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

Yuma Proving Ground, Arizona

Prepared For:
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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Yuma Proving Ground, Arizona

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YPG is situated within two counties, Yuma and La Paz, in the southwestern quarter of Arizona approximately 25 miles to the north-northeast of the city of Yuma, Arizona. The installation occupies 838,174 acres of land and is subdivided into four geographic and functional areas; (1) Main Post Howard, (2) Kofa, (3) Laguna Army Air Field (LAAF), and (4) K9 Village.

Fifteen AOPIs were identified during the PA and recommended for investigation during the SI phase. SI sampling results from the AOPIs sampled were compared to risk screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS.

PFOS, PFOA, and/or PFBS were detected in soil and/or groundwater at all 15 AOPIs; 10 of the 15 AOPIs sampled had PFOS, PFOA, and/or PFBS present at concentrations greater than the OSD risk screening levels. The YPG PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

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

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Y/N/ND/NS)			Recommendation
	GW	SO	SW	
Former Combined Maintenance Facility (YPG-AOPI-01)	No	Yes	No	Further study in a remedial investigation
Former Fire Station (YPG-AOPI-02)	Yes	No	NS	Further study in a remedial investigation
Fire Station 2 (YPG-AOPI-03)	Yes	No	NS	Further study in a remedial investigation
New FTP (YPG-AOPI-04)	NS	Yes	NS	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Y/N/ND/NS)			Recommendation
	GW	SO	SW	
Old FTP (YPG-AOPI-05)	NS	Yes	NS	Further study in a remedial investigation
Drafting Pit (YPG-AOPI-06)	NS	No	NS	No action at this time
C-130 Fuel Response (YPG-AOPI-07)	ND	No	NS	No action at this time
Fire Station 1 (YPG-AOPI-08)	NS	Yes	NS	Further study in a remedial investigation
Fire Station 4 (YPG-AOPI-09)	NS	Yes	NS	Further study in a remedial investigation
Turret Testing Area (YPG-AOPI-10)	NS	Yes	NS	Further study in a remedial investigation
Fire Station 3 (YPG-AOPI-11)	NS	No	NS	No action at this time
Aberdeen Road Fire Response (YPG-AOPI-12)	NS	No	NS	No action at this time
Combined Maintenance Facility (YPG-AOPI-13)	NS	No	NS	No action at this time
Building 105 (YPG-AOPI-14)	Yes	NS	NS	Further study in a remedial investigation
Trap Mission Training Support (YPG-AOPI-15)	NS	Yes	NS	Further study in remedial investigation

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
ND – non-detect
NS – not sampled
SO – soil
SW – surface water

1 INTRODUCTION

The United States (U.S.) Army (Army) is performing preliminary assessments (PAs) and site inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 U.S. Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 U.S. Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Yuma Proving Ground (YPG) based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of PFAS (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the PFOS, PFOA, and PFBS results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, and PFBS risk screening levels to determine whether further investigation is warranted. This report provides the PA/SI for YPG and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

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

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in groundwater (tap water) or soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels (OSD 2021). The September 2021 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. The OSD risk screening levels for tap water (also used to evaluate groundwater) are 40 ng/L for PFOS and PFOA, and 600 ng/L for PFBS. The PFOS and PFOA soil screening levels for the residential and industrial/commercial scenarios are 0.13 milligrams per kilogram (mg/kg) (residential) and 1.6 mg/kg (industrial/commercial). The soil screening levels for PFBS are 1.9 mg/kg (residential) and 25 mg/kg (industrial/commercial). These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

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

1.2.1 PA Objectives

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

1.2.2 SI Objectives

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

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

1.3 PA/SI Process Description

For YPG, PA/SI development followed the process described below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for YPG. The PA and SI processes are documented in the PA/SI QC 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 U.S. Army Environmental Command (USAEC), U.S. Army Corps of Engineers (USACE), YPG, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 19 September 2018, approximately four 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 YPG.

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

- The Installation Management Command (IMCOM) operation order.

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

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 06-08 November 2018. 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 historical knowledge at YPG. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

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

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

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable USAEC POCs, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the

PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI, which serve as the basis for developing the SI scope of work presented in an installation-specific Quality Assurance Project Plan (QAPP) Addendum.

1.3.4 Site Inspection Planning and Field Work

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

The objectives of the SI kickoff teleconference were to:

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

Following development of the SI sampling technical approach, an SI scoping teleconference was held to obtain concurrence on the SI sampling plan from USAEC, USACE, and the installation. Additional discussion topics included:

- regulatory involvement (list USEPA or state agencies if applicable) requirements or preferences
- confirm there were no overlapping unexploded ordnance (UXO) or cultural resource areas
- confirm the plan for IDW handling and disposal
- plan for specific installation access requirements and potential schedule conflicts
- provide an updated SI deliverable and field work schedule.

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 YPG (Arcadis 2020) in **Sections 6.1** through **6.3**.

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

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.1.1 (DoD 2018). Laboratory analytical results were then validated and verified by a project chemist to assess the usability of the data collected. Validated analytical results were summarized in the context of OSD risk screening levels (defined in **Section 6.5**).

2 INSTALLATION OVERVIEW

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

2.1 Site Location

YPG is situated within two counties (Yuma and La Paz) in the southwestern quarter of Arizona approximately 25 miles to the north-northeast of Yuma, Arizona (**Figure 2-1**, **Figure 2-2, and Figure 2-3**). The installation occupies 838,174 acres of land and is subdivided into three geographic and functional areas; (1) the Laguna Region, (2) the Cibola Region, and (3) the Kofa Region. YPG borders Kofa National Wildlife Refuge in the center of its "U" shape, the Colorado River and the Imperial National Wildlife Refuge to the west, and Bureau of Land Management wilderness areas in neighboring portions (U.S. Army Garrison YPG 2017a).

2.2 Mission and Brief Site History

The California-Arizona Maneuver Area was created in 1942. It was an 18,000 square mile training area. The California-Arizona Maneuver Area covered both sides of the Colorado River. It consisted of 12 camps and auxiliary facilities. In 1943, the test mission of YPG started and Yuma Test Branch was created, which tested bridging and fording equipment prior to deployment to the European and Pacific fronts. YPG's mission is to plan, conduct, analyze, and report on the testing of military materiel that is in development, production, and operation, including weapons and vehicle and aviation systems. The testing is completed as directed by the Commanding General, U.S. Army Test and Evaluation Command. YPG also conducts soldier training by all military services. YPG is one of three climate specific training installations – Yuma Test Center at YPG, Cold Regions Test Center at Fort Greely, Alaska, and Tropic Regions Test Center at several tropical sites (U.S. Army Garrison YPG 2017a).

2.3 Current and Projected Land Use

The land ownership within YPG is comprised of government and private parcels. It is a general-purpose facility used for military weapon testing, training, and evaluation (U.S. Army Garrison YPG 2017a). YPG has a working population of approximately 3,000 people and is supplemented by an additional 23,000 visitors per year (Parsons 2010).

2.4 Climate

YPG is situated in the Sonoran Desert. The climate is warm and arid. The high temperature contributes to high evaporation and transpiration rates. In summer, the average daily temperatures range from 80 to 100 degrees Fahrenheit and 40 to 65 degrees Fahrenheit in the winter. YPG has a relatively low average annual rainfall of approximately 3.5 inches (IMCOM 2016). The annual average wind speed is

approximately 8 miles per hour. The prevailing wind direction is from the north in the late autumn which shifts to southeast with summer monsoon (Parson 2012).

