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

Scranton Army Ammunition Plant, Pennsylvania

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U.S. Army Corps of Engineers, Baltimore District
2 Hopkins Plaza
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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Scranton Army Ammunition Plant, Pennsylvania

Kathryn Barry, PhD
Site Inspection Project Manager, Arcadis U.S., Inc.

Rhonda Stone, PMP
Project Manager, Arcadis U.S., Inc.

Jeffrey McDonough, PE
Technical Expert, Arcadis U.S., Inc.

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Prepared by:

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover

Maryland 21076

Arcadis Ref.:

30001997

Date:

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EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This Scranton Army Ammunition Plant (SCAAP) PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense policy and guidance.

SCAAP is located near the center of downtown Scranton, Pennsylvania within Lackawanna County and consists of 15.3 acres. SCAAP is a government-owned, contractor-operated military industrial installation, serving as a manufacturing facility for artillery projectiles. This PA/SI covers the entire installation.

The SCAAP PA identified two AOPIs, which were investigated together during the SI phase. SI sampling results from the AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS. PFOS, PFOA, and PFBS were detected in groundwater; however, PFOS, PFOA, and PFBS were not present at concentrations greater than the risk-based screening levels. The SCAAP PA/SI does not identify the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for no action at this time at each AOPI.

Table ES-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at SCAAP, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels?	Recommendation
	GW	
Forge Shop Building	No	No action at this time
Heat Treat Building	No	No action at this time

Notes:
Soil was not sampled due to uncertainty regarding if and where the floor drains leaked to the subsurface below the AOPIs (**Section 6.2**).

GW – groundwater

1 INTRODUCTION

The United States (U.S.) Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Scranton Army Ammunition Plant (SCAAP) based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether a release has occurred, and the PFOS, PFOA, and PFBS results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, and PFBS risk screening levels to determine whether further investigation is warranted. This report provides the PA/SI for SCAAP and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

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

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water or soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels. The September 2021 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. The OSD risk screening levels for tap water (also used to evaluate groundwater or surface water used as drinking water sources) are 40 ng/L for PFOS and PFOA, and 600 ng/L for PFBS. The PFOS and PFOA soil screening levels for the residential and industrial/commercial scenarios are 0.13 milligrams per kilogram (mg/kg) (residential) and 1.6 mg/kg (industrial/commercial). The soil

screening levels for PFBS are 1.9 mg/kg (residential) and 25 mg/kg (industrial/commercial). These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

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

1.2.1 PA Objectives

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

1.2.2 SI Objectives

An SI is conducted when the PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOPIs to determine whether a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required.

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

1.3 PA/SI Process Description

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

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), SCAAP, and Arcadis U.S., Inc. (Arcadis) on 03 February 2020. Due to a new POC at SCAAP, a second kickoff teleconference was held between POCs from USAEC, SCAAP, and Arcadis on 15 June 2020, which was 5 weeks before the site visit. Discussion included the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and available records requests. The site visit was initially scheduled for March 2020 but was postponed due to the COVID-19 pandemic.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as to gather information on the physical setting and site history at SCAAP.

A read-ahead package was prepared and submitted to the appropriate POCs 2 weeks before the site visit. The read-ahead package contains the following information:

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

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 14 July 2020. An in-brief meeting was held to provide installation staff with the objectives of the site visit and team introductions. **Section 3** includes information regarding personnel interviewed.

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

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

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

deliverables. The exit briefing was conducted on 14 July 2020 with the installation, USAEC, and USACE to discuss preliminary findings of the PA site visit.

1.3.3 Post-Site Visit

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

1.3.4 Site Inspection Planning and Field Work

The SI process was initiated at the installation to evaluate PFOS, PFOA, and PFBS presence or absence at each AOPI and determine whether further investigation is warranted. A combined SI kickoff/scoping teleconference was held between the Army PA team and SCAAP.

The objectives of the combined SI kickoff/scoping teleconference were to:

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

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

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for SCAAP (Arcadis 2020) in **Sections 6.1** through **6.3**.

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

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry and compliant with Table B-15 in the DoD Quality Systems Manual (QSM) 5.3 (DoD and Department of Energy 2019). Laboratory analytical results were then validated and verified by a project chemist to assess the usability of the data collected. Validated analytical results were summarized in the context of OSD risk screening levels (defined in **Section 6.5**).

2 INSTALLATION OVERVIEW

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

2.1 Site Location

SCAAP is located at 156 Cedar Avenue near the center of downtown Scranton, Pennsylvania within Lackawanna County and consists of 15.3 acres (New South Associates, Inc. [NSA] 2020) **(Figures 2-1 and 2-2**). SCAAP is bounded by the Delaware & Lackawanna Railroad tracks and a trolley storage shed for the Electric City Trolley Museum to the north, Cedar Avenue to the east, Mattes Avenue to the southeast, South River Street to the southwest, and South Washington Avenue to the northwest. The installation property is located on a man-made terrace overlooking Roaring Brook and the Lackawanna River, which drains the Wyoming-Lackawanna Valley and merges with the Susquehanna River approximately 8 miles downstream from Scranton (NSA 2020).

2.2 Mission and Brief Site History

The SCAAP complex comprises four major buildings (one administrative and three industrial) and 17 smaller buildings and structures. Most of the installation's grounds are covered by asphalt or concrete, except for a small stretch of grass along South Washington Avenue.

SCAAP is a government-owned, contractor-operated military industrial installation. It is currently under contract with General Dynamics Ordnance and Tactical Systems, Inc. (GD-OTS), which makes artillery projectiles and mortar rounds at the facility.

Construction first occurred on SCAAP in the mid- to late-1850s after the purchase of the land by the Delaware, Lackawanna, and Western Railroad to enlarge the railroad's Scranton yard. Buildings for the Lackawanna Iron and Coal Company were also located on the SCAAP property until the end of the 1800s when the company moved its facilities to New York. The site was reconfigured several times, beginning in the 1870s when the grade and retaining wall were raised, and through the early 1900s when the complex of locomotive repair shops that now house SCAAP's administrative and industrial operations were constructed.

The mission at SCAAP reflects its function as an AMC supply and maintenance installation and government-owned, contractor-operated military industrial installation. The mission of SCAAP is to accomplish the following assignments under contract administration:

1. Operation and maintenance of active facilities in support of current operations. Maintenance and/or layaway of standby facilities (including machinery and package lines received from industry or other government installation) in condition to permit rehabilitation and resumption of production within prescribed time limitations;

2. Procurement, receipt, storage, and issue of necessary supplies, equipment, components, and essential materials;

3. Industrial readiness planning and emergency mobilization planning, including preparation, review, and revision of prescribed plans;

4. Product assurance foundation in support of procurement and production;

5. Production engineering and process engineering;

6. The production and manufacture of metal parts for large caliber ammunition: 105 millimeter (mm) to 155 mm artillery projectiles and the 120 mm family of mortar projectiles (NSA 2020).

2.3 Current and Projected Land Use

Currently SCAAP serves as a manufacturing facility for artillery projectiles. The manufacturing process involves the forging of steel billets into artillery shells through nosing or coining, which gives the billet its projectile shape. The pre-shaped projectile is then rough machined and heat-treated. The projectile is subsequently machine finished, coated with zinc phosphate, and painted. Once the projectile is finished, it is shipped to another DoD facility to be packed and loaded (MEA, Inc. 2000).

