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Subject:
Final Preliminary Assessment/Site Inspection Report for Adelphi Laboratory Center
Contract No: W912DR-18-D-0004
Delivery Order No: W912DR18F0685

Environment

Dear Ms. Jamie Pierce,

Arcadis U.S., Inc. is pleased to provide the Final Preliminary Assessment/Site Inspection Report for per- and polyfluoroalkyl substances at Adelphi Laboratory Center, MD. This document has gone through all the necessary reviews and is considered final.

Please call me at 703.842.5606 or Rhonda Stone at 610.563.6122 if you have any questions or comments.

Respectfully,

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16 December 2022

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FINAL PRELIMINARY ASSESSMENT AND SITE INSPECTION OF PER- AND POLYFLUOROALKYL SUBSTANCES

Adelphi Laboratory Center, Maryland

Prepared For:
U.S. Army Corps of Engineers, Baltimore District
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Baltimore, Maryland 21201

December 2022

Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Adelphi Laboratory Center, Maryland

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EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This Adelphi Laboratory Center PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense (DoD) policy and guidance.

The Adelphi Laboratory Center (ALC) is a sub-installation of Aberdeen Proving Ground. It is an active U.S. Army research and development facility in a suburb of Washington, D.C. ALC was formerly known as Harry Diamond Laboratories (HDL). In 1969, HDL was moved from Washington D.C. to 207 acres of undeveloped land in Adelphi, Maryland. The land assigned to the HDL facility was transferred from the U.S. Naval Surface Warfare Center. In 1991, HDL was renamed ALC, and the Naval Surface Warfare Center was closed under the Base Realignment and Closure Act. During Operation Desert Shield/Desert Storm in the 1990s, all elements of Aberdeen Proving Ground, including ALC, helped test field equipment and mobilize personnel for the war in the Persian Gulf. In 1992, the Laboratory Command at Adelphi, Maryland was re-designated as an Army Research Laboratory.

The ALC PA identified one AOPI for investigation during the SI phase. SI sampling results from the one AOPI were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, PFBS, PFNA, and PFHxS. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI at ALC; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels. PFOS, PFOA, PFBS, PFNA and/or PFHxS were detected groundwater at the one AOPI. PFOS, PFOA, and PFNA were detected in soil at the one AOPI. The one AOPI had PFOS, PFOA, and PFNA present at concentrations greater than the risk-based screening levels. The ALC PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

Table ES-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, PFBS, PFHxS, and PFNA Sampling at Adelphi Laboratory Center, and Recommendations

AOPI Name	PFOS, PFOA, PFBS, PFHxS, and/or PFNA detected greater than OSD Risk Screening Levels? (Yes/No)		Recommendation
	GW	SO	
Building 500	Yes	No	Further study in a remedial investigation

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
SO – soil

1 INTRODUCTION

The United States (U.S.) Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Adelphi Laboratory Center (ALC), Maryland, based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the analytical results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, PFBS, PFNA, and PFHxS risk screening levels to determine whether further investigation is warranted. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI; therefore, there are no HFPO-DA SI analytical results to screen against the OSD risk screening levels. This report provides the PA/SI for ALC and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

PFAS are a class of compounds that have been used in a wide range of industrial applications and commercial products due to their unique surface tension/leveling properties. Due to industry and regulatory concerns about the potential health effects and adverse environmental impacts, there has been a reduction in the manufacture and use of PFAS worldwide. In the U.S., significant reductions in the production, importation, and use of PFOS and PFOA (two individual compounds in the PFAS class) occurred between 2001 and 2015 (Interstate Technology Regulatory Council 2017). PFBS replaced PFOS in some applications and is currently used and manufactured in the U.S.

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water and soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). On 18 May 2022, the USEPA published an update to the RSLs table. The May 2022 RSL table included six PFAS constituents: PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA (USEPA 2022). On 06 July 2022, the OSD issued a memorandum to include

revised risk screening levels based on the May 2022 USEPA RSLs (OSD 2022). The July 2022 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

This PA/SI was conducted consecutively because the results of the PA yielded AOPIs that necessitated continuing onto the SI phase in accordance with CERCLA. Consequently, this report provides the combined objectives of both PA and SI reports.

1.2.1 PA Objectives

During the PA, investigators collect readily available information and conduct site reconnaissance. This PA will evaluate and document areas where PFAS-containing materials were used, stored, and/or disposed, so the Army can distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation.

1.2.2 SI Objectives

An SI is conducted when the PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required.

Installation-specific data quality objectives (DQOs) and the sampling design and rationale are summarized in **Sections 6.1** and **6.2**.

1.3 PA/SI Process Description

For ALC, PA/SI development followed the process as described below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for ALC. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), ALC, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 12 May 2020, 11 weeks before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area

on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as to gather information on the physical setting and site history at ALC.

A read-ahead package was prepared and submitted to the appropriate POCs two weeks before the site visit. The read-ahead package contains the following information:

- The Installation Management Command (IMCOM) operation order
- The Army PA Operations Security requirements package, which includes the antiterrorism/operations security review cover sheet (**Appendix C**)
- The PFAS PA kickoff call minutes
- An information paper on the PA portion of the Army's PFAS PA/SI
- Contact information for key POCs
- A list of the data sources requested and reviewed
- A list of preliminary locations identified during the kickoff call and pre-site visit records review to be evaluated for use, storage, and/or disposal of PFAS-containing materials, where additional information on those areas will be collected through personnel interviews, additional document review, and site reconnaissance.
- A list of roles for the installation POC to consider when recommending potential interviewees.

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 28 July 2020. An in-brief meeting was held to provide installation staff with the objectives of the site visit and team introductions. **Section 3** includes information regarding personnel interviewed.

Personnel interviews were conducted with individuals having significant historical knowledge at ALC. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

Site reconnaissance included visual surveys that assessed the points of potential use, storage, and/or disposal of PFAS-containing materials, as well as potential secondary impacts, and the migration potential from each AOPI (e.g., stormwater drains, building drains and sumps, cracks in the floor/pavement). Physical attributes of the preliminary locations were documented, including local slope and ground and floor conditions (i.e., paved, unpaved, visual staining), surface water bodies and surface flow, potential receptors, and the distance to the installation boundary. Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling. Photo documentation of the preliminary locations was collected, and access limitations or advantages related to potential future sampling activities were noted.

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The installation declined an exit briefing.

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable USAEC POCs, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI, which serve as the basis for developing the SI scope of work presented in an installation-specific Quality Assurance Project Plan (QAPP) Addendum.

1.3.4 Site Inspection Planning and Field Work

The SI process was initiated at the installation to evaluate PFOS, PFOA, PFBS, PFHxS, and PFNA presence or absence at each AOPI and determine whether further investigation is warranted. A combined SI kickoff and scoping teleconference was held between the Army PA team and the ALC to obtain concurrence on the SI sampling plan from USAEC, USACE, and the ALC. Additional discussion topics included:

The objectives of the SI kickoff and scoping teleconference were to:

- discuss the AOPIs selected for sampling and the proposed sampling plan for each AOPI
- gauge regulatory involvement requirements or preferences
- identify overlapping unexploded ordnance or cultural resource areas
- confirm the plan for investigation derived waste (IDW) handling and disposal
- identify specific installation access requirements and potential schedule conflicts
- discuss general SI deliverable and field work schedule information and logistics

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP) was developed and finalized in October 2019 for the USAEC PFAS PA/SI (Arcadis 2019). The PQAPP details general planning processes for collecting data and describes the implementation of quality assurance (QA) and quality control (QC) activities for the SI portion for Army installations nationwide. Additionally, an installation-specific QAPP Addendum was developed to define the DQOs, present the sampling design and rationale, and provide qualifications for project personnel. The SI field work was completed in accordance with the PQAPP (Arcadis 2019) and the approved installation-specific QAPP Addendum. A Site Safety and Health Plan (SSHP) was also developed as an attachment to the QAPP Addendum to identify specific health and safety hazards that may be encountered at the installation during sampling. The SSHP was designed to supplement the Accident Prevention Plan (Arcadis 2018), which was developed for Army installations nationwide. The QAPP Addendum and SSHP were submitted to the installation and finalized before commencement of field work.

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for ALC (Arcadis 2021) in **Sections 6.1** through **6.3**.

After finalization of the QAPP Addendum and SSHP, field planning and coordination with the installation and subcontractors was completed. Once the schedule was determined, field teams mobilized to the installation to complete the scope of work defined in the QAPP Addendum.

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, PFBS, PFHxS, and PFNA analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.3 (DoD and Department of Energy 2019). Laboratory analytical results were then validated and verified by a project chemist to assess the usability of the data collected. Validated analytical results were summarized in the context of OSD risk screening levels (defined in **Section 6.5**).

2 INSTALLATION OVERVIEW

The following subsections provide general information about ALC, including the location and layout, the installation mission(s) over time, a brief site history, current and projected land use, climate, topography, geology, hydrogeology, surface water hydrology, potable wells within a 5-mile radius of the installation, and applicable ecological receptors.

2.1 Site Location

ALC (**Figure 2-1**) is located approximately 25 miles southwest of central Baltimore, Maryland, and 10 miles north of Washington, D.C. and is easily accessible to Interstate 95 (the east coast's primary north-south transportation corridor). ALC is bisected by two Maryland counties and occupies approximately 110 acres in Prince George's County and approximately 97 acres in Montgomery County. **Figure 2-2** details the installation layout of ALC.

2.2 Mission and Brief Site History

ALC is a sub-installation of Aberdeen Proving Ground. It is an active U.S. Army research and development facility in a suburb of Washington, D.C. ALC was formerly known as Harry Diamond Laboratories (HDL). In 1969, HDL was moved from Washington D.C. to 207 acres of undeveloped land in Adelphi, Maryland. The land assigned to the HDL facility was transferred from the U.S. Naval Surface Warfare Center. In 1991, HDL was renamed ALC and the Naval Surface Warfare Center was closed under the Base Realignment and Closure Act (USEPA 2018). During Operation Desert Shield/Desert Storm in the 1990s, all elements of Aberdeen Proving Ground, including ALC, helped test field equipment and mobilize personnel for the war in the Persian Gulf. In 1992, the Laboratory Command at Adelphi, Maryland was re-designated as an Army Research Laboratory (Army 2019). The overall mission at ALC is to provide support services and infrastructure to enable scientific research, development, and the well-being of the workforce at ALC (Army 2019).

2.3 Current and Projected Land Use

ALC activities include development of electronic fuses for explosive ordnance projectiles (e.g., mortars, artillery) and associated electronic technology, research on fluidics, and nuclear weapons effects technologies. Small scale or prototype operations are carried out at ALC rather than large scale production. Operations include metal plating, printed circuit board productions, and operations including the use of an impulse generator and photography (USEPA 2018). ALC consists of a small Army attachment with a population primarily consisting of DoD civilians, a small number of contractors, as well as active-duty Reserve and National Guard soldiers – totaling approximately 1,500 personnel. The Garrison at ALC was created in February of 2003. The Army Research Laboratory is the largest tenant organization at ALC, other tenants at ALC include:

- The Army Reserve Information Operations Command
- Unified Cross Domain Services Management Office
- U.S. Army Contracting Command (Army Contracting Command – Adelphi Contracting Division)

- U.S. Army 93rd Signal Network - Network Enterprise Center
- Logistics Readiness Center
- U.S. Army Cyber Operation Group – 335th Signal Command

2.4 Climate

At ALC, the summers are hot and humid, the winters are very cold and windy, and it is partly cloudy year-round. Over the course of the year, the temperature typically varies from 28 degrees Fahrenheit (°F) to 88°F and is rarely below 15°F or above 96°F. Rain falls throughout the year at ALC. The most rain falls between March and April, with an average total accumulation of 3.6 inches per month. The snowy period of the year lasts for four months, from November 24 to March 24, with a sliding 31-day liquid-equivalent snowfall of at least 0.1 inches. The majority of snow falls between January and February, with an average total liquid-equivalent accumulation of 0.6 inches (USEPA 2018).

