PRELIMINARY ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES

Picatinny Arsenal, NJ

Prepared For:

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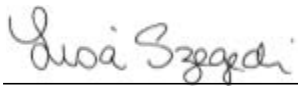
Preliminary Assessment of Per- and Polyfluoroalkyl Substances at Picatinny Arsenal

USAEC PFAS PA

Picatinny Arsenal, New Jersey



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ACRONYMS

Acronym	Definition
°F	Degrees Fahrenheit
%	Percent
AFFF	Aqueous Film Forming Foam
AOPI	Area of Potential Interest
Arcadis	Arcadis U.S., Inc.
ARDEC	Armaments Research, Development and Engineering Center
Army	United States Army
ARNG	Army National Guard
bgs	Below ground surface
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	Conceptual Site Model
DoD	Department of Defense
EDR	Environmental Data Resources, Inc.
GIS	Geographic Information System
GPB	Green Pond Brook
HAL	Health Advisory Level
IMCOM	Installation Management Command
installations	Army installations
IRP	Installation Restoration Program
LOD	Limit of Detection
LOQ	Limit of Quantitation
LTM	Long Term Monitoring
LUC	Land Use Control
MCL	Maximum Contaminant Level
NA	Not Available
ng/L	Nanograms Per Liter
NJ	New Jersey
NJARNG	New Jersey Army National Guard

PA	Preliminary Assessment
PFAS	Per/polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid
PICA	Picatinny Arsenal
POC	Point of Contact
PRB	Permeable Reactive Barrier
ROD	Record of Decision
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The United States Army Corps of Engineers, Baltimore District has contracted Arcadis U.S., Inc. to conduct Preliminary Assessments (PAs) for the U.S. Army Environmental Command on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) at Army installations nationwide. The delivery order number is W912DR17F0396 under W912DR-13-D-0019, Hazardous, Toxic, and Radioactive Waste architectural and engineering services contract. This report provides the PA for Picatinny Arsenal and was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

Programmatically, the Army has focused their PA efforts on two common sources of PFAS at Army installations: the use of aqueous film forming foams (AFFF) and chromium plating. However, other sources of PFAS are also documented in this PA. A combination of documents review, internet keyword searches, and an installation site visit comprising interviews with installation personnel and site reconnaissance visits were used to identify specific areas of suspected PFAS releases.

Ten areas of potential interest (AOPIs) have been identified for this PA at Picatinny Arsenal. Potential PFAS source types and the corresponding AOPIs are summarized below.

Fire Stations	**Building 169 – Firehouse 1**
	Building 3316 – Firehouse 2
Fire Response Areas	**Former Pyrotechnic Area and Sanitary Landfill**
	Former Lower Burning Grounds
	Area 1222 - Gorge
	Building 3801 – New Jersey Army National Guard Helipad Area
Fire Nozzle Testing Areas	**Lawn to the North of Building 3409/3410**
Chromium Plating Operations	**Former Building 24**
Chromium Plating Wastes	**Post Farm Landfill**
Waste Water Treatment Systems	**Former Waste Water Treatment Plant Facility**

The following potential PFAS sources were evaluated at PICA but did not result in an AOPI designation; fire training areas and structures, historical fires/burning, historical metal plating operations, installation storage warehouses, stormwater and sanitary sewer components, water distribution lines, and auto maintenance shops. Other potential PFAS sources such as crash sites, landing areas, fuel spills, hangars and/or buildings with AFFF suppression systems, PFAS-containing pesticide use, photo processing

facilities, car washes, soil application areas and laundry/water proofing facilities were evaluated as part of this PA Program, but are not applicable to or present at PICA.

A site-specific conceptual site model focused on drinking water pathways was then developed for each AOPI based on an evaluation of historical site activities, review of existing records, personnel interviews, and site reconnaissance.

Results from this PA may be used to determine if a Site Inspection for PFAS is warranted at Picatinny Arsenal.

1 INTRODUCTION

1.1 Project Background

The United States (U.S.) Army Corps of Engineers (USACE), Baltimore District has contracted Arcadis U.S., Inc. (Arcadis) to conduct Preliminary Assessments (PAs) for the U.S. Army Environmental Command (USAEC) on the current and historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) at Army installations nationwide. The delivery order number is W912DR17F0396 under the W912DR-13-D-0019, Hazardous, Toxic and Radioactive Waste architectural and engineering services contract. This report provides the PA for Picatinny Arsenal (PICA).

PFAS 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 and environmental impacts, there has been a reduction in the manufacture and use of PFAS. The U.S. reduction of PFOS, PFOA and other PFAS did not occur until the early 2000s (ITRC 2017).

At U.S. Army (Army) installations, the main emphasis of this program is to identify the use and release of Class B firefighting foams, specifically aqueous film forming foam (AFFF), and chromium plating operations, both of which are sources of PFAS. PFOS and PFOA are two individual compounds found in association with these sources and fall under the PFAS class of chemicals.

AFFF was developed in the mid-1960's in response to a need for foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5% hydrocarbon surfactants, and 1% to 3% PFAS. Before use, AFFF is designed to be diluted to a 1%, 3%, or 6% mixture. AFFF releases at Department of Defense (DoD) facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases. Therefore, primary source areas of AFFF include firefighter training areas, current and historic fire stations, nozzle testing areas, crash sites, fuel spill fire responses, as well as hangars and buildings with AFFF suppression systems. The military still primarily uses AFFF for Class B fires, however significant operational changes have been made to restrict uncontrolled releases and non-essential use of PFAS-based 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.

Potential PFAS use associated with chromium plating activities may also be relevant to Army installations. During hard chromium plating, a metal surface is treated with a layer of electrochemically-deposited chromium in a chromic acid bath. PFAS, and especially PFOS, have been used in hard chromium plating as surface tension reducing wetting agents to mitigate the release of aerosolized hexavalent chromium into a working environment. In plating operations, it was historically common for spent plating baths to be disposed of in a lined or unlined pit, or into a sanitary or storm sewer. Therefore, PFAS present in mist suppressants during the plating process could be released to the environment.

In addition to AFFF and chromium plating-related releases, other potential releases of PFAS at Army installations may be associated with the use of some types of insecticides, laundering or water proofing facilities, car washes, engine lubricants, and photo processing. Secondary source areas of PFAS include residuals present in stormwater and sewer systems, wastewater treatment plants, landfills, and remediated soil application areas.

Many of the PFAS found in AFFF and chromium plating operations are surfactants and are found in a charged or ionic state at environmental pH, including PFOS/PFOA, which are both negatively charged. As a result, the major PFAS releases of concern at Army installations are likely to contain PFAS that do not volatilize. The primary media of concern for PFOS/PFOA releases at Army installations are thus soil, groundwater, surface water, and sediment. Once released to the environment, the main factor that slows movement of PFOS/PFOA is the presence of organic matter and organic co-contaminants in soils and sediments. Generally, PFOS/PFOA are mobile in the media of interest and they are not known to break down by any natural processes.

The regulatory environment related to PFAS is evolving as research continues. Currently, there is no set maximum contaminant level (MCL) defined for any PFAS. In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime Health Advisory Level (HAL) of 70 nanograms per liter (ng/L) for PFOS and PFOA, and the sum of PFOS and PFOA (USEPA 2016a; USEPA 2016b). The USEPA HAL for PFOS and PFOA are non-enforceable and non-regulatory according to the USEPA Office of Ground Water and Drinking Water Memorandum, titled Clarification about the Appropriate Application of the PFOA and PFOS Drinking Water Health Advisories, dated November 15, 2016. In addition, some states have proposed or established their own specific standards for PFAS, which include PFOS and PFOA.

1.2 PA Objectives

A PA is a limited-scope investigation performed on every Comprehensive Environmental Response, Compensation, and Liability Information System site. PA investigators collect readily available information and conduct a site and environs reconnaissance. The PA is designed to distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation. The PA also identifies sites requiring assessment for possible emergency response actions (USEPA 1991). The objective of this PA is to identify areas of potential interest (AOPIs) in accordance with the Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018), where a release of PFAS to the environment could have occurred. The PA will evaluate and document areas where an AFFF release or chromium plating operations occurred, as well as other potential releases of PFAS. This PA was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

1.3 PA Process Description

For each installation, PA development follows a similar process involving pre-site visit, site visit, and post-site visit activities. The following sub-sections summarize the activities in each phase of the process.

1.3.1 Pre-Site Visit

An installation kick-off teleconference is held between the Arcadis Project Manager, the Arcadis Regional Team Leader, the USAEC Environmental Support Manager and Regional Team Chief, the USAEC Program Management Team, USACE Regional Point of Contact (POC), and installation POCs four to six weeks prior to the site visit to discuss goals and scope, scheduling, installation access, timeline for the site visit, and access to installation-specific databases and available records.

A records search is conducted pre-site visit to review electronically available documents from the installation and external sources. The purpose of the records search is to identify physical setting and site histories that may be relevant to the use of PFAS, and develop preliminary conceptual site models (CSMs) for drinking water pathways at the installation.

An installation read-ahead package is prepared by Arcadis and submitted to the installation POCs two weeks in advance of the site visit. The read-ahead package contains the Installation Management Command (IMCOM) operation order, antiterrorism/operations security review cover sheet, the PFAS PA Kickoff Call Minutes, an information paper on USAEC's PFAS PA Project, contact information for key POCs, a list of data sources reviewed and requested for review, a list of preliminary locations for site reconnaissance, and a list of roles of potential interviewees.

1.3.2 Site Visit

After notifying the installation POCs, providing the information necessary for Arcadis staff access, and reviewing the Antiterrorism/Operations Security Review Cover Sheet dated 27 July 2018 (**Appendix A**), site visits are conducted. The site visit begins with an installation in-brief to provide installation staff with site visit objectives and introductions. Personnel interviews, an on-post records search, and site reconnaissance at potential AOPIs are conducted by Arcadis during the site visit. Site reconnaissance at the potential AOPIs includes limited visual surveys that assess points of potential PFAS release, potential secondary impacts, and migration potential. Physical attributes of the potential AOPIs are documented, including ground and floor conditions, the presence of groundwater monitoring wells, surface water bodies, potential receptors (with a primary focus on human ingestion of drinking water), and the distance to the installation boundary. Photo documentation of potential AOPIs may be conducted, and access limitations or advantages related to potential future sampling activities are noted. An exit briefing is offered to the installation at the conclusion of the site visit to raise any issues identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. An exit-briefing was not conducted during the Picatinny site visit per the installation POC preference.