There are no plans for construction of any new buildings at SCAAP. Only minimal alteration to and revitalization of existing buildings is planned at SCAAP in the next 5 years as part of general maintenance at the installation (NSA 2020).

2.4 Climate

Pennsylvania weather is broadly characterized by warm summers and cold winters. The following climate statistics were recorded from 1971 to 2000 for Scranton, Pennsylvania. Over a year, the average daily maximum and minimum temperatures are 59.3 degrees Fahrenheit (°F) and 40.4 °F, respectively. The warmest month is July, which averages a high of 82.6 °F, and the coldest month is January, which averages a daily minimum 18.5 °F and a daily maximum of 34.1 °F. The driest month is February, which averages 2.08 inches of rain, and the wettest month is June, which averages 3.97 inches of rain. Scranton averages 38.26 inches of rain per year and 46.2 inches of snow per year (The National Weather Service 2019; NSA 2020).

2.5 Topography

SCAAP sits within a highly industrialized area in Scranton's historic downtown. The installation and the surrounding area are located in man-made and highly disturbed areas, often paved or covered with structures (NSA 2020) (**Figure 2-3**). The installation ground is covered primarily with asphalt or concrete and has a small grassy area proximal to South Washington Avenue. As railroad companies grew in the late 1800's and early 1900's, they re-landscaped the area, including the installation grounds, to support a large railroad yard, locomotive shop, and track. This effort raised the land to the current surface elevation as high as 40 feet above the existing natural grade. The elevation of the installation currently averages approximately 740 feet above mean sea level.

2.6 Geology

SCAAP is within the Wyoming Valley approximately 0.25 mile northeast of where Roaring Brook and the Lackawanna River merge. SCAAP is situated in the Appalachian Mountain section of the Valley and Ridge province, which is characterized by long, thin ridges and broad, flat valleys that run obliquely across Pennsylvania. This section of the province is called the Anthracite Coal Region. It runs southwest to northeast through Lackawanna County and is approximately 6 miles wide. The Appalachian Mountain section forms the Wyoming-Lackawanna Valley and has an outer rim of hard sandstone and Pocono Formation conglomerate mix. The Scranton area, once a glaciated portion of the Appalachian Plateau, is underlain by the Pottsville Formation, which is dominated by sandstone, shale, and anthracite coal deposits. The Pottsville formation forms the inner rim of the valley and consists of layers of Mauch Chunk shale and folded layers of post-Pottsville formation shale, sandstone, conglomerates, and anthracite coal between the inner and outer rim layers (NSA 2020).

The stratigraphy directly below SCAAP is manmade due to construction from railroad companies in the late 1800's and early 1900's. The current surface was elevated approximately 40 feet above the existing natural grade. This construction of the terrace SCAAP currently sits upon entailed building a wall out of a sand and miscellaneous stone conglomerate, then filling the interior area within the wall bounds with coal cinders, slag from iron furnaces, boulders, broken concrete, and native soil (MEA, Inc. 2000).

2.7 Hydrogeology

SCAAP is located approximately 0.25 mile northeast of the Roaring Brook and Lackawanna River confluence in the Wyoming Valley. The area is underlain by the Pottsville Formation, with sandstone shale and anthracite coal deposits. SCAAP is located on an artificial terrace 40 feet above Roaring Brook. In the 1860s, a near vertical stone retaining wall was constructed (MEA, Inc. 2000).

Overall groundwater flow direction is toward the Lackawanna River, which is west and slightly northwest of the site. Groundwater is encountered in fill and shallow bedrock. Depth to water is approximately 28 to 49 feet (from top of casing). It is considered unlikely that the aquifer underlying downtown Scranton will be used in the future. The City of Scranton currently mandates use of city water by ordinance. One of the underlying aquifers is the “mine pool,” which is not considered potable without pretreatment (MEA, Inc. 2000).

2.8 Surface Water Hydrology

Roaring Brook runs adjacent (southeast) to SCAAP and merges with the Lackawanna River approximately 0.25 mile downstream from the installation. The Lackawanna River, a 62-mile-long river flowing northeast to southwest through Scranton, is part of the Chesapeake Bay Watershed, draining approximately 350 square miles within Susquehanna, Wayne, Lackawanna, and Luzerne counties (NSA 2020).

2.9 Relevant Utility Infrastructure

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

2.9.1 Stormwater Management System Description

Since the mid- to late-1990s, stormwater from the impervious surfaces of SCAAP has been collected, filtered, then discharged through a single outfall to Roaring Brook. Prior to the addition of filtration in the 1990s, stormwater was still gathered and discharged through a single outfall to Roaring Brook (**Appendix G**). In April 2010, SCAAP initiated a rooftop rainwater collection system that can capture more than 2,500,000 gallons of rainwater per year. The water diverted from discharge to Roaring Brook then serves as cooling water in production operations (Davidson 2012).

2.9.2 Sewer System Description

SCAAP's industrial and sanitary wastewater are discharged to the sanitary sewer. The Scranton Sewer Authority treatment plant is owned by Pennsylvania American Water Company. Floor drains throughout the installation are connected to the sanitary sewer. SCAAP has a wastewater pretreatment plant dedicated to the zinc phosphating process that was installed in the mid- to late-2010s (**Appendix G**).

2.10 Potable Water Supply and Drinking Water Receptors

No on-post potable wells were identified at SCAAP. The installation purchases its water from Pennsylvania American Water Company– Lake Scranton (Tetrahedron, Inc. 2018). Raw drinking water sources are Lake Scranton; Elmhurst, Williams Bridge, Curtis, and Hollister Reservoirs; and nine groundwater supplies in the Abington District (Pennsylvania American Water 2020).

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report generated for SCAAP, along with Pennsylvania Groundwater Information System data, identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4**). The nearest off-post potable well is approximately 0.3 mile northeast of the installation. All other identified potable wells are more than 1.5 miles away from the installation boundary. The EDR report providing well search results is provided as **Appendix E**. No downstream potable surface water supplies were identified within the 5-mile radius.

2.11 Ecological Receptors

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

The only vegetation at SCAAP is a grassy area along South Washington Avenue and several trees near the installation entrance. Due to SCAAP's completely industrialized landscape, little wildlife is observed at

the installation. However, urbanized areas along the nearby Lackawanna River have been reported to support squirrels, raccoons, woodchucks, skunks, opossums, and beavers (NSA 2000).

2.12 Previous PFAS Investigations

PFAS sampling has not previously been undertaken at SCAAP.

3 SUMMARY OF PA ACTIVITIES

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

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

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

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various installation documents, compliance documents, infrastructure maps, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for SCAAP is provided in **Appendix F**.

3.2 Personnel Interviews

Interviews were conducted during the site visit, except for the Former Facility Engineer and Retired Plant Clearance Officer (interviewed by phone prior to the PA site visit) and the Scranton Fire Department personnel (interviewed by phone after the PA site visit). The list of roles for the installation personnel interviewed during the PA process for SCAAP is presented below (affiliation is with SCAAP unless otherwise noted).