2.5 Topography

ALC's topography (**Figure 2-3**) is characterized by gently rolling hills and outcrops and is located to the west of the east coast Fall Line. The highest elevations generally occur in the northern and western portion of the installation, with a gradual decrease in elevation towards the east and south. Elevations at the site range from 150 to 290 feet above mean sea level.

2.6 Geology

Regional geology consists of the Atlantic Coastal Plain Physiographic Province and is underlain by generally unconsolidated Cretaceous to Tertiary sediments consisting of gravels, sand, silt, and clay. The Cretaceous rocks are of continental origin, while the Tertiary are mostly shallow marine sands and carbonate marls. These sediments are unconformably overlain by younger alluvium and upland gravels of Pliocene to Recent age (Means 2010).

Atlantic Coastal Plain sediments in the area are divided into three major units: the Lower Cretaceous Potomac Group (comprised of the Patuxent, Arundel and Patapsco Formations), the Quaternary Talbot Formation (Pleistocene), and the Holocene (Recent) Sediments.

The sediments gradually increase in thickness and fineness as dip decreases for younger formations. The dip is toward the south and southeast and ranges from an average of 75 feet per mile near the basement rock to an average of 10 feet per mile for the upper Tertiary formations (U.S. Army Garrison Aberdeen Proving Ground 2012; Dames and Moore, Inc 1972; Hazardous Waste Remedial Actions Program 1995).

The ALC facility is gently rolling to hilly with rock outcroppings. The east coast Fall Line or transition zone between the rock Piedmont Province and the unconsolidated sediment of the Atlantic Coastal Plain is located to the west of the ALC facility.

2.7 Hydrogeology

Regionally, groundwater is produced from crystalline basement rock, Potomac Group sediments, and Talbot Formation sediments. Thicker Coastal Plain sediments are found with aquifers that can yield up to 1,000 gallons per minute (U.S. Army Garrison Aberdeen Proving Ground 2012). A 1997 Maryland Geological Survey report divided the Coastal Plain Sedimentary sequence into three aquifers (1, 2, and 3, from shallowest to deepest) and three confining units (1, 2, and 3). Aquifer 1 consists primarily of the Talbot Formation, as well as the shallowest part of the Potomac Group where the Talbot Formation crops out. Aquifer 2 consists mostly of sediments from the Potomac Group, but also from the deeper portion of the Talbot Formation. Aquifer 3 consists entirely of Potomac Group sediment. Potomac Group sediments consist principally of the Patapsco Formation beneath ALC. In addition to these three aquifers, there is also a paleochannel aquifer, which consists of Pleistocene Talbot Formation fluvial and estuarine sedimentary deposits, where present. Confining unit 1 consists of is comprised of organic silty clays and clays and is thin or absent in places, resulting in semi-confined or unconfined portions of Aquifer 2 (U.S. Army Public Health Command 2013). Confining unit 2 consists of organic silty clay and confining unit 3 consists of sandy clay (U.S. Army Public Health Command 2013). At ALC, the depth to water is shallow, generally within 20 feet of the surface (USEPA 2018).

2.8 Surface Water Hydrology

Hydrological systems in close proximity to ALC that would be directly influenced by overland drainage and hyporheic flow through shallow sediment includes Paint Branch Creek that lies just south of the Building 500 AOPI. The stream flows regionally south and eastward to the Anacostia and Potomac River (approximately 15 miles south) (USEPA 2018).

2.9 Relevant Utility Infrastructure

The following subsections provide general information regarding the installation's stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and transport of PFAS constituents at ALC.

2.9.1 Stormwater Management System Description

On-site stormwater drains to the Anacostia River Area as defined by the Maryland Department of Environment with use designation for water contact recreation, protection of aquatic life, and public water supply (DoD 2011).

2.9.2 Sewer System Description

ALC purchases all water and wastewater services directly from the Washington Suburban Sanitary Commission. All wastewater is treated by the Blue Plains Wastewater Treatment Facility, which is owned and operated by the District of Columbia Water and Sewer Authority (DoD 2011).

2.10 Potable Water Supply and Drinking Water Receptors

Current and historical drinking water is supplied to ALC by the Washington Suburban Sanitary Commission water supply, which is sourced by the Patuxent River and Potomac River. Both surface water intakes are located over 17 miles from ALC. There are no water supply wells on ALC, but several private wells exist within 1,000 feet of the ALC boundary.

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for ALC, which along with state and county geographic information system (GIS) provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4**). The EDR report providing well search results provided as **Appendix E**

2.11 Ecological Receptors

The PA team collected information regarding ecological receptors that was available in the installation documents. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

The installation is suitable for many species of wildlife because of the diversity of habitats. ALC includes land consisting primarily of forests, wetlands, and developed land. There are no records of the presence of federal threatened or endangered species, high-quality natural areas, high-quality natural communities, or other heritage information for ALC (Tetra Tech 2001).The Northern long-eared bat and tricolored bat have been identified as state threatened species that may be found within ALC (Rominiecki 2017).

2.12 Previous PFAS Investigations

Previous (i.e., pre-PA) PFAS investigations relative to ALC, including both those conducted and not conducted by the Army, are summarized to provide full context of available PFAS data for ALC. However, only data collected by the Army will be used to make recommendations for further investigation.

In 2017, a PA was conducted for the basewide investigation of PFAS in groundwater at the Former Naval Surface Warfare Center (NSWC) White Oak in Silver Spring, Maryland. This facility borders ALC and is hydraulically upgradient of the Building 500 AOPI. As this was technically an off-post investigation, further details of this PA are explained in **Section 4.3**. The historical analytical results from this investigation are presented in **Table 2-1** and **Figure 2-5**.

In response to the third Unregulated Contaminant Monitoring Rule (UCMR3), one public water system located within 5-miles of ALC was sampled for six PFAS compounds in 2013 and 2014, including PFOS, PFOA, PFBS, PFHxS, and PFNA in 20XX. All compounds were not detected at concentrations above the laboratory limit of quantitation (LOQ; 40, 20, 90, 30 and 20 ng/L for PFOS, PFOA, PFBS, PFHxS, and PFNA, respectively). The laboratory which analyzed samples under UCMR3 met the USEPA's UCMR3 Laboratory Approval Program application and Proficiency Testing criteria for USEPA Method 537 Version 1.1.

The Blossom Point Field Test Area (BPFTA), located approximately 50 miles south of Washington D.C., covers 1,600 acres on the southern end of Cedar Point Neck, in southern Charles County, Maryland.

Nanjemoy Creek forms the western boundary and the Potomac River forms the southern and eastern boundaries of the BPFTA. The BPFTA is an active facility under the ALC. The BPFTA was evaluated as part of this ALC PA/SI and no AOPIs where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred were identified. In August 2021, an article published by the Environmental Working Group (EWG) titled *'Forever chemicals' contamination at Defense Department sites threatens Chesapeake Bay fish* reported that PFOA was detected in a drinking water sample collected in 2016 at a concentration of 1.1 parts per million (ppm) [1.1 milligram/liter] (EWG 2021a). Review of analytical data released to EWG as part of a Freedom of Information Act request, as well as the EWG's interactive web-mapping interface titled *PFAS Contamination in the U.S.* (EWG 2021b) reports the correct PFOA concentration as 1.1 ng/L.

3 SUMMARY OF PA ACTIVITIES

To document areas where any potential current and/or historical PFAS-containing materials were used, stored and/or disposed at ALC, data was collected from three principal sources of information and are described in the subsections below:

1. Records review
2. Personnel interviews
3. Site reconnaissance

Preliminary locations of potential use, storage, and/or disposal of PFAS-containing materials were then evaluated in the PA (during records review, personnel interviews, and/or site reconnaissance) and were categorized as AOPIs or as areas not retained for further investigation at this time based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches). A summary of the observations made, and data collected through records reviews (**Appendix F**), installation personnel interviews (**Appendix G**), and site reconnaissance logs (**Appendix H**) during the PA process for ALC is presented in **Section 4**. Further discussion regarding rationale for not retaining areas for further investigation is presented in **Section 5.1**, and further discussion regarding categorizing areas as AOPIs is presented in **Section 5.2**.

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program administrative record documents, compliance documents, Chevy Chase and Hillandale Volunteer fire department documents, ALC directorate of public works documents, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for ALC is provided in **Appendix F**.

3.2 Personnel Interviews

Interviews were conducted during the site visit.

The list of roles for the installation personnel interviewed during the PA process for ALC is presented below (affiliation is with ALC unless otherwise noted).

- Environmental Engineer
- Building Manager

The compiled interview logs are provided in **Appendix G**.

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at ALC during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. The site reconnaissance logs are provided in **Appendix H**.

Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling.

4 POTENTIAL PFAS USE, STORAGE, AND/OR DISPOSAL AREAS

ALC was evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. There are a variety of PFAS-containing materials used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most prevalent potential source of PFAS chemicals at DoD facilities. As such, this section is organized to summarize the AFFF-related uses first, and all remaining potential PFAS-containing materials in the subsequent section.

4.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5 percent (%) hydrocarbon surfactants, and 1 to 3% PFAS (Interstate Technology Regulatory Council 2020). AFFF concentrate is designed to be diluted with water to become a 1, 3, or 6% foam. AFFF releases at DoD facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases. The military still primarily uses AFFF for Class B fires; however, the current formulations of AFFF contain significantly lower amounts of PFOS, PFOA, and their precursors, and significant operational changes have been implemented to restrict uncontrolled releases and non-essential use of PFAS-containing foams. Army installations may still house AFFF, commonly stored in closed containers (e.g., 55-gallon drums, 5-gallon buckets), within designated storage buildings or at firehouses.

Findings from personnel interviews, site reconnaissance, and document research indicate the use and storage of AFFF at ALC has been primarily associated with a fire suppression system at Building 500. Currently, there are no PFAS-containing materials stored on site.

There is no on-site fire station and no knowledge of emergency firefighting operations being utilized at the installation. ALC relies on the Chevy Chase Fire Department and Hillendale Volunteer Fire Department Station #12 for emergency response services to ALC, who did not have any record of an AFFF response at Adelphi from the 1990s to the time of this report.

4.2 Other PFAS Use, Storage, and/or Disposal Areas

Following document research, personnel interviews, and site reconnaissance at ALC, no other PFAS source types were identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. Other historical operations at Building 500 included the development of electronic fuses for projectiles (i.e., mortar, artillery, rockets, missiles) and associated electronic technology, and research on fluidics and nuclear weapons effects technologies. These operations included the use of metal plating and photographic processes; however, no information relating to the use of PFAS-containing materials was reported in historical documentation or by interviewed site personnel.

There are no current or historical documentation of PFAS use, storage, and/or disposal related to landfills, pesticides, fuel spills, hydraulic fluids/oil, or any other operations other than Building 500 at ALC.

A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations, and did not identify ALC as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

4.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at ALC) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below.

A basewide investigation for PFAS was conducted at the former NSWC White Oak on behalf of the Naval Facilities Engineering Systems Command Atlantic (NAVFAC) Atlantic Base Realignment and Closure Program Management Office, which is located in Silver Spring, Maryland, bordering ALC and hydraulically upgradient of the Building 500 AOPI (NAVFAC 2021). A total of 19 groundwater samples were collected from 16 wells at five potential PFAS source areas for the presence of PFOA, PFOS, and PFBS in June and July 2017 as part of an initial basewide assessment for PFAS. PFHxS and PFNA were not analyzed during this investigation. PFOA and/or PFOS were detected in groundwater at concentrations which exceeded the OSD risk screening levels. PFBS was not detected at concentrations exceeding the OSD risk screening levels (NAVFAC 2021). The historical analytical results from this investigation are presented in **Table 2-1** and **Figure 2-5**.