1.3.3 Post-Site Visit

After the site visit, information collected pre-, during, and post-site visit is reviewed and corroborated by cross-referencing records, interview details, and site visit observations. A site visit trip report is completed following the site visit and provided to the installation, applicable USAEC POCs, and USACE Regional POCs. All information is compiled to develop the installation-specific PA. Site data obtained during the PA are used to develop drinking water pathway CSMs for each AOPI. All map document files and associated geographic information system (GIS) data are provided in **Appendix B**. GIS data layers created for the project have been included in a Spatial Data Standards for Facilities, Infrastructure, and Environment-compliant geodatabase. The PA process is documented in the Preliminary Assessment Quality Control Checklist included as **Appendix C**.

2 INSTALLATION OVERVIEW

The following sub-sections provide general information about PICA including its location, a brief history, its missions over time, current and projected land use, layout, climate, topography, geology, hydrogeology, hydrology, potable wells, and ecological receptors.

2.1 Site Location

PICA, which covers approximately 5,801 acres, contains both improved and unimproved lands and is located in Rockaway Township, Morris County, New Jersey (NJ) approximately 45 miles west of New York City and four miles northeast of Dover, NJ (**Figure 2-1**). The installation is bordered by numerous major highways including State Route 15, Interstate 80, and U.S. Route 46 (**Figure 2-2**) (Army 2016).

2.2 Mission and Brief History

PICA was established in the late 1800s as a storage and powder depot. Production activities began several years before the Spanish-American War, which started in 1898. At the beginning of World War I, PICA was manufacturing smokeless powder and munitions of various sizes. By the end of the war, PICA had begun new operations including the melt-loading of projectiles, manufacture of pyrotechnic signals and flares, experimental manufacture of modern propellants, high explosives, fuzes, and metal components, and the loading of trinitrotoluene and amatol into bombs and projectiles. During World War II, PICA produced thousands of pounds of smokeless powder, boosters, primers, and detonators. PICA also produced thousands of pounds of explosives for the Korean and Vietnam Conflicts (Malcolm Pirnie 2006).

2.3 Current and Projected Land Use

In recent years, PICA's mission has shifted to become an integrated weapons and armaments specialty site for guns and ammunition. To help support this mission, PICA is the site of the Armaments Research, Development and Engineering Center, whose mission is conducting and managing research and development for all assigned weapons systems. PICA houses government-operated munitions R&D facilities, operational ranges for munitions testing, residential housing, and recreational facilities that include a golf course. PICA will continue to be used for military R&D, industrial, residential housing, and recreational activities (fishing, boating, hunting, and golfing) in the future (Weston 2014).

2.4 Climate

PICA has a cool, humid continental climate. The average annual high temperature is 58.0 degrees Fahrenheit (°F) with an average annual low temperature of 37.8 °F. Daytime high temperatures average from 30 °F in January to 80 °F in July. Average humidity during the year is 79 percent (%) with highs observed up to 100% and lows of 49%. Average annual precipitation is 52.39 inches with monthly averages between 0 and 6.6 inches (Weston 2014).

2.5 Topography

The New Jersey Highlands physiographic province, where PICA is located, is between the Appalachian Piedmont physiographic province to the southeast and the Valley and Ridge province to the northwest. The New Jersey Highlands Region is part of the larger New York-New Jersey Highlands, which encompasses 1.1 million acres of Appalachian ridges and valleys stretching from the Hudson River to the Delaware River (Malcolm Pirnie 2006).

PICA encompasses a wide central valley (Picatinny Valley) that is approximately seven miles long, and a narrower parallel intermontane valley (Green Pond Gorge) about two miles long. The total breadth across PICA averages one mile. PICA is situated between Green Pond Mountain on the northwest, Copperas Mountain on the east, and an unnamed hill on the southeast. Overall, the dominant topographic gradient is from the northeast to the southwest with severe slopes present along the northwestern boundary of PICA along Green Pond Mountain (**Figure 2-3**) (Malcolm Pirnie 2006).

The majority of PICA appears on the Dover U.S. Geologic Survey topographic quadrangle. Elevations on PICA range from 685 feet above mean sea level in the valley to 1,287 feet above mean sea level along the ridgeline of Green Pond Mountain. In general, elevations are lower to the south and east and higher to the north and west (Malcolm Pirnie 2006).

2.6 Geology

PICA is located in the New Jersey Highlands physiographic province. The New Jersey Highlands are composed of Proterozoic to Devonian rocks as part of the Appalachian Mountains formed when the continents collided. Four bedrock formations underlie PICA: Precambrian gneiss and other metamorphic rocks, Cambrian Hardyston quartzite, Cambrian Leithsville dolomite, and Silurian Green Pond conglomerate. Unconsolidated Pleistocene-aged glacial till and stratified drift overlie much of the formations. Rocks with highly oxidized iron content are prevalent. Iron ore was extensively mined in the region (Lucey 1972).

The soils at PICA are acidic and primarily derived from glacial deposits. The central portion of PICA has soils that consist of loamy, silty, and gravel clay pan soils along with swampy areas that consist of peat and muck. The southern end of PICA consists of poorly sorted sands, gravels, and boulders bordered by a terminal moraine. To the northwest is a mountain range (Green Pond Mountain) with rough, stony land that formed on jagged, rocky slopes. Glacial till blankets the western and eastern flanks of PICA. Up to 20 feet of glacial till consisting of sand, gravel, and boulders covers the western portion of PICA. The eastern portion of PICA consists of more uniform glacial till with thicknesses ranging from 10 to 25 feet. The valley floor consists of till and drift from glacial lakes and streams with a thickness of up to 200 feet (Dames & Moore 1991).

2.7 Hydrogeology

The below hydrogeology information applies only to the Valley hydrogeology and sites within this area. All AOPIs identified during this PA are located within the Valley portion of PICA. However, it should be noted that there are a number of specific hydrogeological regimes present at PICA that are not included in this description.

Groundwater at PICA is present in four distinct aquifers. The uppermost aquifer is an unconfined aquifer consisting of stratified drift on top of fine sand and silt lake sediments and has a thickness of 20 to 35 feet. Groundwater within this unit occurs from relatively near ground surface to about 30 feet below ground surface (bgs). Groundwater in the unconfined aquifer generally flows toward surface water discharge areas, such as Green Pond Brook (GPB), Bear Swamp Brook, and Lake Picatinny (**Figure 2-2**) (Weston 2014).

Two semi-confined glacial till aquifers (upper and lower) consisting primarily of sand and gravel separated by silt, fine sands, and clay from the upper most unconfined aquifer (Dames & Moore, 1991). The upper semi-confined aquifer is generally encountered in the southern half of the valley. The lower semi-confined aquifer occurs beneath the upper aquifer only in the central valley portion of this area. Groundwater flow direction in the semi-confined aquifers is generally down valley to the southwest and towards surface water discharge areas. Vertical flow is typically upward towards discharge areas except where affected by groundwater withdrawal wells. These three valley-fill aquifers (unconfined, upper semi-confined, and lower semi-confined) have a maximum thickness of approximately 175 feet. The semi-confined glacial till aquifers are the primary water source for PICA. The fourth and deepest aquifer is a bedrock aquifer separated from the confined glacial till aquifer by weathered bedrock with a maximum thickness of 60 feet (Dames & Moore, 1991). Groundwater flow in the bedrock is generally towards the central valley and surface water features; however, locally the foliation and fracturing can alter and control flow directions along fractures and fault planes.

2.8 Surface Water Hydrology

PICA lies within the recharge area of the New Jersey Watershed Management Area 6, the primary water supply for northern New Jersey. Surface water drains primarily from northeast to southwest with GPB serving as the primary drainage for PICA (**Figure 2-2**). GPB originates at a 500-acre spring-fed lake known as Green Pond, located adjacent to the northern border of PICA. All drainages from GPB leaving PICA empty into the Rockaway River, approximately one mile south and east of PICA. Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply. (Malcolm Pirnie 2006).

Main waterbodies within the installation include Green Pond Brook, several unnamed small ponds, Bear Swamp Brook, Picatinny Lake and Lake Denmark. Approximately one mile south of PICA, Green Pond Brook joins the Rockaway River. The Rockaway River flows east through the Boonton Reservoir before joining the Passaic River. Bear Swamp Brook joins Green Pond Brook on the southern end of PICA. Ames Brook as well as the Hibernia Brook tributary flow off PICA exiting along the eastern boundary and join Lake Ames (**Figure 2-2**). Lake Denmark and Picatinny Lake are man-made features that collectively comprise 360 acres of open water. The lakes were constructed in the 1880s and are primarily used for industrial water supply and recreation (Malcolm Pirnie 2006).

Green Pond Brook is the main surface water drainage pathway within the valley. Two man-made lakes (Lake Denmark and Picatinny Lake) are present, both drained by Green Pond Brook. Two tributaries to Green Pond Brook, Robinson Run and Bear Swamp Brook, flow from the ridges on the southeast and northwest sides of the valley, respectively. Finally, wetlands and transition zones around the brooks are present throughout PICA (Malcolm Pirnie 2006).

2.9 Potable Wells

Currently, there are two on-post potable water wells located south of Picatinny Lake and relatively central on the installation, PW-131 and PW-302D (**Figure 2-2**). These on-post wells supply potable water to personnel such as workers and residents at PICA. Potable well PW-131 is screened within the lower semi-confined and bedrock aquifers, however total depth information for this well was not readily available following installation document research. Potable well PW-302D is screened in the dolomitic bedrock aquifer at an interval of 110 to 403 feet bgs (IT Corporation, 2003) and is completed to a depth of 403 feet bgs.

As identified from the relevant Environmental Data Resources (EDR), Inc. report and classification exception area (CEA) well searches for PICA, there are numerous off-post water supply wells surrounding PICA which have various uses and owners. As shown on **Figure 2-4**, there are several water supply wells located southwest of the installation, within the surface and groundwater flow direction paths leaving PICA. These wells include the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club, ranging from one mile to 2.6 miles from the southern boundary of PICA. Off-post potable wells are also present along the surface and groundwater flow direction paths leaving PICA from the eastern boundary (**Figure 2-4**). Specifically, the Rockaway Township Water Department and the Olde Hibernia Inn water supply wells are about 1.75 miles from the eastern boundary of PICA. **Figure 2-4** includes all other potable wells identified within a five-mile radius of PICA. The EDR report providing well search results is provided as **Appendix D**.

2.10 Ecological Receptors

While the focus of this program is on human receptors via potable water pathways, the Arcadis team collected information regarding ecological receptors that is readily available in installation documents reviewed. The information below is provided for future activities should the Army decide to later evaluate exposure pathways that are relevant to ecological receptors.

A variety of wildlife habitats exist at PICA, including dry forested ridgetops, talus slopes, bottomland hardwoods, mesophytic hardwoods, conifer stands, old fields, riparian sites, shrub stands, wetlands, brooks, ponds, and lakes (Weston 2014).