- Facility Engineer
- Former Facility Engineer
- Retired Facility Engineer
- Retired Plant Clearance Officer
- Environmental Health and Safety Manager (GD-OTS)
- Paint Line Supervisor (GD-OTS)
- Acting Deputy Chief (Scranton Fire Department)

- Retired Deputy Chief (Scranton Fire Department)

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

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at SCAAP during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. A photo log from the site reconnaissance is provided in **Appendix H**; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in **Appendix I**.

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

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

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

4.1 AFFF Use, Storage, and Disposal Areas

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

During site reconnaissance of the Forge Shop Building, the building's fire suppression system was observed. It includes a 300-gallon AFFF aboveground storage tank containing Chemguard C303 AFFF. According to an interview with the SCAAP Facility Engineer and GD-OTS Environmental Health and Safety Manager, there have been no AFFF releases related to fire suppression or testing since its installation circa 2017. The 2018 safety data sheet (SDS) provided by the installation did not identify PFAS in the product (Tyco Fire Protection Products 2018). However, a version updated in 2020 includes PFOA in the listing of California Proposition 65 chemicals included in the product, though it is not listed in the "Composition/information on ingredients" section of the SDS (Tyco Fire Protection Products 2020).

A 55-gallon drum of Chemguard C3B AFFF is stored next to the AFFF fire suppression system tank. According to an interview with the SCAAP Facility Engineer, this product was reportedly initially ordered, but never opened after the fire suppression system supplier recommended using a different AFFF product. The SDS includes PFOA in the listing of California Proposition 65 chemicals included in the product, though it is not listed in the "Composition/information on ingredients" section of the SDS (Tyco Fire Protection Products 2019).

According to an interview with a retired SCAAP Plant Clearance Officer, both the Forge Shop Building and the Heat Treat Building had furnace fire suppression systems from the mid-1960s to the early 1980s that relied on foam for fire suppression. When a fire ignited inside a furnace stack during this period, foam was released within the stack to extinguish the fire, then fell out of the bottom of the stack. After the fire was extinguished, water hoses were used to wash the foam into the floor drains, which historically

drained to Roaring Brook. It is unknown whether there was any migration to subsurface soil and groundwater via floor drains and/or leaks and cracks in the building drainage system. It is also unknown whether the foam used was PFAS-containing AFFF.

Analysis of data collected from site reconnaissance, installation personnel interviews, and records review did not identify fire stations or fire training areas at SCAAP. The installation does not have its own fire department, so there has been no additional storage of AFFF or training activities at SCAAP.

The Scranton Fire Department provides fire response services to SCAAP. During site visit interviews with multiple SCAAP employees, it was noted that the Scranton Fire Department has responded to fire emergencies at SCAAP, but that AFFF was not used during the interviewees' tenure at SCAAP. This was confirmed during the interviews with the Scranton Fire Department Acting Deputy Chief and the retired Deputy Chief, who did not remember AFFF being used during fire response at SCAAP. The retired Deputy Chief was associated with the Scranton Fire Department beginning in 1983, so details of fire department response activities at SCAAP prior to 1983 are unknown.

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

Following document research, personnel interviews, and site reconnaissance at SCAAP, Tank #5 in the Paint Department of the Production Shop Building was also identified as a preliminary location for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for the preliminary location is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1,** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

PFAS, specifically PFOS, have been used in metal plating operations as surface tension-reducing wetting agents to mitigate the release of aerosolized chemicals into a working environment. Hard chromium plating is one type of metal plating operation where PFAS-containing mist suppressants were commonly used. From the early 1980s to early 1990s, a chromium rinse was sprayed as part of the phosphatizing process performed in the Paint Department of the Production Shop Building. Though not chromium plating, this historical application of chromium suggested the possibility of PFAS-containing mist suppressant use at SCAAP. However, the chromium spraying operation was completely enclosed in Tank #5, no chromium plating baths were used, and there is no known use of PFAS-containing mist suppressants. Chromium has not been used in this system in the past 17 years according to SDSs provided and SCAAP personnel interviews.

4.3 Readily Identifiable Off-Post PFAS Sources

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

Nearby community fire departments could potentially be off-post PFAS sources within close proximity of SCAAP if they use AFFF. There are 14 fire departments or stations with garages for fire trucks within 5 miles of the installation boundary. Reilly Finishing Technologies, a provider of metal plating services, is located approximately 1.5 miles east-northeast of the installation. Advanced Textile Composites, Inc., a manufacturer of industrial textiles with coatings, resins, and other treatments, is located within 3 miles of

the installation boundary to the northeast. North American Manufacturing, a manufacturer of military grade furniture, personal protective equipment, and other products potentially containing PFAS, is located approximately 1.3 miles north-northeast of the installation boundary.

5 SUMMARY AND DISCUSSION OF PA RESULTS

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

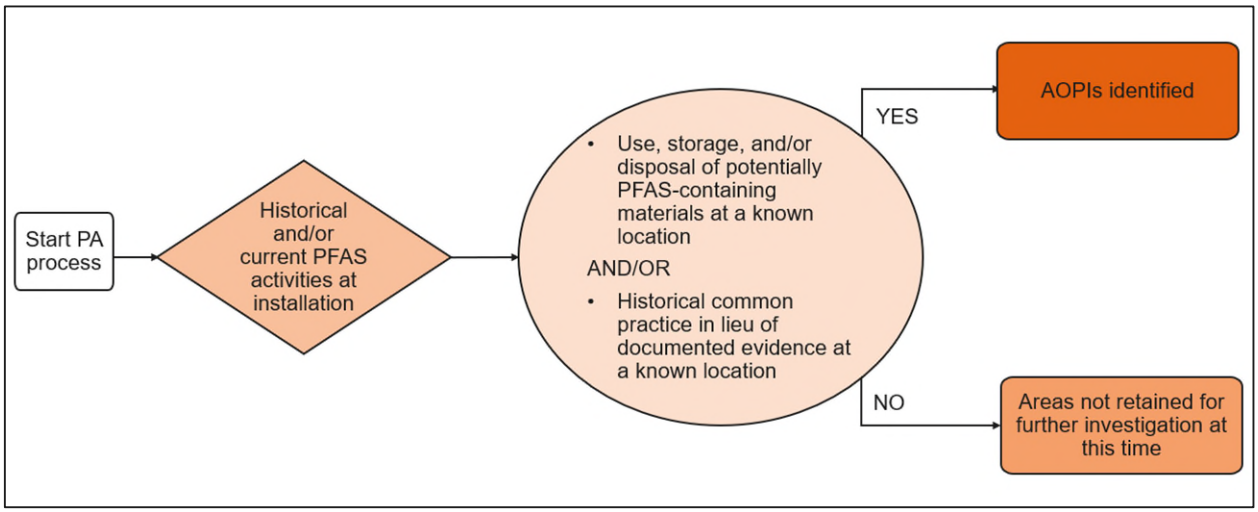

Figure 5-1: AOPI Decision Flowchart

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

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

5.1 Areas Not Retained for Further Investigation

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

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

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

Area Description	Dates of Operation	Relevant Site History	Rationale
#5 Tank Chromium Spraying	Early 1980s to early 1990s	The phosphatizing process included spraying chromium within a sealed tank.	Based on personnel interviews, SDS review, and process research, there is no evidence of PFAS-containing materials being used, stored, and/or disposed of at this location.

