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

Schofield Barracks and Kawailoa-Poamoho Training Area, Hawaii

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August 2023

Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Schofield Barracks and Kawailoa-Poamoho Training Area, Hawaii

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Prepared for:

U.S. Army Corps of Engineers

Contract No.: W912DR-18-D-0004

Delivery Order No.: W912DR1818F0685

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August 2023

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EXECUTIVE SUMMARY

The United States Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations nationwide because the Office of the Secretary of Defense (OSD) has developed risk-based screening levels for these chemicals. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. This report provides the PA/SI for Schofield Barracks (SCHBR) and the PA for its sub-installation Kawailoa-Poamoho Training Area (KLOA), that 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.

SCHBR is a 17,725-acre installation located in the north-central plateau of the island of Oahu, Hawaii, approximately 20 miles northwest of Honolulu, between the Waianae and Koolau Mountain Ranges. The installation is divided into three areas: the west side is known as the Main Post; the east side is known as the East Range; and the southern portion is known as the South Range Acquisition Area. The surrounding area consists of agricultural land, forest reserves, Wheeler Army Airfield (an Army installation located adjacent to SCHBR, between the Main Post and the East Range), the municipality of Wahiawa, and the town of Mililani. Wahiawa (located north of the East Range) is composed of residential, commercial, and light industrial properties, and Mililani (located approximately 2.5 miles southeast of SCHBR) is composed primarily of residential and commercial properties.

KLOA is a sub-installation that borders the SCHBR East Range. KLOA is located in north-central O‘ahu on the western slopes of the Ko‘olau Mountain Range. Access to KLOA is very limited due to the lack of improved roads, steep terrain, and dense vegetation. An improved paved roadway traverses through a small portion of northwestern KLOA; most training and land management activities use helicopters to transport people, equipment, and supplies. The town of Wahiawā is located near the southwestern corner of the sub-installation. KLOA is bordered on the south by Schofield Barracks East Range; on the Ko‘olau crest to the east by private land, Kaipapa‘u Forest Reserve, Hau‘ula Forest Reserve, and Sacred Falls State Park; on the north by Kahuku Training Area; and on the west by private agricultural lands. The majority of KLOA is located in the Waialua District of O‘ahu. The southern portion of KLOA falls within the Wahiawā District.

Based on the results of the PA for KLOA, no AOPIs were identified and no SI or sampling for PFOS, PFOA, PFBS, PFNA, and/or PFHxS was conducted. The SCHBR PA identified five AOPIs for investigation during the SI phase. SI sampling results from the five AOPIs were compared to risk-based screening levels calculated by the OSD for PFOS, PFOA, PFBS, PFNA, and PFHxS. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model

developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at SCHBR because HFPO-DA is generally not a component of military specification aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of HFPO-DA, it is generally not a component of other products the military used. In addition, it is unlikely that HFPO-DA would be an individual chemical of concern in the absence of other PFAS. Therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels. PFOS, PFOA, PFBS, PFNA and/or PFHxS were detected in soil and/or groundwater at all five AOPIs; two of the five AOPIs had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at concentrations greater than the risk-based screening levels. The SCHBR PA/SI identified the need for further study in a remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

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

AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)		Recommendation
	GW	SO	
Former Landfill/OU 4 (SCHBR-12)	No	ND	No action at this time
Building 494: Former Fire Station #15	NS	Yes	Further study in a remedial investigation
Former Pumper Certification Location	NS	No	Further evaluation[1]
Former Training Area	NS	Yes	Further study in a remedial investigation
Building 140: Fire Station #15	NS	No	Further evaluation[1]

Notes:
1 = Soil analytical data indicates PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence below OSD risk screening levels, but because there is a potential for migration to groundwater, further evaluation is recommended.
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
NS – not sampled
SO – soil

1 INTRODUCTION

The United States (U.S.) Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) at Army installations (installations) nationwide because the Office of the Secretary of Defense (OSD) has developed risk-based screening levels for these chemicals. 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 Schofield Barracks (SCHBR) and Kawailoa-Poamoho Training Area (KLOA), Hawaii based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the analytical results were compared to the OSD PFOS, PFOA, PFBS, PFNA, and PFHxS risk screening levels to determine whether further investigation is warranted. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at SCHBR because HFPO-DA is generally not a component of military specification aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of HFPO-DA, it is generally not a component of other products the military used. In addition, it is unlikely that HFPO-DA would be an individual chemical of concern in the absence of other PFAS. Therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels. This report provides the PA/SI for SCHBR and PA for KLOA 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 2016a). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD

2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water and soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). On 18 May 2022, the USEPA published an update to the RSLs table. The May 2022 RSL table included six PFAS constituents: PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA (USEPA 2022). On 06 July 2022, the OSD issued a memorandum to include revised risk screening levels based on the May 2022 USEPA RSLs (OSD 2022). The July 2022 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

The PA/SI at SCHBR was conducted consecutively because the results of the PA yielded AOPIs that necessitated continuing onto the SI phase in accordance with CERCLA. Additionally, a subsequent PA was conducted for the sub-installation KLOA which identified no AOPIs and did not warrant a SI to be conducted. Consequently, this report provides the combined objectives of both PA and SI reports.

1.2.1 PA Objectives

During the PAs, investigators collected readily available information and conducted site reconnaissance (site reconnaissance was not conducted at KLOA because no AOPIs were identified). The PAs evaluated and documented areas throughout SCHBR and KLOA 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

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

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

1.3 PA/SI Process Description

For SCHBR and sub-installation KLOA, PA and/or SI development followed the process as described below. **Section 3** provides a summary of the PA activities completed at both SCHBR and KLOA, and **Section 6** provides a summary of the SI activities completed for SCHBR. Site reconnaissance was not

conducted at KLOA because review of available information did not identify any AOPIs. 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), United States Army Garrison-Hawaii (USAG-HI), and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 07 January 2019, 8 weeks before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

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

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 Installation Management Command (IMCOM) operation order
- 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.

1.3.1.1 Sub-Installation Preliminary Assessment

Following the completion of the SI at SCHBR, USAEC identified the need for a PA to be performed at the sub-installation KLOA. Similarly to the SCHBR PA, a kickoff teleconference was held between applicable POCs from USAEC, USACE, USAG-HI, and Arcadis. The kickoff call occurred on 30 January 2023, to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit if needed, access to installation-specific databases, and to request available records.

A records review was conducted to obtain electronically available documents from the installation and external sources. 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 KLOA. Additionally, personnel interviews were conducted with individuals having significant historical knowledge at KLOA. 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. Upon completion of the records review and interviews, publicly available geographic information was reviewed to confirm that the sub-installation is primarily a vegetated mountainous area with no structures of note present.

A post-PA teleconference was held on 11 April 2023 with applicable POCs from USAEC, USACE, USAG-HI and Arcadis to discuss the results of the PA, which did not identify any AOPIs and confirmed that a SI would not be conducted at KLOA given the information available at the time of the PA.

1.3.2 Preliminary Assessment Site Visit

The site visit at SCHBR was conducted in conjunction with multiple other Hawaii installations between 05 and 22 March 2019. 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 SCHBR. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

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

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. An informal exit briefing was conducted on 21 March 2019 with USAG-HI 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, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI identified at SCHBR, 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 SCHBR to evaluate PFOS, PFOA, PFBS, PFNA, and PFHxS presence or absence at each AOPI and determine whether further investigation is warranted. First, a SI kickoff teleconference was held between the Army PA team, USAG-HI, USAEC, and USACE.[1]

The objectives of the SI kickoff and scoping teleconference was to obtain concurrence on the SI sampling plan from USAEC, USACE, and the installation POCs, as well as a discussion of the following topics:

- AOPIs selected for sampling and the proposed sampling plan for each AOPI
- Identify specific installation access requirements and potential schedule conflicts
- General SI deliverable and field work schedule information and logistics
- Health and safety considerations

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 SCHBR (Arcadis 2022) in **Sections 6.1** through **6.3**.

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

1.3.5 Data Analysis, Validation, and Reporting

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

[1] The SI kickoff teleconference covered six installations on Oahu within USAG-HI's purview: Schofield Barracks, Wheeler Army Airfield, Helemano Military Reservation, Fort Shafter, Tripler Army Medical Center, and Aliamanu Military Reservation.

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 SCHBR and KLOA, 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. Subsections below provide installation overview information for SCHBR, and KLOA as applicable/available.

2.1 Site Location

SCHBR is a 17,725-acre installation located in the north-central plateau of the island of Oahu, Hawaii, approximately 20 miles northwest of Honolulu, between the Waianae and Koolau Mountain Ranges as shown on **Figure 2-1**. The installation is divided into three areas: the west side is known as the Main Post; the east side is known as the East Range; and the southern portion is known as the South Range Acquisition Area. The surrounding area consists of agricultural land, forest reserves, Wheeler Army Airfield (WAAF; an Army installation located adjacent to SCHBR, between the Main Post and the East Range), the municipality of Wahiawa, and the town of Mililani. Wahiawa (located north of the East Range) is composed of residential, commercial, and light industrial properties, and Mililani (located approximately 2.5 miles southeast of SCHBR) is composed primarily of residential and commercial properties (Army 2013). WAAF lies between the main post and the East Range (Army 2013). **Figure 2-2a** details the installation layout of SCHBR.

KLOA is located in north-central Oahu on the western slopes of the Koolau Mountain Range. Access to KLOA is very limited due to the lack of improved roads, steep terrain, and dense vegetation. An improved paved roadway traverses through a small portion of northwestern KLOA; most training and land management activities use helicopters to transport people, equipment, and supplies. The town of Wahiawa is located near the southwestern corner of the installation. KLOA is bordered on the south by Schofield Barracks East Range; on the Koolau crest to the east by private land, Kaipapau Forest Reserve, Hauula Forest Reserve, and Sacred Falls State Park; on the north by Kahuku Training Area; and on the west by private agricultural lands. The majority of KLOA is located in the Waialua District of Oahu. The southern portion of KLOA falls within the Wahiawa District (USAG-HI 2010). **Figure 2-2b** details the installation layout of KLOA.

2.2 Mission and Brief Site History

SCHBR was established in 1908 to provide a base for the Army's defense of Pearl Harbor and the entire Island of Oahu. It is currently the largest Army installation in Hawaii and serves as the Garrison Headquarters. SCHBR provides administration, training, and housing facilities, depot and repair facilities, a medical facility, and community and housing support (Weston 2011).

KLOA was established as a troop maneuver and training area under a non-exclusive maneuver permit on 25 January 1955. Because of the extremely rugged nature of the terrain at KLOA, it is doubtful that the area supported much agriculture prior to acquisition, but upland areas would have been exploited for the naturally occurring flora and fauna (USAG-HI 2010).

2.3 Current and Projected Land Use

Small-scale industrial operations conducted at SCHBR include: vehicle repair, maintenance, rust proofing, and painting; weapons refinishing; optical instrumentation maintenance; laundry operations; photography; electrical equipment service; training aids manufacturing; building maintenance and repair; medical laboratory operations; sewage treatment; and municipal activities (Army 2013). As headquarters for the 25th Infantry Division, 45th Sustainment Brigade, and numerous tenants, SCHBR currently houses approximately 25,000 individuals (Army 2013). Training activities at SCHBR consist of both firing and non-firing activities. Firing activities that involve the use of live ammunition are conducted primarily in the central portion of SCHBR. The training area supports small arms fire, mortars, grenades, and anti-armor training. Indirect fire is limited due to the size of the impact area. Non-firing activities are conducted primarily in the East Range and use is limited to blank ammunition and pyrotechnics (Weston 2011). There are no foreseeable future land use changes for SCHBR at the time of this report.

Kawailoa is used primarily for helicopter aviation training, helicopter unit tactical training, long-range patrol, and command post displacement. Aviation training is restricted to touch and go landings. Aircraft are allowed to remain a minimal amount of time in the same area. Portions of this training area provide an excellent location for mountain and jungle warfare training because of the ravines and dense vegetation present. Approximately 5,310 acres of the installation are suitable for maneuver training activities (e.g., Kawai Iki Trail). However, the remaining area is considered unsuitable for maneuver training activities due to excessively steep slopes. In areas with slopes greater than 20 percent (%), troop deployment is typically limited to single file, small unit maneuvers along ridgelines (USAG-HI 2010). Poamoho is the southern portion (roughly 20%) of Kawailoa. It is used primarily for ongoing aviation training (e.g., low-altitude helicopter maneuvers). Ground training on Poamoho has not occurred within the last decade. Poamoho, located directly north of the Army's Schofield Barracks East Range, is approximately 4,390 acres located entirely within state-owned land leased from Department of Land and Natural Resources. The training area encompasses the 'Ewa Forest Reserve, which is characterized by limited access, dense vegetation, and rugged mountainous terrain with steep slopes and deep valleys. The eastern approximately 1,230 acres of Poamoho is fenced, and the Department of Land and Natural Resources has proposed to include this land in the Natural Area Reserves System. The proposed Natural Area Reserves System area is bounded by the Poamoho Ridge Trail to the north, the summit of the Koolau. Mountains to the east, and the Schofield-Waikane Trail to the south and has been fenced for ungulate (i.e., sheep, goats, and pigs) control (Army 2021).

2.4 Climate

The island of Oahu, located in the tropics, is part of the Hawaiian Volcanic Island chain and as a result sees only two seasons, winter, and summer. Winter is slightly cooler and wetter, but conditions are fairly similar year-round. Oahu is characterized by mild temperatures, persistent northeastern trade winds, moderate humidity, and variation in rainfall over short distances. Greater weather variations occur between elevations and coastal exposures (windward or leeward) than between seasons. According to the Western Regional Climate Center (WRCC), the annual average total precipitation at Upper Wahiawa Station 874.3, Hawaii (518838), located near SCHBR, from April 1971 to November 2015 was 67.48 inches per year (WRCC 2023a). More than half of the average annual rainfall falls during the rainy season that lasts from November through February (Weston 2011). Annual temperatures at Upper

Wahiawa Station 874.3, Hawaii (518838), from April 1971 to November 2015 ranged from an average minimum of 64.4°F to an average maximum of 79.2°F for the period of May 1940 to June 2016 (WRCC 2023a). January and February are the coolest months of the year with an average temperature of 68°F (Weston 2011).

According to the WRCC, the annual average total precipitation at Opaeula 870, Hawaii (517150), located near KLOA, from October 1949 to November 2015 was 55.48 inches per year (WRCC 2023b). Annual temperatures at Opaeula 870, Hawaii (517150) from October 1949 to November 2015 ranged from an average minimum of 63.2°F to an average maximum of 78.1°F.

2.5 Topography

SCHBR is situated on the eastern flank of the Waianae volcanic shield and west of the northwestern flank of the Koolau volcanic shield, in an area termed the Schofield Plateau. The installation is bounded by Waikele Stream to the south and by Wahiawa Reservoir to the north. The land that comprises the installation (**Figure 2-3**) slopes gently towards the south, with an elevation of approximately 860 feet above mean sea level near the Wahiawa reservoir, to approximately 790 feet above mean sea level on the south edge of the plateau. Along the southern boundary of the installation, the slope increases sharply into gullies that drain into the Waikele Stream channel (Weston 2011).

The elevation of KLOA ranges from 1,000 feet in the west to 2,600 ft (793 m) at the summit of the Koolau Mountains. The general topography (**Figure 2-3**) can be rugged, with deep valley floors rising abruptly to steep mountainous terrain (USAG-HI 2010).

2.6 Geology

The Island of Oahu consists of the eroded remnants of two large shield volcanoes, Waianae and Koolau. SCHBR is underlain by the Koolau Basalt member of the Koolau Volcanic series, which abuts the older eroded surface of the Kamaileunu and Lualualei (lower and middle) members of the Waianae Volcanic series. The Koolau Basalt flowed in thin, nearly horizontal layers on which soils developed and alluvial sediments were deposited between flows during eruption of the Koolau Volcano. The Koolau volcanic deposits are overlain by recent alluvial sediments eroded from the Waianae Range, which accounts for the surficial deposits that cover most of the Main Post. The thickness of the alluvial sediments generally increases toward the center of the Schofield Plateau, and beneath that is soil that developed in place on the surface of the Koolau volcanic deposits. Soil is identified as the Wahiawa Series, or Wahiawa silty clay, and the soil surface is underlain by saprolite (basalt that has been intensely weathered in place but retains many of the features of the original rock). Saprolite, which is exposed in some stream channels on SCHBR, grades with depth into less weathered basalt; thus, relatively soft materials are found to depths of 100 to 200 feet below ground surface (bgs) (Weston 2011).

KLOA is located in the Koolau Mountains, which were derived from the erosion of a shield volcano in the Pleistocene era. The rough mountainous land of KLOA is deeply transected by streams and waterfalls and, because of erosion, much of the surface is covered by fields of stones and boulders. The effects of erosion are considered average, and much of the original lava surfaces of the shield volcano remain intact (USAG-HI 2010).