2.5 Topography

YPG is situated within the Sonoran Desert. It is comprised of broad basins or valleys and steep mountain ranges, with the elevations ranging from approximately 200 feet above mean sea level south of the main administrative area to approximately 2,822 feet above mean sea level in the Chocolate Mountains. The four major landforms present are: (1) alluvial fan, (2) mountain highlands, (3) active washes, and (4) Alluvial Plain (Parsons 2012).

2.6 Geology

At YPG, the mountain ranges within and surrounding are composed of igneous rocks (formed from molten rock), including extrusive (volcanic rock) and intrusive (granite and related chrystalline rocks); sedimentary rocks (cemented and consolidated sediments); and metamorphic rocks (changed by heat and pressure). The lowlands between mountain ranges are composed of alluvium (age is Quaternary) which is typically comprised of sand, silt, and clay layers (Parsons 2012). The depth of the sediments is not known (Entech Engineers, Inc. 1987 and Parsons 2012). Sand dunes are visible features along the base (Parsons 2012).

2.7 Hydrogeology

At YPG, there are two separate water bearing units for groundwater: a lower tertiary-rock and a Quaternary alluvium unit (TechLaw, Inc. 2004). The top of the shallow unconfined aquifer ranges from approximately 30 feet below ground surface (bgs) near the Colorado River to over 600 feet bgs upgradient, with groundwater flow generally toward the southwest. The groundwater gradient is 4-5 feet per mile upgradient of the major pumping wells, and less than 4 feet per mile near the Colorado and Gila Rivers. Groundwater near the lower elevation AOPIs is primarily replenished from the Colorado and Gila rivers, and groundwater near the higher elevation AOPIs is primarily replenished from precipitation and runoff (Parsons 2012). The saturated basin fill sediment comprises the principal unconfined aquifer for YPG. The depth to groundwater at the installation varies dependent upon geology, location, and thickness of basin alluvium. The depth to water ranges from 30 feet, in the southwest Laguna Region near the Colorado River, to greater than 750 feet, near Castle Dome Heliport. There are no long-term declines observed in water table elevation on YPG due to lack of development (U.S. Army Garrison YPG 2017a).

2.8 Surface Water Hydrology

At YPG, there are no perennial lakes, streams, or mountain springs within the installation boundaries. The ephemeral stream courses known as washes are the dominant features in the desert. These washes may be steep, stable, narrow channels in higher elevations, grading to wide drainages in the surrounding plains. Washes perform important functions as geomorphic controls and areas of hydrologic recharge. They provide habitats of high relative diversity and biomass. They also serve as movement corridors and

cover sources for wildlife. These washes carry surface drainage from the area towards the Gila River to the south and towards the Colorado River to the west only after a significant rainfall event. Tinajas are other naturally occurring surface water sources. There is limited availability of water so man-made structures such as water tanks, wastewater treatment lagoons, and wildlife water catchments are critical assets (U.S. Army Garrison YPG 2017a).

2.9 Relevant Utility Infrastructure

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

2.9.1 Stormwater Management System Description

Surface runoff from storm events on the western part of YPG generally flows to the west toward the Colorado River, which flows north to south. Surface runoff on the central and eastern parts of YPG generally flows toward the Gila River, which is located south of YPG and flows from east to west towards the Colorado River (U.S. Army Garrison YPG 2017a). Ephemeral desert washes form a network that conveys storm water on and off the installation (U.S. Army Garrison YPG 2017a).

2.9.2 Sewer System Description

YPG operates six wastewater facilities which discharge into septic tanks or specially designed evaporative lagoons. Lagoons are cleaned periodically, and septic tanks are pumped on a regular basis. Septic treatment systems or chemical toilets are provided to work areas beyond the range of the sewer lines. Solid waste is contained in a permitted solid waste facility for non-hazardous residential and industrial waste (U.S. Army Garrison YPG 2017b).

2.10 Potable Water Supply and Drinking Water Receptors

The groundwater wells supply water for potable and non-potable users at separate water distribution systems serving each of the main complexes: Yuma Test Center, Kofa Firing Range (KFR), Laguna Army Air Field (LAAF), Castle Dome Heliport and Annex, and the Main Administrative Area. Due to presence of naturally occurring, elevated concentrations of fluoride and arsenic, the groundwater supplied by most wells is non-potable. Therefore, drinking water is either imported in bottles or treated to bring it below the applicable regulatory limit. There are several remote wells, such as Well R at Lake Alex and Ivan's Well used for industrial application (U.S. Army Garrison YPG 2017a).

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 YPG, 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 2-4**). The EDR report providing well search results provided as **Appendix E**.

2.11 Ecological Receptors

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

In YPG, mesquite bosques are the most important habitat type. These are isolated woodland patches. They provide food and cover for wildlife. A total of 185 bosques were found in the Cibola and Laguna regions. The large desert washes support bosques of mesquite (*Prosopis spp*.), as well as ironwood (*Olneya tesota*), paloverde (*Parkinsonia spp*.), and other tree species. The sensitive plant species is Nichol's Turk's Head Cactus (U.S. Army Garrison YPG 2017b).

The potential sensitive animal species at YPG area are Eagles, Southwestern Bald Eagle, and Golden Eagle. The threatened and endangered species are Yellow-Billed Cuckoo, Ridgeway's Rail (Yuma Clapper Rail), and Southern Willow Flycatcher. The species which need greatest conservation are Morafka's Desert Tortoise, Mohave Fringe-toed Lizard, California Leaf-nosed Bat, Western Yellow Bat, American Peregrine Falcon, and Osprey. The other species of concern observed on YPG are the elf owl (*Micrathene whitneyi*), burrowing owl (*Athene cunicularia*), long-billed curlew (*Numenius americanus*), Gila woodpecker (*Melanerpes uropygialis*), gilded flicker (*Colaptes auratus*), loggerhead shrike (*Lanius ludovicianus*), Bell's vireo (*Vireo bellii*), crissal thrasher (*Toxostoma crissale*), Le Conte's thrasher (*Toxostoma lecontei*), Bendire's Thrasher (*Toxostoma bendirei*) black-chinned sparrow (*Spizella atrogularis*), and sage sparrow (*Amphispiza belli*). The flat-tailed horned lizard (*Phrynosoma mcallii*) occurs west of the Gila Mountains and south of the Gila River. Some of the most conspicuous non-native animal species found on YPG are wild horses and burros (U.S. Army Garrison YPG 2017b).

2.12 Previous PFAS Investigations

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

Drinking water supply wells and treatment facilities were sampled quarterly for PFAS (including PFOS, PFOA, and PFBS) beginning in the fourth quarter of 2016. PFAS was detected in two on-post potable wells (Wells W and Z) proximate to the Gila Main Canal and adjacent to the Colorado River downgradient of the majority of YPG with results ranging from non-detect to 30 ng/L (parts per trillion [ppt]) for PFOA and from non-detect to 17 ng/L for PFOS. Results for PFBS were not available. It cannot be verified that historical sample collection or laboratory analysis for PFAS constituents was conducted in accordance with best practices (standard operating procedures [SOPs]) for PFAS sampling in order to obtain technically defensible/usable data (i.e., not affected by sampling methods and procedures).