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. None of the AOPIs overlap with Installation Restoration Program sites or Headquarters Army Environmental System sites. At the time of this PA, SCAAP has not historically or currently been investigated for the possible presence of PFAS.

The AOPI locations are shown on **Figure 5-2**. This aerial photograph of the AOPIs also includes existing monitoring wells in the vicinity of each AOPI.

5.2.1 Forge Shop Building

The Forge Shop Building is identified as an AOPI following personnel interviews and site reconnaissance due to the storage of AFFF (**Figure 5-2**). During site reconnaissance in the Forge Shop Building, the fire suppression system on the furnace side of the building was observed. It includes a 300-gallon AFFF aboveground storage tank containing Chemguard C303 AFFF.

A 55-gallon drum of Chemguard C3B is stored next to the AFFF fire suppression system tank. This product was reportedly initially ordered, but never opened or used after the fire suppression system supplier recommended using a different AFFF product.

According to an interview with a retired SCAAP Plant Clearance Officer, the Forge Shop Building had a furnace fire suppression system from the mid-1960s to the early 1980s that relied on foam for fire suppression. When a fire ignited inside a furnace stack during this period, foam was released within the stack to extinguish the fire and then fell out of the bottom of the stack. After the fire was extinguished, water hoses were used to wash the foam into the floor drains, which historically drained to Roaring Brook. It is unknown whether the foam used was PFAS-containing AFFF.

The Forge Shop Building has a concrete floor with concrete pits below the furnaces. According to an interview with the SCAAP Facility Engineer, these pits are emptied with a vacuum truck and were epoxy-lined in the early 2000s due to cracks in the concrete. There are currently no other drains near the furnaces in the Forge Shop Building. The current and future land use of this building is industrial.

5.2.2 Heat Treat Building

The Heat Treat Building is identified as an AOPI following personnel interviews due to the historical storage and use of AFFF (**Figure 5-2**). Similar to the Forge Shop Building, the Heat Treat Building had a

furnace stack fire suppression system from the mid-1960s to mid-1980s that relied on foam for fire suppression. According to an interview with a retired SCAAP Plant Clearance Officer, when a fire ignited inside a furnace stack during this period, foam was released within the stack to extinguish the fire and then fell out of the bottom of the stack, as also occurred in the Forge Shop Building. After the fire was extinguished, water hoses were used to wash the foam into the floor drains, which historically drained to Roaring Brook. It is unknown whether the foam used was PFAS-containing AFFF.

The Heat Treat Building has a concrete floor with concrete pits below the furnaces. According to an interview with the SCAAP Facility Engineer, these pits are emptied with a vacuum truck and were epoxy-lined in the early 2000s due to cracks in the concrete. Floor drains in between the furnaces (external to the pits) tie into the stormwater system. The current and future land use of this building is industrial.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at SCAAP, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at SCAAP at both AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2020) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A combined preliminary CSM was prepared for the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). A combined CSM was developed for the AOPIs because source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. The preliminary CSM identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSM identified soil, groundwater, surface water, and/or sediment pathways as potentially complete, which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on the AOPIs' preliminary CSM. The SI scope of work was completed in August 2021 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2020) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at SCAAP. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2020), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater for PFOS, PFOA, and PFBS presence or absence at the sampled AOPIs.

6.2 Sampling Design and Rationale

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

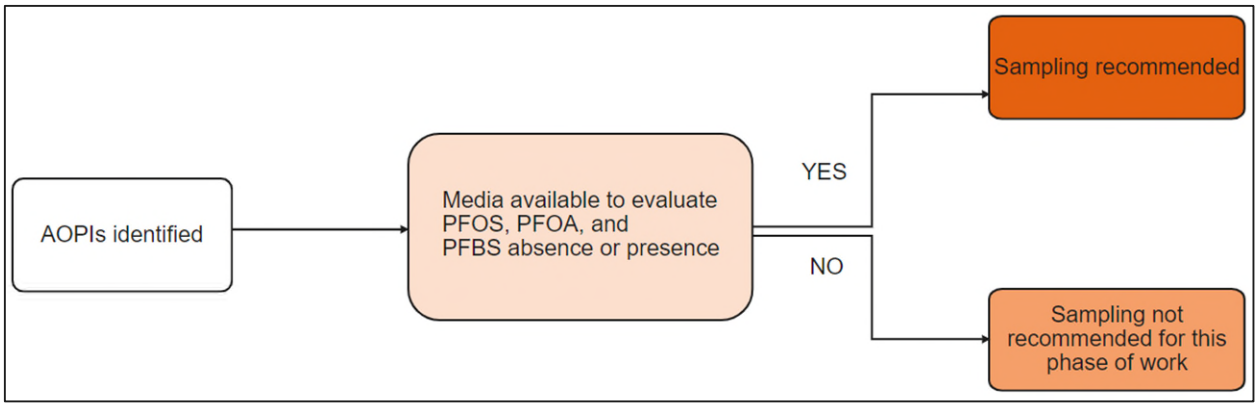

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at SCAAP is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020). Briefly, groundwater samples were collected to inform the interpretation of PFOS, PFOA, and PFBS presence and update the CSM. The two AOPIs identified by the PA were investigated together during the SI phase through collection of groundwater samples from three existing monitoring wells (one upgradient and two downgradient of the AOPIs).

The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. **Table 6-1** includes the monitoring well construction details for the wells sampled during the SI.

Soil was not sampled due to uncertainty regarding if and where the floor drains leaked to the subsurface below the buildings. Sediment from Roaring Brook was not sampled due to the presence of a concrete lining that exists from near the outfall location downstream to the confluence with the Lackawanna River.

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2020), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2020). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2020). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices J** and **K**, respectively.

6.3.1 Field Methods

Due to the long period of time that had elapsed since the existing site monitoring wells were last utilized, they were redeveloped via a modified pump and surge methodology (Arcadis 2020) and then sampled four days after redevelopment.

Groundwater samples were collected from three existing monitoring wells from approximately the center of the saturated screened interval. Field parameters (temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) were measured during purging and allowed to stabilize in accordance with the TGI for PFAS Sampling Procedures and Low-Flow Groundwater Purging for Monitoring Wells (P-11 in Appendix A to the PQAPP, Arcadis 2019) (or purged for a maximum of 20 minutes, whichever is sooner) before groundwater sampling to ensure a representative sample was collected and, potentially, to inform the interpretation of analytical data.

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

6.3.2 Quality Assurance/Quality Control

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

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, and PFBS. EBs were collected for media sampled for PFOS, PFOA, and PFBS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable equipment from which EBs were collected include a water-level meter, tubing/pump, a bladder from the bladder pump, and brushes used for redevelopment as applicable to the sampled media. Analytical results for blank samples are discussed in **Section 7.3**.

6.3.3 Field Change Reports

No minor or major modifications or non-conformances to the approved sampling scope and/or procedures occurred during the sampling event.

6.3.4 Decontamination

Non-dedicated reusable sampling equipment (e.g., water-level meters) that came into direct contact with sampling media was decontaminated before first use, between sampling locations/intervals, and before demobilization in accordance with P-09, TGI - Groundwater and Soil Sampling Equipment Decontamination (Arcadis 2019, Appendix A).