2.7 Hydrogeology

The aquifer beneath the Main Post of SCHBR is part of the Wahiawa Aquifer System in the Central Aquifer Sector (Mink and Lau 1990). The aquifer is a high level, unconfined dike aquifer classified as currently developed for drinking water use by municipal and private users, having a salinity of less than 250 milligrams per liter of chloride, being irreplaceable, and highly vulnerable to contamination (Mink and Lau 1990). On Oahu, because of the limited resources, interconnection among groundwater sources, and the relatively rapid time of groundwater travel, most unconfined aquifers are vulnerable to contamination (Mink and Lau 1990). The aquifer classifications (e.g., high, moderate, low, or no vulnerability to contaminants) are based on familiarity with environmental conditions (Mink and Lau 1990). Depth-to-groundwater at SCHBR is approximately 600 feet bgs (Cape Environmental Management Inc 2019). In general, the direction of groundwater flow at the Main Post is towards the southeast (Oki 1998). USAG-HI geographic information system (GIS) well data indicates the installation drinking water wells are located east of the Main Post, near the western boundary of the East Range (Army 2013).

Surface water and groundwater flow from the mountains to the coast west and then northwest away from the sub-installation (USAG-HI 2010; Oki 1998; Nichols, et al. 1997). KLOA has highly variable groundwater flow with extremely high hydraulic conductivity of 1,000 feet/day flow between aquifers (Oki 1998). The sub-installation is principally above the Wahiawa Aquifer System in the Central Aquifer Sector; however, the northern extent of the sub-installation is above the Waialua and Kawailoa Aquifer Systems in the North Aquifer Sector (State of Hawaii, Department of Land and Natural Resources Commission of Water Resource Management 2023).

2.8 Surface Water Hydrology

SCHBR is transected by multiple streams and gulches. Surface water features on and/or near the central and east side of the Main Post (where all the AOPIs are located) include: Mohiakea Gulch and Waikoloa Gulch, both located near the center of the Main Post; Kaukonahua Stream, which borders the northern installation boundary and Waikele Stream, located adjacent to the southern Main Post boundary. On-installation surface water features are not used as drinking water sources (Army 2013). Additionally, on-installation surface water features do not appear to be used for recreational purposes.

Off-installation surface water features in the surrounding area of SCHBR include Wahiawa Reservoir, which borders the eastern boundary of the Main Post, as well as multiple gulches and streams. Wahiawa Reservoir is used for recreation activities and to irrigate 3,000 acres of pineapple fields. Off-installation surface water features in proximity to SCHBR are likely not used for drinking water (Army 2013).

The primary drainages (**Figure 2-2b**) at KLOA are the ʻElehāhā (intermittent), Helemano, Kaiwikoʻele, Kamananui, Kawai Iki, Kawainui, North Fork Kaukonahua, ʻŌpaeʻula, and Poamoho Streams (USAG-HI 2010). There are no significant off-installation surface water features in the area directly surrounding KLOA.

2.9 Relevant Utility Infrastructure

The following subsections provide general information regarding SCHBR stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and

transport of PFAS constituents at SCHBR. Readily available documents and personnel interviews conducted provided no information regarding stormwater and water management systems or utility infrastructure at KLOA.

2.9.1 Stormwater Management System Description

The majority of SCHBR Main Post drains to Kaukonahua Stream which flows northward, merges with Poamoho Stream, turns into Kiikii Stream, flows through the towns of Waialua and Haleiwa, and drains to Waialua Bay. Available records indicate land near the southern portion of the installation drains into tributaries of Waikele Stream, flows southward through the towns of Mililani and Waipahu, and eventually drains to the West Loch of Pearl Harbor. Additional information is not readily available regarding the specific portion of the installation that drains to Waikele Stream; however, it is likely that areas along the southern portion of the Main Post adjacent to Waikele Stream and portions of the installation south of the Main Post drain to tributaries of Waikele Stream (Army 2013).

2.9.2 Sewer System Description

SCHBR wastewater flows via the sanitary sewer to the Schofield Barracks Wastewater Treatment Plant located on WAAF. It was privatized by the Army and is operated by Aqua Engineers. Wastewater treatment plant sludge is hauled off-site and disposed of by the U.S. Navy. Cesspools are underground containers/pits for the temporary storage and infiltration of liquid waste and sewage. It was noted during an interview, and confirmed by an USEPA news release, that the one remaining cesspool on SCHBR has been closed and replaced with approved wastewater treatment systems (USEPA 2016c). The exact location of the cesspools was undetermined upon review of readily available documents.

2.10 Potable Water Supply and Drinking Water Receptors

Drinking water at SCHBR is obtained from four water supply wells on post owned by USAG-HI Directorate of Public Works (DPW). Groundwater beneath SCHBR, WAAF, and the surrounding region is used as a drinking water source for multiple military installations and facilities, as well as municipal water systems (**Figure 2-4a**).

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for SCHBR, which along with state and county GIS provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4a**). The direction of groundwater flow varies at the installation but in general flows southeast. There are four public supply wells located in Mililani, approximately 3 miles southeast of SCHBR southern border; additionally, the SCHBR water supply wells, located east of the Main posts southern boundary also appear to be downgradient. However, due to the variation in regional groundwater flow in the area and the lack of evidence to confirm flow direction, whether or not an off-post well is truly hydraulically downgradient of an AOPI remains undetermined. Per Operations Security guidance/requirements no army-owned wells or on installation wells are shown on figures in the PA/SI report. The EDR report providing well search results is provided as **Appendix D**.

An EDR report was generated for KLOA, which along with state and county GIS provided by the installation identified several off-post public and private wells within 5 miles of the installation boundary (**Figure 2-4b**). The direction of groundwater flow varies at the sub- installation but in general flows west/northwest mauka to makai (from the mountains to the sea/coast). Two public supply wells are located west and northwest of northern portion of KLOA that would be considered downgradient given the general direction of groundwater flow in the area. Additionally, several public supply wells and domestic wells, not considered to be downgradient, are located along the coast east of the sub-installation. Furthermore, there are public supply wells located north, and northeast of the sub-installation beyond the boundaries of Kahuku Training Area, that bounds KLOA to the north. There is no potable/drinking water source at KLOA**.** Drinking water at KLOA is provided in water buffalos brought in during troop maneuvers. KLOA does receive non-potable water from SCHBR, via a water line connected to the SCHBR water treatment plant.

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.

Four endangered animal species have been documented at SCHBR. They include one bird (Chasiempis sandwichensis ibidis), one terrestrial snail (Achatinella mustelina), and two insects (Drosophila montgomeryi, Drosophila substenoptera). Twenty-three federally listed and eight candidate plant species have been documented at SCHBR (USAG-HI 2010). Developed areas at Schofield contain mostly non-native urban vegetation. Undeveloped areas contain dense vegetation comprised mostly of grasses and understory. In addition, haole koa represent the dominant vegetation in the unimproved portions of Schofield; with the type of haole koa depending on available moisture and topography. Miscellaneous vegetation including monkeypod, banyan, royal Poinciana, loulou, and wiliwili are found in residential and administrative areas (Weston 2011).

Eight endangered animal species have been documented at KLOA and contiguous areas. They include two birds (Chasiempis sandwichensis ibidis and Paroreomyza flammea), one Hawaiian Hoary Bat (Lasiurus cinereus semnotus), and five snails (Achatinella byronii, Achatinella dlecipiens, Achatinella lila, Achatinella livida, Achatinella sowerbyana). Additionally, six snails (Achatinella rosea, Achatinella apexfulva, Achatinella bulimoides, Achatinella leucorraphe, Achatinella pulcherrima, Achatinella swiftii) have been documented as endangered animal species only onsite at KLOA and not in contiguous areas. Furthermore, 27 federally listed and eight candidate plant species have been documented at the sub-installation onsite and contiguous areas (USACE 1997).

2.12 Previous PFAS Investigations

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

The USEPA conducted the third Unregulated Contaminant Monitoring Rule (UCMR3) monitoring between 2013 and 2015. UCMR3 is a national program that collects data for contaminants that are suspected to

be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act (USEPA 2016b). The UCMR3 included the analysis of PFOS, PFOA, PFBS, PFNA, and PFHxS in public water systems serving more than 10,000 people between 2013 to 2015. During monitoring events conducted in 2013 (January, March, June, and July), 2014 (January, February, March, June, July, and September), and 2015 (January) samples were collected from 10 to 20 public supply wells within a 5-mile radius of WAAF. With the exception of two wells located on SCHBR, the locations of sampled wells were undetermined from readily available documents. Results indicated that PFOS, PFOA, PFBS, PNFA, and PFHxS were not detected in any of the samples collected from the public supply wells. The minimum reporting levels at the time of UCMR3 sampling were 40 ng/L for PFOS, 20 ng/L for PFOA, 90 ng/L for PFBS, 20 ng/L for PFNA, and 30 ng/L for PFHxS. The laboratory that analyzed the samples under UCMR3 met the USEPA's UCMR3 Laboratory Approval Program application and Proficiency Testing criteria for USEPA Method 537 Version 1.1.

Drinking water samples were collected from SCHBR on 19 March and 09 September 2014, and 16 October 2017 for PFAS analysis (including PFOS, PFOA, and PFBS) using USEPA Method 537. Based on chain of custody records included with the laboratory reports: the water samples were collected from Building 1575 Post Chlorination; the samples from March and September 2014 were collected/relinquished by USAG-HI DPW; and, although the signature of the person who relinquished the sample from October 2017 is provided on that chain of custody record, the person's organizational affiliation is not identified. Analytical results for samples collected on 19 March and 09 September 2014 indicate PFBS was not detected above the method reporting limit of 90 ng/L, PFOS was not detected above the method reporting limit of 40 ng/L, and PFOA was not detected above the method reporting limit of 20 ng/L. Analytical results for the sample collected 16 October 2017 indicate none of the analyzed constituents were detected above the method reporting limit of 2.0 ng/L (Army 2017).

A review of readily available documents and information indicated that no historical PFAS investigations (including PFOS, PFOA, PFBS, PFNA, and/or PFHxS) have been conducted at KLOA.

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 SCHBR and KLOA, data was collected from three principal sources of information and are described in the subsections below:

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

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 E**), installation personnel interviews (**Appendix F**), site reconnaissance photos (**Appendix G**) and site reconnaissance logs (**Appendix H**) during the PA process for SCHBR and KLOA are 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, the EDR report, various Installation Restoration Program (IRP) administrative record documents, compliance documents, Federal Fire Department (FFD) documents, USAG-HI DPW documents, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for SCHBR and KLOA are provided in **Appendix E**.

3.2 Personnel Interviews

Interviews were conducted during the site visit at SCHBR.

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

- Firefighting Battalion Chief
- General Engineer Supervisor
- Operations and Maintenance Division Chief
- Architectural Historian

[2] A site visit was not conducted at KLOA. Therefore, all reference to site reconnaissance in **Section 3** apply to SCHBR only.

- Historic Architect
- Archivist
- Clean Water Program Manager
- District 1 Chief of Operations
- Firefighting Lieutenant

A site visit was not conducted at KLOA, therefore interviews were conducted telephonically.

The list of roles for the installation personnel interviewed via telephone and email correspondence for KLOA is presented below (affiliation is with KLOA unless otherwise noted).

- Fire Fighter
- Lieutenant
- Range Planning Specialist
- Environmental Compliance Branch Chief
- Range Operations Manager
- Range Officer
- Engineer
- Fire Management Specialist
- FFD District Chief
- FFD Regional Chief

The compiled interview logs for both SCHBR and KLOA are provided in **Appendix F**.

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at SCHBR 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 G**; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in **Appendix H**.

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

Site reconnaissance was not conducted at KLOA in accordance with findings presented in Section 1.3.1.1.

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

SCHBR and KLOA were evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. Unless otherwise specified in the subsections below, all information presented is relevant for SCHBR due to limited relevant information available for KLOA. As such, this section is organized to summarize the aqueous film-forming foam (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 % hydrocarbon surfactants, and 1 to 3% PFAS (Interstate Technology Regulatory Council 2020). AFFF concentrate is designed to be diluted with water to become a 1, 3, or 6% foam. AFFF releases at DoD facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases. The military still primarily uses AFFF for Class B fires; however, the current formulations of AFFF contain significantly lower amounts of PFOS, PFOA, and their precursors, and significant operational changes have been implemented to restrict uncontrolled releases and non-essential use of PFAS-containing foams. Army installations may still house AFFF, commonly stored in closed containers (e.g., 55-gallon drums, 5-gallon buckets), within designated storage buildings or at firehouses.

Findings from personnel interviews, site reconnaissance, and document research indicate that the use and storage of AFFF at SCHBR has been primarily associated with Building 494: Former Fire Station #15, Building 140: Fire Station #15, a Former Pumper Certification Location, and a Former Training Area. FFD personnel indicated incidental AFFF releases are likely to have occurred at Building 494: Former Fire Station #15 from the late 1960s through 2007. Additionally, AFFF containers have historically been stored in a flammables cabinet at Building 140: Fire Station #15, and one bucket of AFFF was observed at Building 140: Fire Station #15 during the reconnaissance visit to SCHBR in March 2019. The Former Pumper Certification Location was used for multiple training exercises and pumper certification activities from 1991 to 1998. Furthermore, the Former Training Area, which is currently occupied by residential housing, was formerly an empty grass field that may have been used for AFFF training exercises from approximately 1991 through 1996.

Document research and personnel interviews conducted in 2023 provided no indication that historical operations at KLOA included the use, storage, and/or disposal of PFAS-containing materials. Furthermore, no history of any live fire training, helicopter crash or fire incidents at KLOA have been reported or documented in readily available information.

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

Following document research, personnel interviews, and site reconnaissance at SCHBR, one former landfill was also identified as a preliminary location for use, storage, and/or disposal of PFAS-containing materials. Excavated soil likely to have contained PFAS from a former training area where AFFF was

used at WAAF was disposed of at the Former Landfill/Operable Unit (OU) 4 (SCHBR-12) in 1980. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

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

4.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at SCHBR) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below. A comprehensive list of potential off-post sources can be found in the EDR report (**Appendix D**). Although these sources are within a 5-mile radius of the SCHBR and KLOA, none of these off-post sources are hydraulically upgradient (west) of SCHBR or (southeast) KLOA.

Table 4-1. SCHBR Readily Identifiable Off-Post PFAS Sources

Facility Name	Facility Address	Type of Facility	Distance and Direction from Installation[1]
Wahiawa Fire Station	640 California Avenue, Wahiawa, Hawaii 96786	Fire Station	0.45, N
Fire Station 41 Mililani Mauka	95-1990 Meheula Parkway, Mililani, Hawaii 96789	Fire Station	0.90, S
Fire Station 36 Mililani	95-269 Kipapa Drive, Mililani, Hawaii 96789	Fire Station	1.50, S
Fire Station 42 Waikele	94-840 Lumiaina Place, Waipahu, Hawaii 96797	Fire Station	4.10, SE
Fire Station 12 Waipahu (Historic)	94891 Waipahu Street Ext, Waipahu, Hawaii 96797	Fire Station	4.70, SE
Discount Wheel and Tire – Wahiawa	217 S Kamehameha Highway, Wahiawa, Hawaii 96786	Automotive Maintenance	0.35, NW
Midas	25 Kamehameha Highway, Wahiawa, Hawaii 96786	Automotive Maintenance	0.60, NW
Wahiawa Laundromat	34 Maalo Street, Wahiawa, Hawaii 96786	Laundry	0.65, NW

Facility Name	Facility Address	Type of Facility	Distance and Direction from Installation[1]
Almas Laundry	27 Mango Street, Wahiawa, Hawaii 96786	Laundry	0.60, NW
Wahiawa General Hospital	128 Lehua Street, Wahiawa, Hawaii 96786	Hospital	0.70, N
The Queen's Health Care Center – Mililani	95-1249 Meheula Parkway, Mililani, Hawaii 96789	Hospital	2.20, S
Walgreens Photo	135 S Kamehameha Highway, Wahiawa, Hawaii 96786	Photo-Processing	0.50, NW
CVS Photo	925 California Avenue, Wahiawa, Hawaii 96786	Photo-Processing	0.55, N
Pioneer Ace Hardware	930 Kilani Avenue, Wahiawa, Hawaii 96786	Paint Facility/Manufacturer	0.75, N
Pristine Painting & Coatings, LLC	401 N Cane Street, Suite A7, Wahiawa, Hawaii 96786	Paint Facility/Manufacturer	0.90, N
Forest Farms	25 Kamananui Road, Wahiawa, Hawaii 96786	Farm	0.25, E
Green World Coffee Farm	71-101 Kamehameha Highway, Wahiawa, Hawaii 96786	Farm	1.10, E

Notes:
1 = Distance in miles from SCHBR to the off-post potential PFAS source.