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 YPG, data was collected from three principal sources of information:

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

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

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program (IRP) administrative record documents, compliance documents, YPG fire department documents, YPG Directorate of Public Works (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 YPG is provided in **Appendix F**.

3.2 Personnel Interviews

Interviews were conducted during the site visit. If a previously identified interviewee was not available during the site visit, attempts were made to complete the interview via telephone before or following the site visit or by contacting an alternate interviewee identified by the installation POC.

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

- Deputy Fire Chief
- Fire Chief
- Drinking Water/National Environmental Policy Act Program Manager, DPW-Environmental Services Division (ESD)
- Environmental Protection Specialist, DPW-ESD
- Chief, Training Exercise Management Office
- DERP Manager, DPW-ESD

- Air Field Manager, LAAF
- Environmental Specialist, Northwind
- Chief, Maintenance Quality, YPG - Assurance
- Pest Controller
- Trax Fire Truck Maintenance, Trax International
- Site Manager for U.S. Customs and Border Protection Tethered Aerostat Radar System
- Assistant Fire Chief
- Health Physicist
- Health Services Commander
- Veterinary Clinic Personnel
- Environmental Engineer

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

3.3 Site Reconnaissance

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

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

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

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

4.1 AFFF Use, Storage, and Disposal Areas

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

As identified in the current assets file and confirmed during site visit interviews with fire department personnel, AFFF was historically stored in Fire Station 1 (Building 3013) and Building 105. Additionally, there has been documented use of AFFF in the following AOPIs: C-130 Fuel Response, LAAF; Aberdeen Road Vehicle Fire Response; Trap Mission Training Support; and Fire Station 3, KFR, with this information coming from both the post-visit teleconference and the QAPP Addendum.

C-130 Fuel Spill response required 30-120 gallons of AFFF to put out a fuel fire, with the fuel and AFFF remaining on concrete, and runoff flowing onto the surrounding dirt. Aberdeen Road required 50 gallons of AFFF to put out a vehicle fire.

Old Fire Station and Fire Stations 2 through 4 were primarily used for fire truck washing and hose pressure testing, with Fire Station 3 having a history of incidental and immediately addressed spills. YPG-05: Old Fire-Fighting Training Pit (FTP) and the New FTP have unknown information regarding the frequency and volume of AFFF usage, but both used fuel-based training fires. Trap Mission Training Support had biannual trainings where 150 to 200 gallons of AFFF were used during each exercise during 2006, with the use of AFFF subsequently being disallowed during training exercises by the Fire Chief.

Fire Station wash racks could also have been linked to releases of PFAS-containing materials to the environment.

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

Following document research, personnel interviews, and site reconnaissance at YPG, other potential PFAS sources were either not identified at the installation or did not prompt further research or constitute categorization as AOPIs. 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 YPG as an installation having used or stored PFAS-containing pesticides/insecticides.

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 YPG) is not part of the PA/SI. Historical off-post PFAS sources were not identified for YPG.

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage and/or disposal of PFAS-containing materials at YPG 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, 15 areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

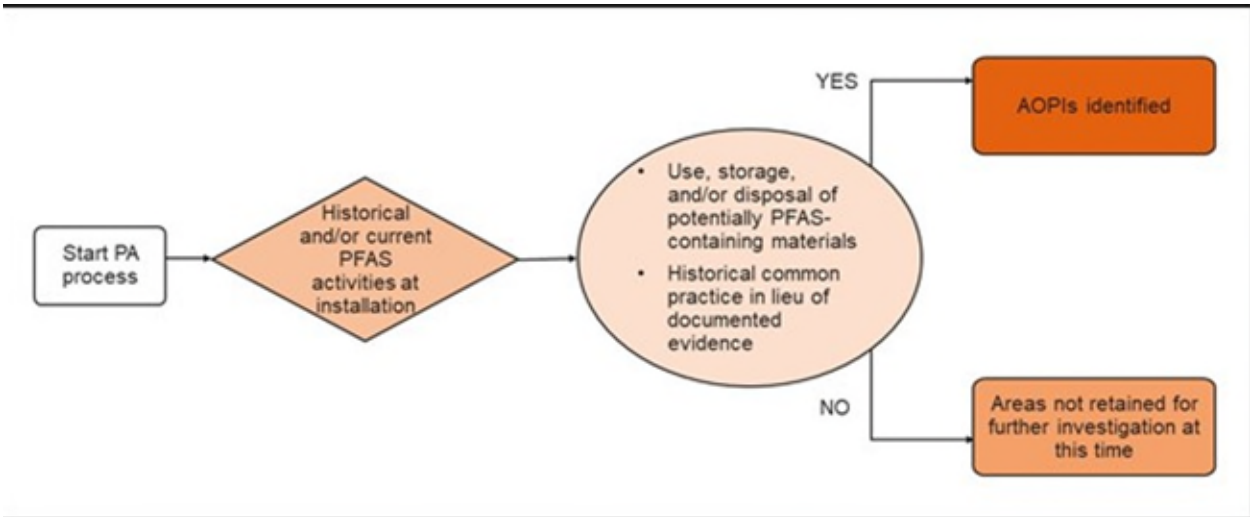

Figure 5--1: AOPI Decision Flowchart

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

Data limitations for this PA/SI at YPG 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
LAAF 27 Hangar, LAAF	Approximately 2016 – present	The LAAF hangar was constructed with no floor drains or grates, and with a high-expansion foam fire-suppression system. The fire department conducted acceptance	No evidence of use, storage, and/or disposal of PFOS,

Area Description	Dates of Operation	Relevant Site History	Rationale
		testing in approximately 2016.The high-expansion foam does not contain AFFF.	PFOA, or PFBS containing material.
Castle Dome Heliport	Unknown – approximately 2008	The Castle Dome Heliport operates a 3,000-foot runway in support of rotary-wing aircraft testing. One interviewee stated that the Castle Dome Heliport is currently used for flying unmanned aerial vehicles (i.e., drones). The heliport was previously used for rotary-wing aircraft. A three-person fire crew and a twin-agent unit (the Fire Chief described it as being akin to a "rolling fire extinguisher") were stationed here prior to 1990. No known AFFF crash/fire responses.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS containing material. Depth to groundwater is greater than 700 feet.
Various Down-Range Air Fields	Unknown	There are several remote test runways located in the Cibola Range. A crash truck may have been present on standby during testing. The Fire Chief is unaware of any incident responses (with or without AFFF) at any of these remote Air Fields.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS containing material.
Healthcare Clinic (Building 990), Main Post/Howard	Unknown – present	It is believed that x-rays were and continue to be processed off site.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS containing material..
Former Dental Clinic (Building 1220), Main Post/Howard	Prior to 1989 – 1990s	It is believed that x-rays were processed off site (Yuma Marine Corp Air Station).	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS containing material.
Veterinary Clinic (Building 226), Main Post/Howard	Unknown – present	It is believed that, prior to switching to digital x-rays, the clinic had a machine that developed x-rays without photo processing equipment.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS containing material.
Patton Level Gravel Fire Response	2 April 2012	On 2 April 2012, the Fire Department responded to a vehicle fire at mile marker 4.4 on the Patton Level Gravel Test Course with water and AFFF. The fire was extinguished with AFFF and water. A maximum of 60 gallons of AFFF was used.	The location of the incident could not be determined.