6.3.5 Investigation-Derived Waste

IDW, including groundwater and decontamination fluids, were containerized and temporarily stored in a frac tank onsite. Once confirmation was received that samples sent to the lab did not have PFAS concentrations above the OSD risk screening levels, the IDW was disposed of in the stormwater treatment system onsite on 04 October 2021.

Equipment IDW was collected in bags and disposed in municipal waste receptacles. Equipment IDW includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) that may come in contact with sampling media. Analytical results for IDW samples collected during the SI are discussed in **Section 7.2**.

6.4 Data Analysis

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

6.4.1 Laboratory Analytical Methods

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

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

6.4.2 Data Validation

All analytical data generated during the SI, except data generated from IDW profiling, were verified and validated in accordance with the data verification procedures described in Worksheets #34 through #36 of the PQAPP (Arcadis 2019). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with DoD QSM 5.3 (DoD and Department of Energy 2019). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation reports for each sample delivery

group are included as attachments to the DUSR in **Appendix L**. The Level IV analytical reports are included within **Appendix L** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

A data usability assessment was completed for all analytical data associated with SI sampling at SCAAP. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix L**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE 2005), the Final DoD General Data Validation Guidelines (DoD 2019) and the Final DoD Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD 2020), that reviewed precision, accuracy, completeness, representativeness, comparability, and sensitivity. A statement of overall data usability is included in the DUSR.

Based on the final data usability assessment, the environmental data collected at SCAAP during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix L**), and as indicated in the full analytical tables (**Appendix M**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and SCAAP QAPP Addendum (Arcadis 2020). It should be noted that the temperature of equipment blank and IDW samples collected on 12 August 2021 exceeded 4 degrees Celsius when measured upon receipt at the laboratory. Perfluoroalkyl acids are recalcitrant to biological degradation on the timescale between sampling and arrival at the laboratory. In addition, if elevated temperatures facilitated precursor transformation in the samples, the resulting PFAS compounds would have been detected by laboratory analytical method and reported. Therefore, the data are usable. Data qualifiers applied to laboratory analytical results for samples collected during the SI at SCAAP are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

Chemical	Residential Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator		Industrial/Commercial Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator
	Tap Water (ng/L or ppt) [1]	Soil (mg/kg or ppm) [1,2]	Soil (mg/kg or ppm) [1,2]
PFOS	40	0.13	1.6
PFOA	40	0.13	1.6
PFBS	600	1.9	25

Notes:

1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September 15 (**Appendix A**).
2. No soil or sediment samples were collected during the SI; therefore, no data will be screened against the Residential Scenario or Industrial/Commercial soil risk screening levels.
mg/kg = milligrams per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater data for this Army PFAS PA/SI. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, or PFBS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at SCAAP (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2020). The sample results discussion below focuses on the PFOS, PFOA, and PFBS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Table 7-1 provides a summary of the groundwater analytical results for PFOS, PFOA, and PFBS. **Table 7-2** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix M** includes the full suite of analytical results for these media, as well as for the QA/QC samples. **Figure 7-1** shows the PFOS, PFOA, and PFBS analytical results in groundwater for the AOPIs. Non-detected results are reported as less than the LOQ. There were no detections of PFOS, PFOA, or PFBS greater than the applicable OSD risk screening levels. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion. Groundwater was generally first encountered at depths of approximately 28 feet below the top of well casing near the installation's eastern boundary (MW-16) and approximately 72 to 76 feet below top of well casing along the western boundary (MW-19 and MW-18, respectively).

Field parameters measured for groundwater during low-flow purging and sample collection and for surface water during sample collection are provided on the field forms in **Appendix K**.

Table 7-2 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Forge Shop Building	No
Heat Treat Building	

7.1 Forge Shop Building and Heat Treat Building Groundwater

This section summarizes the groundwater PFOS, PFOA, and PFBS analytical results associated with the Forge Shop Building and the Heat Treat Building. Due to the proximity of the buildings and a single set of existing monitoring wells representing upgradient and downgradient groundwater for both AOPIs, they were investigated together.

Groundwater samples were collected from three existing monitoring wells at the Forge Shop Building and Heat Treat Building AOPIs (SCAAP-MW-16 [upgradient of the AOPIs] and SCAAP-MW-18 and SCAAP-MW-19 [downgradient of the AOPIs]; **Figure 7-1**])**.** The groundwater samples were collected from the middle of the screened interval. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and/or PFBS were detected in the samples collected; however, there were no exceedances of OSD screening levels.

PFOS was detected below the OSD risk screening level of 40 ng/L at MW-16 (field duplicate, 2.1 J [analyte was positively identified; however, the associated numerical value is an estimated concentration only] ng/L, MW-18 (16 ng/L) and MW-19 (9.8 ng/L). PFOA was detected below the OSD risk screening level of 40 ng/L only at MW-18 (9.4 ng/L). PFBS was detected below the OSD risk screening level of 600 ng/L at MW-16 (3.1 J ng/L in the primary sample; 3.5 ng/L in the field duplicate) and MW-19 (1.8 J ng/L).

7.2 Investigation Derived Waste

A composite sample of the redevelopment purge water and decontamination wastewater was collected from the frac tank that was stored onsite. The PFOS, PFOA, and PFBS concentrations observed did not exceed the OSD risk screening levels. The results indicated the following concentrations in the wastewater: 12 ng/L PFOS, 10 ng/L PFOA, and no detection of PFBS. The IDW water was disposed of in the stormwater treatment system onsite.

The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix M**. A discussion of the sample's temperature exceedance upon receipt at the laboratory is included in **Section 6.4.3**.

7.3 Blank Samples

PFOS, PFOA, and/or PFBS were not detected in any of the blank samples collected during the SI work. The full analytical results for blank samples collected during the SI are included in **Appendix M**. A discussion of the temperature exceedance of three equipment blanks upon receipt at the laboratory is included in **Section 6.4.3**.

7.4 Conceptual Site Model

The preliminary CSM presented in the QAPP Addendum (Arcadis 2020) was re-evaluated and updated, if necessary, based on the SI sampling results. The CSM presented on **Figure 7-2** and in this section therefore represents the current understanding of the potential for human exposure. For both AOPIs, the CSM is the same and is therefore shown on the same figure.

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

Based on the use and/or storage of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment. Generic categories of potential human

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

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

Figure 7-2 shows the CSM for the Forge Shop Building and Heat Treat Building AOPIs. A combined CSM was developed for the AOPIs because source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. Firefighting foam was historically released from fire suppression systems in the furnace stacks of buildings at both AOPIs. After fires were extinguished, water hoses were used to wash the foam into floor drains that likely discharged to Roaring Brook or to the subsurface at that time. Based on the historical use of firefighting foam at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment. Release and transport mechanisms include dissolution in rinse water through the building drainage systems, discharge to surface water and sediment via the outfall on Roaring Brook, migration to subsurface soil and groundwater via floor drains and/or leaks and cracks in the building drainage system, shallow groundwater discharge to the Lackawanna River, and adsorption/desorption between surface water and sediment.