The maximum concentrations of PFOS, PFOA, and PFBS detected in groundwater at NSWC White Oak are summarized below:

PFOS was detected at 1,230 ng/L, above the OSD risk screening level (4 ng/L), at the Former Building 110 AOPI

PFOA was detected at 135 ng/L, above the OSD risk screening level (6 ng/L), at the Former Building 110 AOPI

PFBS was detected at 39.2 ng/L, below the OSD risk screening level (601 ng/L), at the Former Building 110 AOPI

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at ALC, were further refined during the PA process and identified either as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA/SI, one area has been identified as an AOPI. The process used for refining these areas is presented on **Figure 5-1**, below.

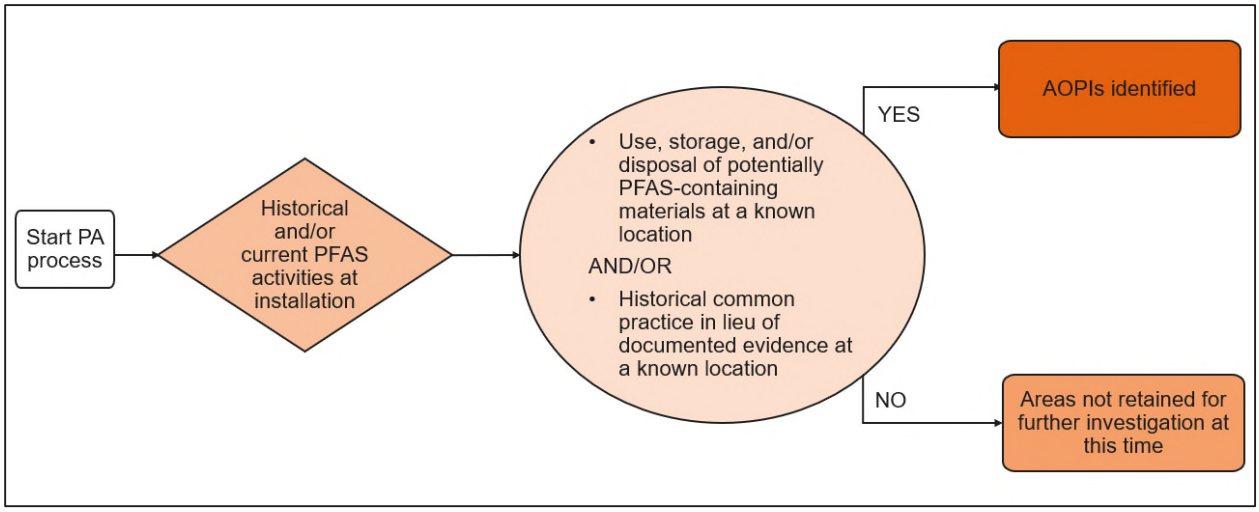

Figure 5-1: AOPI Decision Flowchart

The areas not retained for further investigation are presented in **Section 5.1**. The areas retained as AOPIs are presented in **Section 5.2**.

Data limitations for this PA/SI at ALC are presented in **Section 8**.

5.1 Areas Not Retained for Further Investigation

Through the evaluation of information obtained during records review, personnel interviews, and/or site reconnaissance, the areas described below were categorized as areas not retained for further investigation at this time.

A brief site history and rationale for areas not retained for further investigation are presented in **Table 5-1**, below.

Table 5-1. Installation Areas Not Retained for Further Investigation

Area Description	Dates of Operation	Relevant Site History	Rationale
Building 101 – Outdoor Drum Storage	Unknown	Identified as a potential hazardous waste storage area. Drums stored here reportedly showed signs of	No evidence to suggest that PFOS, PFOA, PFBS, PFNA, PFHxS, or HFPO-DA containing materials

Area Description	Dates of Operation	Relevant Site History	Rationale
		leakage at the time of a site visit conducted in 1989.	were used, stored, and/or disposed of at this location.
White Oak Site 8	Unknown	Formerly a part of the NSWC White Oak facility. This site is a former hazardous waste disposal pit. ALC discovered groundwater contamination originating from this site in 1989. Groundwater constituents included chlorinated volatile organic compounds and metals. A soil removal action at this site was conducted in 1996.	No evidence to suggest that PFOS, PFOA, PFBS, PFNA, PFHxS, or HFPO-DA containing materials were used, stored, and/or disposed of at this location.

5.2 AOPI

An overview for the AOPI identified during the PA process is presented in this section. The one AOPI overlaps with ALC Installation Restoration Program sites (**Figure 5-2**).

The AOPI location is shown on **Figure 5-2**. An aerial photograph of the AOPI that also shows the approximate extent of AFFF use (if applicable) is presented on **Figure 5-3** and includes active monitoring wells in the vicinity of the AOPI.

5.2.1 Building 500 AOPI

The Building 500 AOPI is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical use, storage, and/or disposal of PFAS-containing materials and/or AFFF. Building 500 is a facility where research support for ALC is conducted, including various laboratory and research functions, services, and logistics support. Fire suppression system tanks were located on-site as a precautionary measure for building emergencies and stored along the northeastern side of the building in the oil storage area, potentially with PFAS-containing materials and AFFF, from 1990 to 1996. The fire suppression system was replaced in 1996 and AFFF was removed from the system in April 1998. In May 1998, the entire sprinkler and fire suppression system in Building 500 was flushed using more than 5,000 gallons of fresh water. The rinse water was collected in a tanker truck and hauled offside by a contractor for subsequent disposal. The tanks were isolated from the building water supply, but were not removed until a later, unknown date. During removal, five hose lines were removed and one hose line was left in place. Currently, there are no PFAS-containing materials stored on site.

Building 500 consists of a main bay, former fire suppression tank room, oil storage area, and exterior hose spray area. The enclosed main bay testing area is comprised entirely of concrete flooring. Any potential releases to the bay floor are captured and discharged to an exterior injector pit, which is then directed to an oil-water separator system located exterior to the southwestern edge of the base prior to discharge to Paint Branch Creek. There is also an exterior hose spray area located directly outside of

Building 500, along the southwestern edge of the building. The area is covered in asphalt with a single storm sewer drain located at the center. The application area is directly next to the main oil-water separator used to handle wastewater and runoff originating from Building 500. The surface topography of the area leads all surface water and runoff into the single storm sewer drain. During site reconnaissance, it was noted that the one remaining fire suppression system hose line located along the interior southern side of Building 500 was observed to be dripping water and what appeared to be foam sometime between 2000 to 2005. The hose was then extended to the exterior area and sprayed out to remove residual material within the hose line and to stop the dripping. It was also noted that in early 2020, the hose was inspected and flushed by a fire inspector. Potential releases from 2000 to 2005 occurred at the main bay of the building due to dripping from the one remaining hose line from the fire suppression tanks, as well as potential releases on the asphalt surrounding the exterior hose nozzle testing area.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at ALC, an SI for PFOS, PFOA, PFBS, PFHxS, and PFNA was conducted in accordance with CERCLA. SI sampling was completed at ALC at the one AOPI to evaluate presence or absence of PFOS, PFOA, PFBS, PFHxS, and PFNA in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2021) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil and groundwater pathways as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in April 2022 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2021) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at ALC. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2021), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater and soil for PFOS, PFOA, PFBS, PFHxS, and PFNA presence or absence at the sampled AOPI.

6.2 Sampling Design and Rationale

The rationale for sampling at each AOPI is illustrated on **Figure 6-1** below.

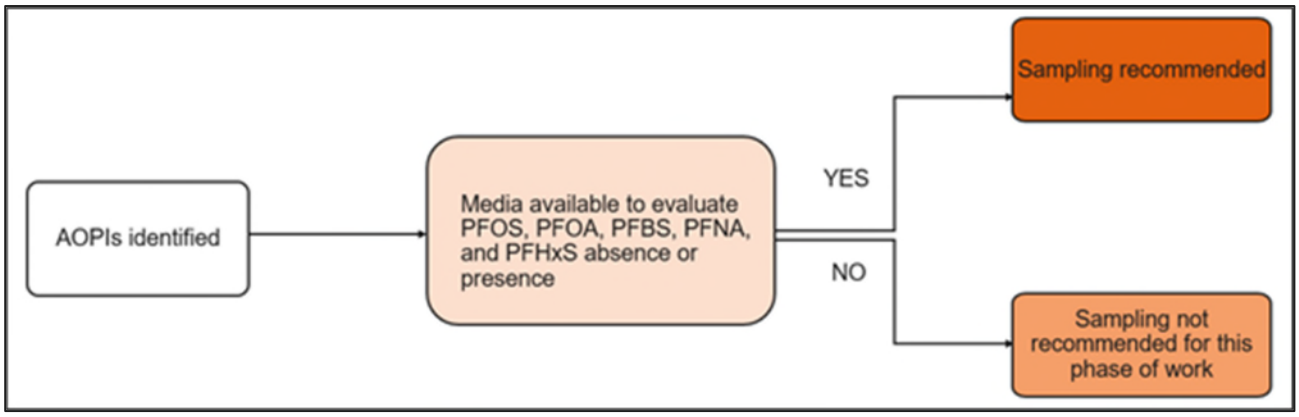

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at ALC is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2021). Briefly, soil and groundwater samples were collected from areas at the Building 500 AOPI, of known or suspected PFAS-containing materials use, storage, and/or disposal. Groundwater was sampled to identify PFOS, PFOA, PFBS, PFHxS, and PFNA presence, type of the 18 selected constituents as listed in Worksheet #15 of the QAPP Addendum and concentrations (Arcadis 2021). Soil was sampled to identify PFOS, PFOA, PFBS, PFHxS, and PFNA presence, type of the 18 selected constituents as listed in Worksheet #15 of the QAPP Addendum, and concentrations (Arcadis 2021). The one soil sample collected at Building 500 was also analyzed for total organic carbon (TOC), pH, and grain size. These data are collected as they may be useful in future fate and transport studies. These targeted sampling areas are believed to have the potential for the greatest PFAS concentrations closest to known or suspected use, storage, and/or disposal of PFAS-containing materials.

During the initial SI sampling event, planned grab groundwater samples were not collected at two of the three proposed locations at the Building 500 AOPI because the direct push technology (DPT) drilling equipment hit refusal before reaching groundwater. In the lone groundwater sample collected, PFOS and PFOA were detected at concentrations narrowly below their respective OSD risk screening levels (which was 40 ng/L at the time of the sampling event). These near exceedances, coupled with the inability to collect data from more than one groundwater sampling location, led to the addition of a new groundwater sample to be collected from an existing monitoring well. A second mobilization was conducted to collect a groundwater sample from an existing monitoring well located south and hydraulically downgradient of the Building 500 AOPI, A-04, to evaluate PFAS presence or absence in groundwater associated with the Building 500 AOPI. The sampling depths at existing monitoring well was at approximately the center of the saturated screened interval. **Table 6-1** includes the monitoring well construction details for the wells sampled during the SI (if available).

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP

Addendum (Arcadis 2021), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2021). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2021). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices I** and **J**, respectively.

6.3.1 Field Methods

Grab groundwater samples were collected from first-encountered groundwater via low-flow sampling procedures from one DPT soil boring at Building 500 through a decontaminated stainless-steel screen point sampler in boreholes using PFAS-free equipment (i.e., decontaminated portable bladder pumps and disposable high-density polyethylene [HDPE] bladders/tubing). One groundwater sample was collected using low-flow purging methods from approximately the center of the saturated screened interval at an existing monitoring well, A-04.

Soil samples were collected via a decontaminated stainless-steel hand auger from the top 2 feet of soil; each 0 to 2 feet interval was homogenized on PFAS-free HDPE plastic sheeting before bottling for analysis.

Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.4.**

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), source blanks for water used in the initial decontamination step for drill tooling, and field blanks for laboratory-supplied water used in the final decontamination step.

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2021), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, PFBS, PFHxS, and PFNA, and TOC only. EBs were collected for media sampled for PFOS, PFOA, PFBS, PFHxS, and PFNA, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2021). The decontaminated reusable equipment from which EBs were collected include HDPE tubing, drill casing, hand augers, and water-level meters as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.4**.