Beneficial resources at PICA include the forest and wildlife corridor offered by the dense forests and wetland areas providing habitat for many of the 41 mammalian, 208 avian, 21 amphibian, 19 reptile, and 26 fish species known to occur at PICA. Numerous invertebrates also occur at PICA, including common species from the Families Odonata and Lepidoptera (i.e., 63 dragonflies, 31 damselflies, 67 butterflies, and 136 moths) (Weston 2014).

3 SUMMARY OF PA ACTIVITIES

The following three principal sources of information were used to develop this PA.

- Records review
- Personnel interviews
- Site reconnaissance

The three sources of data are discussed below, along with their relative application to this PA.

3.1 Records Review

Prior to and during the site visit, various records and reports provided by the installation, as well as those that are publicly available, were reviewed to identify potential AOPIs. Records reviewed included, but were not limited to, various Installation Restoration Program (IRP) administrative record documents, compliance documents, and GIS files. Internet searches were also conducted to identify publicly available and relevant information. Lastly, an EDR report generated for PICA was reviewed to obtain off-post water supply well information. A list of the documents reviewed is provided in the research log (**Appendix E**).

3.2 Personnel Interview

Prior to arriving at the installation, team members scheduled interviews with a preliminary list of individuals who are knowledgeable about the history of the installation. The interview candidates were identified during the preliminary research, in the read-ahead package, follow-up notification emails, during the in-briefing, and through conversations with installation personnel.

The majority of interviews were conducted during the site visit. If a previously identified interviewee was not available during the site visit, attempts were made to complete the interview via telephone before or following the site visit, or to contact an alternate interviewee to collect similar data.

Below is a list of roles for those personnel interviewed during the PA process for PICA (affiliation is with PICA unless otherwise noted).

- Installation Restoration Program Manager
- Hydrologist
- Range Director
- Associate Range Director
- Environmental Chief
- Fire Chief
- Safety Officer
- Assistant Fire Chief
- Former Aviation Maintenance Supervisor at the New Jersey Army National Guard (NJARNG)
- Retired Aircraft Foreman
- Storm Water Program Coordinator – Directorate of Public Works
- Cultural Resources Manager and GIS Coordinator
- The U.S. Army Armament Research, Development and Engineering Center (ARDEC) Environmental Officers
- ARDEC Facilities and Equipment Management Chief
- Hazardous Waste Manager
- Installation Space Manager

- Property Management Chief
- Chief of Operations and Maintenance Division, Directorate of Public Works
- Head of Logistics
- Former Assistant Chief of Police/Directorate of Public Works
- NJARNG General Foreman Shop Chief
- NJARNG Planning and Programming Branch Chief

The compiled interview logs are included as **Appendix F**.

3.3 Site Reconnaissance

During the site visit, team members conducted visual surveys while performing site reconnaissance at potential AOPIs that were identified from records review, the installation in-briefing, and installation personnel interviews (**Table 3-1**). Under some circumstances, previously identified potential AOPIs (e.g., in the read-ahead package, in-brief slides) may not have been visited after personnel site history accounts indicated the site most likely did not warrant further assessment related to possible PFAS releases, or access to the site was restricted. However, the site still may have been further classified as a non-AOPI or an AOPI in Sections 5.1 and 5.2, respectively. A photo log from the site reconnaissance visits is included as **Appendix G** of this PA report and is used by office personnel to validate data collected in the field. The Site Reconnaissance Logs are included in **Appendix H**.

Specific components of the PA site reconnaissance included noting monitoring wells, if present, for access in case the area transitioned to PA phase sampling or the Site Inspection phase.

Table 3-1: Site Reconnaissance Areas

Site Reconnaissance
Fire Related Areas
Former Pyrotechnic Area/Sanitary Landfill*
Former Lower Burning Grounds*
Building 3316 - Firehouse 2*
Building 3321 Fire Department Warehouse
Area 1222 – Gorge*
Lawn to the North of Building 3409/3410*
Building 33 – General Vehicle Maintenance Building
Area 3500 – Homeland Security
Building 3801 – NJARNG Helipad Area*
Building 169 - Firehouse 1*
Metal Plating Areas
Building 64 – Former Metal Plating

Building 95 – Former Copper Plating
Building 24 – Former Chromium Plating*

* indicates this area has been further identified as an AOPI. Please note, this summary is not all-inclusive of all AOPIs at PICA, as site reconnaissance visits were not performed at each potential AOPI.

4 SUMMARY OF PA DATA COLLECTED

The sub-sections below summarize the observations made and data collected during the PA for PICA though records review (**Appendix E**), installation personnel interviews (**Appendix F**), and site reconnaissance (**Appendix H**).

4.1 Previous PFAS Investigations

In 2013, under the third Unregulated Contaminant Monitoring Regulation (UCMR3), PICA collected samples from the existing Building 1383 Water Treatment Plant (WTP). Samples were collected from the point of entry into the distribution system and were analyzed for various parameters, including PFOS and PFOA. Analyses of these samples indicated that PFOS and PFOA were not detected; the limit of detection (LOD) was 40 and 20 ng/L for PFOS and PFOA, respectively.

Because regulatory guidance levels for PFOS and PFOA have dropped, and laboratories are able to achieve lower detection limits, PICA performed proactive PFOS and PFOA sampling on several occasions in 2018 (**Appendix I**). Samples were collected from the on-post potable wells PW-131 and PW-302D. As summarized in **Appendix I,** each sampling location has been shown to contain combined PFOS and PFOA concentrations in pre-treated water above the HAL (70 ng/L). These wells have been used to supply on-post drinking water for many years. Water from these wells is currently being treated by American Water to remove PFOS/PFOA in response to 2018 sampling results.

The results from the recent PICA potable wells sampling, which was conducted on 15 October 2018 are as follows:

- **PW-131**
  - 68.9 ng/L PFOS and 10.6 ng/L PFOA
- **PW-302D**
  - 68.7 ng/L PFOS and 9.6 ng/L PFOA

4.2 Potable Water Supply and Drinking Water Receptors

All information regarding the PICA water supply and potential drinking water receptors is discussed in Section 2.9. No additional information was collected during the site visit that was not already obtained during document research.

4.3 AFFF Use and Storage at Installation

Currently and historically, the Picatinny Fire Department utilizes Building 3321 as a storage warehouse for fire-related equipment and materials, including AFFF. During the site visit on 9 May 2018, Arcadis personnel visited warehouse 3321 and noted AFFF currently stored in 55-gallon drums or in smaller closed containers. Arcadis noted approximately one dozen 55-gallon drums of AFFF in Building 3321, one of which was stored in an overpack container due to a previous leak. According to the PICA fire department, an estimated 10 gallons of AFFF leaked from the drum but was contained and cleaned. Due to the absence of floor drains, the intact floor condition, and even surface level, it was determined that AFFF release to the environment related to this spill is unlikely.

Additionally, AFFF has historically been, and is currently stored in, the Picatinny Fire Department firetrucks, located at both Building 169 - Firehouse 1 and Building 3316 - Firehouse 2.

Following personnel interviews, site reconnaissance trips, and document research, it has been concluded that the sole use of AFFF at PICA has been to assist with Picatinny Fire Department operations, including equipment testing, fire department training (arc training) and fire response activities as described in the following sections.

4.4 Fire Stations, Fire Training Areas, and Firefighting Activities

There are currently two firehouses on PICA utilized by the Picatinny Fire Department. Building 169, also referred to as Firehouse 1, was built approximately ten years ago and is the main location of current fire department operations. Building 3316, also referred to as Firehouse 2, is located further north on the installation and was historically utilized as the sole location of fire department operations prior to the construction of Firehouse 1. Building 3316 - Firehouse 2 is an active firehouse that houses the Squad, Rescue, and Brush Companies, who respond along with Firehouse 1 on a routine basis. Fire truck storage and washing, AFFF fueling operations, and nozzle testing occurred at both firehouses. Nozzle testing with AFFF was performed at the firehouses to ensure optimal flow and release of AFFF mixture in case of emergency use. Nozzle testing involved spraying AFFF through fire equipment, which could lead to a release to the environment if the mixture was not fully contained.

Although there are no formally dedicated fire training areas on-post, fire training involving AFFF occurred on the Lawn North of Building 3409/3410 and the adjacent tree line (arc testing). Similar to the nozzle testing performed at the firehouses, the arc training within this area did not involve a live fire but was performed as part of fire equipment training to maximize the arc, reach, and distance covered of AFFF in case of emergency use. This training occurred in the early 2010s, however there are currently no fire training exercises performed utilizing AFFF at PICA, in accordance with the Army guidance.

Firefighting activities involving AFFF were confirmed at various PICA locations, including:

- Former Lower Burning Grounds (not since the early 1990s).
- Former Pyrotechnic Area and Sanitary Landfill (not since 1990).
- Area 1222 – Gorge (not since 1988)
- Building 3801 - NJARNG Helipad Area (not since 1989)

The Picatinny Fire Department used AFFF on multiple occasions at the Former Lower Burning Grounds and the Former Pyrotechnic Area and Sanitary Landfill to better extinguish fires in the bog/peaty material in these areas. The Picatinny Fire Department also utilized AFFF to extinguish lingering fires in the Gorge due to rocky topography.

In 1988 or 1989, the Picatinny Fire Department utilized AFFF to respond to a fire that occurred on a concrete slab adjacent to Building 3801 at the NJARNG Helipad area. The fire occurred due to a static electricity spark during a helicopter defueling operation. The Picatinny Fire Department used about twenty gallons of AFFF to extinguish the fire.

4.5 Chromium Plating Operations

Based on document research and personnel interviews, Arcadis confirmed there are no current chromium plating operations at PICA. Following the analysis of information collected during the site visit, Arcadis identified one area with confirmed historical chromium plating operations at PICA. Building 24 and its associated waste lagoons, have since been demolished. The plating facility was originally built in 1942 but was gutted in 1960 and a new plating facility was installed in the southeast section of the building.

Also in 1960, two exterior wastewater lagoons were constructed on the southwest side of the building and were lined with sand and clay. The combined volume of the lagoons was approximately 55,000 gallons. Operations in Former Building 24 included anodizing with chromic and sulfuric acids; cleaning; degreasing; deburring; and plating with chromium, cadmium, copper, tin and nickel. The building also contained a chemical storage area where chemicals and rinse solutions for the plating operations were kept. Chromic acid was among the main chemicals used for the plating processes. Wastes generated from these processes included chromic solutions and wastewater from plating and anodizing operations.

Spent solutions flowed by gravity to the industrial waste treatment plant that was located adjacent to the plating operation in the southwest section of the building. Effluent from the chromate treatment tank and effluent from the cyanide destruction process were pumped into an alkali reservoir before being routed to the acid and chromium tanks. Following treatment, the wastewater was sent to the lagoons where the water percolated into the ground. Within the effluent that was discharged to the lagoons, chromium was found to be the predominant metal.