Area Description	Dates of Operation	Relevant Site History	Rationale
Desert March Course #13 Off-road Vehicle Response	30 November 2010	The Desert March Course #13 Off-Road Vehicle Fire Response occurred on 30 November 2010. Two fire trucks responded to a vehicle fire at Desert March Course #13 Off-Road Test Course kilometer marker 1.0 with approximately 750 gallons of water and 30 gallons of AFFF.	The location of the incident could not be determined.

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. None of the AOPIs overlap with YPG IRP sites and/or Headquarters Army Environmental System sites (**Figure 5-2**). The AOPI and current site status are discussed within each AOPI subsection presented below. At the time of this PA, none of the YPG IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS. Each AOPI was assigned an alias in sequential order starting with YPG-AOPI-01 for sample naming convention. These aliases were created in response to a character limit imposed by the laboratory during the sample check in process.

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-10** and include active monitoring wells in the vicinity of each AOPI. **Table 2-1** presents the well construction details for the monitoring wells.

5.2.1 Former Combined Maintenance Facility, Main Post / HCA (YPG-AOPI-01)

The Former Combined Maintenance Facility, Main Post / HCA (**Figure 5-3**) is identified as an AOPI following activities potentially relevant to the use, storage, and/or disposal of PFAS-containing materials at the Former Combined Maintenance Facility, located in the Main Post / HCA in Building 204, that occurred from prior to 1980 to approximately 1994 when the facility performed fire truck maintenance. Water and occasionally AFFF were discharged to test the pumps and lines in the rear yard and into a wash in the northeast area of the rear yard. Surface runoff flows to a wash that flows west to the Gila Gravity Main Canal 0.38 miles to the west. The canal provides water for irrigation and for various users in Yuma County, including the Yuma County drinking water supply (IMCOM 2016). Groundwater likely flows south-southwest toward the Colorado River located approximately 1.65 miles to the west.

5.2.2 Former Fire Station, Main Post / HCA (YPG-AOPI-02)

The Former Fire Station, Main Post / HCA (**Figure 5-4**) is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Former Fire Station (Building 611) that occurred from approximately the late 1970s to 2012 or 2013, when the station was closed and operations transitioned to the new location in Building 608. Fire truck washing and annual hose pressure testing was historically conducted on the apron. Fire trucks from Fire Station 2 are

currently washed with water and brushes on the Former Fire Station apron. From the apron, water drains south into a stormwater swale that flows west towards the Gila Gravity Main Canal.

5.2.3 Fire Station 2, Main Post / HCA (YPG-AOPI-03)

The Fire Station 2, Main Post / HCA (**Figure 5-4**) is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at Fire Station 2 (Building 608) that occurred from approximately 2012 to present. Annual hose pressure testing, which may contain AFFF, is conducted on premises, likely on the northern or southern side of the station building; water drains across the street and into the stormwater swale next to the Former Fire Station that flows west towards the Gila Gravity Main Canal.

5.2.4 New FTP, LAAF (YPG-AOPI-04)

The New FTP, LAAF (**Figure 5-9**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the New FTP that occurred from 1987 to 25 July 2005. The New FTP was a concrete-lined approximately 86-foot-diameter area used monthly for training exercises. Approximately 100 to 300 gallons of fuel were piped into the concrete pad followed by water to allow the fuel mixture to float. The fuel mixture was ignited and a mixture of water and 6% Ansulite AFFF was used to extinguish the fire. An estimated 64,800 gallons of fuel was used in the pit over its lifetime. Operation of the New FTP ceased in late July 2005 when a broken diesel fuel line was discovered, and cleanup was initiated. The New FTP was subsequently closed and demolished. During demolition, the concrete lining was found to be breached in several locations and the soil underneath the liner impacted by training operations. The concrete lining was removed as part of the cleanup; the disposal location is unknown.

5.2.5 Old FTP, LAAF (YPG-AOPI-05)

The Old FTP, LAAF (**Figure 5-9**) is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Old FTP that occurred from approximately the mid-1960s to approximately 2004. The Old FTP, which operated from the mid-1960s to 1987, was an unlined, bermed, 100-foot-diameter area located approximately 35 feet from the New FTP. The Old FTP was used to conduct fire training exercises; however, frequency and volume of AFFF use during its operation are unknown. The pit soils were regraded in the late 1990s and partially covered with a concrete pad. A propane-fired aircraft simulator was installed, and it was reactivated for fire-training exercises in the late 1990s or by 2001. There has been no known AFFF use in the reactivated area of the Old FTP.

5.2.6 Drafting Pit, LAAF (YPG-AOPI-06)

The Drafting Pit, LAAF (**Figure 5-9**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Drafting Pit that occurred from an unknown date to early 2018. Fire truck pumps were hooked up to the self-contained drafting pit which is an underground metal tank with an above-ground metal hood set in a concrete pad. Water was

recirculated to pumps to perform nozzle testing through systems with probable AFFF residuals from previous fire response or training.

5.2.7 C-130 Fuel Spill Response, LAAF (YPG-AOPI-07)

The C-130 Fuel Spill Response, LAAF (**Figure 5-10**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the C-130 Fuel Spill Response that occurred on 8 March 2012. Between 30 and 120 gallons of AFFF were applied as a foam blanket over approximately 50 to 60 gallons of fuel spilled on the north pad during aircraft fueling. All fuel and AFFF reportedly remained on the concrete and were subsequently contained with approximately 500 pounds of absorbent; the disposal location of the absorbent is unknown. Runoff potentially containing residual AFFF would have flowed onto the surrounding dirt to the southwest and possibly to the southeast of the pad. A site interviewee indicated the north pad cement has since reportedly been replaced by a pad with a larger footprint; however, aerial photographs from 2011 and 2013 indicate no change in the size of the pad.

5.2.8 Fire Station 1, LAAF (YPG-AOPI-08)

The Fire Station 1, LAAF (**Figure 5-8**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at Fire Station 1 (Building 3013) that occurred from 1961 to present. The fire station has potentially historically stored AFFF. Fire truck washing and annual hose pressure testing are conducted on the back apron and flight line. The water from these activities either evaporates or flows via drains to a wash at the southern end of the flight line.

5.2.9 Fire Station 4, LAAF (YPG-AOPI-09)

The Fire Station 4, LAAF (**Figure 5-8**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at Fire Station 4 (Building 3034) that occurred from 2017 to present. Fire truck washing and annual hose pressure testing are conducted on the back apron. Incidental spills were confirmed on the fire station apron as well as a 0.5-gallon spill from a fire truck seam leak in early 2018.

5.2.10 Turret Testing Area, LAAF (YPG-AOPI-10)

The Turret Testing Area, LAAF (**Figure 5-9**) is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Turret Testing Area that occurred from an unknown date to present. A dirt road located immediately south of the flight line is used for fire truck system and turret testing where water and possibly AFFF are sprayed.