6.3.3 Field Change Reports

No instances of major scope modifications (i.e., those that may have had a significant impact on the project scope and/or data usability/quality, or required stop-work, and warranted discussion with USACE) were encountered during the ALC SI work.

In some cases, clarifications to the established scope of work were needed but do not necessarily constitute a non-conformance from the sampling plans described in the QAPP Addendum. Minor modifications from and clarifications for the procedures and scope of work detailed in the QAPP Addendum and PQAPP and that did not affect DQOs are documented in Field Change Report (FCR) included as **Appendix K** and are summarized below:

FCR-ACL-01: During the SI sampling event, planned grab groundwater samples were not collected at two of the three proposed locations at the Building 500 AOPI because the DPT equipment hit refusal at approximately 17, 9.5 and 10 feet below ground surface (bgs) at ALC-B500-1-GW, ALC-B500-2-GW, and ALC-B500-3-GW, respectively. One groundwater sample was collected from boring location ALC-B500-1-GW, but groundwater was not observed in the other two borings prior to DPT refusal. An additional groundwater sample collected from an existing monitoring well, A-04 was added to the scope of work to evaluate PFOS, PFOA, PFBS, PFHxS, and PFNA presence or absence in groundwater associated with the Building 500 AOPI.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., stainless-steel trowels, hand augers, drill cutting shoes and casing, screen-point samplers, water-level meters) that came into direct contact with sampling media was decontaminated before first use, between sampling locations/intervals, and before demobilization in accordance with P-09, TGI - Groundwater and Soil Sampling Equipment Decontamination (Arcadis 2019, Appendix A).

6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, decontamination fluids, and disposable equipment were collected and placed in Department of Transportation-approved 55-gallon drums, labeled as non-hazardous, segregated by medium: waters, soil, and equipment, and transported to a staging area pending analysis. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and HDPE tubing) that may come in contact with sampling media. Analytical results for IDW samples collected during the SI are discussed in **Section 7.2**. The signed non-hazardous IDW waste manifest documentation is provided in **Appendix L**.

6.4 Data Analysis

The subsections below summarize the laboratory analytical methods and the methodology used to evaluate data collected during the SI through data verification and usability assessments (as completed by a project chemist, independent of the project team).

6.4.1 Laboratory Analytical Methods

Analytical samples collected during the SI were submitted to Eurofins Lancaster Laboratories Environmental an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, PFBS, PFHxS, and PFNA. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019). Eighteen PFAS-related compounds, including PFOS, PFOA, PFBS, PFHxS, and PFNA, were analyzed in groundwater and soil samples by liquid chromatography with tandem mass spectrometry, an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B-15.

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2021) by the analytical method noted:

- TOC by Solid Waste Test Method 846 9060A
- Grain size analysis by American Society for Testing and Materials D422-63
- pH by Solid Waste Test Method 846 9045D.

These data are collected as they may be useful in future fate and transport studies.

The laboratory limit of detection (LOD) is defined as “the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99 percent confidence” (DoD 2017). The lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias is known as the LOQ (DoD 2017). Concentrations detected between the LOD and LOQ, therefore, are considered estimates and are qualified as such on laboratory analytical reports. Instrument-specific detection limits (e.g., the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99 percent confidence; DoD 2017), as provided for each analyte by the laboratory, are reported along with the LODs and LOQs in the laboratory analytical reports included in the Data Usability Summary Report (DUSR) (**Appendix M**).

6.4.2 Data Validation

All analytical data generated during the SI, except grain size and data generated from IDW profiling, were verified and validated in accordance with the data verification procedures described in Worksheets #34 through #36 of the PQAPP (Arcadis 2019). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with DoD QSM 5.3 (DoD and Department of Energy 2019). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation reports for each sample delivery group are included as attachments to the DUSR in **Appendix M**. The Level IV analytical reports are included within **Appendix M** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

A data usability assessment was completed for all analytical data associated with SI sampling at ALC. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix M**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE 2005), the Final DoD General Data Validation Guidelines (DoD 2019) and the Final DoD Data Validation

Guidelines Module 3: Data Validation Procedure for Per-and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD 2020), that reviewed precision, accuracy, completeness, representativeness, comparability, and sensitivity. A statement of overall data usability is included in the DUSR.

Based on the final data usability assessment, the environmental data collected at ALC during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix M**), and as indicated in the full analytical tables (**Appendix N**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and ALC QAPP Addendum (Arcadis 2021). Data qualifiers applied to laboratory analytical results for samples collected during the SI at ALC are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

The OSD risk screening levels for PFOS, PFOA, PFBS, PFHxS, PFNA, and HFPO-DA in groundwater (tap water) and soil were calculated using the USEPA's RSL calculator for residential and industrial/commercial worker receptor scenarios and current toxicity values. These risk screening levels are shown in **Table 6-2**.

Table 6-2 OSD Risk Screening Levels Calculated for PFOS, PFOA, PFBS, PFHxS, PFNA, and HFPO-DA in Tap Water and Soil Using USEPA's Regional Screening Level Calculator

Chemical	Residential Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator		Industrial/Commercial Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator
	Tap Water (ng/L or ppt) [1]	Soil (mg/kg or ppm) [1,2]	Soil (mg/kg or ppm) [1,2]
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFHxS	39	0.13	1.6
PFNA	6	0.019	0.25
HFPO-DA[3]	6	0.023	0.35

Notes:

1. Risk screening levels for tap water and soil provided by the OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06 (**Appendix A**).
2. All soil data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI.
3. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels.

mg/kg = milligram per kilogram

ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater data for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at ALC are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, PFBS, PFHxS, and PFNA will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, PFBS, PFHxS, or PFNA are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at ALC (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2021). The sample results discussion below focuses on the PFOS, PFOA, PFBS, PFHxS, and PFNA analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Tables 7-1 through **7-2** provide a summary of the groundwater and soil analytical results for PFOS, PFOA, PFBS, PFHxS, and PFNA. **Table 7-3** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix N** includes the full suite of analytical results for these media, as well as for the QA/QC samples. **Figure 7-1** shows the PFOS, PFOA, PFBS, PFHxS, and PFNA analytical results in groundwater and soil for the AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, PFBS, PFHxS, and/or PFNA greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or ppt, and soil data are reported in mg/kg, or ppm.

Field parameters measured for groundwater during low-flow purging and sample are provided on the field forms in **Appendix J**. Soil descriptions are provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was first encountered at a depth of approximately 10.54 feet bgs at the Building 500 AOPI. The other two locations did not encounter groundwater before hitting refusal at 9.5 and 10 feet bgs, respectively.

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Building 500	Yes

7.1 Building 500

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFHxS, and PFNA analytical results associated with Building 500 shown on **Figure 7-1** and **Tables 7-1** and **7-2**.

7.1.1 Groundwater

One grab groundwater sample was collected from one boring via DPT at first-encountered groundwater at Building 500 AOPI (ALC-B500-1-GW [duplicate sample collected at ALC-B500-1-GW]; **Figure 7-1**). One groundwater sample was collected from one existing monitoring well at the Building 500 AOPI (ALC-A4-1-GW; **Figure 7-1**). A summary of PFOS, PFOA, PFBS, PFHxS, and PFNA groundwater analytical results is provided in **Table 7-1**.

PFOS was detected at a concentration greater than the OSD risk screening level of 4 ng/L in the groundwater samples: ALC-B500-1-GW-121421 (32 J ng/L) and at a concentration less than the OSD risk screening level of 4 ng/L in the groundwater sample: ALC-A4-1-GW-041122 (3.8 ng/L). The J qualifier indicates that the analyte was positively identified; however, the associated numerical value is an estimated concentration only.

PFOA was detected at a concentration greater than the OSD risk screening level of 6 ng/L in the groundwater samples: ALC-B500-1-GW-121421 (29 J ng/L) and at a concentration less than the OSD risk screening level of 6 ng/L in the groundwater sample: ALC-A4-1-GW-041122 (1.4 J ng/L).

PFBS was detected at a concentration less than the OSD risk screening level of 601 ng/L in the groundwater samples: ALC-B500-1-GW-121421 (2.6 J ng/L) and ALC-A4-1-GW-041122 (1.3 J ng/L).

PFHxS was detected at a concentration less than the OSD risk screening level of 39 ng/L in the groundwater samples: ALC-B500-1-GW-121421 (35 J ng/L) and ALC-A4-1-GW-041122 (3.2 ng/L).

PFNA was detected at a concentration greater than the OSD risk screening level of 6 ng/L in the groundwater sample: ALC-B500-1-GW-121421 (10 J ng/L). PFNA was not detected in the groundwater sample ALC-A4-1-GW-041122.

7.1.2 Soil

Soil samples were collected from four locations at Building 500 AOPI (ALC-B500-1-SO [duplicate sample collected at ALC-B500-1-SO], ALC-B500-2-SO, ALC-B500-3-SO, ALC-B500-4-SO; **Figure 7-1**). A summary of PFOS, PFOA, PFBS, PFHxS, and PFNA soil analytical results is provided in **Table 7-2**.

PFOS was detected at a concentration less than the residential OSD risk screening level of 0.013 mg/kg in soil sample ALC-B500-1-SO-(0.5-2.0)-121421 (0.0011 J mg/kg).

PFOA was detected at a concentration less than the residential OSD risk screening level of 0.019 mg/kg in soil sample ALC-B500-1-SO-(0.5-2.0)-121421 (0.00093 J mg/kg).

PFBS was not detected in any of the soil samples collected.

PFHxS was not detected in any of the soil samples collected.

PFNA was detected at a concentration less than the OSD risk screening level of 0.019 mg/kg in soil sample ALC-B500-1-SO-(0.5-2.0)-121421 (0.001 J mg/kg).

PFOS, PFOA, PFBS, PFHxS, and PFNA were not detected in soil samples: ALC-B500-2-SO, ALC-B500-3-SO, and ALC-B500-4-SO.

7.2 Investigation Derived Waste

IDW consisted of soil and groundwater and was stored in Department of Transportation approved 55-gallon drums. Non-hazardous labels were used for the storage of the IDW. A total of two 55-gallon drums, one for groundwater and one for soil were filled and staged outside of the Building 500 area prior to waste profiling and disposal. Groundwater and soil samples collected as part of the investigation were used as representative profiling data for PFAS IDW. The PFOS, PFOA, PFBS, PFHxS, and PFNA concentrations observed exceeded the OSD risk screening levels. A composite sample of the purge and

decontamination wastewater, as well as a composite sample of the excavated soil were analyzed for trichloroethene. The IDW water was collected from the installation by US Ecology, Inc. on 30 June 2022 and disposed at an off-post Subtitle C landfill located in Belleview, Michigan that accepts PFAS-containing waste, as agreed upon by the installation. Full analytical results for IDW samples collected are included in **Appendix N**.

7.3 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, PFBS, PFHxS, and PFNA, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The TOC in the soil sample was 12,700 J- mg/kg. The TOC at this installation was within the range of values typically observed in topsoil (5,000 to 30,000 mg/kg). The combined percentage of fines (i.e., silt and clay) in soils at ALC was an average of 24.2%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture of the soil, average of 17.06%, was typical for clay (0 to 20%). The pH of the soil was neutral (approximately 7 standard units). Based on these geochemical and physical soil characteristics observed underlying the installation during the SI, PFAS constituents are expected to be relatively less mobile at ALC than in soils with lower percentages of fines and TOC.

7.4 Blank Samples

PFOS, PFOA, PFBS, PFHxS, and PFNA were not detected in any of the blank samples collected during the SI work. The full analytical results for blank samples collected during the SI are included in **Appendix N**.

7.5 Conceptual Site Model

The preliminary CSM presented in the QAPP Addendum (Arcadis 2021) was re-evaluated and updated, if necessary, based on the SI sampling results. The CSM presented on **Figure 7-2** and in this section therefore represents the current understanding of the potential for human exposure.