In 1981, the sand and clay lined lagoons were replaced by two concrete-lined lagoons. Treated effluent continued to be discharged to the lagoons from which it flowed into a settling tank and eventually discharged into Bear Swamp Brook. Bear Swamp Brook flows adjacent to the industrialized section of PICA and Former Building 24 before discharging into the GPB.

In 1982, plating operations were discontinued. This closure included the excavation of 317 cubic yards of soil, to a depth of about 10 feet. Final closure of the Building 24 surface lagoons occurred in 1991 and included demolition of the concrete basins and excavation of additional soils. The action removed 660 cubic yards of soil and 240 cubic yards of concrete. Documentation confirming whether PFAS containing mist suppressants were used or not was unavailable.

4.6 Readily Identifiable Off-Post Potential PFAS Sources

Although an exhaustive search to identify potential off-post PFAS sources is not part of this PA, potential off-post PFAS sources within a 5-mile radius of the installation boundary were identified from analysis of readily available data collected during the PA and are described below.

As identified during the records search, the Radiation Technology, Inc. Site is located to the east of PICA and was declared a federal Superfund Site in 1984. Beginning in 1947, the site began to support rocket engine and component testing programs. Documentation whether or not PFAS were used in these operations was not obtained.

Nearby community fire departments such as the Dover Fire Department, Birchwood Fire Department, Jefferson Township Fire Department, Wharton Fire Department, and Hibernia Fire Department could potentially be off-post PFAS sources within close proximity of PICA, if they use AFFF. It was also noted during site visit interviews with the PICA fire department that many or most of the off-post fire departments are still using older PFAS-containing AFFF.

Interviews with Picatinny Fire Department personnel identified several occasions when AFFF was used during a fire response off-post. The following off-post fire responses were within a 5-mile radius of the installation boundary:

- On 22 June 2001, two commercial trucks collided on Route 80, resulting in a tanker fire and explosion in Denville, NJ. One of the tankers carried over 3,000 gallons of gasoline, leading to an

explosion following the crash. Over six different fire departments, including the Picatinny Fire Department, responded and utilized AFFF to extinguish the fire.

- On 28 December 2013, nearly 25 fire departments responded to a junkyard fire at Sars Auto Wreckers on Schoolhouse Road in Jefferson, NJ. At least 4,500 gallons of AFFF concentrate were used to suppress the fire.
- In 1998, approximately 1,200 gallons of six percent AFFF concentrate were used during a fire response at a gas station/tank fire in Jefferson.

4.7 Relevant Utility Infrastructure

The following subsections include information related to how the utility's infrastructure may influence the fate and transport of PFAS at PICA.

4.7.1 Storm Water Management System Description

Storm water drainage at PICA is controlled through three dams and an extensive network of surface and subsurface conduits and culverts. The principal drainage channels flowing through improved grounds on the installation are the lower reaches of GPB and the middle and lower reaches of Bear Swamp Brook.

4.7.2 Sewer System Description

Sanitary waste water generated from PICA is conveyed via gravity mains and pumping stations to the Rockaway Valley Regional Sewage Authority. The waste water treatment plant formerly operating at Building 80 was demolished in 2011 (Renova Environmental Services 2017).

4.7.3 Water Supply System Description

As indicated during the site visit in-briefing, water mains at PICA leaked an estimated 31 million gallons per year for an uncertain amount of time. The system consists of over 220,000 feet of piping and was replaced by slip lining the pipes in 2008. Prior to the repair, the leaky water mains may have resulted in wide spread groundwater mixing of PFAS across PICA.

4.8 Other Potential PFAS Sources at PICA

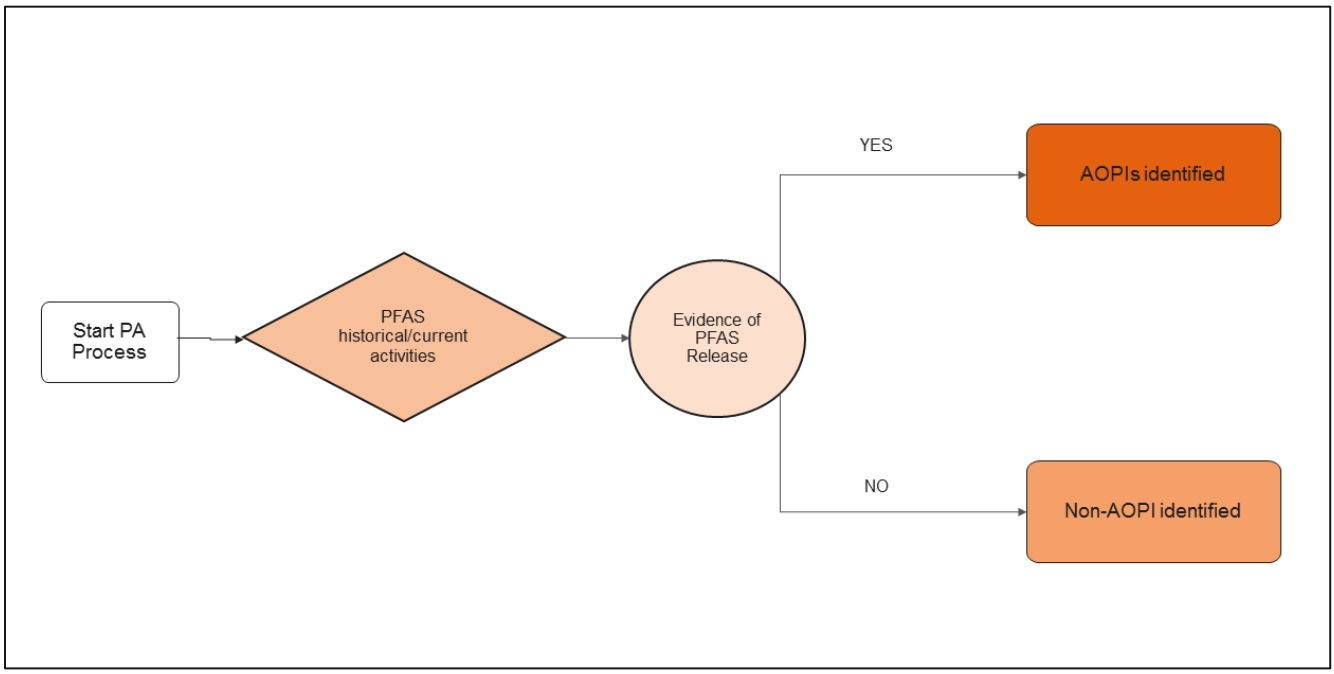
In addition to AFFF and chromium plating-related sources, other potential sources of PFAS may be associated with the use of some types of insecticides, car washes and engine lubricants, laundry or water proofing and photo processing facilities.

Following document research and the site visit, Arcadis did not identify an AOPI at PICA related to other potential PFAS sources. Further discussion regarding areas not retained as AOPIs is presented within Section 5.

5 SUMMARY OF AOPIs AND AREAS RESEARCHED

Areas evaluated for potential PFAS use or storage and/or potential release to the environment at PICA were further categorized as, not retained as AOPIs (non-AOPIs), and AOPIs, during this PA. Of these areas, 15 have not been retained as AOPIs and 10 have been classified as AOPIs.

In accordance with the established process for this PA program, areas researched are categorized and presented as referenced in the flowchart.



Areas not retained as AOPIs are presented in Section 5.1.

Areas retained as AOPIs and their corresponding drinking water pathway CSMs are presented in Section 5.2.

Several of the identified AOPIs overlap with PICA IRP sites. The AOPI, overlapping IRP site identifier, and current site status are discussed within each AOPI subsection. However, it should be noted that at the time of this PA, none of the PICA IRP sites have historically been investigated or are currently being investigated for possible PFAS presence.

The AOPI locations are shown on **Figure 5-1**. **Figures 5-2** through **5-12** contain aerial photographs of each AOPI and include active monitoring wells in the vicinity of each AOPI. The entire PICA monitoring well inventory is included as **Appendix J**.

Section 5.3 presents data limitations for this PA at PICA.

5.1 Areas Not Retained as AOPIs

Table 5-1 presents the areas that were previously identified as potential PFAS sources (e.g., AFFF storage, non-AFFF fire incidents, non-chromium metal plating activities, car washes, auto maintenance, photo-processing, insecticide use or storage, WWTPs, landfills) where use or storage was not identified, or a release was not suspected Therefore, subsequent potential drinking water receptors were not identified for these areas.

Table 5-1: Areas Not Retained as AOPIs - PFAS Release Not Suspected

Area Description	Dates of Operation	Relevant Site History	Why Eliminated
Building 3045	Not available (NA)	Fluorochemical Storage Building - This building was likely used for the storage of fire-retardants.	The fire-retardants stored in this building are not PFAS related.
Building 33	NA	General Vehicle Maintenance Facility - Maintenance on a variety of vehicles is conducted inside this building. PICA fire trucks have received minor maintenance such as oil changes in this building, however none of the foam components of the trucks are serviced or inspected here. PICA fire trucks are serviced and inspected at a specialized maintenance location off-post. Potential for PFAS use as part of motor hydraulic oils.	Based on the site recon and interviews, it was determined that maintenance was not conducted on the foam components of the trucks in this building. It was also noted that there were no known foam discharges during the minor services. Therefore, a PFAS release from AFFF is not likely. There was no evidence of PFAS release to the environment from motor hydraulic oils.
Fuselage in 600 area	NA	A fuselage, which appears to be burned, is in the 600 area. Based on interviews, it was determined that the fuselage was used solely for target practice, not fire training.	Because the fuselage was not used for fire training purposes, an AFFF release is not likely.
Fire in 200 Area	Early 2010's	A fire occurred in this area in the early 2010s. Bambi buckets were used to put out the fire.	Bambi buckets were used with water, not AFFF to put out the brushland fire.

Area Description	Dates of Operation	Relevant Site History	Why Eliminated
3500 Area	Prior to 1950 related to rocket testing. Unknown from 1950-2010. Homeland Security uses starting in 2010 to present.	Historically, this area was used for rocket testing and rocket fuel development. There is a gap in operations/known site use from about 1950 to 2010 when Homeland Security took over.	There is no confirmed use of AFFF or evidence of operations involving PFAS.
Building 64	Prior to 1961	Historical records indicated metal plating occurred in this building from 1942 to 1961, preceding the time period of interest for PFAS mist suppressants.	Based on interviews with site personnel and review of on-post documents, there is no evidence of a PFAS release since metal plating activities were conducted before the time period of interest for PFAS mist suppressants.
Pyrotechnic Demonstration Area (Site-019)	Prior to 1989	Historical records prior to 1989 identified a potentially burned helicopter in this area.	Based on site interviews and further document research, there is no evidence of AFFF use at this location.
NCO Club Fire	1999	A fire occurred in this building as it was being constructed in 1999.	Based on interviews with Picatinny Fire Department personnel, it was determined that AFFF was not used in this fire response.
House off Parker Road	Unknown-present	This area/structure was identified as a potential fire training area during site interviews.	Based on interviews with Picatinny Fire Department personnel, it was determined that this house is used for smoke-based rescue, and there are no active fires or AFFF used in the trainings.