Table 4-2. KLOA Readily Identifiable Off-Post PFAS Sources

Facility Name	Facility Address	Type of Facility	Distance and Direction from Sub-Installation[1]
Fire Station #16 Wahiawa	640 California Avenue, Wahiawa, Hawaii 96786	Fire Station	2.40, Southwest
Rich's Whips	721 Kilani Avenue, Wahiawa, Hawaii 96786	Car Wash	2.25, Southwest
Aloha Gas	150 Kamehameha Highway, Wahiawa, Hawaii 96786	Car Wash	2.35, Southwest
Brunos Auto Detailing	10 South Kamehameha Highway, Wahiawa, Hawaii 96786	Car Wash	2.48, Southwest

Facility Name	Facility Address	Type of Facility	Distance and Direction from Sub-Installation[1]
Sunset Auto Services, Inc.	207 North Cane Street, Wahiawa, Hawaii 96786	Automotive Maintenance	2.12, Southwest
Ace Transmission and General Repair LLC	720 Kilani Avenue, Wahiawa, Hawaii 96786	Automotive Maintenance	2.23, Southwest
Oil Changers	961 Center Street, Wahiawa, Hawaii 96786	Automotive Maintenance	2.25, Southwest
Hawaii Rides INC	651 Kilani Avenue, Wahiawa, Hawaii 96786	Automotive Maintenance	2.29, Southwest
Gerber Collision and Glass	415-A Kilani Avenue, Wahiawa, Hawaii 96786	Automotive Maintenance	2.38, Southwest
Midas	25 Kamehameha Highway, Wahiawa, Hawaii 96786	Automotive Maintenance	2.45, Southwest
Jetso Auto Center Fire2	200 Block of Palm Street, Wahiawa, Hawaii 96786	Automotive Maintenance Fire	2.21, Southwest
Wahiawa General Hospital	128 Lehua Street, Wahiawa, Hawaii 96786	Hospital	2.30, Southwest
Walgreens Photo	135 South Kamehameha Highway, Wahiawa, Hawaii 96786	Photo Processing	2.62, Southwest
Pristine Painting and Coatings LLC	410 North Cane Street, Suite A7, Wahiawa, Hawaii 96786	Paint Facility / Manufacturer	2.03, Southwest

Notes:

1 = Distance in miles from KLOA to the off-post potential PFAS source.

2 = In November 2015, there was a blaze at the Jetso Auto Center in the 200 block of Palm Street in Wahiawa. “Eight fire companies with 34 personnel...were required to extinguish the main fire” (Honoré 2015). “’At the time of the fire, there was probably a threat of burning gas and oil and fuels and whatever fuels were in the building,’ said Fire Battalion Chief John Kino” (Daysog 2015).

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at SCHBR and KLOA 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, five areas have been identified as AOPIs at SCHBR and zero areas have been identified as AOPIs at KLOA. Therefore, all information presented after **Section 5.1** is relevant for SCHBR only. The process used for refining these areas is presented on **Figure 5-1**, below.

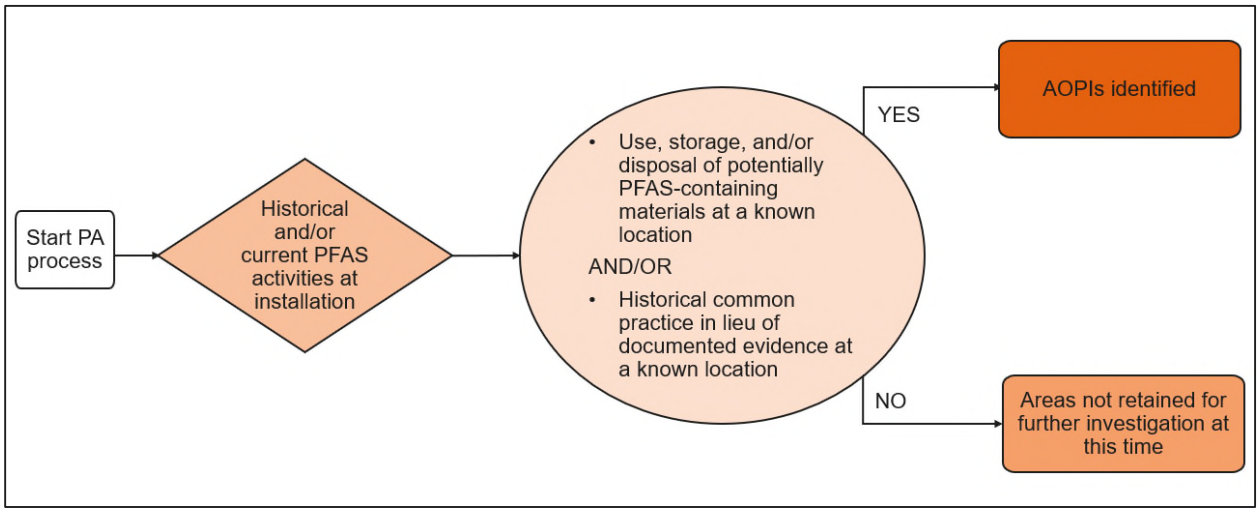

Figure 5-1: AOPI Decision Flowchart

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

Data limitations for this PA/SI at SCHBR and KLOA are presented in **Section 8**.

5.1 Areas Not Retained for Further Investigation

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

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

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

Area Description	Dates of Operation	Relevant Site History	Rationale
SCHBR: Building 1500: Foam Test	2018 or 2019	The fire suppression system for the communications center located in the basement of Building 1500 was tested. Confirmed with the SCHBR DPW Facilities Manager that the system utilizes a halon replacement that does not contain PFAS.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location.
SCHBR: Helicopter Crash	2003	A helicopter crashed in one of the training areas. There was no fire and no known or suspected AFFF use.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location.
SCHBR: Fire and Rescue Training Facility	Unknown to present	This facility (#1201) is used for brushland/wildfire fire-fighting training only. There is no known or suspected use of AFFF.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location.
SCHBR: Golf Course Pest Control Shop	See Relevant Site History	The Golf Course Pest Control Shop consists of Building 2013 (bulk storage of pesticides from 1990 through at least 1993), the area and concrete pad outside of Building 2051 (pesticide mixing and washing down equipment since before the 1980s to 1990 when it was demolished), and Building 2101 and adjacent outdoor mixing area (temporary bulk storage of pesticides during Building 2013 renovations in 1991) (Harding Lawson Associates [Harding] 1993).	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: Building 368: Former Pesticide Storage and Building 379: Former Herbicide Storage Shed	Approximately 1965 to 1984	Pesticides used to be stored in a room within Building 368 (SCHBR-02; FFA 38; HQAES: 15815.1002) from 1968 to an unknown time. Pesticide formulation and mixing was conducted adjacent to Building 368 from approximately 1969 to 1984, with excess and outdated pesticides being disposed of through Defense Property Disposal Office, Pear City (Weston 1990). The Building 379 storage shed (SCHBR-04; FFA 39; HQAES 15815.1004) was a storage site for herbicides during its time in use. Herbicide formulation/mixing was performed at a wash rack located south of Building 379 and rinsates were discharged into the storm drain (Weston 1990). A	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.

Area Description	Dates of Operation	Relevant Site History	Rationale
		telephonic interview with the IMCOM Pest Management Consultant noted that Sulfuramid (may have contained PFAS) was phased out in 1996. The IMCOM Pest Management Consultant provided records of potentially PFAS-containing pesticides and insecticides used at and/or stored at Army installations and did not identify SCHBR as an installation having used or stored PFAS-containing pesticides/insecticides. An inventory of the pesticides was reviewed during the PA site visit as well as an inventory of pesticides used in the 1970s indicate that no pesticides containing PFAS currently or historically have been used at SCHBR.	
SCHBR: Pest Control Shop	Various to present	The Pest Control Shop (Site 21) consists of Buildings 368 (SCHBR-02; FFA 38; room used for pesticide storage since 1968; discussed in more detail in row below), 368F (pesticide storage shed with no floor berms constructed in 1989; pesticides were stored on the floor), 369 (crate at the south end of the building and exposed to the elements; stored unusable herbicides), 370 and 380 (SCHBR-33; HQAES: 15815.1060) pesticide storage from the 1950s to 1968), 374 (storage shed at the east end of the building used to store pesticides from at least 1964 until 1972), 2025 (used for bulk storage of pesticides from the 1960s until at least 1993), and the former Building 2090 (used for pesticide storage prior to the 1950s) (Harding 1993). Building 368F stores pesticides on the floor. During the September 1991 M&E site visit, a waterline mark was observed at a height of approximately 6 inches above the bottom of the Building 368F door. Some boxes containing Pramitol 5PS were water damaged. There are no reported spills of large quantities of pesticides associated with the Pest Control Shop buildings (Harding 1993).	No evidence of PFOS, PFOA, or PFBS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.

Area Description	Dates of Operation	Relevant Site History	Rationale
SCHBR: Photography Laboratory and Photography Operations	1972 to 1992	Both the photography laboratory and photography operation facilities were in Building 2065. Reports indicate that chemicals were disposed in the sanitary sewer system and that Training Aids Support Center had its own silver recovery unit, discharging the fixer solution to the sanitary sewer along with the waste developer. Interviews indicate that black and white fixer solution was collected and sent elsewhere for silver recovery. All other solutions were disposed in the sanitary sewer system.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: Arts and Crafts Building Photography Laboratory	1988	Building 572 is the installation's arts and crafts center (or it was in 1992 and 1993), and it contains a photography laboratory. Color film processing chemicals are disposed to the sanitary sewer. Fixer for black and white image processing was collected and run through a silver recovery process (Harding 1993).	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: 24 Hour Photo Service	1988 to present	The photography facility (SCHBR-44; FFA 32; HQAES: 15815.1071) is located in Building 693 and houses photographic developing equipment and chemicals. Spent solutions containing silver metal are reported to be shipped to Hickam Air Force Base for extraction and disposal. No indications of chemical releases were evident within the premises (Harding 1993).	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: Health Clinic	Various	The Health Clinic (SCHBR-40, FFA 28; HQAES: 15815.1067) consist of Buildings 664, 672, 673, 676, 677, 679, 682, 683, 685, 686, 687, 689, and 691. This site contains 3 x-ray units with onsite processing. This site also receives x-rays to be developed from the veterinary clinic on SCHBR. X-rays are only known to have been processed in Building 676 (Radiology), which was built during or just prior to the 1920s (Harding 1993). As of 1992, the Radiology Building (Building 676) stored spent fixer related to x-ray processing inside (Harding 1993). Reports	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.

Area Description	Dates of Operation	Relevant Site History	Rationale
		indicate that waste fluid from onsite x-ray units discharges to the sanitary sewer. An onsite recovery system is in use, through which all solutions are cycled before discharge into the sanitary sewer system. Amalgam, used in fillings, is stored in a waste fixer solution until it is sent through a precious metals recovery program for mercury recovery.	
SCHBR: Dental Clinic	During or just prior to the 1920s to Present	The active Dental Clinic (SCHBR-43; FFA 31; HQAES: 15815.1070) is housed in Building 684 and contains 6 x-ray units for onsite x-ray processing. Small quantities of chemicals are stored onsite, which are mainly consumed during use, resulting in almost no discharge (Harding 1993). Reports indicate that waste fluid from onsite x-ray units discharges to the sanitary sewer. Amalgam containing mercury and spent fixer containing silver are contained and recycled through an onsite metals silver recovery program system with spent solutions discharged to the sanitary sewer. There are no indications of spills or unauthorized releases present.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: Veterinary Clinic	1976 to present	The Veterinary Clinic (SCHBR-39; FFA 27; HQAES: 15815.1066) was built in 1976 and consists of Buildings 934, 935, and 936. The clinic itself is housed in Building 936. X-rays are developed at the Health Clinic (Weston 1990. Small amounts of medical chemicals, including medicines and bactericides, are discharged to the sanitary sewer (Harding Lawson Associates 1993).	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
SCHBR: Former Laundry	1943 to a date undetermined from readily available documents	The Former Laundry (SCHBR-17; FFA 52; HQAES: 15815.1048) was identified as part of Operable Unit 1 during a PA/SI performed on Operable Unit 1 in late 1991 and early 1992 (Harding 1992). There is no further information identified about its period of use, what was laundered, or to where effluent was discharged. The facility was demolished in circa 1971 with most of the former footprint now under	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.

Area Description	Dates of Operation	Relevant Site History	Rationale
		approximately 30 feet of artificial fill and a part of Highway H2 (Harding 1992).	
KLOA: Landing Zones	Various	No known fires or crashes at or near the landing zones. No fire trucks carrying AFFF are staged near landing zones during training.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.
KLOA: Brush Fires (various)	Various	Occasional brush fires caused by the Osprey helicopters that the U.S. Marines use, likely the exhaust of the downward-facing engines ignite grass beneath them. FFD is only allowed to use Class A[1] foam; they use PHOS-CHEK foam.	No evidence of PFAS-containing materials used, stored, and/or disposed of at this location. This area is not associated with AFFF or metal plating.

Notes:

1 = Class A foam is is used to extinguish fires with Class A fuels (i.e., wood, paper, cloth, trash, and plastics) and does not contain PFAS (U.S. Department of Interior 2022).

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. The Former Landfill AOPI overlaps with a SCHBR IRP site and a Headquarters Army Environmental System (HQAES) site (**Figure 5-2**). The AOPI, overlapping IRP site identifier, HQAES number, and current site status are discussed within each AOPI subsection presented below. At the time of this PA, none of the SCHBR IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS.

The AOPI locations for SCHBR are shown on **Figure 5-2**. Detailed views of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-7** and include active monitoring wells in the vicinity of each AOPI.

5.2.1 Former Landfill/OU 4 (SCHBR-12; HQAES: 15815.1029)

The Former Landfill/OU 4 (SCHBR-12) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical disposal of PFAS-containing materials (**Figure 5-3**). The former landfill covers approximately 35 acres and is currently bounded by an 8-foot chain-link fence along the northern and western perimeter, as well as a portion of the southeastern perimeter. Steep wooded slopes bound the former landfill along the northeastern perimeter and the unfenced portion of the

southeastern perimeter. The landfill was an open burn dump from 1942 through 1967, at which time it was converted to a sanitary landfill. The WAAF Former Fire-Fighter Training Area in the southeast area of WAAF was used by firefighters when WAAF was an U.S. Air Force installation from the 1950s until 1980. In 1980, the contaminated soil, which was likely to have contained PFAS, at the WAAF Former Fire-Fighter Training Area was excavated and taken to a landfill at SCHBR, and replacement soil was subsequently brought in to fill the excavation. The landfill was closed in 1981. A variety of solid waste was disposed of at the landfill including, but not limited to, waste from industrial operations, medical wastes, organic solvents, sewage sludge, asbestos, pesticide containers, unusable paints, and metallic debris. A 2 to 2.5-foot-thick compacted soil cover was installed over the waste. The landfill does not contain a bottom or top liner system.

In addition, although specific information regarding construction of the landfill soil cover is not readily available, a historical investigation report for OUs at SCHBR indicates the Former Landfill/OU 4 was capped with a clay cover in 1982, however, the clay cover contained tensional cracks and was not considered an impermeable layer (Harding 1992). Available records indicate: the Record of Decision for the Former Landfill/OU 4 identified maintenance and revegetation of the landfill cover as the selected remedy for the Former Landfill/OU 4; in 1998, site closeout activities at the Former Landfill/OU 4 were completed and accepted by USEPA; and, remaining activities to be performed at the Former Landfill/OU 4 include long-term maintenance of the soil and vegetative cover and enforcement of institutional controls (Na Alii Consulting & Sales, LLC 2021).

Prior to closure, landfill operation inadequacies resulted in refuse being dumped over the edge of the landfill, underground fires, leachate production, methane gas production and emission, slope instability, odors, and ponding water (Army 2013).

Historically, surface water runoff from the landfill resulted in uncontrolled discharge to the adjacent streams and gulches (Harding 1992). Surface water drained northeast across the landfill toward Kaukonahua Gulch, with some local drainage occurring south towards Waikoloa Gulch and north to Mohiakea Gulch (Harding 1992).

In 1980, there was an unlined drainage ditch near the center of the landfill (Harding 1992). Analytical results from a site investigation conducted in 1991 at SCHBR indicated metals, organochlorine pesticides, and polychlorinated biphenyls were detected in a soil sample collected from a drainage ditch near the center of the former landfill (likely in the same location as the historical unlined drainage ditch) (Harding 1992). There is currently a drainage channel near the center of the former landfill that drains to the northeast, towards a downgradient drainage chute that discharges to Kaukonahua Gulch. If PFAS are present, they are likely to be encountered in soil northeast of that center drainage channel, near Kaukonahua Gulch. The drainage channel, drainage chute, and Kaukonahua Gulch are illustrated on **Figure 5-3**.