Many of the PFAS constituents found in AFFF are surfactants (which do not volatilize) and are found in a charged or ionic state at environmentally-relevant pH (i.e., pH 5 to 9 standard units). The PFOS, PFOA, PFBS, PFHxS, and PFNA are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS, PFHxS, and PFNA releases at Army installations are soil, groundwater, surface water, and sediment. Once released to the environment, a primary factor that inhibits the movement of PFAS constituents is the presence of organic matter and organic co-constituents in soils and sediments. Generally, PFAS constituents are mobile in the potentially affected media, and they are not known to be fully broken down by natural processes.

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPI, affected media are likely to consist of soil and groundwater and could include surface water and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge from shallow groundwater to surface water, and adsorption/desorption between surface water and sediment. Generic categories of potential human receptors and their associated exposure scenarios that are typically evaluated in a

CERCLA human health risk assessment were considered and include on-installation site workers (e.g., industrial/commercial workers, utility workers, or future construction workers who could be exposed to chemicals in soil at an AOPI or to chemicals in tap water in an industrial/commercial building), on-installation residents (e.g., adults and children who could be exposed to chemicals in tap water in a residence), and on-installation recreational users (e.g., hikers or hunters who could be exposed to chemicals in waterways at an installation). Off-installation receptor types could include drinking water receptors (i.e., commercial/industrial workers or residents) and recreational users.

Human exposure pathways are shown as “complete”, “potentially complete”, or “incomplete” on the CSM figure. A complete exposure pathway consists of a constituent source and release mechanism, a transport or retention medium, an exposure point where human contact with the contaminated medium could occur, and an exposure route at the exposure point. If any of these elements is missing, the exposure pathway is incomplete. Pathways are “potentially complete” where data are insufficient to conclude the pathway is either “complete” or “incomplete”. Additionally, the CSM does not include ecological receptors and exposure pathways. The potential for ecological exposures to PFOS, PFOA, PFBS, PFHxS, and PFNA may be evaluated at a future date if those pathways warrant further consideration.

Figure 7-2 shows the CSM for the Building 500 AOPI, where PFAS-containing materials were potentially stored for extended periods of time in the oil storage area. Releases of PFAS-containing materials historically occurred outside of the main bay of the building due to potential leakage from the hoses outside of the station, as well as on the grass to the west of the building during nozzle testing activities.

The following summarizes the exposure pathways shown in **Figure 7-2**:

- There are no permanent residents at ALC, and on-post recreational activities are unlikely. Therefore, all exposure pathways for on-installation residents and recreational users are incomplete.

- PFOS, PFOA, and PFNA were detected in soil at the Building 500 AOPI. Site workers (i.e., installation personnel) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.

- Building 500 AOPI is wholly located within the installation boundary; therefore, the soil exposure pathway for off-installation receptors is incomplete.

- PFOS, PFOA, PFBS, PFHxS, and PFNA were detected in groundwater at the Building 500 AOPI. ALC is supplied drinking water by a public water utility. There are no drinking water supply wells at ALC. However, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the on-post groundwater downgradient of the AOPI.

- Groundwater originating at this AOPI flows off-post through the installation’s southern boundary. In the absence of PFAS land use controls preventing potable use of the groundwater in this area, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.

- A drainage system collects stormwater runoff and shallow groundwater in the vicinity of the Building 500 complex. This underdrain system also connects to storm sewers located around the complex. Water captured by the underdrain and storm sewer system is treated by an oil-water separator and discharged to a small, off-post stream located 300 feet south of Building 500, which eventually flows through various creeks

and tributaries into the Anacostia River area. On-installation site workers are not likely to contact surface water and sediment of these waterbodies; therefore, these exposure pathways are incomplete.

- Surface water bodies flow off-post through the installation's southeastern boundary. Recreational users off-post could contact constituents in surface water and sediment through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Following the SI sampling, human exposure pathways for the one AOPI were considered to be complete or potentially complete. Although the CSM indicates complete or potentially complete exposure pathways may exist, the recommendation for remedial investigation is based on the comparison of analytical results for PFOS, PFOA, PFBS, PFHxS, and PFNA to the OSD risk screening levels (**Table 6-2**).

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified the AOPI at ALC based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release of PFOS, PFOA, PFBS, PFHxS, and PFNA to the environment occurred.

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, PFBS, PFHxS, and PFNA in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, PFBS, PFHxS, and PFNA in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, PFBS, PFHxS, and PFNA use, storage, and/or disposal at ALC. Following the evaluation, one AOPI was identified.

The AOPI was sampled during the SI at ALC to identify presence or absence of PFOS, PFOA, PFBS, PFHxS, and PFNA at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the ALC QAPP Addendum (Arcadis 2021).

The one AOPI had detections of PFOS, PFOA, and PFNA in groundwater and soil, with concentrations that exceeded the OSD risk screening levels in groundwater only.

The maximum concentrations of PFOS, PFOA, PFBS, PFHxS, and PFNA detected in soil and groundwater at ALC are summarized below by media:

Groundwater

PFOS was detected at 32 J ng/L, above the OSD risk screening level for tap water (4 ng/L), in sample ALC-B500-1-GW-121421 at the Building 500 AOPI

PFOA was detected at 29 J ng/L, above the OSD risk screening level for tap water (6 ng/L), in sample ALC-B500-1-GW-121421 at the Building 500 AOPI

PFBS was detected at 2.6 J ng/L, below the OSD risk screening level for tap water (601 ng/L), in sample ALC-B500-1-GW-121421 at the Building 500 AOPI

PFHxS was detected at 35 J ng/L, below the OSD risk screening level for tap water (39 ng/L), in sample ALC-B500-1-GW-121421 at the Building 500 AOPI

PFNA was detected at 10 J ng/L, above the OSD risk screening level for tap water (6 ng/L), in sample ALC-B500-1-GW-121421 at the Building 500 AOPI

Soil

PFOS was detected at 0.0011 J mg/kg, below the OSD risk screening level for soil (0.013 mg/kg), in sample ALC-B500-1-SO-(0.5-2.0)-121421 at the Building 500 AOPI

PFOA was detected at 0.00093 J mg/kg, below the OSD risk screening level for soil (0.019 mg/kg), in sample ALC-B500-1-SO-(0.5-2.0)-121421 at the Building 500 AOPI

PFBS was not detected in any of the soil samples collected

PFHxS was not detected in any of the soil samples collected

PFNA was detected at 0.001 J mg/kg, below the OSD risk screening level for soil (0.019 mg/kg), in sample ALC-B500-1-SO-(0.5-2.0)-121421 at the Building 500 AOPI

Following the SI sampling, human exposure pathways for the one AOPI were considered to be complete or potentially complete. The soil exposure pathway for on-installation site workers is complete. Although there are no drinking water supply wells at ALC, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for on-installation site workers is potentially complete to account for potential future use of the on-post groundwater downgradient of the AOPI. The groundwater exposure pathway for off-installation drinking water receptors is also potentially complete. Finally, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) are potentially complete for off-installation recreational users who may be exposed to constituents in off-post waterbodies.

Although the CSMs indicate complete and potentially complete exposure pathways may exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, PFBS, PFHxS, and PFNA to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at ALC, PFOS, PFOA, PFBS, PFHxS, and PFNA sampling and recommendations for each AOPI; further investigation is warranted at ALC. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

Table 8-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, PFBS, PFHxS, and PFNA Sampling at Adelphi Laboratory Center, and Recommendations

AOPI Name	PFOS, PFOA, PFBS, PFHxS, and/or PFNA detected greater than OSD Risk Screening Levels? (Yes/No)		Recommendation
	GW	SO	
Building 500	Yes	No	Further study in a remedial investigation

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
SO – soil

Data collected during the PA (**Sections 3** through **5**) and SI (**Sections 6** through **8**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, PFBS, PFHxS, and PFNA at ALC are discussed below.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, PFBS, PFHxS, and PFNA use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the

installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to what is contained in the off post well search results (**Appendix E**).

The searches for ecological receptors and off-post PFOS, PFOA, PFBS, PFHxS, and PFNA sources were not exhaustive and were limited to easily identifiable and readily available information evaluated during the relevant documents research, installation personnel interviews, and site reconnaissance.

Finally, the available PFOS, PFOA, PFBS, PFHxS, and PFNA analytical data is limited to results from on-post drinking water well sources. Available data, including PFOS, PFOA, PFBS, PFHxS, and PFNA, is listed in **Appendix N**, which were analyzed per the selected analytical method.

Results from this PA/SI indicate further study in a remedial investigation is warranted at ALC in accordance with the guidance provided by the OSD.

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ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
ALC	Adelphi Laboratory Center
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
BPFTA	Blossom Point Field Test Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
DPT	direct-push technology
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
EWG	Environmental Working Group
FCR	Field Change Report
GIS	geographic information system
GW	groundwater
HDL	Harry Diamond Laboratories
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army or Reserve installation
LOD	limit of detection

LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
NAVFAC	Naval Facilities Engineering Systems Command Atlantic
ng/L	nanograms per liter (parts per trillion)
NSWC	Naval Surface Warfare Center
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States
UCMR3	third Unregulated Contaminant Monitoring Rule
USACE	United States Army Corps of Engineers

USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency

TABLES

Table 2-1
Historical Select PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

			PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
		Screening Criteria[1]	4		6		601	
Location	White Oak Naval Surface Warfare Center Site Name	Sample Date	Result	Qual	Result	Qual	Result	Qual
04GW80	IRP Site 5	6/28/2017	**94.3**		**18.9**		12.4	
04GW81S	IRP Site 5	6/28/2017	1.61	J	1.43	J	5.17	U
04GW82	IRP Site 5	6/29/2017	5.34	U	2.17	J	2.49	J
05GW01	IRP Site 5	6/29/2017	**205**		**48.8**		5.43	U
FD01 (Parent: 05GW01)	IRP Site 5	6/29/2017	**199**		**51.3**		2.30	J
06GW01	IRP Site 6	7/12/2017	**5.47**	J	**11.3**	J	4.56	J
06GW02	IRP Site 6	7/12/2017	**16.5**		**20.1**		21.8	
06FD01 (Parent: 06GW02)	IRP Site 6	7/12/2017	**13.5**		**20.6**		21.7	
07GW102	IRP Site 7	6/29/2017	**433**		**73.9**		9.06	
07GW202	IRP Site 7	6/28/2017	**7.68**	J	**7.22**	J	5.60	J
07GW41	IRP Site 7	6/29/2017	**262**		**30.3**		4.16	J
46GW205	IRP Site 7	6/28/2017	**6.07**	J	**7.05**	J	6.05	J
FD01 (Parent: 46GW205)	IRP Site 7	6/28/2017	**22.6**	J	**15.2**		2.48	J
11MW204S	IRP Site 33	6/29/2017	**29.6**		**76.0**		9.66	
11MW204D	IRP Site 33	6/29/2017	**38.3**		**95.8**		9.95	
33GW01	IRP Site 33	7/12/2017	**28.1**		**90.6**		10.7	
11MW205S	Former Building 110	6/29/2017	**36.8**		**14.7**		6.18	J
11MW205D	Former Building 110	6/29/2017	**20.3**		**49.6**		11.3	
11GW101	Former Building 110	7/12/2017	**1230**		**135.0**		39.2	

Table 2-1
Historical Select PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

Notes:
Bolded values indicate the result exceeded the screening criteria.
PFHxS and PFNA were not analyzed during this investigation.
1. Screening criteria for groundwater sampling results follows the 2022 Office of the Secretary of Defense (OSD) risk screening levels, (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06).

