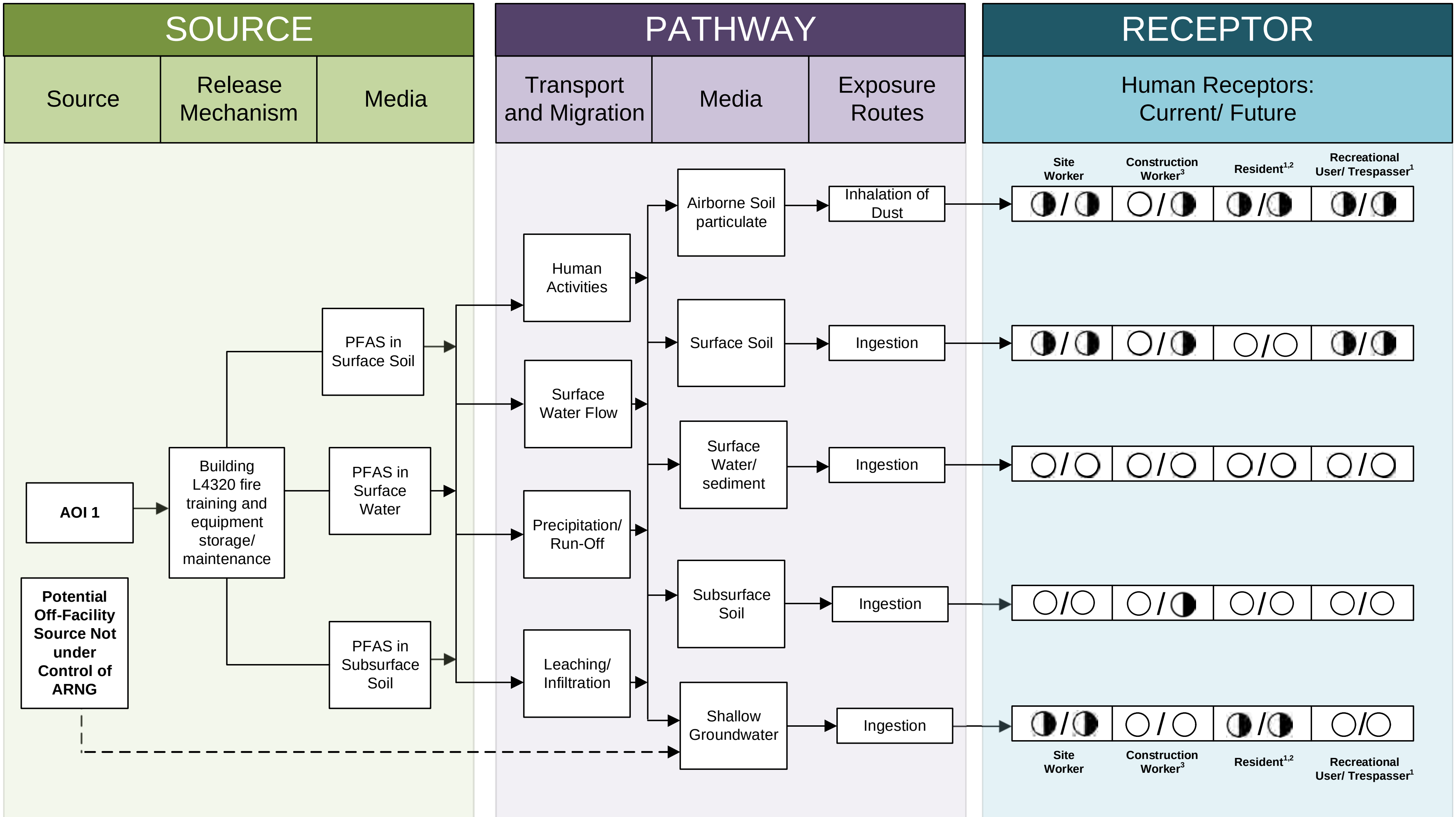
7.2 Groundwater Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete pathway exists between the sources and potential receptors by evaluating the five components listed at the beginning of **Section 7**. Two monitoring wells were installed on the downgradient facility boundary based on the inferred groundwater flow direction. No monitoring wells were installed within or immediately surrounding any of the identified AOIs. The objective of the downgradient facility boundary monitoring wells was to evaluate PFAS in groundwater that could be affected by potential on-facility releases at any of the AOIs. PFOA, PFOS, and PFBS were detected in both permanent monitoring wells but did not exceed the SLs. Due to the depth of water across the facility (measured depth to water in SBAH-01 and SBAH-02 was 157.56 and 166.60 feet bgs, respectively), it is unlikely construction workers or recreational users/trespassers would encounter groundwater. Therefore, the ingestion exposure pathway for these receptors is incomplete. Two water supply wells exist on SBAH and provide water to the facility. Both wells have been sampled (by AZARNG and AECOM) and had detectable concentrations of PFAS. Therefore, the ingestion exposure pathway for site workers is considered potentially complete. Additionally, off-facility wells were identified in the Arizona Well Registry associated with Global Water utilities, providing water to the community of Red Rock. As a result, the ingestion exposure pathway for off-facility residents is considered potentially complete. The CSM is presented on **Figure 7-1** through **Figure 7-4**.