Area Description	Dates of Operation	Relevant Site History	Why Eliminated
Building 732 - PICA-143/Site 108	NA	A flare fire, possibly containing zirconium and Teflon, occurred on a loading platform adjacent to Building 732.	Based on interviews with Picatinny Fire Department personnel, it was determined that AFFF was not used in this fire response.
Installation-Wide	NA	As part of TECUP (Toxic and Energetics Cleanup Program), numerous buildings were demolished across the installation. Buildings were burned for decontamination and/or decommissioning purposes.	Based on interviews with Picatinny Fire Department personnel and document reviews, it was determined that AFFF was not used for this program.
Installation-Wide	Prior to 2008	As noted during onsite interviews, previously leaky water mains, which were repaired in 2008, may have resulted in wide spread mixing of groundwater from the water supply wells that have shown detections of PFOS/PFOA in multiple sampling events.	The leaky water mains were repaired, and therefore no longer acting as a pathway or source of PICA to groundwater.
PICA-169/Site 169	NA	A fire, which affected Buildings 1409, 1408, and 1411, occurred in this area in 1989.	Based on interviews with Picatinny Fire Department personnel, as well as document reviews, it was determined that AFFF was not used during this fire response.
PICA0171/Site 171	1985	A transformer fire, which affected Buildings 3106, 3109, and 3111, occurred in this area.	Based on interviews with Picatinny Fire Department personnel, as well as document reviews, it was

Area Description	Dates of Operation	Relevant Site History	Why Eliminated
			determined that AFFF was not used in this fire response.
Building 3321/ Warehouse Storage	After 1988	This building, which is used by the Picatinny Fire Department for storage, currently has AFFF stored within the building. Previously, a spill of approximately 10 gallons of AFFF occurred from a drum inside the building.	The spill was contained and cleaned. In addition, there are no floor drains and the floor is sealed. Due to the containment of the spill and minimal pathways of migration, there is no evidence of AFFF or PFAS release to the environment.
Building 95	Prior to the late 1980's	Ending in the late 1980's, Building 95 housed copper plating activities, specifically etching circuit boards.	Based on interviews and site recon visits, it was concluded that there were no chromium plating operations at this building; therefore, there is no evidence of PFAS release.

5.2 AOPIs and CSMs

Section 5.2 provides AOPI overviews and corresponding drinking water pathway CSM summaries for each AOPI identified during the PA evaluation process. The focus of this assessment is on potential human exposures via drinking water ingestion. Therefore, the CSMs focus on drinking water pathways via groundwater and surface water that is known to be used as a source of potable water. Other exposure pathways are not specifically evaluated for this PA report.

A groundwater exposure pathway is potentially complete where contaminants could migrate from the source area to groundwater that is used for drinking water. At PICA, on-post potable water is obtained from two drinking water wells in the central portion of the installation. AOPIs within the vicinity and those that are upgradient and have the potential to influence groundwater associated with these potable wells were noted as having a potentially complete groundwater exposure pathway for on-post drinking water receptors. AOPIs that have the potential to influence groundwater that flows off-post were noted as having a potentially complete exposure pathway for off-post receptors.

A surface water exposure pathway is potentially complete where contaminants could be present in a surface water body that serves or could realistically serve in the future, as a potable water source. Surface water bodies on-post are not utilized and are not likely to be used in the future for potable water purposes to supply PICA, therefore there are no AOPIs that have a potentially complete surface water pathway for on-post drinking water receptors. There are various surface water bodies within PICA that flow off-post towards surface water bodies with known potable uses, therefore all surface water pathways are shown as potentially complete for off-post receptors.

AOPI-specific drinking water pathway CSM summaries are provided below in **Tables 5-2** through **5-11** and in **Figures 5-13** through **5-22.**

5.2.1 The Former Pyrotechnic Area and Sanitary Landfill

The Former Pyrotechnic Area and Sanitary Landfill was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to historical fire responses. Prior to 1990, AFFF was utilized in this area once or twice a year by the Picatinny Fire Department to extinguish lingering fires on the peaty grounds associated with this area (**Figure 5-2**); it is unknown what specific product or volume of AFFF was released. In addition to confirmed AFFF use in the Former Pyrotechnic Area and Sanitary Landfill, historical landfilling activities at the Sanitary Landfill included dumping of sanitary waste, fly ash, ordnance, industrial wastes, and wastewater treatment plant sludge. These landfilling wastes could also potentially contribute to PFAS release in this area.

As part of the IRP, the Former Pyrotechnic Area and Sanitary Landfill are addressed under PICA-066 for soils and PICA-205 for groundwater due to past landfilling operations. PICA-066 has LUCs in place and is in the long-term monitoring phase (LTM) phase. PICA-205 addresses Area B groundwater associated with the Former Pyrotechnic Area and Sanitary Landfill. In addition to LUCs, amendment injections and monitoring have been ongoing since 2008 as part of the Remedial Action Operation for PICA-205.

The Former Pyrotechnic Area and Sanitary Landfill CSM information is presented in **Table 5-2** below and in **Figure 5-13**.

Table 5-2: AOPI CSM Information Profile – Former Pyrotechnic Area and Sanitary Landfill

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Former Pyrotechnic Area/Sanitary Landfill consists of a marshy area that is relatively level, with a large pond located within the bounds of the site. There is a small building on site, as well as numerous monitoring wells (**Figure 5-2**).
	Latitude, Longitude	40°55'9" N, 74°35'13" W
Land Use	Current/Future Land Use	Industrial
CSM Profile (**Figure 5-13**)	Human Receptors	The AOPI is downgradient of the on-post potable wells. Groundwater and surface water originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on the groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil, Surface Water
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption. Constituents could migrate from surface water of the marshy area to which AFFF was released to downstream surface water bodies that could be used as a potable water source (off-post).
	Exposure Media and Applicable Receptors	Surface water and groundwater associated with this area flow off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club (**Figure 2-4**). The Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply.

5.2.2 Former Lower Burning Grounds

The Former Lower Burning Grounds was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to historical fire responses. The Picatinny Fire Department used AFFF intermittently in this area (**Figure 5-3**) to extinguish lingering fires due to difficulty associated with extinguishing fires on the peaty grounds in this area. The specific AFFF used and overall volume used over time is unknown. The majority of these responses involving AFFF happened prior to the early 1990s.

As part of the IRP, the Former Lower Burning Grounds is addressed under PICA-002 due to historic burn area uses. In addition to the placement of an asphalt cap, soil cover and wetland mitigation, requirements

of the remedial design for PICA-002 include groundwater monitoring, land use certifications, wetland mitigation reporting, and maintenance of the cap and cover. The site is currently in the LTM phase.

Former Lower Burning Ground CSM information is presented in **Table 5-3** below and in **Figure 5-14**.

Table 5-3: AOPI CSM Information Profile – Former Lower Burning Grounds

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Former Lower Burning Grounds consist of a flat, level field with peaty/organic materials present and marshy areas. Current use includes a solar farm. (**Figure 5-3).**
	Latitude, Longitude	40°55'28" N, 74°34'44" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-14**)	Human Receptors	The AOPI is downgradient of the on-post potable wells. Groundwater and surface water originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on the groundwater and surface water flow from this area, there is a potentially complete exposure pathway for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil, Surface Water
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption. Constituents could migrate from surface water of the marshy areas to which AFFF was released to downstream surface water bodies that could be used as a potable water source (off-post).
	Exposure Media and Applicable Receptors	Surface water and groundwater associated with this area flow off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club (**Figure 2-4**). The Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply.

5.2.3 Building 3316 – Firehouse 2

Building 3316 – Firehouse 2 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to firehouse operations. Approximately 10 years ago, prior to the construction of Firehouse 1, Building 3316 – Firehouse 2 was historically used as

the sole fire department at PICA. Building 3316 - Firehouse 2 still operates as an active firehouse and is the location of fire truck storage and fire department operations. Historical operations included fire truck storage and washing, AFFF fueling operations, and nozzle testing. Nozzle testing at Building 3316 – Firehouse 2 resulted in AFFF release within the parking lot with potential for runoff to surrounding soils (**Figure 5-4**). An estimated 55 gallons of three to six-percent AFFF were released in this area.

As part of the IRP, Building 3316 – Firehouse 2 is being addressed under PICA-096, a consolidated site (Army 2016).

The Building 3316 – Firehouse 2 CSM information is presented in **Table 5-4** below and in **Figure 5-15**.

Table 5-4: AOPI CSM Information Profile - Building 3316 - Firehouse 2

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	Building 3316 – Firehouse 2 consists of a stone/brick building used for office/living space for Picatinny Fire Department personnel. Also included in the building are multiple bays for firetruck and firefighting materials storage. There is a wraparound paved parking lot and an additional storage building behind the main firehouse. Small grassy areas and a longer lawn strip are east of the firehouse and its associated parking lots (**Figure 5-4**).
	Latitude, Longitude	40°57'2" N, 74°32'18" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-15**)	Human Receptors	Groundwater within this area flows away from on-post potable wells and eventually migrates off-post through the eastern installation boundary. Based on groundwater flow from this area, there is a potentially complete exposure pathway for off-post residents consuming water from wells potentially impacted by this AOPI.
	Source Media	Soil, impervious surfaces (e.g., parking area).
	Migration Routes/Release Mechanisms	Arcadis did not note any proximal surface water bodies during site reconnaissance to Building 3316 – Firehouse 2 or during aerial photo review, therefore it is unlikely that constituents associated with this area could migrate via surface water. Constituents could migrate from soil to groundwater via desorption/dissolution.
	Exposure Media and Applicable Receptors	Groundwater within this area flows off-post through the eastern boundary towards several off-post potable wells such as the Rockaway Township Water Department and the Olde Hibernia Inn (**Figure 2-4**).

5.2.4 The Lawn to the North of Building 3409/3410

The Lawn to the North of Building 3409/3410 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to training operations. In the early 2010's, the Lawn to the North of Building 3409/3410 was used by the Picatinny Fire Department on multiple occasions as a location of AFFF training activities such as arc training and nozzle testing. As mentioned in previous sections, arc training and nozzle testing do not involve live fire training, but test capabilities of fire response equipment and foam coverage. An estimated sixty gallons of AFFF at a three to six-percent concentration were released due to training in this area and were concentrated on the grassy and wooded portions (**Figure 5-5**).