5.2.11 Fire Station 3, KFR (YPG-AOPI-11)

The Fire Station 3, KFR (**Figure 5-6**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at Fire Station 3 (Building 3189) that occurred from 1996 to present. Historical incidental AFFF spills were typically immediately addressed. Unaddressed spilled liquids potentially containing AFFF would have entered trench drains that lead to an oil-water separator. Oil from the oil-water separator is stored in a nearby aboveground storage tank and

water is discharged to active, lined, evaporative sewage lagoons. Annual hose pressure testing is conducted on the back apron. Fire trucks are washed with water and brushes on the front or back apron. Water potentially contaminated with residual AFFF flows either off the front apron and crosses the street to an unnamed wash or off the back apron toward the west and south to unnamed washes.

5.2.12 Aberdeen Road Vehicle Fire Response, KFR (YPG-AOPI-12)

The Aberdeen Road Vehicle Fire Response, KFR, (**Figure 5-6**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Aberdeen Road Vehicle Fire Response that occurred on 2 September 2010 at KFR. A vehicle fire was extinguished with water but continued to reignite. Up to 50 gallons of AFFF were used to extinguish the fire in response. The fire response was either immediately west or south of nearby Building 3522 on a heavily cracked impervious surface.

5.2.13 Combined Maintenance Facility, KFR (YPG-AOPI-13)

The Combined Maintenance Facility, KFR (**Figure 5-7**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Combined Maintenance Facility (Building 3504) that occurred from approximately 1992 to present. Fire truck maintenance for AFFF-containing trucks is conducted at this facility, which could potentially result in AFFF spills or release of PFAS-containing water from washing or testing activities.

5.2.14 Building 105 (YPG-AOPI-14)

Building 105 (**Figure 5-3**) is identified as an AOPI due to historical AFFF storage within the building. Reportedly, up to 209 5-gallon pails of Buckeye AFFF 3% were stored along the northeastern wall of Building 105 from 2003-2018. The building floor is paved without drains, and there is no evidence of AFFF spills. Surface runoff flows to a wash that flows west to the Gila Gravity Main Canal 0.30 miles to the west. The canal provides water for irrigation and for various users in Yuma County, including the Yuma County drinking water supply (YPG 2016). Groundwater likely flows south-southwest toward the Colorado River located approximately 0.86 miles to the west.

5.2.15 Trap Mission Training Support, K-9 Village (YPG-AOPI-15)

The Trap Mission Training Support, K-9 Village (**Figure 5-5**), is identified as an AOPI following activities potentially relevant to use, storage, and/or disposal of PFAS-containing materials at the Trap Mission Training Support area that occurred in approximately 2006. The Fire Department participated in two or three biennial trainings and used approximately 150 to 200 gallons of AFFF each time. The Fire Chief prohibited AFFF use during these training exercises in 2007. The exact location of each exercise varied based on the helicopter training prop placement. The area is restricted. On-site interviews were conducted before sampling to obtain more information on specific locations of AFFF use.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at YPG, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at YPG at 15 AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2020) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, Engineer Manual 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, and surface water 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 August and September 2020 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the SOPs, technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2020) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analysis procedures for the SI phase at YPG. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

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

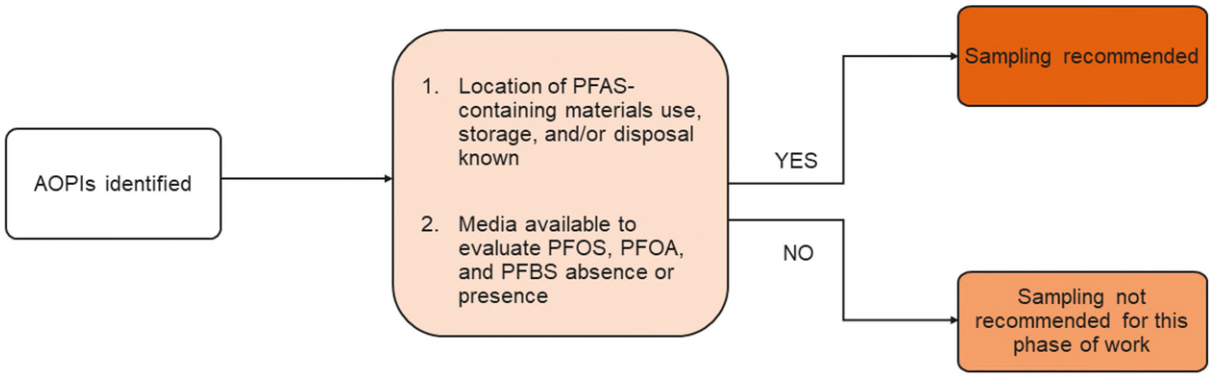

Figure 6--1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at YPG is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020). Brief summaries per AOPI are below:

- **Former Combined Maintenance Facility:** Shallow soil samples were collected in two locations directly outside the former hangar doors. An additional shallow soil sample and an additional groundwater sample were collected to the west, which is potentially downgradient. A groundwater sample was also collected from an existing monitoring well located downgradient to the southwest. Three surface water samples were taken from the Gila Gravity Main Canal, which is potentially downgradient of the Former Combined Maintenance Facility. The Gila Gravity Main Canal is also potentially downgradient of Building 105.
- **Building 105:** A grab groundwater sample was collected downgradient of Building 105. Please note that this sampling location was originally associated with the Former Combined Maintenance Facility but was determined to be more representative of impacts downgradient of Building 105.
- **Former Fire Station:** Shallow soil samples were collected where the apron discharges to a swale and to the west of the former fire station. A groundwater sample was collected downgradient to the west of the former fire station.
- **Fire Station 2:** Shallow soil samples and a groundwater sample were collected from the north apron underneath cracked asphalt.
- **C-130 Fuel Spill Response:** Three shallow soil samples and one deep soil sample were collected off the edge of the associated concrete pad. A groundwater sample was collected from existing production Well B.
- **Fire Station 1:** A shallow and one deep soil sample were taken from underneath the asphalt on the east apron. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.
- **Fire Station 4:** Shallow soil samples and one deep soil sample were collected where flow from the apron first meets soil and near the apron drainage outlet. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

- **Turret Testing Area:** Five shallow soil samples and one deep soil sample were collected in the assumed spray path along the perimeter of the AOPI. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.
- **New FTP:** Two shallow soil samples and one deep soil sample were collected from the interior of the FTP. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.
- **Old FTP:** Shallow soil samples and one deep soil sample were collected from three locations surrounding the perimeter of the AOPI. Subsurface soil samples were collected from two of these locations due to potential soil disturbance from historical construction. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.
- **Drafting Pit:** Four shallow soil samples and one deep soil sample were collected near the bottom of the drafting pit. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.
- **Aberdeen Road Vehicle Fire Response:** Two shallow soil samples and one deep soil sample were collected where the paved surface meets soil. One shallow soil sample was collected from the drainage swale nearby. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.
- **Fire Station 3:** Two shallow soil samples and one deep soil sample were collected across the road from the east apron where any surface drainage would first meet soil. One shallow soil sample was collected where surface drainage from the west apron enters an earthen swale. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.
- **Combined Maintenance Facility:** Three shallow soil samples and one deep soil sample were collected outside the bay doors. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.
- **Trap Mission Training Support:** Shallow soil samples were collected at five locations where AFFF was deployed to the environment. Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

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.

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2020), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2020). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, 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 2020). The subsections below provide a summary of the field methods and procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices J** and **K**, respectively.