It is unknown whether the detected concentrations of PFOA, PFOS, and PFBS in the facility boundary monitoring wells are attributed to potential releases at the identified AOIs. The inferred groundwater flow direction could not be refined during the SI due to the limited number of monitoring wells installed. Additionally, the inferred groundwater flow direction could be influenced by pumping from onsite water supply wells. This could potentially explain the contamination in the water supply wells. Soil detections confirm that PFAS was likely released to soil; however, the pathway from surface and subsurface soil to groundwater (over 150 feet bgs) is not fully understood. Additionally, PFAS has been detected in the SBAH water supply wells which are located up-gradient of the AOIs. Therefore, an adjacent source could be contributing to the overall detections in groundwater at the facility. During the PA, several adjacent sources were identified up-gradient of SBAH at the Pinal Airpark (**Figure 2-1**) where AFFF was known to be released; however, no specific information regarding those releases was available. Additionally, no upgradient facility boundary wells were installed to assist with groundwater flow direction or identification of adjacent sources of PFAS. The lack of monitoring wells installed across the facility (at the up-gradient boundary, AOIs, etc.) presents a data gap, and as a result, several DQOs remain unresolved.

7.3 Surface Water and Sediment Exposure Pathway

No natural surface water features are present at the facility or immediately downgradient of the facility. The stormwater drainage ditches collect stormwater runoff during rain events as flood control measure and for aquifer recharge. Given the limited rain events and high evapotranspiration rates, the likelihood of encountering surface water or saturated sediments is low and this pathway is considered incomplete for all receptors at all four AOIs.