The Lawn to the North of Building 3409/3410 does not overlap with an IRP site at PICA.

The Lawn to the North of Building 3409/3410 CSM information is presented in **Table 5-5** below and on **Figure 5-16**.

Table 5-5: AOPI CSM Information Profile - Lawn to the North of Building 3409/3410

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The area consists of a grassy lawn area to the north of Buildings 3409 and 3410. There is a gravel roadway that separates the lawn and a wooded area. There are abandoned stormwater collection system structures within the grassy area (**Figure 5-5**).
	Latitude, Longitude	40°57'26" N, 74°32'3" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-16**)	Human Receptors	Groundwater and surface water within this area flow away from on-post potable wells and eventually off-post through the eastern installation boundary. Based on groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption.
	Exposure Media and Applicable Receptors	Surface water and groundwater within this area flow off-post through the eastern boundary towards several off-post potable wells such as the Rockaway Township Water Department and the Olde Hibernia Inn (**Figure 2-4**).

5.2.5 Area 1222 – Gorge

Area 1222 – Gorge was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to historical fire responses. Prior to 1988, the Picatinny Fire Department used AFFF periodically to extinguish fires that started due to the munitions testing activities that occur in this area (**Figure 5-6**). It was noted that large volumes of AFFF were used in this area, but at a one-percent concentration. AFFF was used due to the difficulty in extinguishing fires on the rocky topography associated with this area. Note that the area where AFFF was used needs to be confirmed and may change during the SI.

Area 1222 – Gorge is an operational range. The open denotation area that is within Area 1222 - Gorge is Resource Conservation and Recovery Act regulated.

Area 1222 - Gorge CSM information is presented in **Table 5-6** below and in **Figure 5-17**.

Table 5-6: AOPI CSM Information Profile - Area 1222 - Gorge

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Gorge is an operational range at PICA and contains training equipment/structures related to range missions. Within the gorge there are sections of rocky topography, steep slopes, small streams, and wooded vegetation. There are some small ponding areas of water due to craters created from training activities (**Figure 5-6**).
	Latitude, Longitude	40°58’11” N, 74°32’0” W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-17**)	Human Receptors	Groundwater within this area flows towards the on-post potable wells. Therefore, there is a potentially complete exposure pathway for drinking water receptors utilizing the on-post potable wells. Based on groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil, Surface Water
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption. Constituents could migrate from surface water to which AFFF was potentially released in the Gorge to downstream surface water bodies that could be used as a potable water source (off-post).
	Exposure Media and Applicable Receptors	Surface water and groundwater within this area eventually flow off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water

		Department, and Sun N Fun Beach Club (**Figure 2-4**). The Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply.

5.2.6 Former Building 24

Former Building 24 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to historical chromium plating operations. The chromium plating operations at Former Building 24 began in approximately 1942 and continued until about 1982. Former waste water lagoons associated with Former Building 24 operations received process waste water that could have potentially contained PFAS-containing wastes from chromium plating mist suppressants. As mentioned in Section 4.5, these waste water lagoons were clay-lined until 1981; therefore, they had the potential to release PFAS to the environment. In addition, PFAS releases related to Former Building 24 operations could be into the Bear Swamp Brook, which runs adjacent to each former structure and received effluent process waste water. Former Building 24 and its associated lagoons have since been demolished (**Figure 5-7**).

Under the IRP, Former Building 24 groundwater and surface water is addressed under PICA-076 due to former chromium plating activities and associated waste water lagoons at the site. The ROD for PICA-076 Area D Groundwater included the shutdown of an interim pump and treat system, installation of a permeable reactive barrier (PRB), as well as monitored natural attenuation sampling of groundwater and surface water. The PRB consists of a mixture of zero-valent iron and sand to reduce chlorinated solvents discharging to GPB. The location of Former Building 24 in relation to the PRB and GPB is shown on **Figure 5-8**.

Former Building 24 is 0.15 miles from the closest on-post potable well, PW-131, which has known PFOS/PFOA detections (**Appendix I**).

Former Building 24 CSM information is presented in **Table 5-7** below and in **Figure 5-18**.

Table 5-7: AOPI CSM Information Profile - Former Building 24

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Former Building 24 lot is now used as a parking lot. Building 25 still exists and borders the site. Bear Swamp Brook runs between where the associated lagoons were and the Former Building 24 lot. Where the lagoons were constructed is now a grassy/gravel surface that does not have a defined use (**Figure 5-7**).
	Latitude, Longitude	40°56’28” N, 74°34’15” W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-18**)	Human Receptors	Groundwater associated with this area is 0.15 miles from, and within the capture zone of, on-post potable well PW-131. Therefore, there is a

		potentially complete exposure pathway for on-post drinking water receptors utilizing the on-post potable wells. Groundwater and surface water originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on the groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Subsurface Soil associated with historical wastewater lagoons Surface Water (Bear Swamp Brook).
	Migration Routes/Release Mechanisms	Constituents could migrate from subsurface soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption. Constituents could migrate from surface water of Bear Swamp Brook to downstream surface water bodies that could be used as a potable water source (off-post).
	Exposure Media and Applicable Receptors	Surface water and groundwater associated with this area eventually flow off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club (**Figure 2-4**). The Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply.

5.2.7 Building 169 – Firehouse 1

Building 169 – Firehouse 1 was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to firehouse operations. Building 169 – Firehouse 1 is the most recently constructed firehouse currently utilized by the Picatinny Fire Department, built approximately 10 years ago. Over the past 10 years, an estimated 55 gallons of AFFF have been released during nozzle testing and hose cleanouts at this location. Nozzle testing and hose cleanouts within the firehouse bays and parking lot could have resulted in AFFF release in this area (**Figure 5-8**). Firetrucks that stored AFFF were also washed and housed in the parking lots and internal bays at this firehouse. During site reconnaissance at Building 169 – Firehouse 1, the Picatinny Fire Chief stated that AFFF was released into the floor drains within the building bays during fire truck tank cleanouts and fire truck washing. AFFF rinses released to these floor drains within the bays were conveyed to the WWTP via the sanitary sewer system (**Appendix H**).

Under the IRP, the groundwater under Building 169 - Firehouse 1 is located within the boundary of PICA-204 which addresses Mid-Valley Groundwater/ The firehouse is not included in any IRP sites.

The Building 169 – Firehouse 1 CSM information is presented in **Table 5-8** below and in **Figure 5-19**.

Table 5-8: AOPI CSM Information Profile - Building 169 - Firehouse 1

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	Current firehouse that includes a garage to house fire trucks as well as office/living space for Picatinny Fire Department personnel. Outside of Building 169 is an associated parking lot for fire trucks and personnel vehicles. The site also includes a grassy lawn area (**Figure 5-9**).
	Latitude, Longitude	40°56'19" N, 74°33'42" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-19**)	Human Receptors	Groundwater associated with this area is within the capture zone of on-post well 302D. Therefore, there is a potentially complete exposure pathway for on-post drinking water receptors utilizing the on-post potable wells. Groundwater originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on groundwater flow from this area, there is a potentially complete exposure pathway for off-post residents consuming water from wells potentially impacted by this AOPI.
	Source Media	Soil, Impervious surfaces (e.g., parking area).
	Migration Routes/Release Mechanisms	Arcadis did not note any proximal surface water bodies during site reconnaissance to Building 169 – Firehouse 1 or during aerial photo review, therefore it is unlikely that constituents associated with this area could migrate via surface water. Constituents could migrate from soil to groundwater via desorption/dissolution.
	Exposure Media and Applicable Receptors	Groundwater within this area eventually flows off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club (**Figure 2-4**).

5.2.8 The Former WWTP Facility

The Former WWTP Facility was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to the possibly of AFFF rinse reaching the WWTP via the sanitary sewer system. During site reconnaissance, Arcadis noted sanitary sewer drains proximal to AFFF release locations. At Building 3801 – NJARNG Helipad Area, Arcadis noted a sanitary sewer manhole in the grassy area downgradient of AFFF fire response release on the helipad that could have potentially captured AFFF rinse and been conveyed to the WWTP (**Appendix H**). Although the facility building was demolished in 2011, the sludge beds (**Figure 5-9**) could potentially be a secondary source of PFAS due to AFFF-related wastes received.

Under the IRP, the Former WWTP Facility and sludge beds were addressed within PICA-070. The site has been listed as Response Complete and has LUCs in place for soils.

The Former WWTP Facility CSM information is presented in **Table 5-9** below and in **Figure 5-20**.

Table 5-9: AOPI CSM Information Profile - Former WWTP Facility

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Former WWTP Facility consisted of the sewage treatment plant and its associated structures and sheds as well as the sludge drying bed and leach fields on the southern portion of the facility lot (**Figure 5-10**).
	Latitude, Longitude	40°93'39" N, 74°57'28" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-20**)	Human Receptors	The AOPI is downgradient of the on-post potable wells. Groundwater and surface water originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil (Former sludge bed and leach fields)
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption.
	Exposure Media and Applicable Receptors	Surface water and groundwater associated with this area flow off-post through the southern boundary towards several off-post potable wells such as the Roxbury Township, Roxbury Township Water Department-Shore Hills, Wharton Water Department, Dover Water Department, and Sun N Fun Beach Club (**Figure 2-4**). The Rockaway River is the major tributary to the Boonton Reservoir, located approximately 10 miles southeast of PICA, and used as the Jersey City water supply.

5.2.9 Post Farm Landfill

The Post Farm Landfill was identified as an AOPI following installation personnel interviews due to the relation to chromium plating wastes. It was indicated that drums found at the Post Farm Landfill came from Former Building 24, as well as other buildings. Due to the potential for operations at Former Building 24 to involve PFAS-containing mist suppressants, it is possible that wastes disposed here contained PFAS. Beginning in the 1940s through 1979, the Post Farm Landfill received a variety of industrial waste (**Figure 5-10**) generated at PICA, including fly ash, paint stripping wastes, phenols, and spent explosive laden hydraulic oils. In addition to the chromium plating-related wastes, spent hydraulic oils and paint sludges could potentially be a secondary source of PFAS as well.

Under the IRP, the Post Farm Landfill is addressed under PICA-065 due to historical landfilling operations. The site has LUCs in place and groundwater is monitored as part of the LTM phase.

The Post Farm Landfill CSM information is presented in **Table 5-10** below and in **Figure 5-21**.