6.3.1 Field Methods

Groundwater Sampling

Groundwater samples were collected to determine PFOS, PFOA, and/or PFBS presence and to update individual AOPI drinking water CSMs. Grab samples were collected either by using a low-flow bladder pump at existing monitoring wells on site, or by using rotary sonic technology from a point at each potential source area site. The sampling points were located at AOPIs as follows: Former Combined Maintenance Facility, Building 105, Fire Station 2, and the Former Fire Station.

Each sampling point was positioned in possible areas of infiltration or migration, with the first encountered shallow groundwater being sampled at each point. Likely areas of infiltration or migration were areas where runoff collected on permeable ground from a suspected release area, in addition to groundwater soil drains. The groundwater was at approximately 40-60 feet bgs in the Main Post / HCA. The depth to groundwater across YPG varies greatly, from 30 feet bgs to greater than 700 feet bgs. In areas where groundwater is shallow, water samples were collected, but in areas where groundwater exceeded the capabilities of direct-push technology (DPT) sampling equipment and surface water infiltration to groundwater was highly unlikely, groundwater was not sampled and instead a 10-12 feet bgs soil sample was collected to capture the vertical extent of potential PFOS, PFOA, and/or PFBS impacts over time. Because PFOS, PFOA, and/or PFBS is not very mobile in the fine soils at YPG, the annual rainfall amount is small and the evapotransportation rate is high, impacts to groundwater from surface infiltration are extremely unlikely. The estimated maximum depth of water infiltration at YPG is 10 –12 feet bgs based on discussions with John Glover (YPG, Ecologist).

DPT boring and sampling was done in accordance with TGI for PFAS-Specific Drilling and Monitoring Well Installation, for sampling at 11 of the 15 AOPIs that were sampled. The DPT equipment hit refusal at sampling locations associated with the Former Combined Maintenance Facility, Fire Station 2, and

Former Fire Station AOPIs. A second mobilization was conducted to collect soil and groundwater samples utilizing rotary sonic technology at those three AOPIs, and in addition collected a grab groundwater sample at the Building 105 AOPI near MW-5, which was damaged and could not be sampled during the initial mobilization. Samples were collected from existing groundwater wells, where operational (monitoring well MW1 and production Well B) to understand potential impacts. Multiple groundwater monitoring wells exist at YPG, however, few proximal to the AOPIs were functioning at the time of the sampling. Samples were collected from the approximate center of the saturated screen interval.

Per the Final QAPP Addendum (Arcadis 2020), the sampling approach in desert areas with deep water tables did not include DPT groundwater samples at or downgradient from AOPIs and instead included a shallow soil sample collected from 0-2 feet bgs and an additional composite soil sample collected from 10-12 feet bgs. The soil sample collected from 10-12 feet bgs was held at the laboratory pending results from the 0-2 feet bgs samples. The decision to analyze the 10-12 feet bgs sample was primarily based on the results of the 0-2 feet bgs samples; if the 0-2 feet bgs sample did not have PFOS, PFOA, and/or PFBS detections or if detections exceeded residential or industrial/commercial OSD risk screening levels, then the laboratory was instructed to discard the 10-12 feet bgs sample. If the 0-2 feet bgs sample was detected but did not exceed residential or industrial/commercial OSD risk screening levels, then the laboratory was instructed to analyze the 10-12 feet bgs sample. Field parameters were measured in accordance with TGI for PFAS Sampling Procedures and Low-Flow Groundwater Purging for Monitoring Wells to ensure collection of the representative sample and to determine PFAS presence via analytical data. Each borehole's groundwater samples coordination was recorded using a handheld global positioning system (GPS) unit.

Soil Sampling

Soil samples were collected to evaluate presence or absence of PFOS, PFOA, and/or PFBS at potential release areas, as well as the potential of these PFOS, PFOA, and/or PFBS sources to affect drinking water via surface water and groundwater, and to update individual AOPI CSMs. Soil samples were analyzed for select PFAS, with one soil sample from each AOPI analyzed for total organic carbon (TOC), pH, and grain size. Soil lithological descriptions were continuously logged and documented on field forms. Soil samples were collected by hand auger or DPT sampling method in accordance with the TGI for PFAS-Specific Drilling and Monitoring Well Installation. Surface soil samples were collected from the top 2 feet of native soil with a hand auger. Surface soil samples were collected from a discrete point on every AOPI for a total of 64 surface soil sampling points. Additional subsurface samples were collected from the following AOPIs: C-130 Fuel Response, Fire Station 1, Fire Station 4, Turret Testing Area, New FTP, Old FTP, Drafting Pit, Aberdeen Road Vehicle Fire Response, and Fire Station 3 for a total of nine subsurface sampling points. Deeper soil samples were collected to account for the potential vertical migration of PFOS, PFOA, and/or PFBS in soil within the arid climate in areas where the estimated depth to groundwater precluded groundwater sampling. DPT boring and sampling was completed using a dual-tube, top-down method, with soil samples being taken from areas most likely to have been impacted by the suspected use, storage, and/or disposal of PFAS-containing materials, and sampling location coordinates' recording with a handheld GPS.

Surface Water Sampling

Three grab surface water samples were collected from locations on the Gila Gravity Main Canal near the Former Combined Maintenance Facility AOPI to determine the presence or absence of PFOS, PFOA,

and/or PFBS in possible secondary source areas. Two upstream sample results would be considered representative of the Colorado River water that could be influencing drinking water wells at YPG. The southernmost sample location was selected based on proximity to Wells W and Z, which had historical PFOS, PFOA, and/or PFBS detections (**Table 2-2**). Samples were collected from downstream to upstream to reduce siltation in sequential samples before being analyzed for PFOS, PFOA, and/or PFBS. Field parameters (temperature, pH, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential) were measured during surface water sampling to inform the interpretation of analytical data. Location coordinates for the surface water sampling were recorded using a handheld GPS.

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

6.3.2 Quality Assurance/Quality Control

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

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate samples were collected for media sampled for PFOS, PFOA, and PFBS, and total organic carbon (TOC) only. EBs were collected for media sampled for PFOS, PFOA, and PFBS, at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable equipment from which EBs were collected include tubing, drill casing and cutting shoes, hand augers, water-level meters, acetate liners, bailers, and stainless-steel trowels as applicable to the sampled media. Source blanks were collected from the water used to pressure-wash drill tooling. Analytical results for blank samples are discussed in **Section 7.3**.

6.3.3 Field Change Reports

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

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

- FCR 1
    - One planned groundwater sample was not collected at location YPG-AOPI-12-WELLI-GW because the dedicated pump at this well was out of commission at the time of the site inspection field event.
    - Groundwater data will not be available for the Aberdeen Road Vehicle Fire Response AOPI.

  - Three soil samples were collected at this AOPI and will be used to evaluate presence or absence of PFOS, PFOA, and/or PFBS at the Aberdeen Road Vehicle Response AOPI.
- FCR 2
  - One sample (YPG-AOPI-01-02-GW) was originally associated with the Former Combined Maintenance Facility AOPI, but after evaluation of groundwater and surface water flow directions, has been associated with the Building 105 AOPI, which was added based on direction from the Army on AFFF storage areas.
- FCR 3
  - One sample (YPG-AOPI-01-MW-5) was unable to be collected due to monitoring well damage. A new groundwater sample point (YPG-AOPI-01-02-GW) near the monitoring well location was added to the sampling scope to account for the lack of groundwater data at this AOPI.