5.2.2 Building 494: Former Fire Station #15

The Building 494: Former Fire Station #15 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical use and storage of AFFF (**Figure 5-4**). The former fire station operated from 1924 to 2007. Use of AFFF in the military began in the late 1960s. Although no specific releases have been identified, FFD personnel noted that incidental AFFF releases are likely to

have occurred at the former fire station from the late 1960s through 2007. The building is currently occupied by an archive.

Historically, the fire station bays had three floor drains that connected via underground drainage outside the building to either the storm sewer system or sanitary sewer system. All the floor drains have since been plugged.

5.2.3 Former Pumper Certification Location

The Former Pumper Certification Location is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical use of AFFF for training exercises and activities (**Figure 5-5**). The AOPI is located off Lyman Road, near the intersection of Lyman Road and Trimble Road. The area was used for multiple training exercises and pumper certification activities from 1991 to 1998. According to personnel interviews conducted during the PA, staff would park the fire truck on Lyman Road, near an earthen swale that drains toward the southeast, and spray AFFF into a grassy area north/northeast of the roadway. The spray area, located between Lyman Road and a fence that borders an adjacent storage facility, is covered in soil and/or grass and other vegetation. Water infiltrated the spray area quickly, leaving no standing water; AFFF did not reach the storage facility fence line.

5.2.4 Former Training Area

The Former Training Area is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical use of AFFF for fire fighter training exercises (**Figure 5-6**). The AOPI is currently occupied by residential housing; however, the area was formerly an empty grass field that may have been used for AFFF training exercises from approximately 1991 through 1996.

According to personnel interviews conducted during the PA, FFD staff would have parked the fire truck near the corner of Waianae Avenue and Dickman Road and sprayed towards the southeast. If AFFF was used, any AFFF that may have spilled from the truck would have likely landed on the paved road. Spillage onto the paved road would have likely flowed to a storm sewer.

5.2.5 Building 140: Fire Station #15

The Building 140: Fire Station #15 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical use and storage of AFFF (**Figure 5-7**). The fire station came into operation in 2007 and at the time of this PA was still in operation. Fire trucks carry AFFF, however there have been no known leaks or spills. Although all truck maintenance activities (including filling the trucks with AFFF) have been performed at Hickam Air Force Base since 2007, AFFF containers have historically been stored in a flammables cabinet at the fire station. The flammables cabinet is located inside a closet that can only be accessed by an exterior door. One 5-gallon pail of Ansulite 3% AFFF was observed at the station during the reconnaissance visit to SCHBR in March 2019. According to personnel interviews conducted during the PA and readily available documents, no testing with AFFF or flushing has been conducted at the fire station.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at SCHBR, a SI for PFOS, PFOA, PFBS, PFNA, and PFHxS was conducted in accordance with CERCLA. As described in **Section 5**, no AOPIs were identified at KLOA. As a result, an SI was not conducted at KLOA and the sub-installation will not be referenced again until the Conclusions and Recommendations (**Section 8**).

SI sampling was completed at SCHBR at five of the AOPIs to evaluate presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS in comparison with the OSD risk screening levels. Ten AOPIs identified during the PA were not recommended for further investigation in an SI, as discussed in **Section 5.1.** As such, an installation-specific QAPP Addendum (Arcadis 2022) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each AOPI located at SCHBR in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil, groundwater, surface water, and sediment pathways as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in July 2022 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2022) 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 SCHBR. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described In **Section 6.3.4**. 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 2022), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater and soil for PFOS, PFOA, PFBS, PFNA, and PFHxS presence or absence at each of the sampled AOPIs.

6.2 Sampling Design and Rationale

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

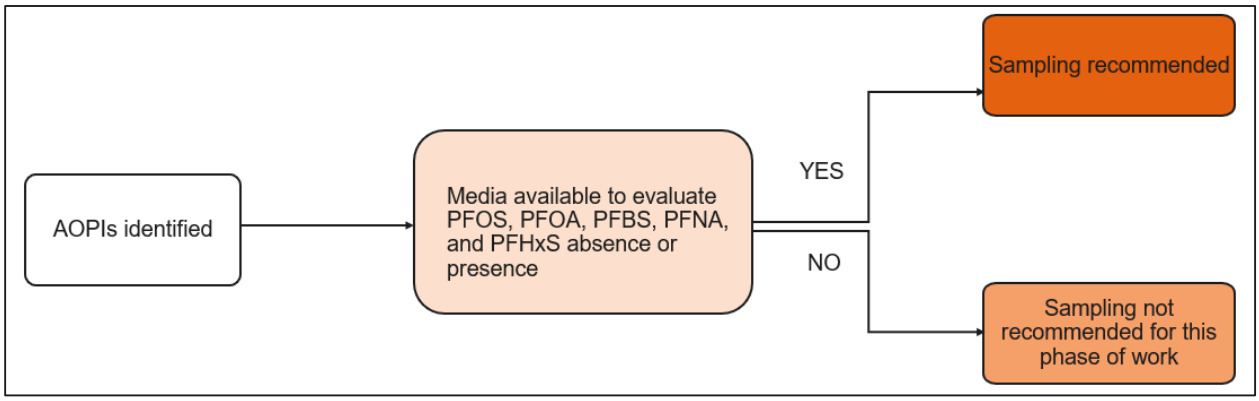

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at SCHBR is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2022). Briefly, soil and/or groundwater samples were collected from areas at the AOPIs of known or suspected PFAS-containing materials use, storage, and/or disposal. Groundwater was sampled to identify PFOS, PFOA, PFBS, PFHxS, and PFNA presence, type (of the 18 selected constituents as listed in Worksheet #15 of the QAPP Addendum), and concentrations (Arcadis 2022). Soil was sampled to identify PFOS, PFOA, PFBS, PFHxS, and PFNA presence, type of the 18 selected constituents as listed in Worksheet #15 of the QAPP Addendum, and concentrations (Arcadis 2022). One soil sample per AOPI was also analyzed for total organic carbon (TOC), pH, and grain size. These data are collected as they may be useful in future fate and transport studies. These targeted sampling areas are believed to have the potential for the greatest PFAS concentrations closest to known or suspected use, storage, and/or disposal of PFAS-containing materials.

For each of the five AOPIs, samples were collected at locations of known or suspected use, storage, and/or disposal of PFAS-containing materials, locations of surface runoff collection, and downgradient locations if exact use, storage, or disposal locations are unknown. Sample locations were selected based on site-specific historical evidence and surface runoff / surface conditions observed in the field at each sampled AOPI. The targeted sampling areas were positioned in the center, downgradient, and/or cross-gradient of suspected PFAS (including PFOS, PFOA, PFBS, PFNA, and PFHxS) use, storage, and/or disposal areas. Sample media types collected for each AOPI were based on media most likely to confirm the presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS. Soil samples were collected from each of the five AOPIs. The focus of the soil sampling was the upper 2 feet of native soil. A groundwater sample was collected from one AOPI [Former Landfill/OU 4 (SCHBR-12)] from an existing monitoring well (MW 4-4). 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 (if available).

Groundwater sampling was not included as part of the SI at AOPIs Building 494: Former Fire Station #15, Former Pumper Certification Location, Former Training Area, and Building 140: Fire Station #15. SCHBR is characterized by deep groundwater (approximately 600 feet bgs). Based on the depth to groundwater, no drilling for the collection of groundwater samples was included at the AOPIs listed above.

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 2022), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2022). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2022). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, tailgate health and safety forms, utility and structures checklist, and sample collection logs) documenting the SI sampling activities are included in **Appendices I** and **J**, respectively. Photographs of the sampling activities are included in **Appendix K**.

6.3.1 Field Methods

Composite soil samples were collected via hand auger from 0 to 2 feet bgs. In general, sampling points were positioned in the center, downgradient, and/or cross-gradient of the suspected release area. Soil collected with the hand auger was transferred to a stainless-steel bowl where it was mixed for homogenization. A portion of the homogenized soil was then placed in the sample container and packed with ice in a cooler to meet the preservation temperature requirements. A new pair of nitrile gloves and sleeves made of un-coated flash spun high density polyethylene fibers were worn to collect each sample to prevent PFAS contamination. Soil lithological descriptions were continuously logged and documented on field forms and coordinates for each sampling location were recorded using a handheld global positioning system.

The groundwater sample was collected from an existing monitoring well (MW 4-4) at the Former Landfill/OU 4 (SCHBR-12) AOPI. Groundwater was purged using a dedicated pump installed approximately at the center of the saturated screened interval until water quality meter parameters stabilize. Although a low-flow sampling method was not used, PFAS sampling precautions were followed. Following the well purge, the groundwater sample was collected. Any known PFAS-containing components at the well head, including the polyvinyl chloride adapter pipe used to redirect groundwater flow for purging and sampling, were replaced with PFAS-free components. Given that the existing monitoring well had dedicated, down-hole equipment, a dedicated equipment background (DEB) was collected and analyzed for PFAS as described in **Section 6.3.3**. Groundwater samples were packed with ice in a cooler to meet the preservation temperature requirements.

Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.5**.

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), source blanks for water used in the initial decontamination step, 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 2022), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, PFBS, PFNA, and PFHxS only. EBs were collected for media sampled for PFOS, PFOA, PFBS, PFNA, and PFHxS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2022). The decontaminated reusable equipment from which EBs were collected include the hand auger and stainless-steel bowl as applicable to the sampled media. Source blanks were collected from deionized water during decontamination of soil sampling equipment. Analytical results for blank samples are discussed in **Section 7.8**.

6.3.3 Dedicated Equipment Background

DEB samples were collected at a frequency of one DEB per AOPI at AOPIs where groundwater sampling was conducted at existing monitoring wells that contained dedicated, down-hole equipment. When collecting samples from monitoring wells with dedicated, down-hole equipment, two water samples were taken from one monitoring well at each AOPI. One DEB sample was collected from the first water produced through the pump and tubing and was used to evaluate whether the dedicated equipment may be impacting the PFOS, PFOA, PFBS, PFNA, and/or PFHxS results, as it is unknown if the dedicated equipment was comprised of PFAS-containing components; PFOS, PFOA, PFBS, PFNA, and/or PFHxS concentrations in the DEBs reflect concentrations of stagnant groundwater, and they may be biased high by contributions from equipment that contains PFOS, PFOA, PFBS, PFNA, and/or PFHxS components. The parent sample was collected after the well was purged until the field parameters stabilized. Further DEB analysis is included in **Section 7.6**.

6.3.4 Field Change Reports

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

Additionally, no minor or major modifications or non-conformances to the approved sampling scope and/or procedures occurred during the sampling events.

6.3.5 Decontamination

Non-dedicated reusable sampling equipment (e.g., stainless-steel trowels and hand augers) 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**).

6.3.6 Investigation-Derived Waste

Investigation-derived waste (IDW), including soil cuttings, purged groundwater, and decontamination fluids were collected and discharged to the ground at the point of collection (e.g., soil cuttings were returned to the boring, purge water was disposed of on the ground immediately downgradient of the well, and decontamination water was discharged to the ground at the point of sample collection. Disposable equipment IDW was collected in bags and disposed in municipal waste receptacles. Equipment IDW includes personal protective equipment and other disposable materials (e.g., nitrile gloves, sleeves made of un-coated flash spun high density polyethylene fibers, paper towels, and garbage bags) that may come in contact with sampling media.

6.4 Data Analysis

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

6.4.1 Laboratory Analytical Methods

Analytical samples collected during the SI were submitted to Eurofins Lancaster Laboratories Environmental, an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, PFBS, PFNA, and PFHxS, 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, PFBS, PFNA, and PFHxS, were analyzed for in groundwater and soil samples using an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B-15.

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil and sediment samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2022) by the analytical method noted:

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

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

The laboratory limit of detection (LOD) is defined as “the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99 percent confidence” (DoD 2017). The lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias is known as the 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 grain size, 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 SCHBR. 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 SCHBR 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 SCHBR QAPP Addendum (Arcadis 2022). Data qualifiers applied to laboratory analytical results for samples collected during the SI at SCHBR are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

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

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

The OSD residential tap water risk screening levels will be used to compare all groundwater for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at SCHBR are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, PFBS, PFNA, and PFHxS will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, PFBS, PFNA, or PFHxS 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 SCHBR (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 2022). The sample results discussion below focuses on the PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Tables 7-1 and **7-2** provide a summary of the groundwater and soil analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS. **Table 7-3** 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. An overview of AOPIs at SCHBR with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-6** show the PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results in groundwater and soil for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection are provided on the field forms in **Appendix J**. Soil descriptions are provided on the field forms in **Appendix J**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater was first encountered at a depth of approximately 559.32 feet bgs in the existing monitoring well sampled at Former Landfill/OU 4 (SCHBR-12).

Table 7-3 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Yes/No)
Former Landfill/OU 4 (SCHBR-12)	No
Building 494: Former Fire Station #15	Yes
Former Pumper Certification Location	No
Former Training Area	Yes
Building 140: Fire Station #15	No

7.1 Former Landfill/OU 4 (SCHBR-12)

The subsections below summarize the groundwater and soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with Former Landfill/OU 4 (SCHBR-12) shown on **Figure 7-2** and **Tables 7-1** and **7-2.**

7.1.1 Groundwater

One grab groundwater sample [SCHBR-(MW4-4)-102022] and a duplicate sample were collected on 20 October 2022 from an existing monitoring well (MW 4-4) located north-northeast and downgradient of the AOPI following purging using a portable submersible pump (**Figure 7-2, Table 7-1**). The depth to static groundwater was 559.32 feet below top of casing (**Appendix J**). Analytical results are as follows (duplicate results are shown in brackets):

- PFOS was detected in the groundwater sample at a concentration of 0.76 J (estimated quantity) ng/L. The detected concentration does not exceed the OSD tap water risk screening level (4 ng/L).
- PFOA was detected in the groundwater sample at a concentration of 4.7 ng/L [4.7 ng/L]. The detected concentration does not exceed the OSD tap water risk screening level (6 ng/L).
- PFBS was detected in the groundwater sample at a concentration of 1.4 J ng/L [1.5 J ng/L]. The detected concentration does not exceed the OSD tap water risk screening level (601 ng/L).
- PFNA was not detected in the groundwater sample. Therefore, there were no exceedances of the OSD tap water risk screening level (6 ng/L).
- PFHxS was detected in the groundwater sample at a concentration of 15 ng/L [15 ng/L]. The detected concentration does not exceed the OSD tap water risk screening level (39 ng/L).

7.1.2 Soil

Two soil samples were collected via hand auger at the Former Landfill/OU 4 (SCHBR-12) AOPI on 07 September 2022. Soil sample SCHBR-FLF-1-SO-090722 (0-2 feet bgs) was located approximately 150 feet southwest of MW-4 along a cleared path leading down to the drainage chute shown in **Figure 7-2** and SCHBR-FLF-2-SO-090722 (0-2 feet bgs) was located approximately 200 feet west of MW-4 within the drainage chute. A field duplicate (SCHBR-FD-1-SO-090722) was collected and corresponds to parent sample SCHBR-FLF-2-SO-090722. The field duplicate sample results are shown in brackets below following the parent sample results. A summary of PFOS, PFOA, PFBS, PFNA, and PFHxS soil analytical results is provided in **Table 7-2**.

- PFOS was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.013 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFOA was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFBS was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).
- PFNA was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).

- PFHxS was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

7.2 Building 494: Former Fire Station #15

The subsection below summarizes the soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with Building 494: Former Fire Station #15 shown on **Figure 7-3** and **Table 7-2**.

7.2.1 Soil

Four soil samples were collected via hand auger at the Building 494: Former Fire Station #15 AOPI on 07 and 08 September 2022. SCHBR-FFS-1-SO-09082 (0-2 feet bgs), SCHBR-FFS-2-SO-090822 (0-2 feet bgs), SCHBR-FFS-3-SO-090722 (0-2 feet bgs), and SCHBR-FFS-4-SO-090722 (0-2 feet bgs) were located in the southeast, south, east, and northeast areas, respectively, of the AOPI shown on **Figure 7-3**.