Table 5-10: AOPI CSM Information Profile - Post Farm Landfill

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	The Post Farm Landfill is surrounded by wooded vegetation and is located proximal to the southeastern installation boundary. The area is no longer an active landfill and does not currently have any known uses. There are numerous active monitoring wells in the vicinity of this area (**Figure 5-11**).
	Latitude, Longitude	40°91'91" N, 74°57'24" W
Land Use	Current/Future Land Use	Industrial
CSM Profile (**Figure 5-21**)	Human Receptors	The AOPI is downgradient of the on-post potable wells. Groundwater originating at this AOPI eventually migrates off-post through the southern installation boundary. Based on the groundwater flow from this area, there is a potentially complete exposure pathway for off-post residents consuming water from wells potentially impacted by this AOPI.
	Source Media	Subsurface Soil (drum burial area)
	Migration Routes/Release Mechanisms	Arcadis did not note any proximal surface water bodies during document review or aerial photo review, therefore it is unlikely that constituents associated with this area could migrate via surface water. Constituents could migrate from soil to groundwater via desorption/dissolution.
	Exposure Media and Applicable Receptors	Groundwater associated with this area flows off-post through the eastern boundary towards the southern portion of PICA. (**Figure 2-4**).

5.2.10 Building 3801 – NJARNG Helipad Area

Building 3801 – NJARNG Helipad Area was identified as an AOPI following document research, personnel interviews, and site reconnaissance due to AFFF use related to a historical fire response. In 1988 or 1989, the Picatinny Fire Department utilized AFFF to respond to a fire that occurred on a concrete slab adjacent to Building 3801 at the NJARNG Helipad area. The fire occurred due to a static electricity spark during a vehicle fueling operation. Approximately 20 gallons of a three to six-percent AFFF were used to extinguish the fire and was released directly on the concrete pad, with potential for migration to surrounding soils (**Figure 5-11**).

As part of the IRP, Building 3801 – NJARNG Helipad Area is addressed under PICA-096, a consolidated site (Army 2016).

The Building 3801 – NJARNG Helipad Area CSM information is presented in **Table 5-11** below and in **Figure 5-22**.

Table 5-11: AOPI CSM Information Profile - Building 3801 - NJARNG Helipad Area

Profile Type	Information Needs	Preliminary Assessment Findings
Site Profile	AOPI Site Structures/Description	This site is operated by the NJARNG and consists of a building with office space and an attached garage to perform maintenance repairs. Other components of the site include a helipad south of the building, fuel ASTs, large open storage lots, multiple stormwater drains in the parking lot and adjacent to the helipad, and grassy/lawn areas spread out between paved sections (**Figure 5-12**).
	Latitude, Longitude	40°57'35" N, 74°31'37" W
Land Use	Current Land Use	Industrial
CSM Profile (**Figure 5-22**)	Human Receptors	Groundwater and surface water within this area flow away from on-post potable wells and eventually off-post through the eastern installation boundary. Based on groundwater and surface water flow from this area, there are potentially complete exposure pathways for off-post residents consuming water from wells or off-post surface water bodies potentially impacted by this AOPI.
	Source Media	Soil, Impervious surfaces (i.e., concrete slab).
	Migration Routes/Release Mechanisms	Constituents could migrate from soil to groundwater via desorption/dissolution and from soil to surface water via runoff, dissolution and adsorption.
	Exposure Media and Applicable Receptors	Surface water and groundwater associated with this area flow off-post through the eastern boundary towards several off-post potable wells such as the Rockaway Township Water Department and the Olde Hibernia Inn (**Figure 2-4**).

5.3 Data Limitations at PICA

Data limitations relevant to the development of this PA for PFAS at PICA are noted below. Sampling has not been conducted to confirm presence or absence of PFAS at each of the 9 AOPIs identified above. Available sampling data for PICA (**Appendix I**), show detections of PFOS/PFOA in on-post potable wells at PICA (**Figure 2-2**), however due to the lack of sampling in each of the above identified AOPIs, it is unclear what the potential source(s) of the detections in the on-post potable wells could be.

Another data limitation and uncertainty relevant to the data evaluation at PICA is the history of the leaking water mains. As identified during site visit interviews, water mains at PICA leaked an estimated 31 million gallons per year for an uncertain amount of time until repair in 2008. It is uncertain when the system began leaking, and whether the leaking pipes impacted surrounding groundwater. However, it should be noted that in 2013, PICA collected samples from Building 1383 WTP from the point of entry into the distribution system. The samples were analyzed for various parameters including PFOS and PFOA; neither compound was detected. The LOD limits were 40 and 20 ng/L for PFOS and PFOA, respectively.

Although there are no current chromium plating operations at PICA, it was confirmed during document research, site visit interviews, and site reconnaissance trips that historic chromium plating operations occurred at Former Building 24 and that process wastewater was displaced into adjacent former lagoons. However, a site-specific process description for chromium plating operations at PICA was not available; therefore, it could not be confirmed that PFAS containing mist suppressants were used in the chromium plating operations at PICA.

Arcadis was able to confirm the use of AFFF throughout PICA related to Picatinny Fire Department operations. However, a few of the AOPIs that were identified related to AFFF use such as the Pyrotechnic Area and Sanitary Landfill, the Former Lower Burning Grounds, and Area 1222 – Gorge are lacking specific details related to AFFF release. Some specifics such as foam percent concentrations, overall volume of AFFF released per event or collectively are unknown and were not collected during interviews and site reconnaissance visits.

The EDR report (**Appendix D**) and CEA well search received from PICA personnel was referenced when identifying potential off-post drinking water receptors. 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 EDR report and the CEA well search results. There may be additional updated well records that are not present in the EDR and CEA well search that Arcadis reviewed.

Readily identifiable potential off-post PFAS sources were documented in this PA for PICA. This search was not exhaustive and was limited to areas that were identified during relevant document research, installation personnel interviews, and site reconnaissance trips.

Finally, the CSMs presented in this report intentionally focus on the potential for human exposure through ingestion of groundwater or surface water that is used as a source of potable water. The Army implements controls which prevent any intrusive work without directorate of public works approval per the Master Plan and the dig permitting process. Therefore, the potential for future on-post receptors through new potable well installations are incomplete pathways. However, these Army controls do not prevent future consumption of drinking water for land if it is no longer controlled by the Army. Potential human exposures through other environmental media, such as soil/airborne dust, sediment, aquatic biota, etc., are not evaluated. The potential for toxicity from human exposures to PFAS through non-drinking water exposure pathways has not yet been established and may be evaluated at a future date, after it has been determined that those pathways warrant further consideration.

6. CONCLUSION

Arcadis conducted this PA to document PFAS releases at Picatinny Arsenal, in accordance with CERCLA and as contracted by USACE Baltimore District. Programmatically, the Army has focused their PA efforts on two major sources of PFAS: the use of AFFF and mist suppressants associated with chromium plating operations. However, other potential sources of PFAS at the installation have been documented in this PA. A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFAS releases.

On-post drinking water wells located in the central part of the installation have been shown to contain PFOS and PFOA at combined concentrations above the USEPA HAL. These wells have been used to supply on-post drinking water for many years, and this water is currently being treated to remove PFAS. This PA has identified AOPIs that may be impacting the supply wells within the central part of the installation, as well as other AOPIs that have the potential to impact groundwater or surface water migrating off-post. Priority is given to AOPIs that have the most potential to impact off-post groundwater or surface water given the presence of drinking water supplies located south and east of the post.

A total of 25 potential areas of PFAS release were evaluated. Following the evaluation, 10 AOPIs were identified. A site-specific drinking water pathway CSM was developed for each AOPI based on an assessment of existing records, personnel interviews, and site reconnaissance trips.

CSM development identified all 10 AOPIs as having the potential to impact drinking water receptors.

AOPIs with potential to impact drinking water receptors through the southern boundary:

- Former Pyrotechnic Area and Sanitary Landfill
- Former Lower Burning Grounds
- Former Building 24
- Building 169 – Firehouse 1
- Former WWTP Facility

AOPIs with potential to impact drinking water receptors through the eastern boundary:

- Building 3801 –NJARNG Helipad Area
- Post Farm Landfill

AOPIs that are upgradient or in the capture zone of on-post potable wells:

- Area 1222 – Gorge
- Former Building 24
- Building 169 – Firehouse 1

Results from this PA may be used to determine if a Site Inspection for PFAS is warranted at PICA.

7. REFERENCES

Army, 2015. Integrated Natural Resources Management Plan. April.

Army, 2016. Army Defense Environmental Restoration Program Installation Action Plan. September.

Army, 2018. *Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances.* September

Dames & Moore, 1991. Remedial Investigation Concept Plan for Picatinny Arsenal. March.

IT Corporation, 2003. Area D Groundwater Feasibility Study. May

ITRC, 2017. History and Use of Per-and Polyfluoroalkyl Substances (PFAS). November.

Lucey, Carol S. 1972. Geology of Morris County in Brief. Bureau of Geology and Topography, Trenton, New Jersey. 1972.

Malcolm Pirnie, Inc., 2006. Final Historical Records Review Picatinny Arsenal New Jersey. November.

Renova Environmental Services, 2017. Spill Prevention, Control, and Countermeasure (SPCC) Plan 2017 Update. October.

USEPA, 1991. Guidance for Performing Preliminary Assessments Under CERCLA. EPA/540/G-91/013. September.

USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). EPA/822/R/16/004. May.