Acronyms/Abbreviations:
FD = field duplicate sample
IRP = Installation Restoration Program
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
U	Not detected at or above the detection limit

Table 6-1
Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

Associated AOPI	Well Identification	Screened Interval (ft bgs)	Total Depth (ft bgs)
Building 500	A-01	6.4 - 16.4	16.4
	A-02	16.4 - 31.4	31.4
	A-03	16 - 31	31
	A-04	10.8 - 30.8	30.8
	C-10	5 - 25	25
	C-11	64.5 - 74.5	74.5
	C-13	5.3 - 25.3	33.3

Acronyms and Abbreviations:
AOPI = area of potential interest
bgs = below ground surface
ft = feet

Table 7-1
Groundwater PFOS, PFOA, PFBS, PFHxS, and PFNA Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

					Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)		PFHxS (ng/L)		PFNA (ng/L)	
					OSD Tapwater Risk Screening Level	4		6		601		39		6	
Associated AOPI	Location Type	Location	Sample ID / Parent Sample ID	Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Building 500	Monitoring Well	ALC-B500-1	ALC-B500-1-GW-121421	12/14/2021	N	**32**	J	**26**	J	**2.6**	J	**35**	J	**9.1**	J
			ALC-B500-FD-GW-121421 / ALC-B500-1-GW-121421	12/14/2021	FD	**31**	J	**29**	J	**2.6**	J	**32**	J	**10**	J
			ALC-A4-1-GW-041122	04/12/2022	N	**3.8**		**1.4**	J	**1.3**	J	**3.2**		0.91	U

Table 7-1
Groundwater PFOS, PFOA, PFBS, PFHxS, and PFNA Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Gray shaded values indicate the result was detected greater than the Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06).

Acronyms/Abbreviations:
-- = not applicable
AOPI = area of potential interest
FD = field duplicate sample
GW = groundwater
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

Table 7-2
Soil PFOS, PFOA, PFBS, PFHxS, and PFNA Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

			Analyte			PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)		PFHxS (mg/kg)		PFNA (mg/kg)	
			OSD Industrial/Commercial Risk Screening Level			0.16		0.25		25		1.6		0.25	
			OSD Residential Risk Screening Levels			0.013		0.019		1.9		0.13		0.019	
Associated AOPI	Location Type	Location	Sample ID / Parent Sample ID	Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Building 500	Soil	ALC-B500-1	ALC-B500-1-SO-(0.5-2.0)-121421	12/14/2021	N	**0.0011**	J	**0.00047**	J	0.0023	UJ	0.00068	UJ	**0.00082**	J
			ALC-B500-FD-SO-(0.5-2.0)-121421 / ALC-B500-1-SO-(0.5-2.0)-121421	12/14/2021	FD	**0.0011**	J	**0.00093**	J	0.0027	UJ	0.0008	UJ	**0.001**	J
Building 500	Soil	ALC-B500-2	ALC-B500-2-SO-(0.5-2.0)-121421	12/14/2021	N	0.00081	UJ	0.00081	UJ	0.0027	UJ	0.00081	UJ	0.00081	UJ
Building 500	Soil	ALC-B500-3	ALC-B500-3-SO-(0.5-2.0)-121421	12/14/2021	N	0.00063	UJ	0.00063	UJ	0.0021	UJ	0.00063	UJ	0.00063	UJ
Building 500	Soil	ALC-B500-4	ALC-B500-4-SO-(0.5-2.0)-121421	12/14/2021	N	0.00063	UJ	0.00063	UJ	0.0021	UJ	0.00063	UJ	0.00063	UJ

Table 7-2
Soil PFOS, PFOA, PFBS, PFHxS, and PFNA Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Adelphi Laboratory Center, Maryland

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for the residential and commerical/industrial scenario (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 06.). No concentrations of PFOS, PFOA, PFBS, PFHxS, or PFNA exceeded the OSD risk screening levels.

Acronyms/Abbreviations:
AOPI = area of potential interest
DPT = Direct-Push Technology
FD = field duplicate sample
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier

Qualifier	Description
J	The analyte was positively identified; however the associated numerical value is an estimated concentration only
U	The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).
UJ	The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise.

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

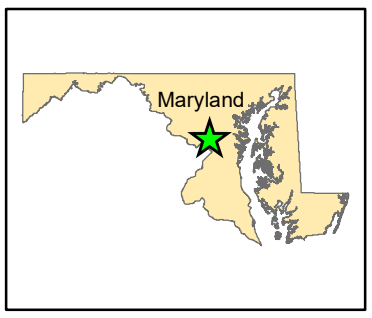
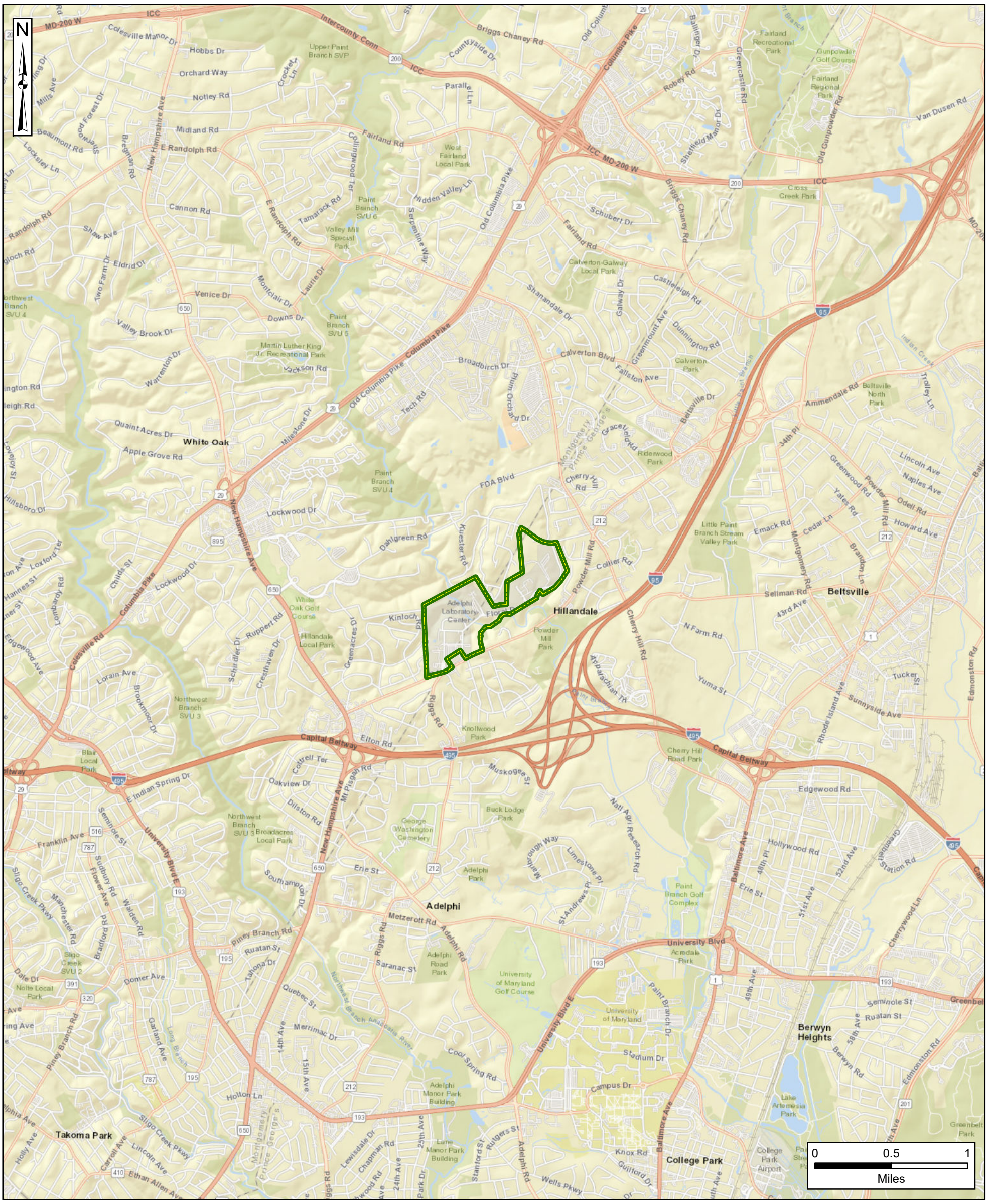


Figure 2-1
Site Location



Installation Boundary

Data Sources:
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

Figure 2-2
Site Layout

Installation Boundary

River/Stream (Perennial)

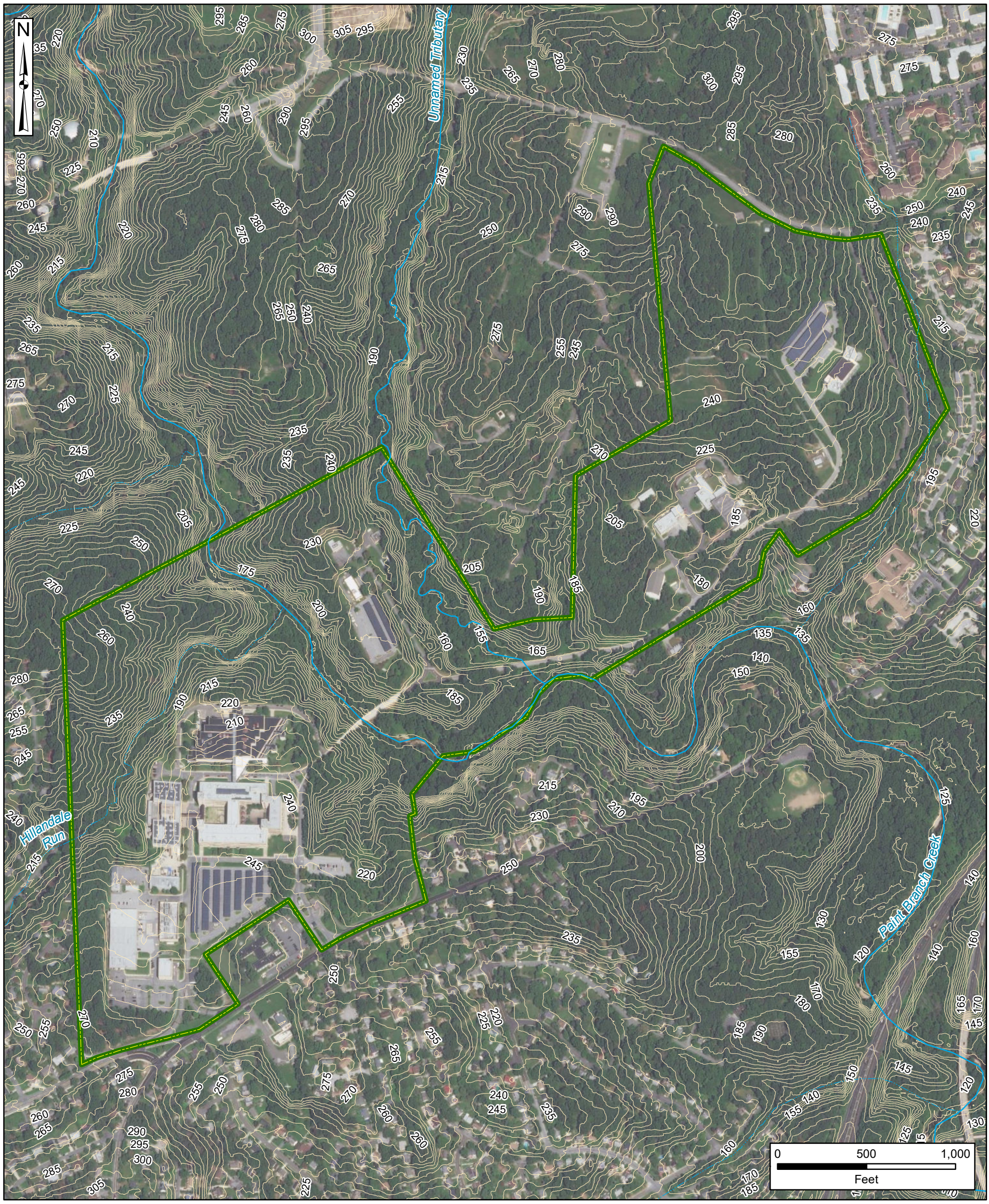
Stream (Intermittent)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