- PFOS was detected in all the soil samples at concentrations of 0.012 mg/kg, 0.13 mg/kg, 0.064 mg/kg, and 0.035 mg/kg at SCHBR-FFS-1-SO-090822, SCHBR-FFS-2-SO-090822, SCHBR-FFS-3-SO-090722, and SCHBR-FFS-4-SO-090722, respectively. Three of the four detected concentrations (SCHBR-FFS-2-SO-090822, SCHBR-FFS-3-SO-090722, and SCHBR-FFS-4-SO-090722) exceed the residential OSD risk screening level (0.013 mg/kg) but not the industrial/commercial OSD risk screening level.
- PFOA was detected in all the soil samples at concentrations of 0.0021 J+ (estimated quantity; may be biased high) mg/kg, 0.0064 J mg/kg, 0.0026 mg/kg, and 0.0021 mg/kg at SCHBR-FFS-1-SO-090822, SCHBR-FFS-2-SO-090822, SCHBR-FFS-3-SO-090722, and SCHBR-FFS-4-SO-090722, respectively. The detected concentrations do not exceed the residential OSD risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFBS was not detected in any of the four soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).
- PFNA was detected in all the soil samples at concentrations of 0.0022 J mg/kg, 0.0034 J+ mg/kg, 0.0017 mg/kg, and 0.00067 mg/kg at SCHBR-FFS-1-SO-090822, SCHBR-FFS-2-SO-090822, SCHBR-FFS-3-SO-090722, and SCHBR-FFS-4-SO-090722, respectively. The detected concentrations do not exceed the residential OSD risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFHxS was detected in two of the four soil samples at concentrations of 0.0046 mg/kg and 0.0019 mg/kg at SCHBR-FFS-2-SO-090822 and SCHBR-FFS-3-SO-090722, respectively. The detected concentrations do not exceed the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

7.3 Former Pumper Certification Location

The subsection below summarizes the soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with Former Pumper Certification Location shown on **Figure 7-4** and **Table 7-2**.

7.3.1 Soil

Five soil samples were collected via hand auger at the Former Pumper Certification Location AOPI on 06 September 2022. Soil samples SCHBR-FPCL-1-SO-090622 (0-2 feet bgs), SCHBR-FPCL-2-SO-090622 (0-2 feet bgs), SCHBR-FPCL-3-SO-090622 (0-2 feet bgs), SCHBR-FPCL-4-SO-090622 (0-2 feet bgs), and SCHBR-FPCL-5-SO-090622 (0-2 feet bgs) were located along the southwest boarder of the AOPI alongside Lyman Road shown on **Figure 7-4**.

- PFOS was detected in three of the five soil samples at concentrations of 0.0017 mg/kg, 0.0013 mg/kg, and 0.0011 mg/kg at SCHBR-FPCL-2-SO-090622, SCHBR-FPCL-4-SO-090622, and SCHBR-FPCL-5-SO-090622, respectively. The detected concentrations do not exceed the OSD residential risk screening level (0.013 mg/kg) or the OSD industrial/commercial risk screening level (0.16 mg/kg).
- PFOA was detected in three of the five soil samples at concentrations of 0.00048 J mg/kg, 0.00062 J mg/kg, and 0.00048 J mg/kg at SCHBR-FPCL-2-SO-090622, SCHBR-FPCL-4-SO-090622, and SCHBR-FPCL-5-SO-090622, respectively. The detected concentrations do not exceed the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFBS was not detected in any of the five soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).
- PFNA was not detected in any of the five soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFHxS was not detected in any of the five soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

7.4 Former Training Area

The subsections below summarize the soil PFOS, PFOA, PFBS, PFNA, PFHxS analytical results associated with the Former Training Area shown on **Figure 7-5** and **Table 7-2**.

7.4.1 Soil

Three soil samples were collected via hand auger at the Former Training Area AOPI on 06 September 2022. Soil samples SCHBR-FTA-1-SO-090622 (0-2 feet bgs), SCHBR-FTA-2-SO-090622 (0-2 feet bgs), and SCHBR-FTA-3-SO-090622 (0-2 feet bgs) were located along the southwestern boarder of the AOPI as shown on **Figure 7-5**.

- PFOS was detected in all three soil samples at concentrations of 0.0058 mg/kg, 0.034 mg/kg, and 0.0039 mg/kg at SCHBR-FTA-1-SO-090622, SCHBR-FTA-2-SO-090622, and SCHBR-FTA-3-SO-090622, respectively. One of the three detected concentrations (SCHBR-FTA-2-SO-090622) exceeded the OSD residential risk screening level (0.013 mg/kg) but not the OSD industrial/commercial risk screening level (0.16 mg/kg).
- PFOA was detected in all three soil samples at concentrations of 0.00060 J+ mg/kg, 0.0026 J+ mg/kg, and 0.00055 J+ mg/kg at SCHBR-FTA-1-SO-090622, SCHBR-FTA-2-SO-090622, and SCHBR-FTA-3-SO-090622, respectively. The detected concentrations do not exceed the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFBS was not detected in any of the three soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).
- PFNA was detected in two of the three soil samples at concentrations of 0.00086 J+ mg/kg and 0.0017 J+ mg/kg at SCHBR-FTA-1-SO-090622 and SCHBR-FTA-2-SO-090622, respectively. The detected concentrations do not exceed the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFHxS was not detected in any of the three soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

7.5 Building 140: Fire Station #15

The subsections below summarize the soil PFOS, PFOA, PFBS, PFNA, and PFHxS analytical results associated with Building 140: Fire Station #15 shown on **Figure 7-6** and **Table 7-2**.

7.5.1 Soil

Two soil samples were collected via hand auger at the Building 140: Fire Station #15 AOPI on 08 September 2022. Soil Samples SCHBR-FS15-1-SO-090822 (0-2 feet bgs) and SCHBR-FS15-2-SO-090822 (0-2 feet bgs) were located northwest of Building 140: Fire Station #15 as shown on **Figure 7-6**.

- PFOS was detected in both soil samples at concentrations of 0.00084 mg/kg and 0.0024 mg/kg at FS15-1-SO-090822 and SCHBR-FS15-2-SO-090822, respectively. The detected concentrations do not exceed the residential OSD risk screening level (0.013 mg/kg) or the OSD industrial/commercial risk screening level (0.16 mg/kg).
- PFOA was detected in both soil samples at concentrations of 0.00066 J mg/kg and 0.0017 mg/kg at FS15-1-SO-090822 and SCHBR-FS15-2-SO-090822, respectively. The detected concentrations do not exceed the residential OSD risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).

- PFBS was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (1.9 mg/kg) or the OSD industrial/commercial risk screening level (25 mg/kg).
- PFNA was detected in one of the two soil samples (SCHBR-FS15-2-SO-090822) at a concentration of 0.0016 mg/kg. The detected concentration does not exceed the OSD residential risk screening level (0.019 mg/kg) or the OSD industrial/commercial risk screening level (0.25 mg/kg).
- PFHxS was not detected in either of the soil samples. Therefore, there were no exceedances of the OSD residential risk screening level (0.13 mg/kg) or the OSD industrial/commercial risk screening level (1.6 mg/kg).

7.6 Dedicated Equipment Background Sample

One DEB (SCHBR-FLF-DEB-1-102022) was collected in association with parent sample SCHBR-MW4-4-GW-102022 at existing monitoring well MW 4-4. The parent sample and DEB pair had detections for PFOS, PFOA, PFBS, PFNA, and/or PFHxS constituents in both the parent and DEB sample (**Appendix L**). PFOS, PFOA, PFBS, PFNA, and/or PFHxS results between the paired DEB and parent sample had little variation, suggesting minor equipment influence, if any. MW 4-4 did not exceed any OSD screening levels in either the parent or DEB samples. The one DEB sample pair collected at SCHBR suggests that sampling using the dedicated downhole sampling equipment did not bias sample results for PFOS, PFOA, PFBS, PFNA, and/or PFHxS.

7.7 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, PFBS, PFNA, and PFHxS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The full analytical results from samples collected during the SI are included in **Appendix M**. The TOC in the soil samples ranged from 6,960 to 11,900 mg/kg. The TOC at this installation was within range than typically observed in topsoil: 5,000 to 30,000 mg/kg. The combined percentage of fines (i.e., silt and clay) in soils at SCHBR ranged from 21.6 to 95.6% with an average of 53.72%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture of the soil at SCHBR ranged from 11.4 to 23.5% with an average of 18.11% was typical for clay (0 to 20%). The pH of the soil ranged from 5.9 J standard units to 7.7 J standard units with an average of 6.98 standard units which is approximately neutral. Based on these geochemical and physical soil characteristics observed underlying the installation during the SI, PFAS constituents are expected to be relatively less mobile at SCHBR than in soils with lower percentages of fines and TOC.

7.8 Blank Samples

PFOS, PFOA, PFBS, PFNA, and PFHxS 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**.

7.9 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2022) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figure 7-7** through **Figure 7-9** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus 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, PFBS, PFNA, and PFHxS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS, PFNA, and PFHxS releases at Army installations are soil, groundwater, surface water, and sediment. Once released to the environment, a primary factor that inhibits the movement of PFAS constituents is the presence of organic matter and organic co-constituents in soils and sediments. Generally, PFAS constituents are mobile in the potentially affected media, and they are not known to be fully broken down by natural processes.

Based on the use, storage, and/or disposal of PFAS-containing materials at the 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, PFBS, PFNA, and PFHxS may be evaluated at a future date if those pathways warrant further consideration.

CSMs were developed for each individual AOPI at SCHBR and were combined where source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. The following exposure pathway determinations apply to all CSMs:

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in groundwater from a monitoring well located northeast and downgradient of the Former Landfill/OU 4 (SCHBR-12) AOPI. Groundwater samples were not collected at the Building 494: Former Fire Station #15, Former Pumper

Certification Location, Former Training Area, and Building 140: Fire Station #15 AOPIs. However, PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil samples collected at the four AOPIs; therefore, the compounds may be present in the underlying groundwater. Hydrogeological conditions at SCHBR are complex; however, the AOPIs appear to be upgradient or cross gradient of the four drinking water wells used to supply potable water to SCHBR. The groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers (i.e., installation personnel) and residents are potentially complete.

- Recreational users are not likely to contact groundwater during outdoor recreational activities; therefore, the groundwater exposure pathway for on-installation recreational users is incomplete.
- Groundwater originating at the AOPIs likely flows off-installation through the Main Post's north/northeast boundaries and south/southeast boundaries. Due to the lack of land use controls preventing potable use of the off-installation groundwater, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- PFOS, PFOA, PFBS, PFNA, and/or PFHxS may be transported to local surface water features via stormwater runoff, overland flow, and/or shallow groundwater discharge. Surface water features at SCHBR are not used as drinking water sources and are not likely regularly accessed by site workers or residents; therefore, the surface water and sediment exposure pathways for on-installation site workers and residents are incomplete.
- Recreational users could contact constituents in streams and gulches via incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for on-installation recreational users are potentially complete.
- Off-installation surface water features in proximity to SCHBR are likely not used for drinking water. However, recreational users could contact constituents in surface water and sediment via incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Additional exposure pathway descriptions for each CSM are listed below by figure.

Figure 7-7 shows the CSM for the Former Landfill/OU 4 (SCHBR-12) AOPI. Soil likely to have contained PFAS was disposed of at the landfill in 1980 and could have been transported to surrounding area soils prior to installation of the compacted soil cover. Access to the former landfill, which is bounded by an 8-foot-high chain-link fence and steep wooded slopes, is restricted to authorized personnel only.

- PFOS, PFOA, PFBS, PFNA, and PFHxS were not detected in any of the soil samples collected at the Former Landfill/OU 4 (SCHBR-12) AOPI. Based on the SI sample results, the soil exposure pathways for all receptors are incomplete.

Figure 7-8 shows the CSM for the Building 494: Former Fire Station #15, Former Pumper Certification, and Building 140: Fire Station #15 AOPIs. AFFF may have historically been released to soil and/or paved surfaces during standard operations at the Building 494: Former Fire Station #15, as a result of storing PFAS-containing materials containers at the current fire station (Building 140: Fire Station #15), and during training exercises and pumper certification at the Pumper Certification Location AOPI.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil samples collected at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- On-installation residents and recreational users and off-installation receptors are not likely to frequent the AOPIs. Therefore, the soil exposure pathways for those receptors are considered to be incomplete.

Figure 7-9 shows the CSM for the Former Training Area AOPI. AFFF may have historically been released to soil and/or paved surfaces during training exercises.

- PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil samples collected at this AOPI. The AOPI is currently occupied by residential housing. Site workers (e.g., landscaping personnel) and residents could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathways for on-installation site workers and residents are complete.
- Recreational users and off-installation receptors are not likely to frequent the AOPI; therefore, the soil exposure pathways for those receptors are considered to be incomplete.

Following the SI sampling, all five AOPIs were considered to have complete or potentially complete exposure pathways. Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for remedial investigation or additional supplemental groundwater sampling is based on the comparison of analytical results for PFOS, PFOA, PFBS, PFNA, and PFHxS to the OSD risk screening levels (**Table 6-2**).

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI at SCHBR included two distinct efforts. The PA identified AOPIs at SCHBR based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release of PFOS, PFOA, PFBS, PFNA, and PFHxS to the environment occurred. Additionally, a subsequent PA was conducted for the sub-installation KLOA which identified no AOPIs.

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, PFBS, PFNA, and PFHxS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, PFBS, PFNA, and PFHxS in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, PFBS, PFNA, and PFHxS use, storage, and/or disposal at SCHBR. Following the evaluation at SCHBR, four AOPIs were identified. Site reconnaissance was not conducted at KLOA due to the identification of zero AOPIs upon completion of the PA. Therefore, all information presented below regarding the SI is relevant for SCHBR only.

All AOPIs were sampled during the SI to identify presence or absence of PFOS, PFOA, PFBS, PFNA, and PFHxS at each AOPI. Of the six PFAS compounds presented in the 06 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at SCHBR because HFPO-DA is generally not a component of military specification AFFF and based on its history including distribution limitations that restricted use of HFPO-DA, it is generally not a component of other products the military used. In addition, it is unlikely that HFPO-DA would be an individual chemical of concern in the absence of other PFAS. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the SCHBR QAPP Addendum (Arcadis 2022).

All five AOPIs at SCHBR had detections of PFOS, PFOA, PFBS, PFNA, and/or PFHxS in groundwater or soil, and two AOPIs (Building 494: Former Fire Station #15 and Former Training Area) exceeded OSD risk screening levels for PFOS in soil only. PFOS was detected at concentrations exceeding the residential OSD risk screening level (0.013 mg/kg), but not the industrial/commercial OSD risk screening level (0.16 mg/kg), in three soil samples (SCHBR-FFS-2-SO-090822, SCHBR-FFS-3-SO-090722, and SCHBR-FFS-4-SO-090722) collected from the Building 494: Former Fire Station #15 AOPI and one soil sample (SCHBR-FTA-2-SO-090622) collected from the Former Training Area AOPI.

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

Groundwater

PFOS was detected at 0.76 J ng/L, below the OSD risk screening level for tap water (4 ng/L), in sample SCHBR-MW4-4-102022 at the Former Landfill/OU 4 (SCHBR-12) AOPI.

PFOA was detected at 4.7 ng/L, below the OSD risk screening level for tap water (6 ng/L), in sample SCHBR-MW4-4-102022 at the Former Landfill/OU 4 (SCHBR-12) AOPI.

PFBS was detected at 1.4 J ng/L, below the OSD risk screening level for tap water (601 ng/L), in sample SCHBR-MW4-4-102022 at the Former Landfill/OU 4 (SCHBR-12) AOPI.

PFNA was not detected in the groundwater sample collected.

PFHxS was detected at 15 ng/L, below the OSD risk screening level for tap water (39 ng/L), in sample SCHBR-MW4-4-102022 at the Former Landfill/OU 4 (SCHBR-12) AOPI.

Soil

PFOS was detected at 0.13 mg/kg, above the residential OSD risk screening level for soil (0.013 mg/kg), in sample SCHBR-FFS-2-SO-090822 at the Building 494: Former Fire Station #15 AOPI.

PFOA was detected at 0.0064 J mg/kg, below the residential OSD risk screening level for soil (0.019 mg/kg), in sample SCHBR-FFS-2-SO-090822 at the Building 494: Former Fire Station #15 AOPI.

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

PFNA was detected at 0.0034 J+ mg/kg, below the OSD risk screening level for soil (0.019 mg/kg), in sample SCHBR-FFS-2-SO-090822 at the Building 494: Former Fire Station #15 AOPI.

PFHxS was detected at 0.0046 mg/kg, below the residential OSD risk screening level for soil (0.13 mg/kg), in sample SCHBR-FFS-2-SO-090822 at the Building 494: Former Fire Station #15 AOPI.

Following the SI sampling, all five AOPIs with confirmed PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence were considered to have complete or potentially complete exposure pathways. Soil exposure pathways for on-installation site workers are complete at the four AOPIs where PFOS, PFOA, PFBS, PFNA, and/or PFHxS were detected in soil. The groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete for all five AOPIs. Due to a lack of land use controls off-installation and downgradient of SCHBR, the groundwater exposure pathways for off-installation drinking water receptors are also potentially complete for the five AOPIs. Surface water is not used for drinking water at SCHBR, however recreational users could contact constituents in surface water and sediment via incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways are potentially complete for all five AOPIs.