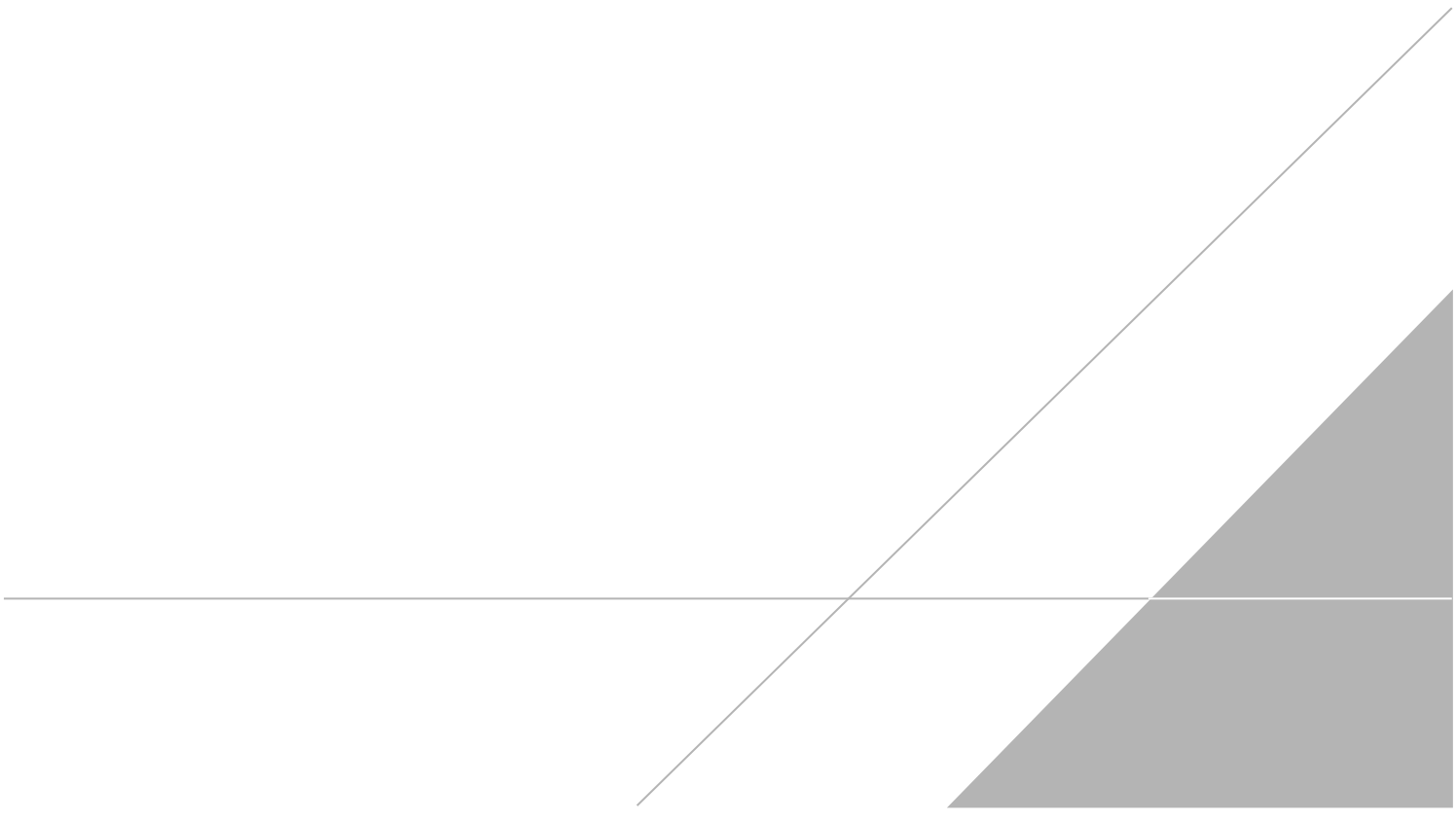
USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). EPA/822/R/16/005. May.

Weston Solutions, Inc., 2014. Final Remedial Investigation Report. Military Munitions Response Program Remedial Investigation September.

FIGURES

APPENDIX A

Antiterrorism/Operations Security Review Cover Sheet

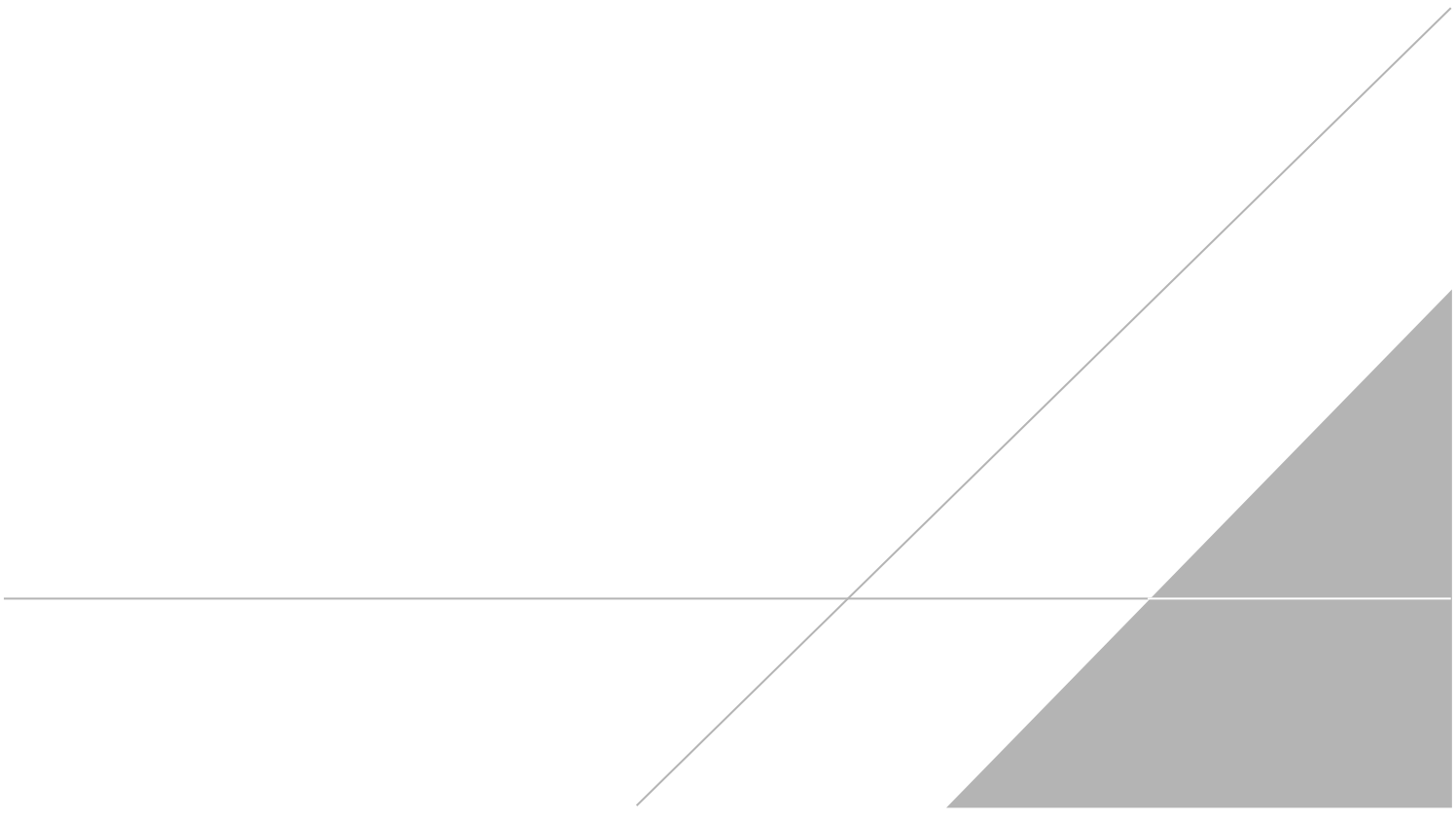


APPENDIX B

GIS Deliverable CD (only included in final electronic copy)

APPENDIX C

Installation PA Quality Control Checklist



APPENDIX D

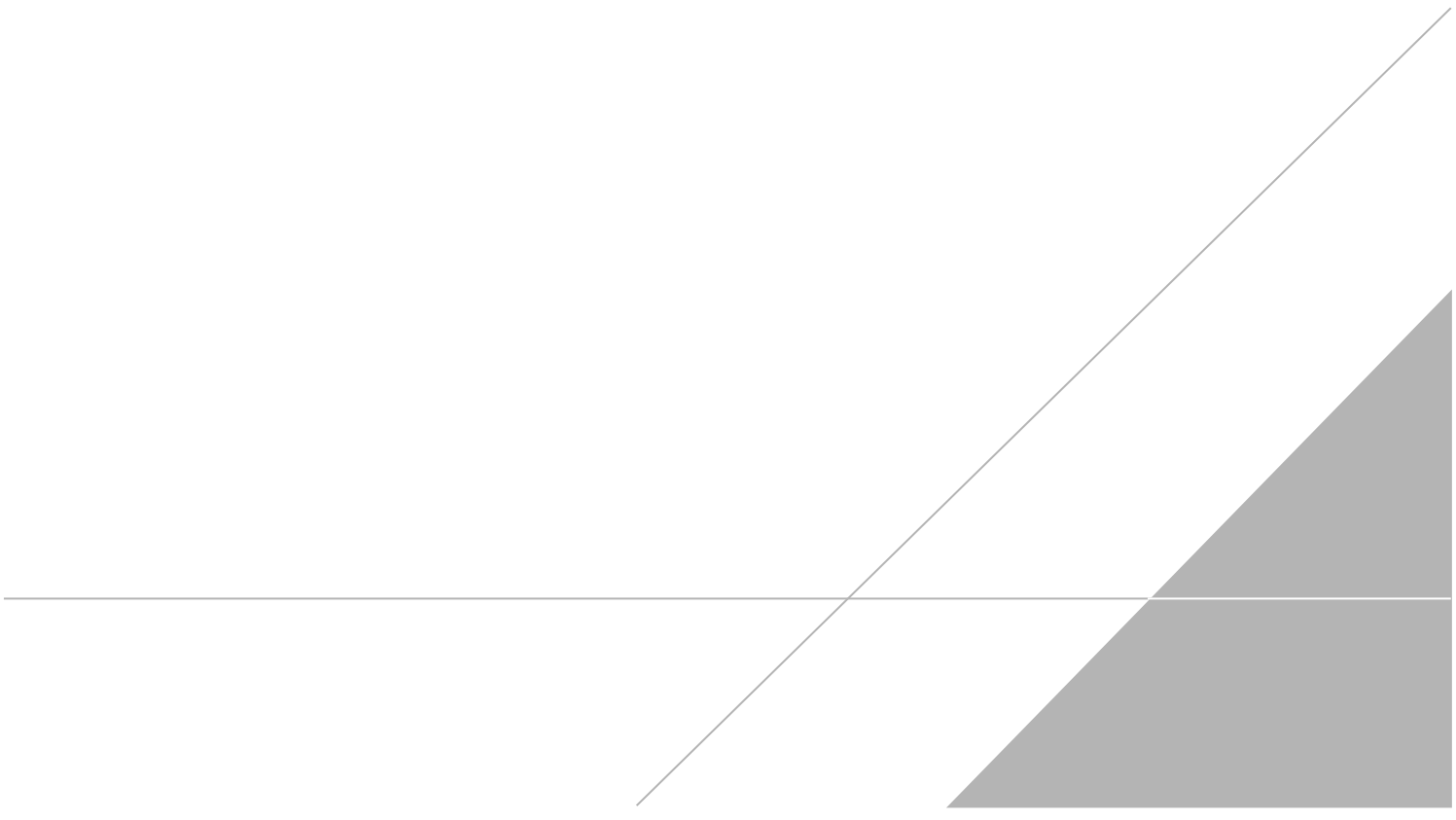
Installation EDR Survey Reports (only included in final electronic copy)

APPENDIX E

Compiled Research Log

APPENDIX F

Compiled Interview Logs



APPENDIX G

Site Reconnaissance Photos

APPENDIX H

Compiled Site Reconnaissance Logs

APPENDIX I

PFAS Analytical Summary Table – Picatinny Arsenal, New Jersey

APPENDIX J

Installation Monitoring Well Inventory