The following exposure pathway determinations apply to both AOPIs:

- There are no residents or recreational users at SCAAP. Therefore, all exposure pathways for on-installation residents and recreational users are incomplete.
- Soil samples were not collected during the SI due to uncertainty regarding if and where the floor drains leaked to the subsurface below the buildings (**Section 6.2**). If PFOS, PFOA, and/or PFBS are present in subsurface soil and future maintenance of building drainage systems, demolition, or construction occurs at the AOPIs, site workers (e.g., utility maintenance workers or future construction workers) could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the subsurface soil exposure pathway for on-installation site workers is potentially complete under a potential future exposure scenario (e.g., future utility work, building demolition, or construction).
- The AOPIs are not likely to be regularly accessed by off-installation receptors. Therefore, the soil exposure pathway for these receptors is incomplete.

- Installation groundwater is not used as a potable water source. A deed notification is in place restricting the installation's groundwater from being used for drinking water or agricultural purposes, and the City of Scranton currently mandates use of city water when reasonably available. Therefore, future drinking water well installations on-post are unlikely. SCAAP purchases its drinking water from Pennsylvania American Water Company – Lake Scranton. Lake Scranton is upgradient of the AOPIs. Therefore, the groundwater and surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers are incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at the Forge Shop Building and Heat Treat Building AOPIs. Groundwater generally flows west and northwest off-post towards the Lackawanna River. While City of Scranton ordinance requires connection to the public water supply when it is reasonably available, there are potable water wells located within a 5-mile radius of the installation. Therefore, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- There are no surface water bodies on-post. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation site workers are incomplete.
- Discharges from the building drainage system via the outfall on Roaring Brook are historical; therefore, presence of PFOS, PFOA, and/or PFBS in Roaring Brook surface water is not expected. Since the time that historical releases occurred, Roaring Brook has been concrete lined, eliminating the potential for human exposure to PFOS, PFOA, and/or PFBS that could be present in sediment. Therefore, the Roaring Brook surface water and sediment exposure pathways for off-installation receptors are incomplete.
- Surface water bodies within 5 miles downstream of the installation are not currently used, and are unlikely to be used in the future, as drinking water sources. Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation drinking water receptors is incomplete. However, recreational users could contact constituents in the Lackawanna River through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Following the SI sampling, both AOPIs were considered to have potentially complete exposure pathways. Although the CSM indicates potentially complete exposure pathways exist, the recommendation for remedial investigation is based on the comparison of analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2).**

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at SCAAP based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances (Army 2018). The SI included sampling at AOPIs to determine whether a release of PFOS, PFOA, and PFBS to the environment occurred.

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

No on-post potable wells were identified at SCAAP, which purchases its water from Pennsylvania American Water Company – Lake Scranton. The nearest off-post potable well is approximately 0.3 mile northeast of the installation and all other identified potable wells are more than 1.5 miles away from the installation boundary.

Both AOPIs identified were sampled during the SI at SCAAP to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the SCAAP QAPP Addendum (Arcadis 2020).

Both AOPIs had detections of PFOS, PFOA, and PFBS in groundwater; however, PFOS, PFOA, and PFBS were not present at concentrations greater than the OSD risk screening levels. The maximum concentrations of PFOS and PFOA detected in groundwater were 16 ng/L and 9.4 ng/L, respectively, in MW-18. The maximum concentration of PFBS in groundwater was 3.1 J ng/L, detected in MW-16.

Following the SI sampling, the Forge Shop Building and Heat Treat Building AOPIs had confirmed PFOS, PFOA, and/or PFBS presence and were considered to have potentially complete exposure pathways. The subsurface soil exposure pathway for on-installation site workers is potentially complete because they (e.g., utility maintenance workers or future construction workers) could contact constituents via incidental ingestion, dermal contact, or inhalation of dust. The groundwater exposure pathway for off-installation drinking water receptors is potentially complete because there are potable water wells within a 5-mile radius of the installation. The surface water and sediment exposure pathways for off-installation recreational users are potentially complete because recreational users could contact constituents in the Lackawanna River through incidental ingestion and dermal contact.

Although the CSM indicates potentially complete exposure pathways exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at SCAAP, PFOS, PFOA, and PFBS sampling, and recommendations for each AOPI; further investigation is not warranted at SCAAP.

Table 8-1 Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at SCAAP, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels?	Recommendation
	GW	
Forge Shop Building	No	No action at this time
Heat Treat Building	No	No action at this time

Notes:
Soil was not sampled due to uncertainty regarding if and where the floor drains leaked to the subsurface below the AOPIs (**Section 6.2**).

GW – groundwater

Data collected during the PA (**Sections 3** through **5**) and SI (**Sections 6** and **7**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, and PFBS at SCAAP are discussed below.

Generally, there was not an exhaustive search performed to identify off-post PFAS sources, as this investigation is focused on the installation property. Additionally, the identity and volumes of the foam historically used for fire suppression in the furnace stacks of the Forge Shop Building and Heat Treat Building is unknown. There is also uncertainty regarding migration to subsurface soil and groundwater via floor drains and/or leaks and cracks in the building drainage system in these buildings. The SDSs of all products historically used in Tank #5 of the Production Shop were unavailable to confirm mist suppressants were not used (i.e., PFAS-containing materials were not used).

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, and PFBS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

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

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

Finally, only groundwater was sampled for PFOS, PFOA, and PFBS. Available data, including PFOS, PFOA, and PFBS, is listed in **Appendix M**, which were analyzed per the selected analytical method.

Results from this PA/SI indicate further study in a remedial investigation is not warranted at SCAAP in accordance with the guidance provided by the OSD.

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ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
AMC	Army Materiel Command
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DoD	Department of Defense
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
GD-OTS	General Dynamics Ordnance and Tactical Systems, Inc.
GIS	geographic information system
GW	groundwater
IDW	investigation-derived waste
installation	United States Army or Reserve installation
J	The analyte was positively identified; however, the associated numerical value is an estimated concentration only
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
mm	millimeter
NSA	New South Associates, Inc.
ng/L	nanograms per liter (parts per trillion)
OSD	Office of the Secretary of Defense
PA	preliminary assessment

PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SCAAP	Scranton Army Ammunition Plant
SDS	safety data sheet
SI	site inspection
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TGI	technical guidance instruction
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency

TABLES

Table 6-1 Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Scranton Army Ammunition Plant, Pennsylvania

Area of Potential Interest	Sampling Location ID	Total Well Depth$_1$ (ft bgs)	Total Well Depth$_2$ (ft toc)	Top of Casing Elevation$_3$ (ft)	Depth to Groundwater$_2$ (ft btoc)	Groundwater Elevation (ft)	Screened Interval$_1$ (ft bgs)	Casing Diameter (inches)	Dedicated Equipment (Yes/No)
Forge Shop Building and Heat Treat Building	MW-16	50	46.15	499.88	27.34	472.54	28.5-48.5	4	No
	MW-18	110	109.47	504.00	76.91	427.09	70-110	4	No
	MW-19	104	104.36	500.50	72.81	427.69	74-104	4	No

Acronyms/Abbreviations:
bgs - below ground surface
btoc - below top of casing
ft - feet
ID - identification
toc - top of casing

Sources:
1. Scranton Army Ammunition Plant
2. Measurements from March 2021 field event
3. MEA, Inc. 2000

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Scranton Army Ammunition Plant, Pennsylvania

					Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
					OSD Tapwater RiskScreening Level	40		40		600	
Associated AOPI	Location Type	Location	Sample ID / Parent Sample ID	Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Forge Shop and Heat Treat Buildings AOPIs	Monitoring Well	SCAAP-MW-16	SCAAP-FD-01-081621 / SCAAP-MW-16-081621	08/16/2021	FD	**2.1**	J	3.5	U	**3.5**	
			SCAAP-MW-16-081621	08/16/2021	N	3.4	U	3.4	U	**3.1**	J
	Monitoring Well	SCAAP-MW-18	SCAAP-MW-18-081621	08/16/2021	N	**16**		**9.4**		3.6	U
	Monitoring Well	SCAAP-MW-19	SCAAP-MW-19-081621	08/16/2021	N	**9.8**		3.5	U	**1.8**	J

Notes:
Bolded values indicate the result was detected greater than the limit of detection.