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

Table 8-1 Summary of AOPIs Identified during the PA; PFOS, PFOA, PFBS, PFNA, and PFHxS Sampling at SCHBR; and Recommendations

AOPI Name	PFOS, PFOA, PFBS, PFNA, and/or PFHxS detected greater than OSD Risk Screening Levels? (Yes/No/ND/NS)		Recommendation
	GW	SO	
Former Landfill/OU 4 (SCHBR-12)	No	ND	No action at this time
Building 494: Former Fire Station #15	NS	Yes	Further study in a remedial investigation
Former Pumper Certification Location	NS	No	Further evaluation[1]
Former Training Area	NS	Yes	Further study in a remedial investigation
Building 140: Fire Station #15	NS	No	Further evaluation[1]

Notes:
1 = Soil analytical data indicates PFOS, PFOA, PFBS, PFNA, and/or PFHxS presence below OSD risk screening levels, but because there is a potential for migration to groundwater, further evaluation is recommended.
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
NS – not sampled
SO – soil

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

Although soil analytical data indicates PFOS, PFOA, PFBS, PFNS, and/or PFHxS presence below OSD risk screening levels at the Building 494: Former Fire Station #15, Former Pumper Certification Location, and Building 140: Fire Station #15 AOPIs, groundwater pathways are potentially complete at these AOPIs. Groundwater samples were not collected during the SI, therefore supplemental groundwater sampling is recommended to further investigate the groundwater exposure pathways.

It is our understanding that FFD personnel are generally stationed at a FFD fire station for approximately two years before rotating to another fire station. The SCHBR fire station (Building 140: Fire Station #15 AOPI) came into operation in 2007. The PA site visit team was able to interview a FFD battalion chief currently stationed at Fire Station #15 (stationed at SCHBR for approximately 2 years by the time of the PA site visit) as well as one other FFD lieutenant who had previously been stationed at Fire Station #15. There is the potential for other historical fire responses with AFFF on SCHBR about which interviewees were unaware.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the SCHBR and KLOA PA processes. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, PFBS, PFNA, and PFHxS 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 the SCHBR and KLOA PAs; therefore, the information reviewed regarding off-post wells is limited to what is contained in the off post well search results (**Appendix D**).

The SCHBR and KLOA searches for ecological receptors and off-post PFOS, PFOA, PFBS, PFNA, and PFHxS 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 at SCHBR (site reconnaissance was not conducted at KLOA because AOPIs were not identified at this installation during the PA).

Finally, the available PFOS, PFOA, PFBS, PFNA, and PFHxS analytical data at SCHBR is limited to on-post soil sampling locations. The one sample taken from the existing monitoring well (MW 4-4) at the Former Landfill/OU4 (SCHBR-12) showed evidence of result bias from dedicated downhole sampling equipment. However, there were no exceedances of PFOS, PFOA, PFBS, PFNA, and/or PFHxS in the parent or associated DEB sample and no detections in the soil samples collected at the AOPI, therefore further investigation is not warranted at this AOPI. Available data, including PFOS, PFOA, PFBS, PFNA, and PFHxS, is listed in **Appendix M**, which were analyzed per the selected analytical method. HFPO-DA was not in the suite of PFAS compounds analyzed during the SI at SCHBR because it was not considered to be a constituent of concern at the time; therefore, there are no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels.

Results from the PA at KLOA indicate further investigation is not warranted at this time; however, results from the PA/SI at SCHBR indicate further study in a remedial investigation is warranted in accordance with the guidance provided by the OSD.

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ACRONYMS

°F	degrees Fahrenheit
%	percent
AFFF	aqueous film-forming foam
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	United States Army
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DEB	dedicated equipment background
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DPW	Directorate of Public Works
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
GIS	geographic information system
GW	groundwater
Harding	Harding Lawson Associates
HFPO-DA	hexafluoropropylene oxide dimer acid
HQAES	Headquarters Army Environmental System
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army or Reserve installation
IRP	Installation Restoration Program
KLOA	Kawailoa-Poamoho Training Area
LOD	limit of detection

LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
ND	non-detect
ng/L	nanograms per liter (parts per trillion)
NS	not sampled
OSD	Office of the Secretary of Defense
OU	operable unit
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SCHBR	Schofield Barracks
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States

UCMR3	third Unregulated Contaminant Monitoring Rule
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USAG-HI	United States Army Garrison Hawaii
USEPA	United States Environmental Protection Agency
WAAF	Wheeler Army Airfield
WRCC	Western Regional Climate Center

TABLES

Table 6-1 Monitoring Well Construction Details
USAEC PFAS Preliminary Inspection/Site Inspection
Schofield Barracks and Kawailoa-Poamoho Training Area, Hawaii

Associated AOPI	Well Identification	Coordinates		Screened Interval (ft bgs)	Total Depth (ft bgs)
		Latitude	Longitude		
Former Landfill/OU 4 (SCHBR-12)	MW 4-4	21.5063888	-158.0725	546 - 696	770

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

Table 7-1 Groundwater PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Schofield Barracks and Kawailoa-Poamoho Training Area, Hawaii

Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)		PFNA (ng/L)		PFHxS (ng/L)	
			OSD Tapwater Risk Screening Level	4		6		601		6		39	
			Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SCHBR-MW4-4-GW	SCHBR-(MW4-4)-102022 /	10/20/2022	N	**0.76**	J	**4.7**		**1.4**	J	1.8	U	**15**	
	SCHBR-FD-1-GW-102022	10/20/2022	FD	1.8	U	**4.7**		**1.5**	J	1.8	U	**15**	

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

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

Qualifier:
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)

Table 7-2 Soil PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Schofield Barracks and Kawailoa-Poamoho Training Area, Hawaii

Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)		PFNA (mg/kg)		PFHxS (mg/kg)	
			OSD Industrial/Commercial Risk Screening Level	0.16		0.25		25		0.25		1.6	
			OSD Residential Risk Screening Level	0.013		0.019		1.9		0.019		0.13	
			Sample Type	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SCHBR-FFS-1-SO	SCHBR-FFS-1-SO-090822	09/08/2022	N	**0.012**		**0.0021**	J+	0.0024	U	**0.0022**	J	0.00071	U
SCHBR-FFS-2-SO	SCHBR-FFS-2-SO-090822	09/08/2022	N	**0.13**		**0.0064**	J	0.0024	U	**0.0034**	J+	**0.0046**	
SCHBR-FFS-3-SO	SCHBR-FFS-3-SO-090722	09/07/2022	N	**0.064**		**0.0026**		0.0024	U	**0.0017**		**0.0019**	
SCHBR-FFS-4-SO	SCHBR-FFS-4-SO-090722	09/07/2022	N	**0.035**		**0.0021**		0.0022	U	**0.00067**		0.00067	U
SCHBR-FLF-1-SO	SCHBR-FLF-1-SO-090722	09/07/2022	N	0.00073	U	0.00073	U	0.0024	U	0.00073	U	0.00073	U
SCHBR-FLF-2-SO	SCHBR-FLF-2-SO-090722 / SCHBR-FD-1-SO-090722	09/07/2022	N	0.00071	U	0.00071	U	0.0024	U	0.00071	U	0.00071	U
		09/07/2022	FD	0.00074	U	0.00074	U	0.0025	U	0.00074	U	0.00074	U
SCHBR-FPCL-1-SO	SCHBR-FPCL-1-SO-090622	09/06/2022	N	0.00073	U	0.00072	U	0.0024	U	0.00072	U	0.00073	U
SCHBR-FPCL-2-SO	SCHBR-FPCL-2-SO-090622	09/06/2022	N	**0.0017**		**0.00048**	J	0.0024	U	0.00073	U	0.00073	U
SCHBR-FPCL-3-SO	SCHBR-FPCL-3-SO-090622	09/06/2022	N	0.00072	U	0.00072	U	0.0024	U	0.00072	U	0.00072	U
SCHBR-FPCL-4-SO	SCHBR-FPCL-4-SO-090622	09/06/2022	N	**0.0013**		**0.00062**	J	0.0024	U	0.00071	U	0.00071	U
SCHBR-FPCL-5-SO	SCHBR-FPCL-5-SO-090622	09/06/2022	N	**0.0011**		**0.00048**	J	0.0024	U	0.00071	U	0.00071	U
SCHBR-FS15-1-SO	SCHBR-FS15-1-SO-090822	09/08/2022	N	**0.00084**		**0.00066**	J	0.0023	U	0.0007	U	0.0007	U
SCHBR-FS15-2-SO	SCHBR-FS15-2-SO-090822	09/08/2022	N	**0.0024**		**0.0017**		0.0021	U	**0.0016**		0.00063	U
SCHBR-FTA-1-SO	SCHBR-FTA-1-SO-090622	09/06/2022	N	**0.0058**		**0.0006**	J+	0.0024	U	**0.00086**	J+	0.00072	U
SCHBR-FTA-2-SO	SCHBR-FTA-2-SO-090622	09/06/2022	N	**0.034**		**0.0026**	J+	0.0024	U	**0.0017**	J+	0.00067	U
SCHBR-FTA-3-SO	SCHBR-FTA-3-SO-090622	09/06/2022	N	**0.0039**		**0.00055**	J+	0.0023	U	0.00067	U	0.0007	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2022. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July).
3. Gray shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2022).
4. Gray shaded and italicized values indicate the result was detected greater than the industrial/commercial scenario (i.e., and therefore greater than the residential scenario) risk screening levels (OSD 2022).

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

Qualifier:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
J+ = The result is an estimated quantity; the result may be biased high.
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 Schofield Barracks and Kawailoa-Poamoho Training Area, HI

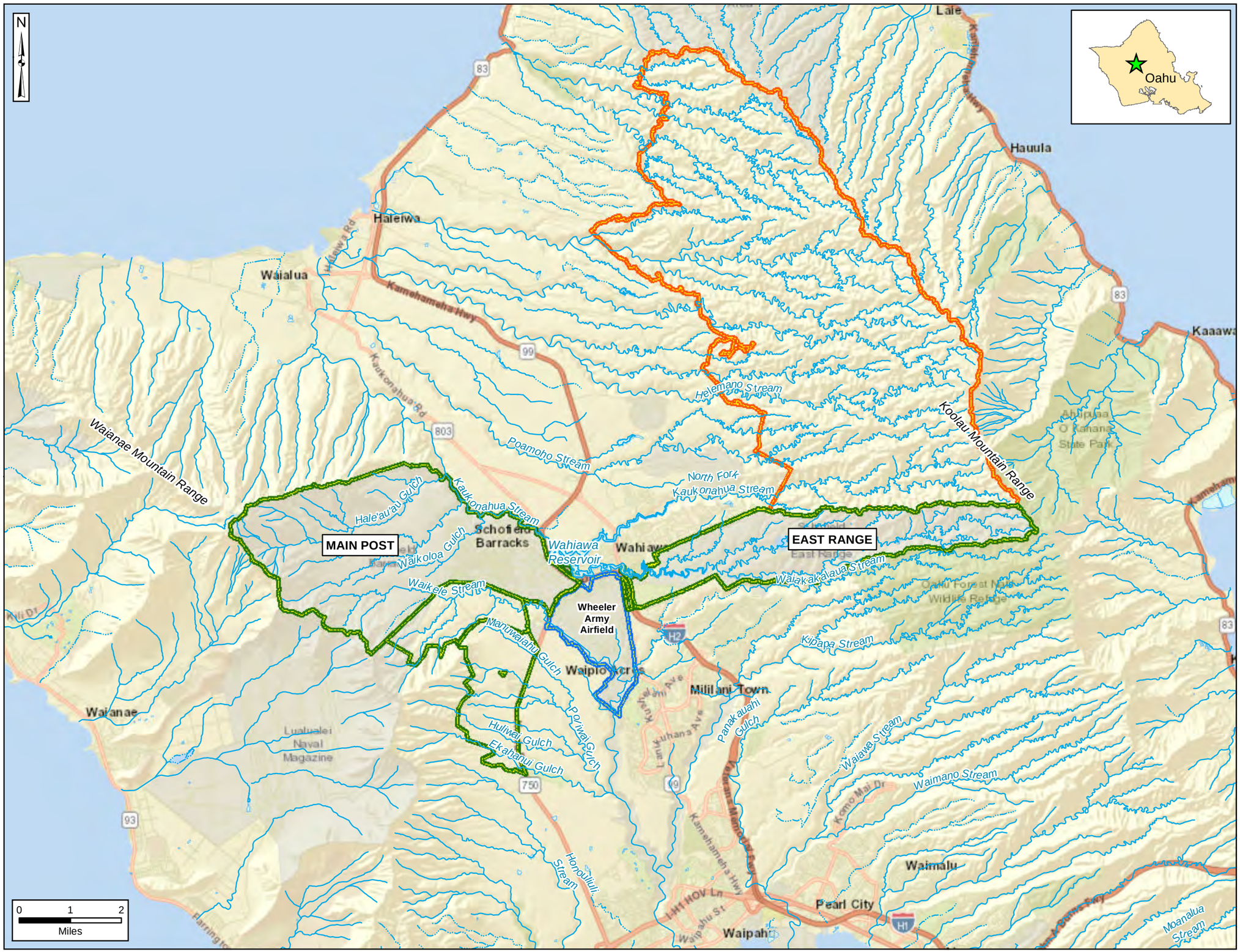

Figure 2-1
Site Location

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body

Data Sources:
USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

ARCADIS

Figure 2-2a
Schofield Barracks Site Layout

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Assumed Groundwater Flow Direction
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

Data Sources:
USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
EDR, Well, Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 2-2b
Kawailoa-Poamoho Training Area Site Layout

N

KAWAILOA

POAMOHO

WAIPAHU-EWA-WAIANAE

WAIPAHU-EWA-WAIANAE

ZIONS LAIE

ZIONS LAIE

ZIONS LAIE

ZIONS LAIE

ZIONS LAIE

WAIALUA-HALEIWA

WAIALUA-HALEIWA

WAIALUA-HALEIWA

WAIALUA-HALEIWA

WAIALUA SUGAR COMPANY

Wahiawa BWS WAHIAWA

CAMP STOVER

KUNIA VILLAGE

MILILANI

MILILANI

WAIAHOLE

Wheeler Army Airfield

Schofield Barracks

Wahiawa Reservoir

Helemano Stream

Poamoho Stream

North Fork Kaukonahua Stream

Kaukonahua Stream

Waikele Stream

Waiakakalaua Stream

Manuwaiahu Gulch

Waikoloa Gulch

Mohiakea Gulch

Haleauau Gulch

Koolau Mountain Range

Haleiwa

Hauula

Kahuku Training Area

Lale Bay

Kahana Bay

Sacred Falls State Park

Hupuas & Kahana State Park

Schofield Barracks East Range

Oahu Forest Natl Wildlife Refuge

NCTAMS PAC

0 0.5 1 Miles

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- Paomoho
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Assumed Groundwater Flow Direction
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

Data Sources:
USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
EDR, Well, Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 2-3
Topographic Map

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Surface Water Flow Direction
- Assumed Groundwater Flow Direction
- Elevation Contour (Index)
- Elevation Contour (Intermediate)

Notes:
1) Contour labels are in feet.
2) In general, the direction of groundwater flow at the Schofield Barracks Main Post is towards the southeast and at Kawailoa-Poamoho Training Area is from the mountains to the coast west and then northwest away from the installation (USAG-HI 2010; Oki 1998; Nichols, et al. 1997. *Geohydrology of the Central Oahu, Hawaii, Ground-Water Flow System and Numerical Simulation of the Effects of Additional Pumping* (United States Geological Survey Water-Resources Investigations Report 97-4276)).
3) Surface water flow direction is based on hydrology and topography.

Data Sources:
USAG-HI, GIS Data, 2018;
USGS, Water-Resources Investigations Report 97-4276, Groundwater Flow, 1998;
Hawaii State GIS, Elevation Contours, 2022;
HI State GIS, Rivers/Streams, 2018;
ESRI, ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 4 North

N

0 0.5 1 Miles

MAIN POST

EAST RANGE

Waianae Mountain Range

Koolau Mountain Range

Helemano Stream

Poamoho Stream

North Fork Kaukonahua Stream

Kaukonahua Stream

Hale'auau Gulch

Waikoloa Gulch

Wahiawa Reservoir

Waikele Stream

Waiakakalaua Stream

Manuwalahu Gulch

Poliwai Gulch

Hulmai Gulch

Ekahanui Gulch

Kipapa Stream

Panakauahi Gulch

Waiawa Stream

Waimano Stream

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 2-4a
Schofield Barracks
Off-Post Potable Supply Wells

Legend

- Schofield Barracks
- 5-Mile Radius
- Kawailoa-Poamoho Training Area
- Other Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

Note: Public Water Supply System Well data from the Federal Reporting Data System includes water systems that provide water to at least 25 people for at least 60 days annually. Other designated use wells includes agricultural wells, industrial wells, irrigation wells and wells of other or unknown use.