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

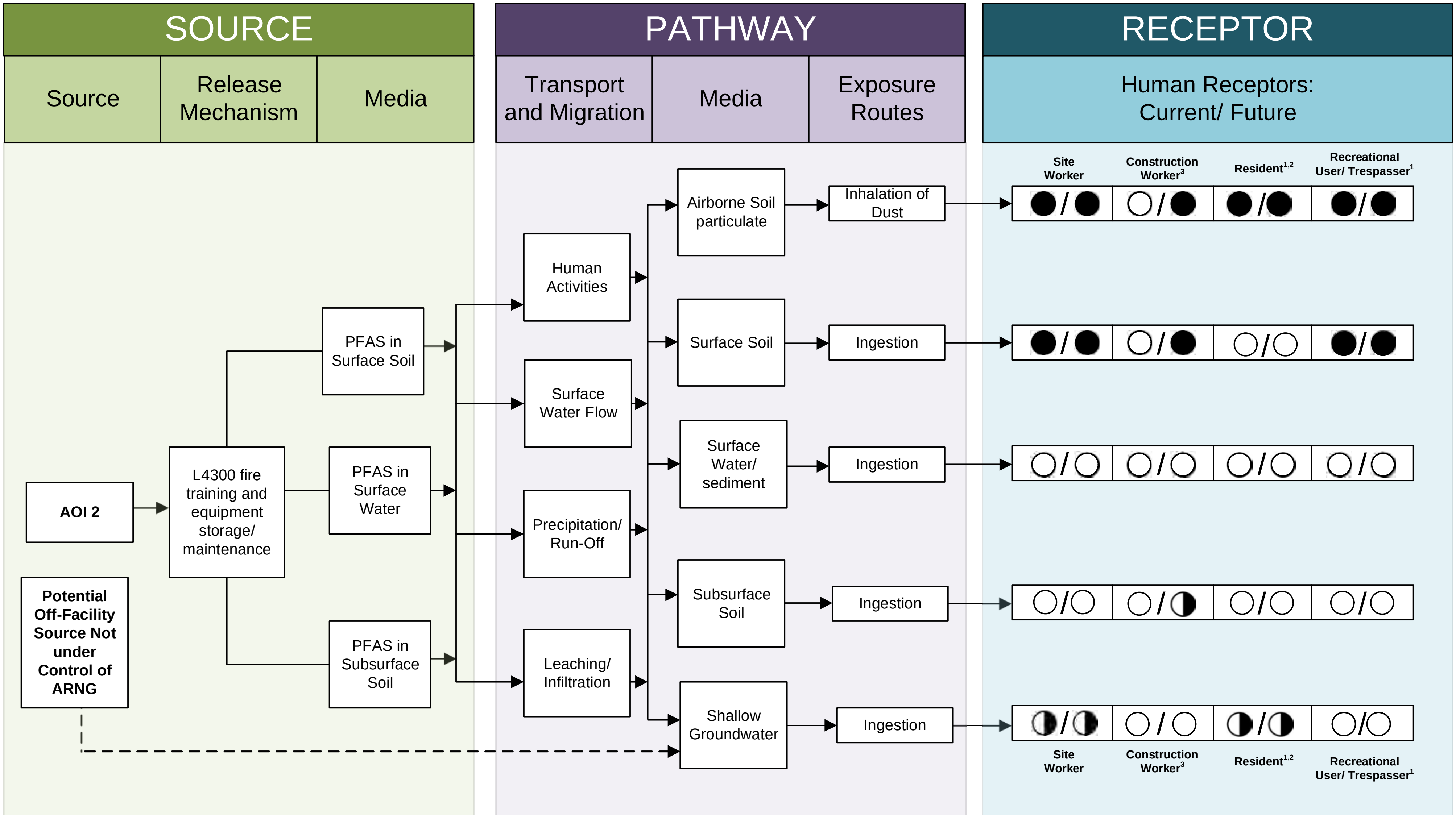
Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Active construction within AOI 1 was occurring as of the date of SI field work.

Figure 7-1
Conceptual Site Model, AOI 1
Silverbell Army Heliport



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

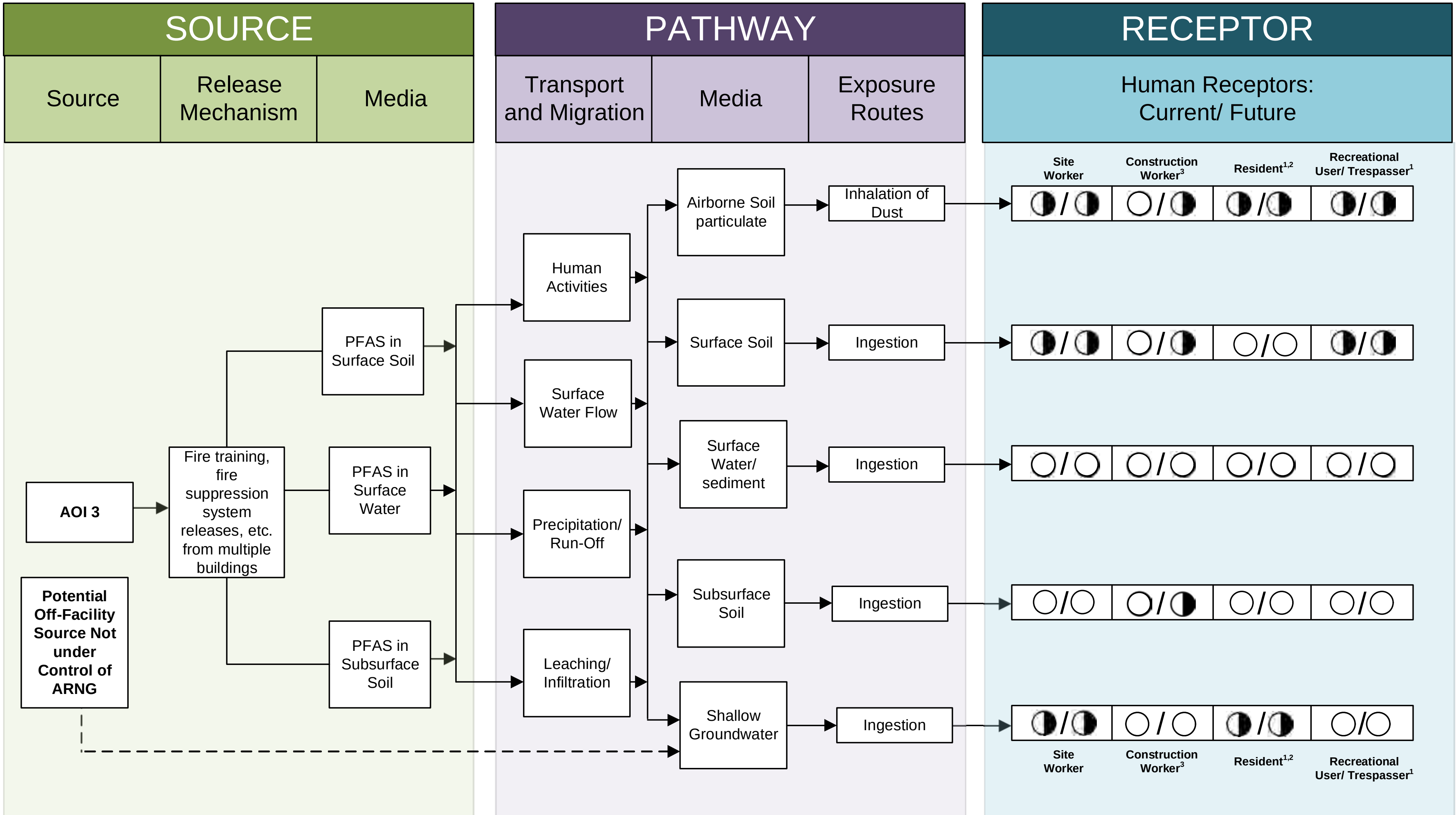
Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Active construction within AOI 2 was occurring as of the date of SI field work.