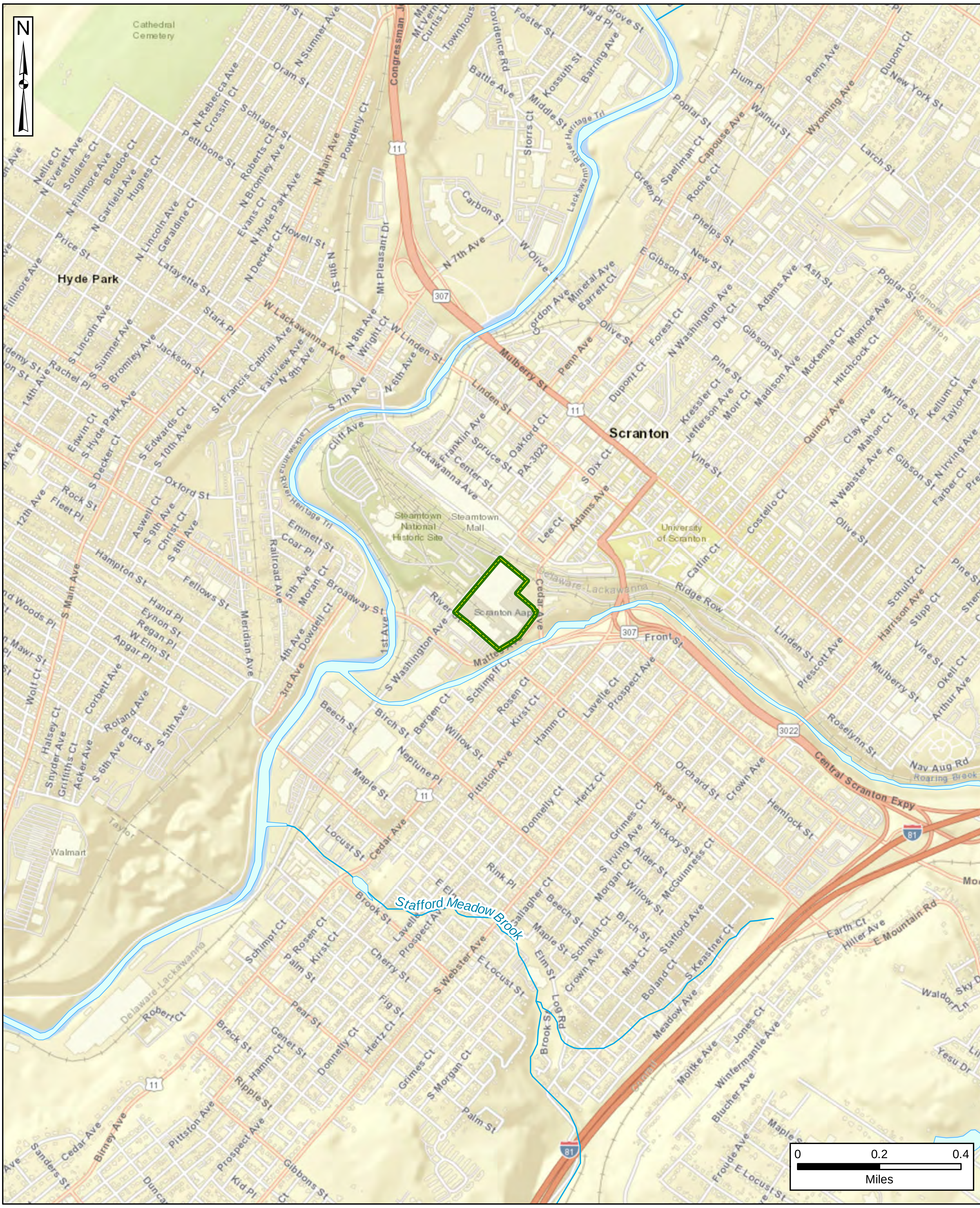
Acronyms/Abbreviations:
AOPI = area of potential interest
FD = field duplicate sample
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
OSD = Office of the Secretary of Defense
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier
SCAAP = Scranton Army Ammunition Plant

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

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 2-1
Site Location



Installation Boundary

River/Stream (Perennial)

Water Body

Data Sources:
USGS, NHD Data, 2020
ESRI ArcGIS Online, World Street Map

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 2-2
Site Layout

Installation Boundary

Monitoring Well

Data Sources:
MEA, Inc., *Final Report Scranton Army Ammunition Plant, Scranton, Pennsylvania*, 2000;
USGS, NHD Data, 2020;
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 2-3
Site Topography

Installation Boundary

River/Stream (Perennial)

Water Body

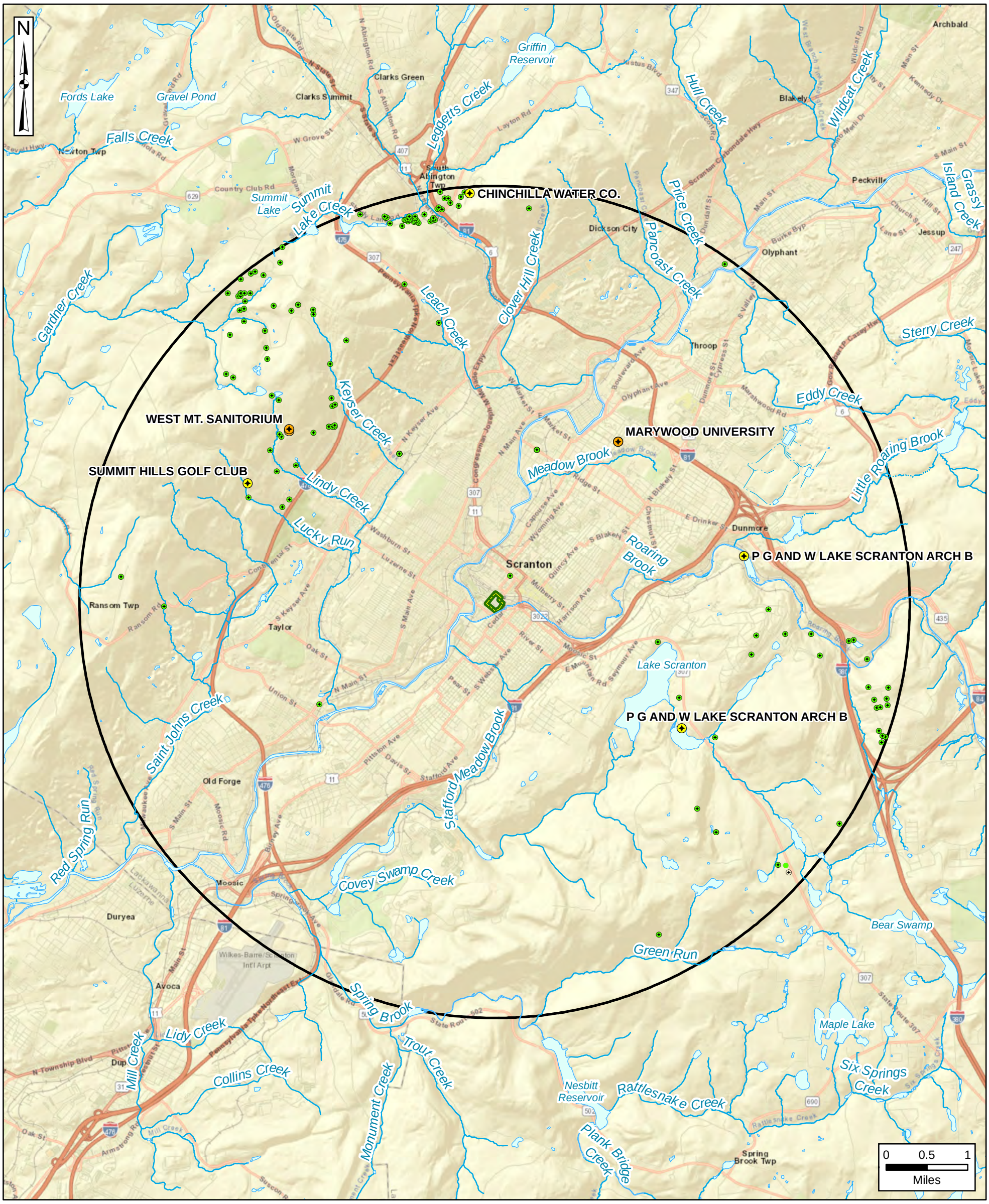
Elevation Contour (feet)