Data Sources:
USAG-HI, GIS Data, 2018
EDR, Well Data, 2018
HI State GIS, Rivers/Streams, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

0 1 2 Miles

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

ARCADIS

Figure 2-4b
Kawailoa-Poamoho Training Area Off-Post Potable Supply Wells

Legend

- Kawailoa-Poamoho Training Area
- Poamoho
- 5-Mile Radius
- Schofield Barracks
- Other Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

Note: Public Water Supply System Well data from the Federal Reporting Data System includes water systems that provide water to at least 25 people for at least 60 days annually. Other designated use wells includes agricultural wells, industrial wells, irrigation wells and wells of other or unknown use.

Data Sources:
USAG-HI, GIS Data, 2018
EDR, Well Data, 2018
HI State GIS, Rivers/Streams, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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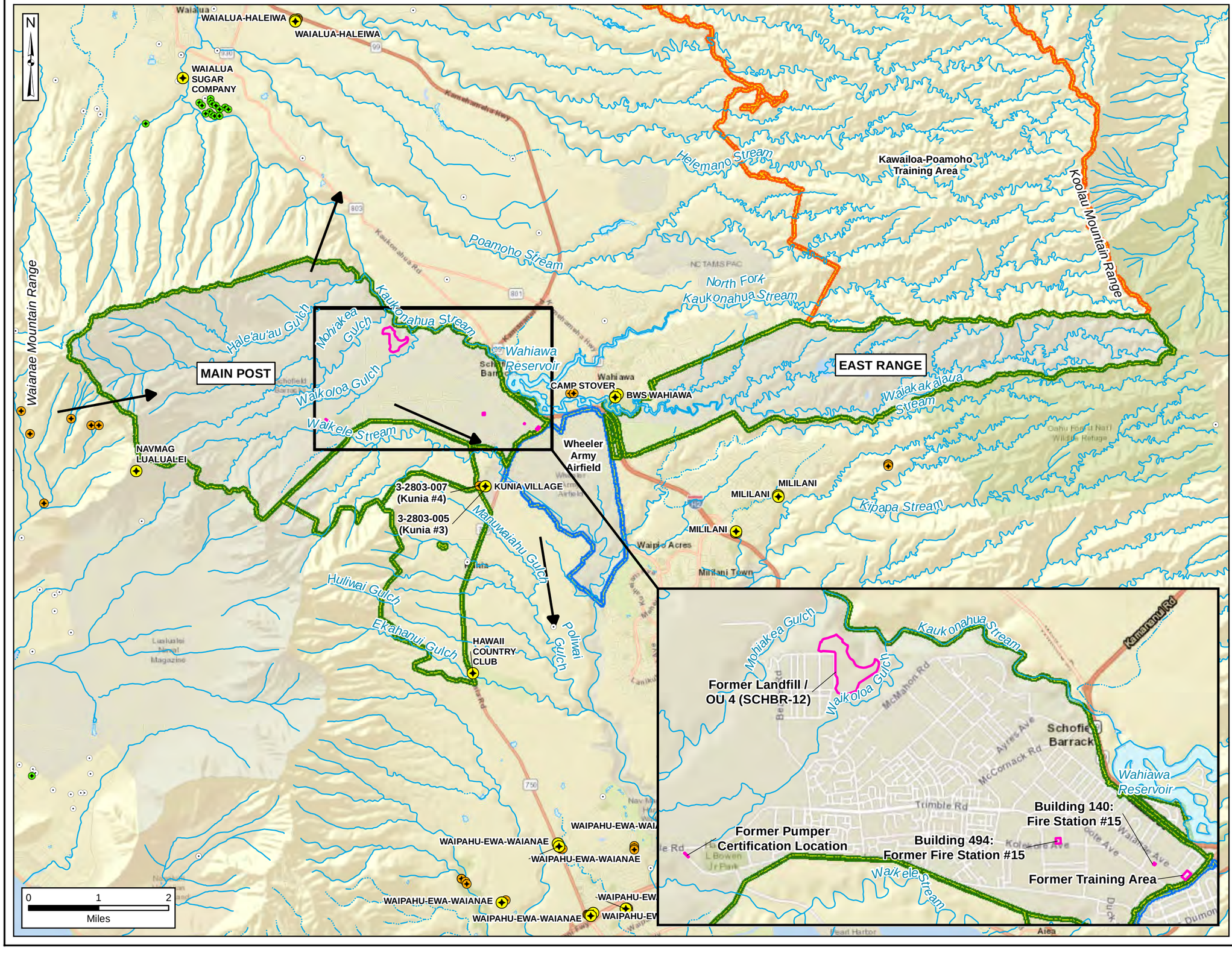
Figure 5-2
AOPI Locations



Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Assumed Groundwater Flow Direction
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

AOPI = area of potential interest
OU = Operable Unit
SCHBR = Schofield Barracks

Note: Public Water Supply System Well data from the Federal Reporting Data System includes water systems that provide water to at least 25 people for at least 60 days annually. Other designated use wells includes agricultural wells, industrial wells, irrigation wells and wells of other or unknown use.

Data Sources:
USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
EDR, Well, Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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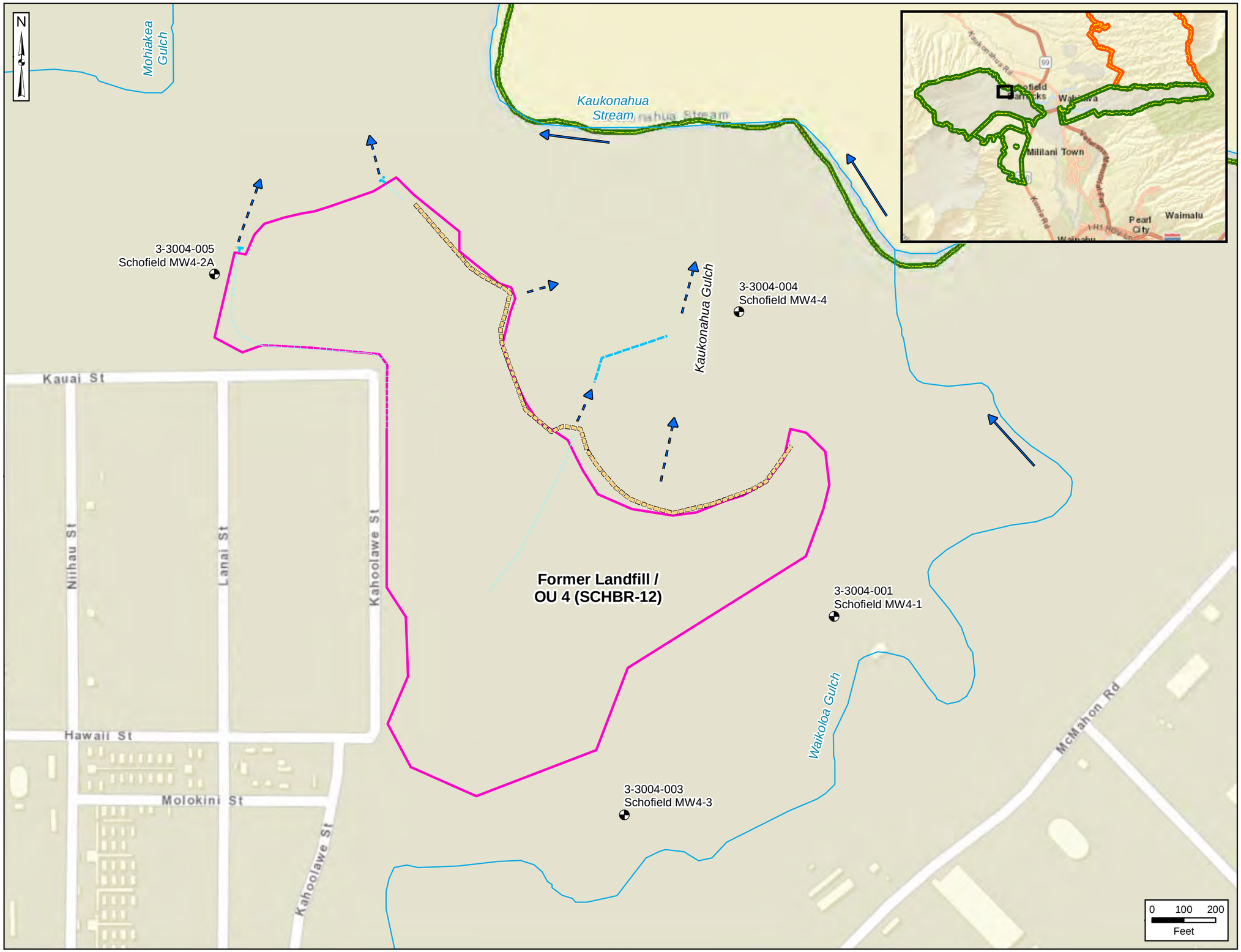
Figure 5-3
Former Landfill / OU 4
(SCHBR-12)



Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stream (Perennial)
- Drainage Channel
- Drainage Chute
- Runoff Control Berms
- Monitoring Well
- Surface Water Flow Direction
- Stormwater/Surface Runoff Flow Direction

AOPI = area of potential interest
OU = Operable Unit
SCHBR = Schofield Barracks

Data Sources:
MW4-1, MW4-2A, MW4-3, and MW4-4 well locations: USAEC and DPW USAG-HI, (CAPE Figure) *Final Long-Term Monitoring Report, OU 2 and OU4, Schofield Barracks, Annual Report FY18*, 2019

Kaukonahua Gulch location: Harding Lawson Associates, *Final Preliminary Assessment/Site Investigation Report For OU 1, OU 2, and OU 4, Schofield Barracks*, 1992

USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS
Preliminary Assessment / Site Inspection
Schofield Barracks and Kawailoa-Poamoho Training Area, HI

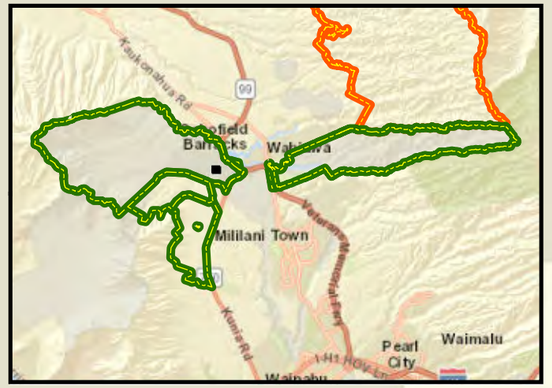


Figure 5-4
Building 494:
Former Fire Station #15

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stormwater/Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

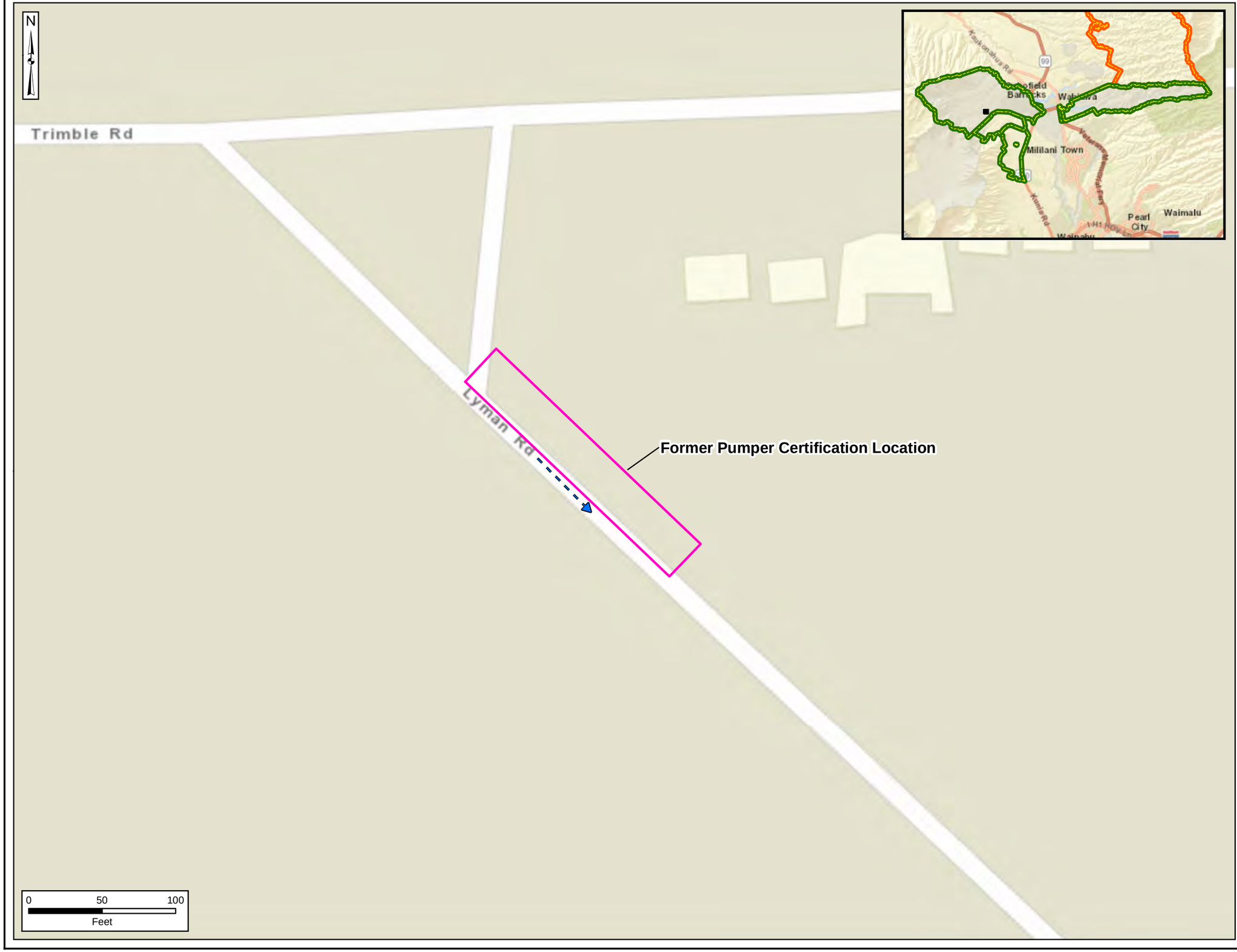


Figure 5-5
Former Pumper Certification Location

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stormwater/Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 5-6
Former Training Area

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI

AOPI = area of potential interest

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 5-7
Building 140: Fire Station #15

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI

AOPI = area of potential interest

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 7-1
AOPI Locations and OSD Risk Screening Level Exceedances

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- AOPI with OSD Risk Screening Level Exceedance
- Adjacent Military Installation
- Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Water Flow Direction
- Assumed Groundwater Flow Direction
- Public Water Supply System Well
- Other Public Supply Well
- Domestic Well
- Other Designated Use Water Well

AOPI = area of potential interest
OSD = Office of the Secretary of Defense
OU = Operable Unit
SCHBR = Schofield Barracks

Note: Public Water Supply System Well data from the Federal Reporting Data System includes water systems that provide water to at least 25 people for at least 60 days annually. Other designated use wells includes agricultural wells, industrial wells, irrigation wells and wells of other or unknown use.

Data Sources:
USAG-HI, GIS Data, 2018
HI State GIS, Rivers/Streams, 2018
EDR, Well, Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

N

0 1 2 Miles

MAIN POST

EAST RANGE

Former Landfill / OU 4 (SCHBR-12)

Former Pumper Certification Location

Building 494: Former Fire Station #15

Building 140: Fire Station #15

Former Training Area

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

SCHBR-MW4-4-GW	
Date	10/20/2022
Depth	559.32 ft
PFOS	**0.76 J** [1.8 U]
PFOA	**4.7 [4.7]**
PFBS	**1.4 J [1.5 J]**
PFNA	1.8 U [1.8 U]
PFHxS	**15 [15]**

SCHBR-FLF-1-SO	
Date	9/7/2022
Depth	0-2 ft
PFOS	0.00073 U
PFOA	0.00073 U
PFBS	0.0024 U
PFNA	0.00073 U
PFHxS	0.00073 U

SCHBR-FLF-2-SO	
Date	9/7/2022
Depth	0-2 ft
PFOS	0.00071 U [0.00074 U]
PFOA	0.00071 U [0.00074 U]
PFBS	0.0024 U [0.0025 U]
PFNA	0.00071 U [0.00074 U]
PFHxS	0.00071 U [0.00074 U]

Kaukonahua Stream

Kaukonahua Gulch

Waikoloa Gulch

3-3004-005
Schofield MW4-2A

3-3004-001
Schofield MW4-1

3-3004-003
Schofield MW4-3

Former Landfill / OU 4 (SCHBR-12)

Kauai St
Niihau St
Lana
Kahoolawe St
Hawaii St
Molokini St
Kamehameha Hwy

0 100 200
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Groundwater results are reported in nanograms per liter (ng/L).
3. Duplicate sample results are shown in brackets.
4. 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).