Figure 7-2
Conceptual Site Model, AOI 2
Silverbell Army Heliport



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

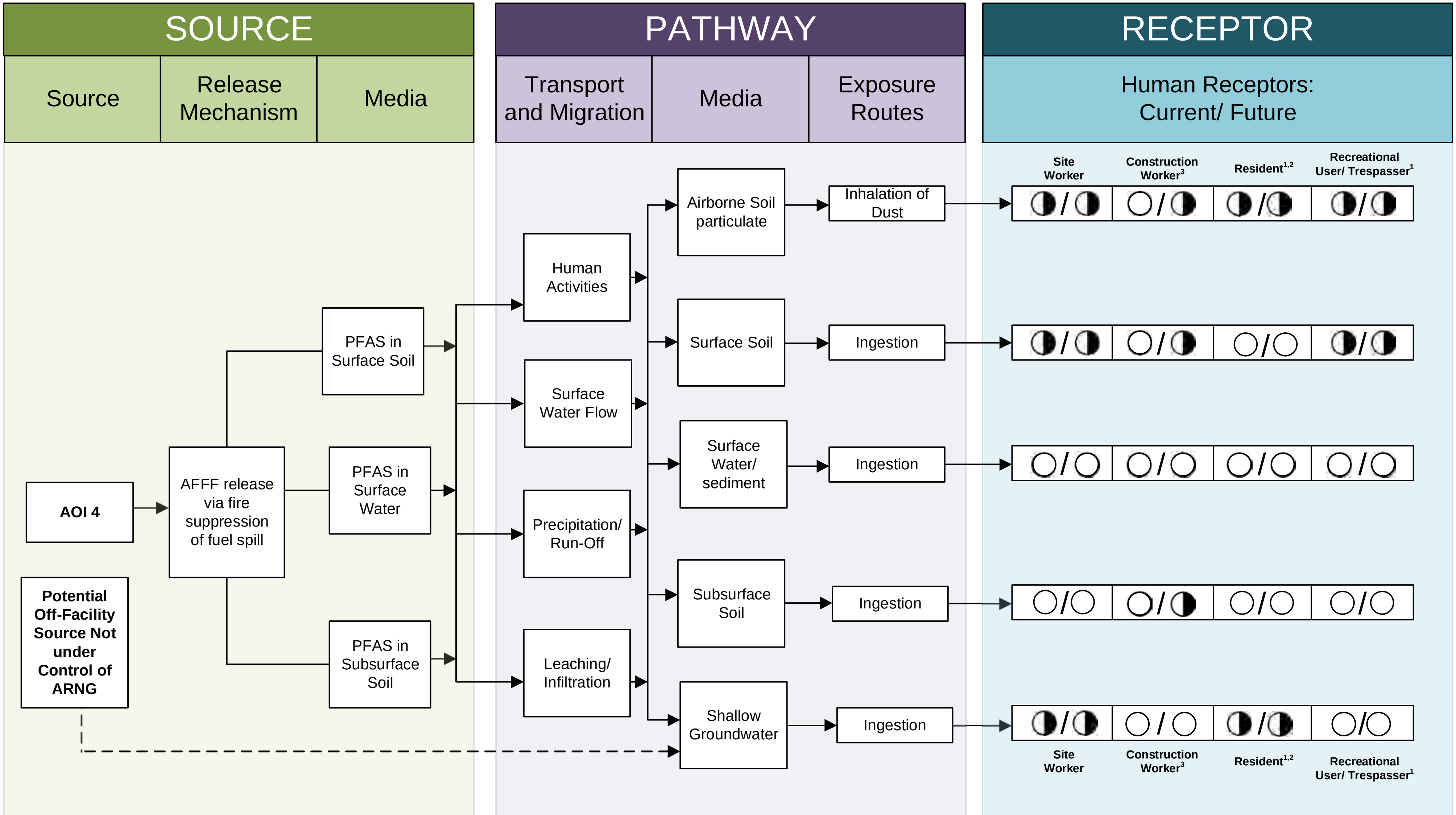
Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