Figure 2-3
Topographic Map



Installation Boundary

River/Stream (Perennial)

Stream (Intermittent)

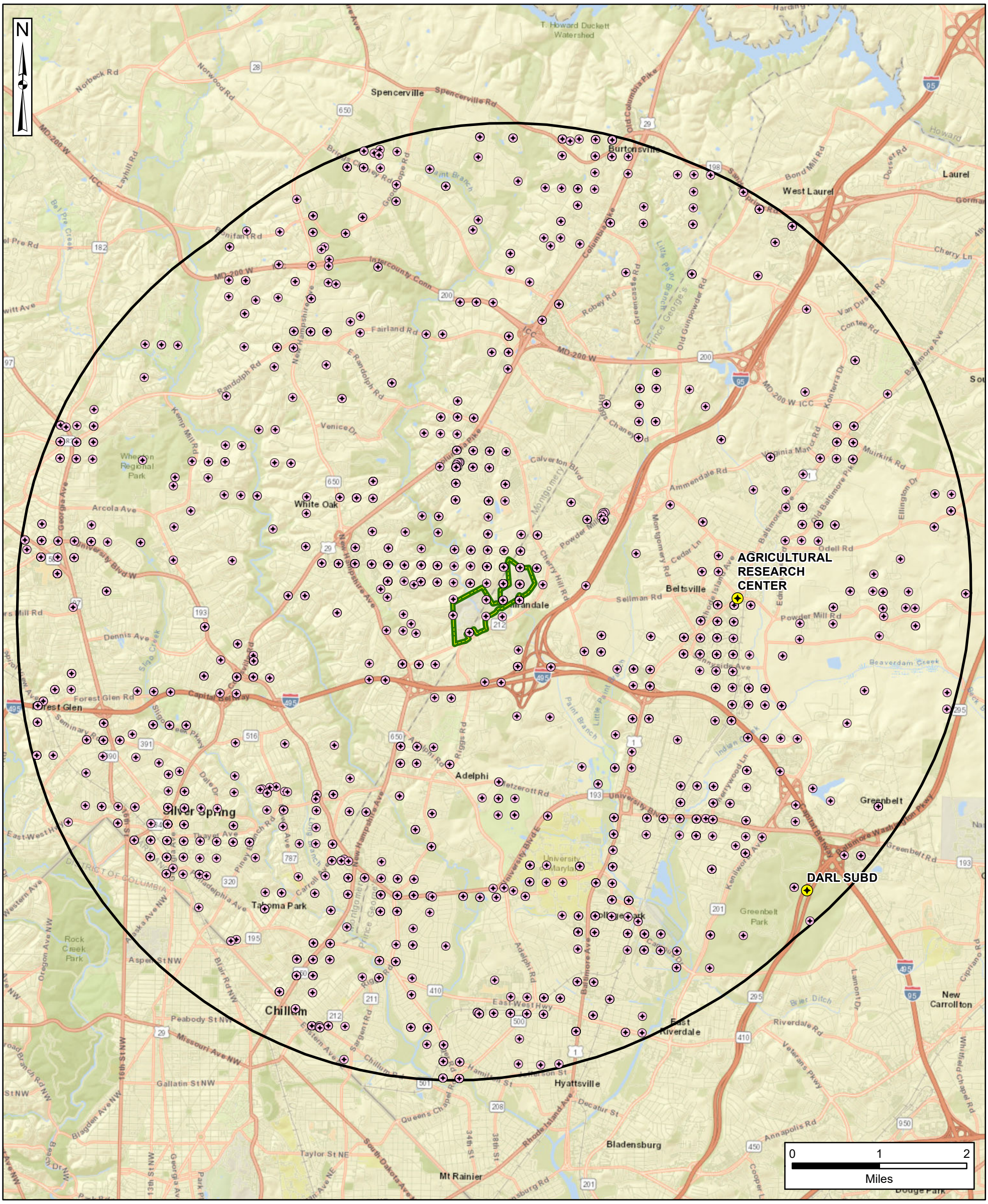
Elevation Contour (5 feet)

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

Figure 2-4
Off-Post Potable Supply Wells



Installation Boundary

Public Water Supply System Well

Water Well (Unspecified Use)

Data Sources:
EDR, Well Data, 2020
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

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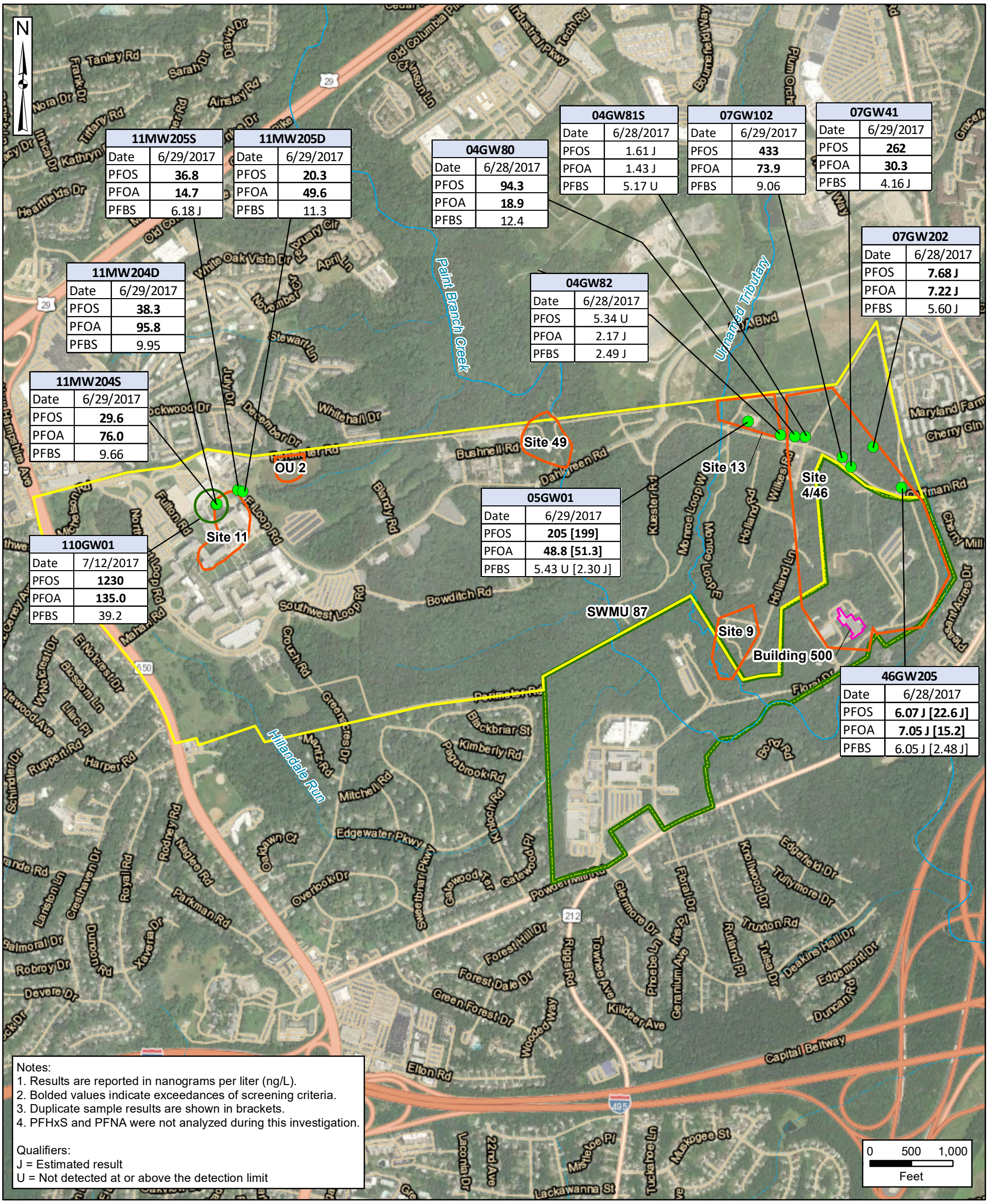
Figure 2-5
Historical PFAS Sampling Results for the White Oak Naval Surface Warfare Center



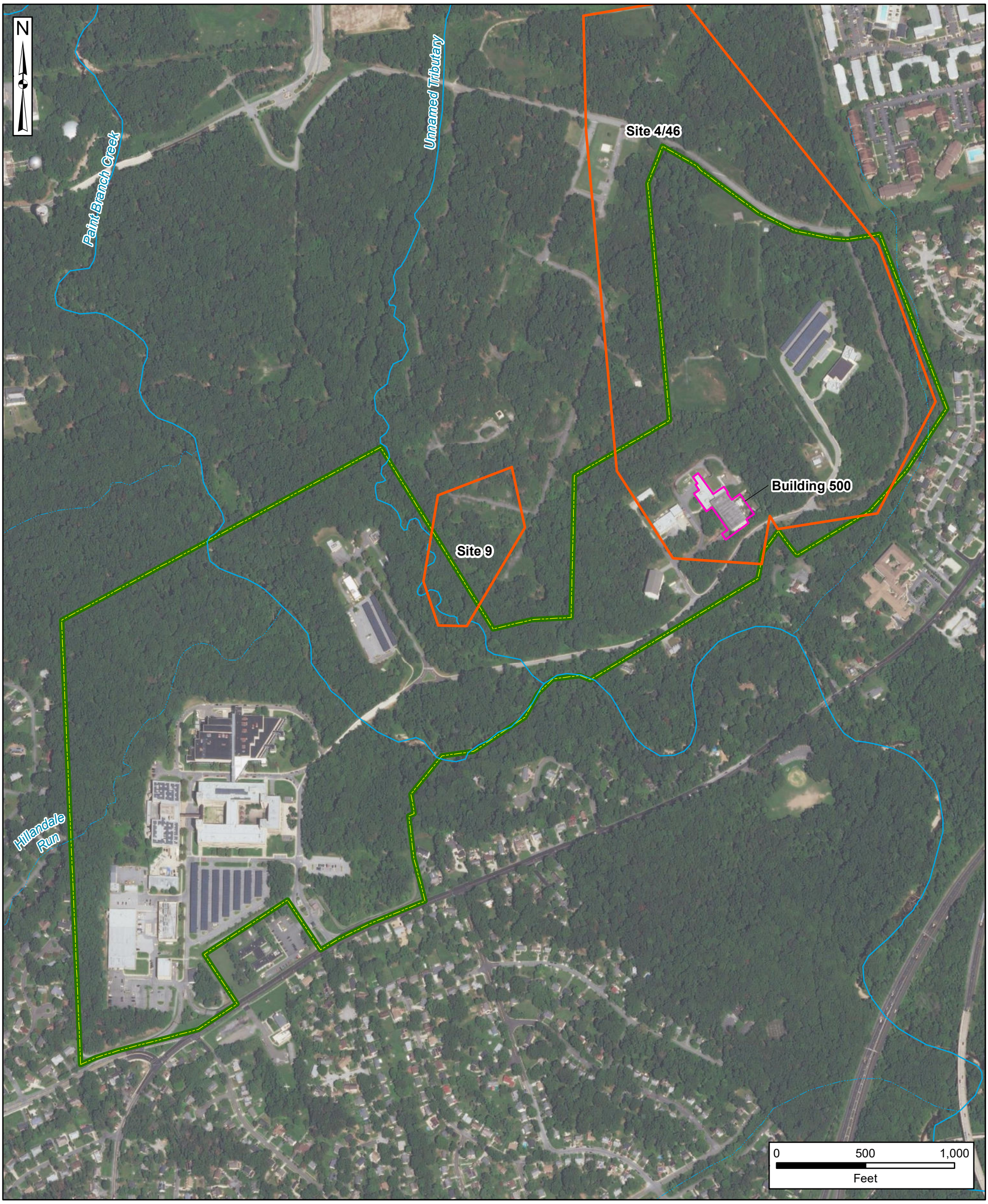
AOPI = area of potential interest
IRP = Installation Restoration Program
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
PFHxS = perfluorohexane sulfonic acid
PFNA = perfluorononanoic acid