Data Sources:
USGS, NHD Data, 2020
USGS, Elevation Data, 2020
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 2-4
Off-Post Potable Supply Wells



Installation Boundary

5-Mile Radius

Public Water System Supply Well (EDR)

Institutional Well (PaGWIS)

Domestic Well (PaGWIS)

Note: Public water supply system labels are as provided in the EDR Report. See Appendix E for further information.

EDR = Environmental Data Resources, Inc.
PaGWIS = Pennsylvania Groundwater Information System

Data Sources:
EDR, Well Data, 2020
PaGWIS, Well Data, 2020
USGS, NHD Data, 2020
ESRI ArcGIS Online, World Street Map

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 5-2
AOPI Locations

Installation Boundary

AOPI

Monitoring Well

Groundwater Flow Direction

(427.09) Groundwater Elevation (March 2021) (feet)

AOPI = area of potential interest

Data Sources:
MEA, Inc., *Final Report Scranton Army Ammunition Plant, Scranton, Pennsylvania*, 2000;
USGS, NHD Data, 2020;
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North

USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 7-1
Forge Shop Building and Heat Treat Building AOPIs
PFOS, PFOA, and PFBS Analytical Results

Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Duplicate sample results are shown in brackets.
3. Bolded values indicate detections.

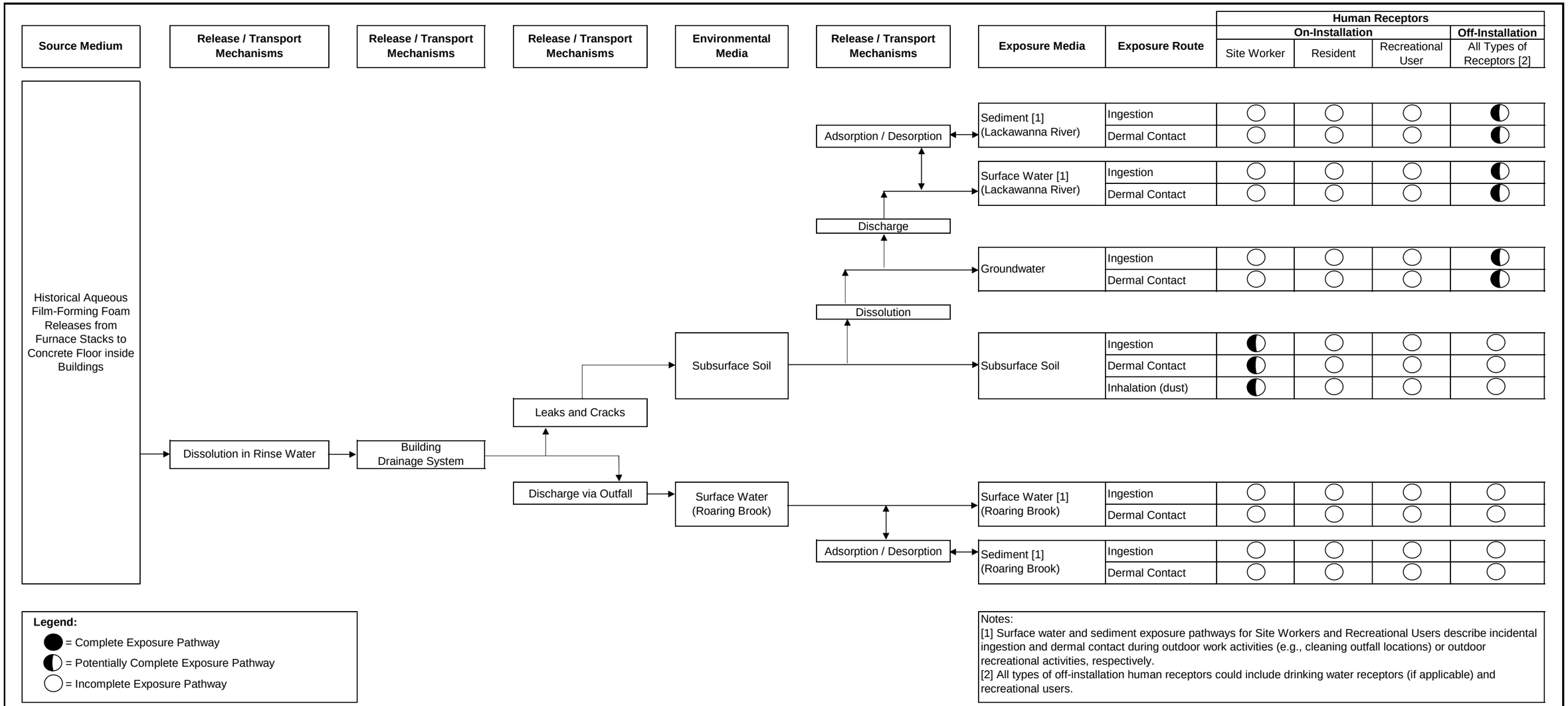
Qualifiers:
J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Groundwater Flow Direction
Monitoring Well
Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
MEA, Inc., *Final Report Scranton Army Ammunition Plant, Scranton, Pennsylvania*, 2000;
USGS, NHD Data, 2020;
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 18 North



Conceptual Site Model - Forge Shop Building and Heat Treat Building AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection
Scranton Army Ammunition Plant, PA

Figure 7-2

Arcadis U.S., Inc.

7550 Teague Road

Suite 210

Hanover, Maryland 21076

Tel 410 987 0032

Fax 410 987 4392

www.arcadis.com