1. The resident and recreational users refer to off-site receptors.
2. Inhalation of dust for off-site receptors is likely insignificant.
3. Active construction within AOI 3 was occurring as of the date of SI field work.

Figure 7-3
Conceptual Site Model, AOI 3
Silverbell Army Heliport



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

Potentially Complete Pathway

Potentially Complete Pathway with Exceedance of SL

NOTES

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

Figure 7-4
Conceptual Site Model, AOI 4
Silverbell Army Heliport

8. Summary and Outcome

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

8.1 SI Activities

The SI field activities were conducted from 4 to 23 October 2021 and consisted of utility clearance, sonic boring, soil sample collection, permanent monitoring well installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021a), except as noted in **Section 5.8**

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

- Thirty (30) soil samples from 19 boring locations;
- Two low-flow groundwater samples from two newly installed permanent monitoring well locations; and
- Seventeen (17) QA samples.

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

8.2 SI Goals Evaluation

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

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

   PFOA, PFOS, and PFBS were detected at the facility in soil and groundwater. PFOA, PFOS, and PFBS were detected both at the source areas, as well as, at the facility boundary between source areas and potential downgradient drinking water receptors. In soil, PFOS exceeded the SL of 130 µg/kg at two locations in AOI 2. No other soil results exceeded the SLs. PFOA, PFOS, and PFBS were detected in groundwater at the two facility boundary monitoring wells (generally located downgradient of the four AOIs) but did not exceed SLs. Based on these results, only AOI 2 has soil or groundwater detections that exceed SLs.

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

   PFOA, PFOS, and PFBS were detected in soil at potential release areas and in groundwater from two facility boundary monitoring wells; however, concentrations were below the SLs. However, soil detections at AOIs 1, 3, and 4 detected elevated concentrations (within an order of magnitude of the SL) of PFOA, PFOS, or PFBS in surface and subsurface soil. Additionally, no AOI-specific monitoring wells were installed at the potential release areas to confirm presence or absence of PFAS in groundwater. The results suggest no threat to human health or the environment exists based on SLs; however, additional characterization is required.

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

   Based on the data collected during this SI, there is a potentially complete pathway between the potential PFAS release areas and downgradient drinking water receptors; however, a TCRA is not a consideration at this time. PFOA, PFOS, and PFBS results from two facility boundary monitoring wells confirmed the presence of these compounds in groundwater at the facility boundary. However, the concentrations detected were below the individual SLs and USEPA HAs and, as a result, do not trigger a TCRA at this time.

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

   The geological data collected during the SI found alternating layers of well-graded silty sand and gravel and semi-confining layers of silty clay to clay. The borings were completed at depths between 15 and 250 feet bgs. Isolated layers of clay to silty sand were also observed in the boring logs at thicknesses ranging from a few inches to several feet thick. Many of the logs also reported varying percentages of gravel and cobbles. These observations are consistent with the lithology expected for the regional depositional environment.