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

ARCADIS

Figure 7-2
Former Landfill / OU 4 (SCHBR-12)
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results

Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stream (Perennial)
- Drainage Channel
- Drainage Chute
- Runoff Control Berms
- Monitoring Well
- Surface Water Flow Direction
- Stormwater/Surface Runoff Flow Direction
- Shallow Soil Sampling Location
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft = feet
GW = groundwater
OU = Operable Unit
PFBS = perfluorobutanesulfonic acid
PFHxS = perfluorohexane sulfonate
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SCHBR = Schofield Barracks
SO = soil

Data Sources:
MW4-1, MW4-2A, MW4-3, and MW4-4 well locations: USAEC and DPW USAG-HI, (CAPE Figure) *Final Long-Term Monitoring Report, OU 2 and OU4, Schofield Barracks, Annual Report FY18*, 2019

Kaukonahua Gulch location: Harding Lawson Associates, *Final Preliminary Assessment/Site Investigation Report For OU 1, OU 2, and OU 4, Schofield Barracks*, 1992

USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

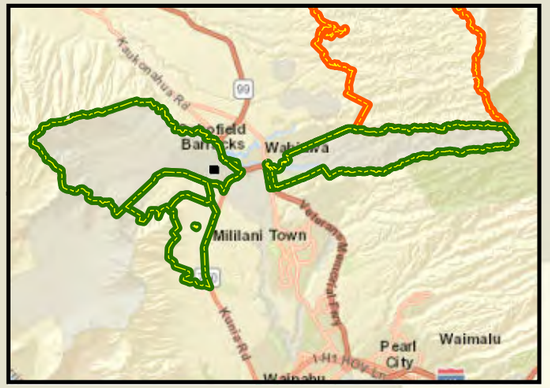
Chemical	Residential Scenario Risk Screening Level	Industrial/Commercial Scenario Risk Screening Level
	Soil (mg/kg)	Soil (mg/kg)
PFOS	0.013	0.16
PFOA	0.019	0.25
PFBS	1.9	25
PFNA	0.019	0.25
PFHxS	0.13	1.6

SCHBR-FFS-4-SO	
Date	9/7/2022
Depth	0-2 ft
PFOS	**0.035**
PFOA	**0.0021**
PFBS	0.0022 U
PFNA	**0.00067**
PFHxS	0.00067 U

SCHBR-FFS-3-SO	
Date	9/7/2022
Depth	0-2 ft
PFOS	**0.064**
PFOA	**0.0026**
PFBS	0.0024 U
PFNA	**0.0017**
PFHxS	**0.0019**

SCHBR-FFS-1-SO	
Date	9/8/2022
Depth	0-2 ft
PFOS	**0.012**
PFOA	**0.0021 J+**
PFBS	0.0024 U
PFNA	**0.0022 J**
PFHxS	0.00071 U

SCHBR-FFS-2-SO	
Date	9/8/2022
Depth	0-2 ft
PFOS	**0.13**
PFOA	**0.0064 J**
PFBS	0.0024 U
PFNA	**0.0034 J+**
PFHxS	**0.0046**



Building 494:
Former Fire Station #15

Heard Ave

Kolekole Ave

Kolekole Ave

2079

2080

Schofield Barracks

0 50 100
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.
3. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

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

USAEC PFAS
Preliminary Assessment / Site Inspection
Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 7-3
Building 494:
Former Fire Station #15
PFOS, PFOA, PFBS, PFNA, and PFHxS
Analytical Results

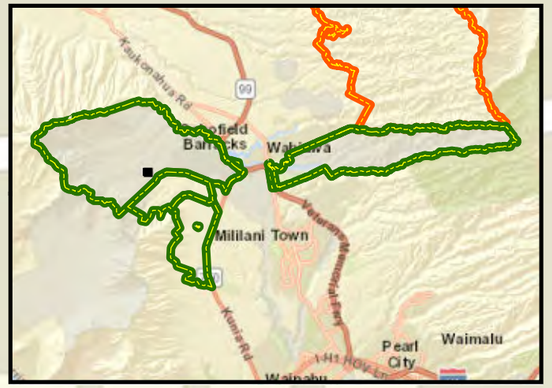
Legend
- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stormwater/Surface Runoff Flow Direction
- Shallow Soil Sampling Location

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

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

Chemical	Residential Scenario Risk Screening Level	Industrial/Commercial Scenario Risk Screening Level
	Soil (mg/kg)	Soil (mg/kg)
PFOS	0.013	0.16
PFOA	0.019	0.25
PFBS	1.9	25
PFNA	0.019	0.25
PFHxS	0.13	1.6



SCHBR-FPCL-1-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	0.00073 U
PFOA	0.00072 U
PFBS	0.0024 U
PFNA	0.00072 U
PFHxS	0.00073 U

SCHBR-FPCL-2-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.0017**
PFOA	**0.00048 J**
PFBS	0.0024 U
PFNA	0.00073 U
PFHxS	0.00073 U

SCHBR-FPCL-3-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	0.00072 U
PFOA	0.00072 U
PFBS	0.0024 U
PFNA	0.00072 U
PFHxS	0.00072 U

SCHBR-FPCL-4-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.0013**
PFOA	**0.00062 J**
PFBS	0.0024 U
PFNA	0.00071 U
PFHxS	0.00071 U

SCHBR-FPCL-5-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.0011**
PFOA	**0.00048 J**
PFBS	0.0024 U
PFNA	0.00071 U
PFHxS	0.00071 U

Former Pumper Certification Location

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. 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).

0 50 100
Feet

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

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Figure 7-4
Former Pumper Certification Location PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results

Legend

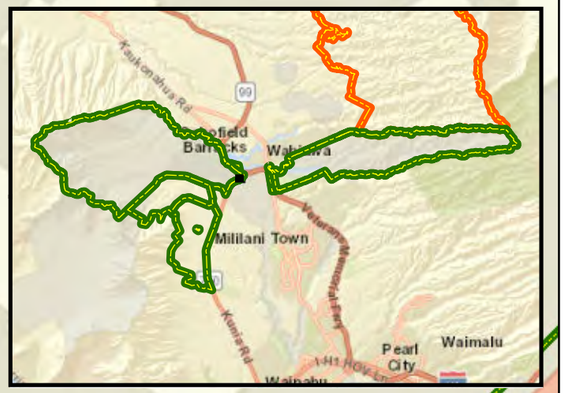
- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Stormwater/Surface Runoff Flow Direction
- Shallow Soil Sampling Location

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

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

Chemical	Residential Scenario Risk Screening Level	Industrial/Commercial Scenario Risk Screening Level
	Soil (mg/kg)	Soil (mg/kg)
PFOS	0.013	0.16
PFOA	0.019	0.25
PFBS	1.9	25
PFNA	0.019	0.25
PFHxS	0.13	1.6



Former Training Area

SCHBR-FTA-1-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.0058**
PFOA	**0.00060 J+**
PFBS	0.0024 U
PFNA	**0.00086 J+**
PFHxS	0.00072 U

SCHBR-FTA-2-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.034**
PFOA	**0.0026 J+**
PFBS	0.0024 U
PFNA	**0.0017 J+**
PFHxS	0.00067 U

SCHBR-FTA-3-SO	
Date	9/6/2022
Depth	0-2 ft
PFOS	**0.0039**
PFOA	**0.00055 J+**
PFBS	0.0023 U
PFNA	0.00067 U
PFHxS	0.00070 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.
3. Results that exceed Office of the Secretary of Defense (OSD) residential scenario risk screening levels (OSD 2022) are highlighted gray.

Qualifiers:
J+ = The result is an estimated quantity; the result may be biased high.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 50 100
Feet

Dickman
Young Ct
Belcher Ct
Kunia Rd
Alainae Ave
750
54
57
2

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

ARCADIS

Figure 7-5
Former Training Area
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results

Legend
- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Shallow Soil Sampling Location

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

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North

Chemical	Residential Scenario Risk Screening Level	Industrial/Commercial Scenario Risk Screening Level
	Soil (mg/kg)	Soil (mg/kg)
PFOS	0.013	0.16
PFOA	0.019	0.25
PFBS	1.9	25
PFNA	0.019	0.25
PFHxS	0.13	1.6

SCHBR-FS15-2-SO	
Date	9/8/2022
Depth	0-2 ft
PFOS	**0.0024**
PFOA	**0.0017**
PFBS	0.0021 U
PFNA	**0.0016**
PFHxS	0.00063 U

Building 140: Fire Station #15

SCHBR-FS15-1-SO	
Date	9/8/2022
Depth	0-2 ft
PFOS	**0.00084**
PFOA	**0.00066 J**
PFBS	0.0023 U
PFNA	0.00070 U
PFHxS	0.00070 U

Devol Rd

Waianae Ave

0 50 100
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. 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).

USAEC PFAS Preliminary Assessment / Site Inspection Schofield Barracks and Kawailoa-Poamoho Training Area, HI

ARCADIS

Figure 7-6
Building 140: Fire Station #15
PFOS, PFOA, PFBS, PFNA, and PFHxS Analytical Results

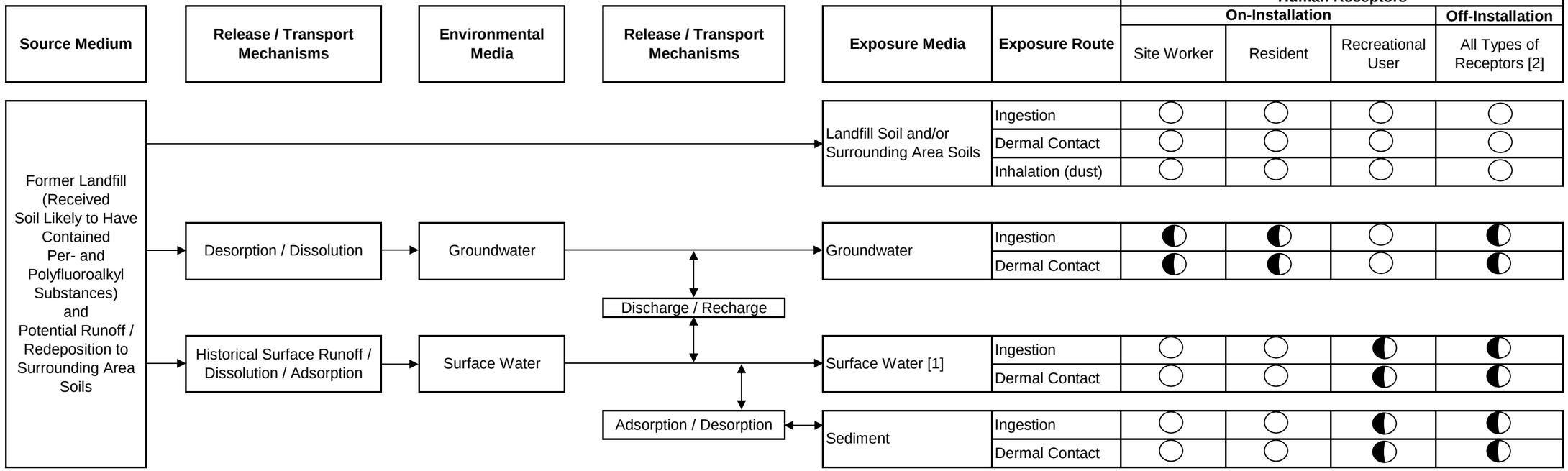
Legend

- Schofield Barracks
- Kawailoa-Poamoho Training Area
- AOPI
- Shallow Soil Sampling Location

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

Data Sources:
USAG-HI, GIS Data, 2018
ESRI, ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 4 North



Legend:

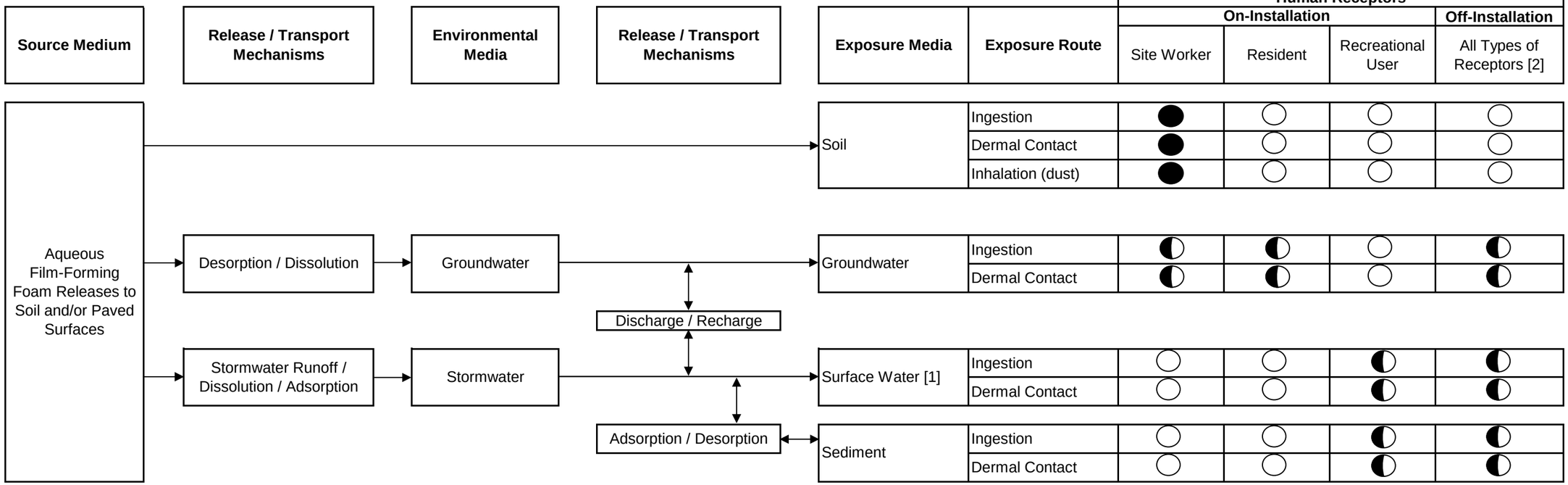
- ● = Complete Exposure Pathway
- ◐ = Potentially Complete Exposure Pathway
- ○ = Incomplete Exposure Pathway

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

ARCADIS

Conceptual Site Model for Former Landfill / OU 4 (SCHBR-12) AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Schofield Barracks, Hawaii

Figure 7-7



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Notes:

[1] Surface water exposure pathway for Site Workers and Residents describes a drinking water scenario, and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario.

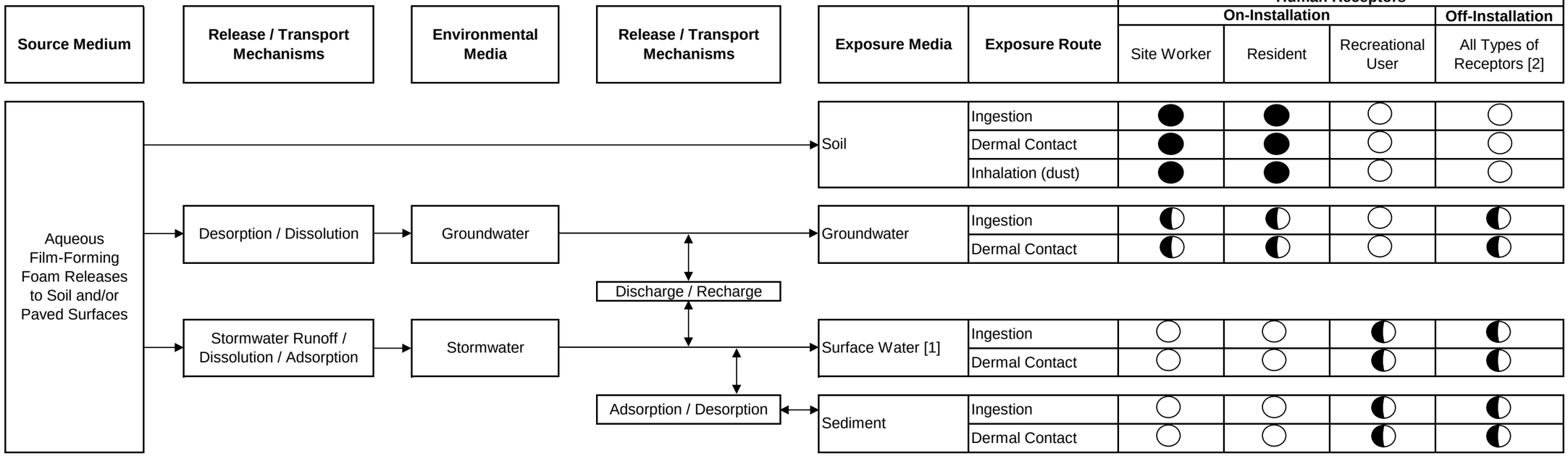
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

Conceptual Site Model for Building 494: Former Fire Station #15, Former Pumper Certification Location, and Building 140: Fire Station #15 AOPIs

USAEC PFAS Preliminary Assessment / Site Inspection

Schofield Barracks, Hawaii

Figure 7-8



Legend:

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

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

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Conceptual Site Model for Former Training Area AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Schofield Barracks, Hawaii

Figure 7-9