6.3.4 Decontamination

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

6.3.5 Investigation-Derived Waste

IDW, including soil cuttings, groundwater, surface water, and decontamination fluids was disposed of at the site of generation at each AOPI. Equipment IDW, which includes personal protective equipment and other disposable materials (e.g., gloves, plastic sheeting, Lexan tubes, and high-density polyethylene and silicon tubing) and disposable equipment that may have contacted sampling media were double bagged and disposed of in approved dumpsters at YPG.

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, and PFBS analysis 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 2020). Eighteen PFAS-related compounds, including PFOS, PFOA, and PFBS were analyzed for in groundwater, soil, and surface water samples using an analytical method that is ELAP-accredited and compliant with QSM 5.1.1 (DoD 2018), Table B-15. Copies of laboratory analytical reports generated during the SI are included as attachments to the Data Usability Summary Report (DUSR) in **Appendix M**.

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 2020) 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 M**).

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 2020). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with DoD QSM 5.1.1 (DoD 2018). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation reports for each sample delivery group are included as attachments to the DUSR in **Appendix M**. The Level IV analytical reports are included within **Appendix M** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

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

Based on the final data usability assessment, the environmental data collected at YPG during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix M**), and as indicated in the full analytical tables (**Appendix N**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and YPG QAPP Addendum (Arcadis 2020). Data qualifiers applied to laboratory analytical results for samples collected during the SI at YPG are provided in the data

tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures:

6.5 Office of the Secretary of Defense Risk Screening Levels

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

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

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

Notes:
1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating PFAS within the DoD Cleanup Program. October 15 (**Appendix A**). The risk screening levels for PFBS in tap water and soil were updated in April 2021 based on the updated toxicity values published by the USEPA (USEPA 2021).
2. All soil and/or sediment data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet below ground surface), regardless of the current and projected land use of the AOPI. Soil samples collected from greater than two but less than 15 feet below ground surface will be compared to the Industrial/Commercial risk screening levels only.
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 and/or surface water data (if the surface water is an expression of groundwater [i.e., springs/seeps] or if surface water is used as a drinking water source nearby) for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at YPG are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, and PFBS 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, or PFBS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

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

Tables 7-1 through **7-3** provide a summary of the groundwater, soil, and surface water analytical results for PFOS, PFOA, and PFBS. **Table 7-4** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix N** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at YPG with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-9** show the PFOS, PFOA, and PFBS analytical results in groundwater, soil, and surface water for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS 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 and surface water data collected during the SI are reported in ng/L, or parts per trillion, and soil data are reported in mg/kg, or parts per million.

Field parameters measured for groundwater during low-flow purging and sample collection and for surface water during sample collection are provided on the field forms in **Appendix K**. Soil descriptions are provided on the field forms in **Appendix K**. The results of the SI are grouped by AOPI and discussed for each medium as applicable. Groundwater in areas where groundwater sampling was implemented was generally first encountered at depths of approximately 30-65 feet bgs.

Table 7-4 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Y/N)
Former Combined Maintenance Facility (YPG-AOPI-01)	Yes
Former Fire Station (YPG-AOPI-02)	Yes
Fire Station 2 (YPG-AOPI-03)	Yes
New FTP (YPG-AOPI-04)	Yes
Old FTP (YPG-AOPI-05)	Yes
Drafting Pit (YPG-AOPI-06)	No
C-130 Fuel Response (YPG-AOPI-07)	No
Fire Station 1 (YPG-AOPI-08)	Yes
Fire Station 4 (YPG-AOPI-09)	Yes
Turret Testing Area (YPG-AOPI-10)	Yes
Fire Station 3 (YPG-AOPI-11)	No

AOPI Name	OSD Exceedances (Y/N)
Aberdeen Road Fire Response (YPG-AOPI-12)	No
Combined Maintenance Facility (YPG-AOPI-13)	No
Building 105 (YPG-AOPI-14)	Yes
Trap Mission Training Support (YPG-AOPI-15)	Yes

7.1 Areas of Potential Interest

The subsections below summarize the soil, surface water, and groundwater sampling results from all AOPIs sampled during the SI field event at YPG. Analytical data can be found for each respective media type in **Tables 7-2** through **7-4**.

7.1.1 Former Combined Maintenance Facility (YPG-AOPI-01)

The subsections below summarize the soil, surface water, and groundwater PFOS, PFOA, and PFBS analytical results associated with Former Combined Maintenance Facility (YPG-AOPI-01).

7.1.1.1 Soil

Soil sampling was conducted at the Former Combined Maintenance Facility at three borings, one of which (YPG-AOPI-01-01-SO) was co-located with a groundwater sample (YPG-AOPI-01-01-GW). Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-2** shows the analytical results for soil sampling locations at the Former Combined Maintenance Facility. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected in soil at all three of the sample locations at the Former Combined Maintenance Facility ranging from 0.00047 J mg/kg (YPG-AOPI-01-01-SO) to 0.051 mg/kg (YPG-AOPI-01-03-SO). None of the PFOS concentrations exceeded the residential or industrial/commercial OSD risk screening levels.

PFOA was detected in soil at all three of the sample locations at the Former Combined Maintenance Facility ranging from 0.0043 mg/kg (YPG-AOPI-01-SO) to 0.24 mg/kg (YPG-AOPI-01-03-SO). The PFOA concentration of 0.24 mg/kg (YPG-AOPI-01-03-SO) exceeded the residential OSD risk screening level.

PFBS was detected in soil at two of the three sample locations at the Former Combined Maintenance Facility ranging from 0.0006 J mg/kg (YPG-AOPI-01-02-SO) to 0.0057 mg/kg (YPG-AOPI-01-03-SO). None of the PFBS concentrations exceeded the residential or industrial/commercial OSD risk screening level.

7.1.1.2 Surface Water

Surface water sampling was conducted at locations along the Gila Gravity Main Canal near the Former Combined Maintenance Facility. Samples were collected via a high-density polyethylene bucket and

stainless-steel extender arm. **Figure 7-2** shows the analytical results for surface water sampling associated with the Former Combined Maintenance Facility.

PFOS was detected in surface water at two of the sample locations associated with the Former Combined Maintenance Facility ranging from 1.4 J in the duplicate sample (YPG-AOPI-01-03-SW) to 5.6 J- ng/L (YPG-AOPI-01-02-SW). None of the PFOS concentrations exceeded the OSD tap water risk screening level.

PFOA was detected in surface water at two of the sample locations associated with the Former Combined Maintenance Facility ranging from 2.0 BJ+ ng/L (YPG-AOPI-01-02-SW) to 2.3 BJ+ in the duplicate sample (YPG-AOPI-01-03-SW). None of the PFOA concentrations exceeded the OSD tap water risk screening level.

PFBS was detected in surface water at one of the sample locations associated with the Former Combined Maintenance Facility at 1.2 J ng/L (YPG-AOPI-01-01-SW). The PFBS concentration did not exceed the OSD tap water risk screening level.

7.1.1.3 Groundwater

Groundwater sampling was conducted at the Former Combined Maintenance Facility at two locations. One location was collected via rotary sonic boring, and the second was collected from an existing monitoring well (MW-1). **Figure 7-2** shows the analytical results for groundwater sampling at the Former Combined Maintenance Facility. Groundwater samples were collected at the first encountered groundwater, ranging from 35-48 feet bgs.