   Depth to water measured ranged from 157.29 to 166.17 feet bgs in the two monitoring wells installed during the SI. The aquifer was found to consist of alternating layers of sand, silty sand, and clayey sand with varying degrees of moisture ranging from saturated to moist. Thin layers of finer material did appear to act as micro-confining layers, but it is unlikely these minor units impacted the hydraulic connectivity of the saturated units above and below. Only a general, estimated groundwater flow direction could be inferred from these two data point. Refining the facility-specific groundwater flow direction should be an objective of any future investigation. These geologic and hydrogeologic observations inform development of the technical approach for the RI.

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

   Based upon the results of the SI, it is likely on-facility releases have contributed to the detected concentrations in soil across the facility. Soil results confirmed PFOA, PFOS, and PFBS are present in surface soils and are likely attributed to potential releases from on-facility activities. The source of PFOA, PFOS, and PFBS concentrations detected in groundwater at the facility boundary are more uncertain and additional investigation is necessary to determine whether historical releases to the surface at identified AOIs are contributing to PFAS detections in groundwater.

   As mentioned in Section 7, two deep water supply wells exist on the facility and are located east of the AOIs. PFAS analysis of sampling from these wells detected PFOA, PFOS, and PFBS at concentrations similar to the detections in the downgradient facility boundary wells, but the supply wells are screened several hundred feet deeper. The source of the contamination in the two water supply wells is unknown; however, an upgradient municipal airport with potential PFAS release areas was identified during the PA. The radius of influence and pumping conditions at the two water supply wells have not been evaluated with respect to impacts on the nature and extent of PFOA, PFOS, and PFBS at the facility or whether active pumping could induce groundwater flow from the potential on- or off-facility release areas to the supply wells. These details are included for informational purposes only. The SI did not perform an evaluation of the aquifer and hydraulic connectivity between the facility boundary monitoring wells and other off-facility monitoring wells. The impact of potential up-gradient sources should be an objective of any future investigation.

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

   Based on the detections of PFOA, PFOS, and PFBS in soil and groundwater on the facility, there is a potentially complete pathway between source and potential downgradient receptors. However, it is unclear whether the detected concentrations in groundwater are entirely related to ARNG activity at SBAH given the detected concentrations of PFAS in the nearby SBAH water supply wells. Further evaluation between the source areas and detections in groundwater should be an objective of any future investigation.

8.3 Outcome

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

- At AOI 1, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.
- At AOI 2, PFOA, PFOS, and PFBS were detected in soil, and PFOS detections exceeded the SL of 130 micrograms per kilogram (µg/kg) at two locations. Based on the results of the SI, further evaluation of AOI 2 is warranted in an RI.
- At AOI 3, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.
- At AOI 4, PFOA, PFOS, and PFBS were detected in soil but were below the SLs. However, without AOI-specific groundwater data, data gaps remain from and warrant further investigation during an RI.
- Two monitoring wells were installed at the facility boundary to assess groundwater impacts for the entire facility from the identified AOIs. PFOA, PFOS, and PFBS were detected in groundwater at both monitoring wells, but were below SLs.
- Several potential up-gradient release areas exist which could contribute to the concentrations of PFAS in groundwater detected in the facility boundary monitoring wells and on-facility water supply wells. The SI did not perform a comprehensive evaluation of the aquifer and hydraulic connectivity between the on-facility wells (monitoring and water supply) and off-facility monitoring wells.

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

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI. Based on the results of this SI, further evaluation is warranted in the RI for all four AOIs (AOI 1 through AOI 4).

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area	Groundwater – Facility Boundary
1	Building L4320 and surrounding area	◐	NA	◐
2	Building L4300 and surrounding area	●	NA	◐
3	Northeastern Boundary Release Locations	◐	NA	◐
4	Alpha, Charlie, and Bravo Rows	◐	NA	◐

Legend:
N/A = not applicable
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels
○ = not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Building L4320	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI
2	Building L4300 and surrounding area	Exceedances of SLs in soil at source area. No exceedances of soil or groundwater at the facility boundary.	Proceed to RI
3	Northeastern Boundary Release Locations	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI
4	Alpha, Charlie, and Bravo Rows	Data gaps remain after completion of the SI. No AOI-specific monitoring wells/groundwater data to support evidence of potential impacts to surface and shallow subsurface soil releases.	Proceed to RI

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