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

Figure 5-2
AOPI Locations



Installation Boundary
AOPI
IRP Site
River/Stream (Perennial)
Stream (Intermittent)

AOPI = area of potential interest
IRP = Installation Restoration Program

Data Sources:
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

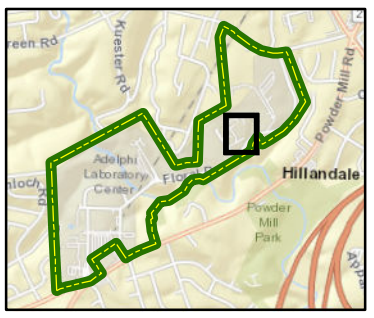
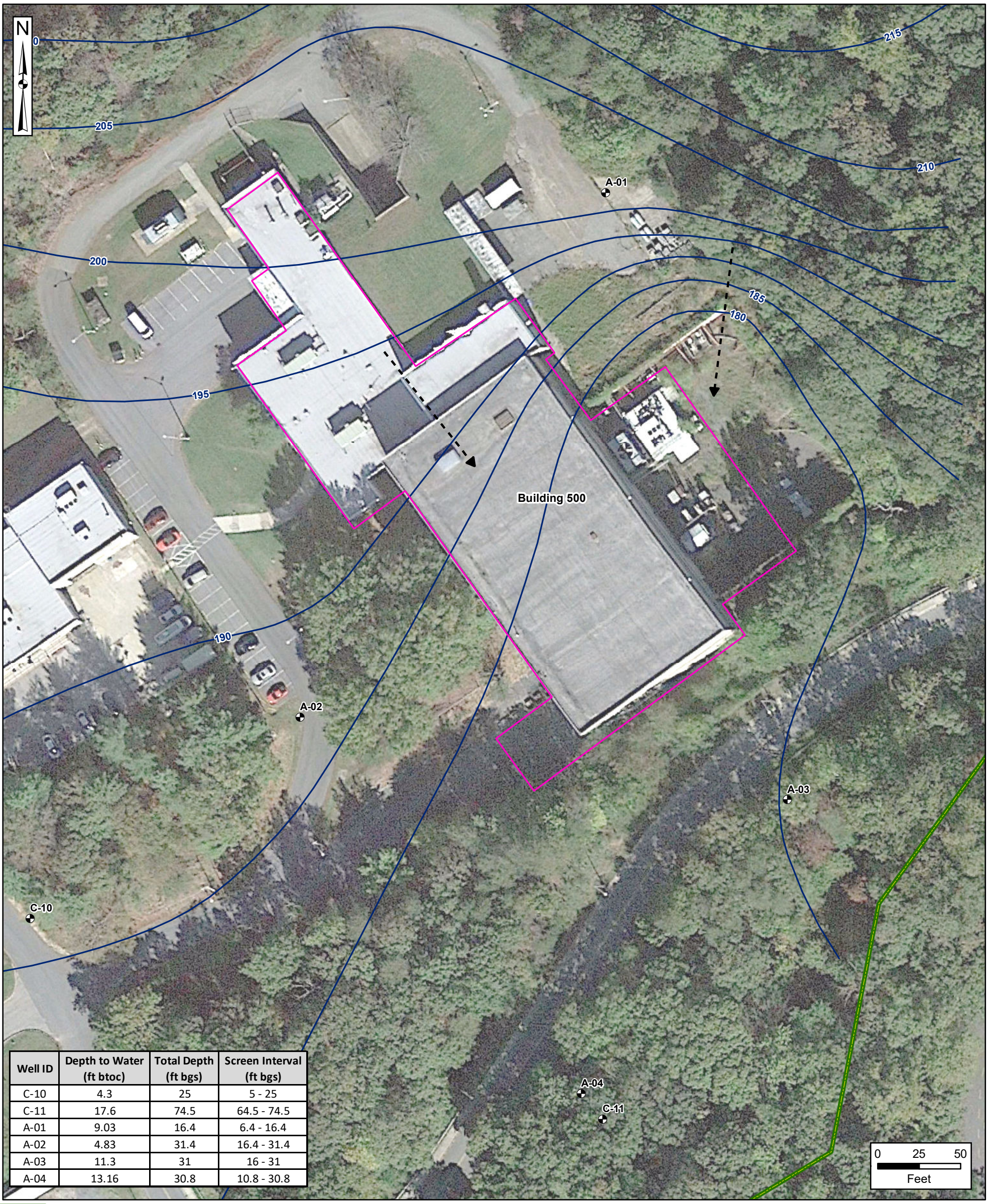


Figure 5-3
Aerial Photo of Building 500



Well ID	Depth to Water (ft btoc)	Total Depth (ft bgs)	Screen Interval (ft bgs)
C-10	4.3	25	5 - 25
C-11	17.6	74.5	64.5 - 74.5
A-01	9.03	16.4	6.4 - 16.4
A-02	4.83	31.4	16.4 - 31.4
A-03	11.3	31	16 - 31
A-04	13.16	30.8	10.8 - 30.8

Installation Boundary
AOPI
Monitoring Well
Groundwater Contour (1998) (feet)
Inferred Groundwater Flow Direction Based on Groundwater Contours

AOPI = area of potential interest
bgs = below ground surface
btoc = below top of casing
ft = feet

Note: Monitoring well locations approximated based on review of historical documents and aerial photography

Data Sources:
Tetra Tech NUS, Inc., *Site Investigation Report for Site 46, Naval Surface Warfare Center, White Oak, Maryland*, Groundwater Contours and Wells, 1998;
Google Earth, Aerial Imagery, 2021

Coordinate System:
WGS 1984, UTM Zone 18N

USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, MD

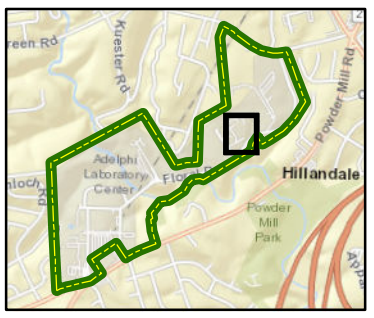


Figure 7-1
Building 500
PFOS, PFOA, PFBS, PFHxS, and PFNA Analytical Results

Chemical	Residential Scenario Risk Screening Level		Industrial/Commercial Scenario Risk Screening Level
	Tap Water (ng/L)	Soil (mg/kg)	Soil (mg/kg)
PFOS	4	0.013	0.16
PFOA	6	0.019	0.25
PFBS	601	1.9	25
PFHxS	39	0.13	1.6
PFNA	6	0.019	0.25

ALC-B500-1-SO	
Date	12/14/2021
Depth	0.5-2.0 ft
PFOS	**0.0011 J [0.0011 J]**
PFOA	**0.00047 J [0.00093 J]**
PFBS	0.0023 UJ [0.0027 UJ]
PFHxS	0.00068 UJ [0.0008 UJ]
PFNA	**0.00083 J [0.001 J]**

ALC-B500-1-GW	
Date	12/14/2021
PFOS	**32 J [31 J]**
PFOA	**26 J [29 J]**
PFBS	**2.6 J [2.6 J]**
PFHxS	**35 J [32 J]**
PFNA	**9.1 J [10 J]**

ALC-B500-3-SO	
Date	12/14/2021
Depth	0.5-2.0 ft
PFOS	0.00063 UJ
PFOA	0.00063 UJ
PFBS	0.0021 UJ
PFHxS	0.00063 UJ
PFNA	0.00063 UJ

ALC-B500-4-SO	
Date	12/14/2021
Depth	0.5-2.0 ft
PFOS	0.00063 UJ
PFOA	0.00063 UJ
PFBS	0.0021 UJ
PFHxS	0.00063 UJ
PFNA	0.00063 UJ

ALC-B500-2-SO	
Date	12/14/2021
Depth	0.5-2.0 ft
PFOS	0.00081 UJ
PFOA	0.00081 UJ
PFBS	0.0027 UJ
PFHxS	0.00081 UJ
PFNA	0.00081 UJ

ALC-A4-1-GW	
Date	4/12/2022
PFOS	**3.8**
PFOA	**1.4 J**
PFBS	**1.3 J**
PFHxS	**3.2**
PFNA	0.91 U

Notes:
1. Groundwater results are reported in nanograms/liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Building 500
A-02
A-03
A-04
C-10
C-11
205
190
185
180
0 25 50
Feet

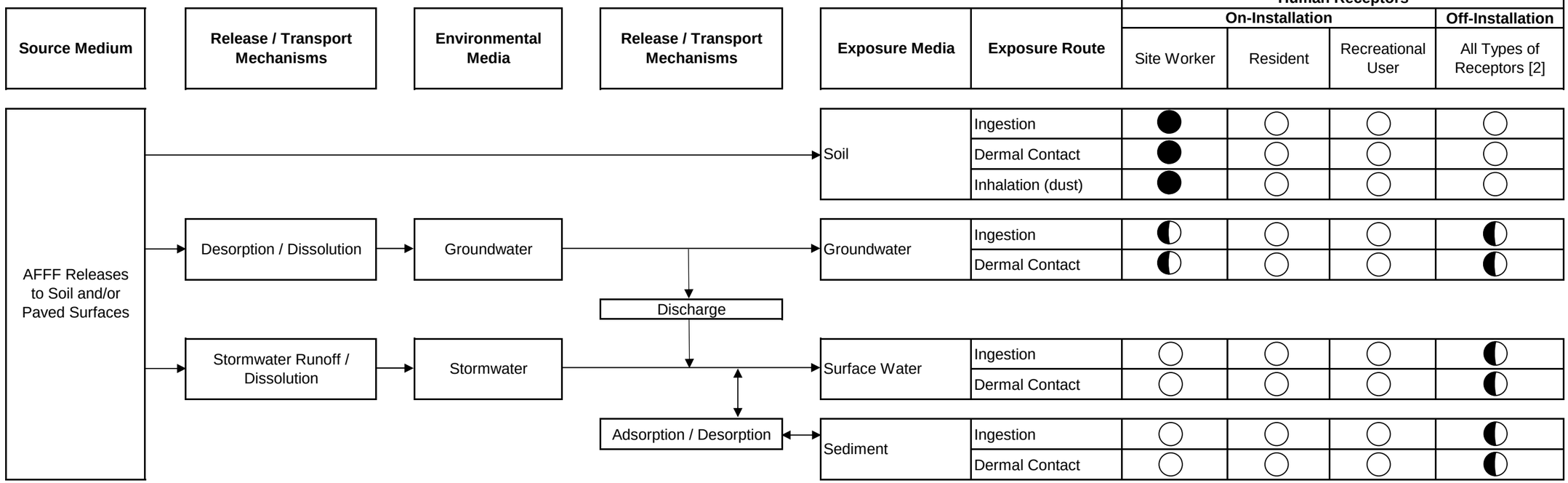
Installation Boundary
AOPI
Monitoring Well
Groundwater Contour (1998) (feet)
Inferred Groundwater Flow Direction Based on Groundwater Contours
Shallow Soil Sampling Location
Soil/Groundwater Boring
Groundwater Samping Location (Well)

AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Note: Monitoring well locations approximated based on review of historical documents and aerial photography

Data Sources:
Tetra Tech NUS, Inc., *Site Investigation Report for Site 46, Naval Surface Warfare Center, White Oak, Maryland*, Groundwater Contours and Wells, 1998;
Google Earth, Aerial Imagery, 2021

Coordinate System:
WGS 1984, UTM Zone 18N



Legend:

- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

Notes:
[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.
AFFF = aqueous film-forming foam
AOPI = area of potential interest

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Conceptual Site Model - Building 500 AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Adelphi Laboratory Center, Maryland

Figure 7-2