PFOS was detected in groundwater at both sample locations at the Former Combined Maintenance Facility ranging from 1.9 ng/L (YPG-AOPI-01-01-GW) to 3.4 ng/L (YPG-AOPI-01-MW1-GW). PFOS did not exceed the OSD tap water risk screening level at either location.

PFOA was detected in groundwater at both sample locations at the Former Combined Maintenance Facility ranging from 10 ng/L (YPG-AOPI-01-MW1-GW) to 20 ng/L (YPG-AOPI-01-01-GW). Neither of the PFOA concentrations exceeded the OSD tap water risk screening level.

PFBS was detected in groundwater at both sample locations at the Former Combined Maintenance Facility ranging from 2.5 ng/L (YPG-AOPI-01-MW1-GW) to 9.1 ng/L (YPG-AOPI-01-01-GW). Neither of the PFBS concentrations exceeded the OSD tap water risk screening level.

7.1.2 Former Fire Station (YPG-AOPI-02)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with the Former Fire Station (YPG-AOPI-02).

7.1.2.1 Soil

Soil sampling was conducted at the Former Fire Station at two borings, one of which (YPG-AOPI-02-01-SO) was co-located with a groundwater sample (YPG-AOPI-02-01-GW). Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-3** shows the analytical results for soil sampling locations at the Former Fire Station. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at 0.00093 mg/kg (YPG-AOPI-02-01-SO) and at 0.00047J mg/kg (YPG-AOPI-02-02-SO) and the location's duplicate at 0.00082 mg/kg. These concentrations did not exceed the residential OSD risk screening levels.

PFOA was detected at 0.00022 J (YPG-AOPI-02-02-SO) and the location's duplicate sample at 0.00022 J mg/kg. These concentrations did not exceed the residential OSD risk screening levels. PFOA was not detected in the other sample location YPG-AOPI-02-01-SO.

PFBS was not detected in soil at either sample location at the Former Fire Station AOPI.

7.1.2.2 Groundwater

Groundwater sampling was conducted at the Former Fire Station at one location. The groundwater sample was collected via a rotary sonic boring. **Figure 7-3** shows the analytical results for groundwater sampling at the Former Fire Station. The groundwater sample was collected at the first encountered groundwater, at 45 feet bgs.

PFOS was detected in groundwater at the groundwater sampling location at the Former Fire Station. PFOS was detected at 630 J ng/L (YPG-AOPI-02-01-GW), which exceeded the OSD tap water risk screening level.

PFOA was detected at 24 J in the groundwater sample location (YPG-AOPI-02-01-GW) at the Former Fire Station. The PFOA concentration did not exceed the OSD tap water risk screening level.

PFBS was detected in groundwater at 11 J ng/L at the groundwater sampling location (YPG-AOPI-02-01-GW) at the Former Fire Station. The PFBS concentration did not exceed the OSD tap water risk screening level.

7.1.3 Fire Station 2 (YPG-AOPI-03)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Fire Station 2 (YPG-AOPI-03).

7.1.3.1 Soil

Soil sampling was conducted at Fire Station 2 at two borings, one of which (YPG-AOPI-03-01-SO) was co-located with a groundwater sample (YPG-AOPI-03-01-GW). Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-3** shows the analytical results for soil sampling locations at the Fire Station 2. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at 0.0025 mg/kg (YPG-AOPI-03-02-SO) and the location's field duplicate sample at 0.0015 mg/kg (YPG-AOPI-FD-SO-080620-02). These concentrations did not exceed the residential OSD risk screening level. PFOS was not detected at the other sample location, YPG-AOPI-03-01-SO.

PFOA was detected at 0.00071 mg/kg (YPG-AOPI-03-02-SO) and the location's field duplicate sample at 0.00052 J mg/kg (YPG-AOPI-FD-SO-080620-02). These concentrations did not exceed the residential OSD risk screening level. PFOA was not detected in the other sample location, YPG-AOPI-03-01-SO.

PFBS was not detected in soil for either sample location at the Fire Station 2 AOPI.

7.1.3.2 Groundwater

Groundwater sampling was conducted at Fire Station 2 at one location via a rotary sonic boring. **Figure 7-3** shows the analytical results for groundwater sampling at the Fire Station 2. The groundwater sample was collected at the first encountered groundwater, at 60 feet bgs.

PFOS was detected in groundwater at the groundwater sampling location at the Fire Station 2. PFOS was detected at 47 ng/L (YPG-AOPI-03-01-GW), which exceeded the OSD tap water risk screening level.

PFOA was detected in groundwater at 15 J ng/L (YPG-AOPI-03-01-GW) at the sampling location at the Fire Station 2. The PFOA concentration did not exceed the OSD risk screening level.

PFBS was not detected in groundwater at the sampling location at the Former Fire Station.

7.1.4 New Fire-Fighting Training Pit (YPG-AOPI-04)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with the New FTP (YPG-AOPI-04). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.4.1 Soil

Soil sampling was conducted at the New FTP at two borings, one of which (YPG-AOPI-04-02-SO) included two soil samples: one collected from 0 to 2 feet bgs and one collected from 10 to 12 feet bgs. Composite soil samples from 0 to 2 feet bgs were collected using a hand auger. The sample collected from 10 to 12 feet bgs was collected with DPT. **Figure 7-8** shows the analytical results for soil sampling locations. Concentrations of PFOS, PFOA, and PFBS from samples collected from 0 to 2 ft bgs were compared to the residential and industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in all three soil samples at the New FTP. At one of the borings (YPG-AOPI-04-01-SO) taken at 0 to 2 ft bgs, the concentration of PFOS was detected at 0.22 mg/kg, which exceeded the residential OSD risk screening level.

PFOA was detected in all three soil samples at the New FTP. At one of the borings (YPG-AOPI-04-01-SO), the concentration of PFOA were detected at 0.43 mg/kg, which exceeded the residential OSD risk screening level.

PFBS was detected in one soil sample location (YPG-AOPI-04-02) in a sample collected from 0 to 2 ft bgs at 0.0075 mg/kg which did not exceed the residential or industrial/commercial OSD risk screening level. PFBS was not detected in the other two samples from this AOPI.

7.1.5 Old Fire-Fighting Training Pit (YPG-AOPI-05)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Old FTP (YPG-AOPI-05). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.5.1 Soil

Soil sampling was conducted at the Old FTP (YPG-AOPI-05) at three borings, each of which (YPG-AOPI-05-01-SO, YPG-AOPI-05-02-SO, and YPG-AOPI-05-03-SO) included two soil samples: one collected from 0 to 2 feet bgs and one deeper sample collected from 5 to 10 feet bgs or 10 to 12 feet bgs. Composite soil samples from 0 to 2 feet bgs were collected using a hand auger and the deeper samples were collected with DPT. **Figure 7-8** shows the analytical results for soil sampling locations. Concentrations of PFOS, PFOA, and PFBS from samples collected from 0 to 2 ft bgs were compared to the residential and industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in all six samples at the Old FTP. Concentrations of PFOS in two of the three samples taken from 0 to 2 feet bgs exceeded the residential OSD risk screening level at 0.98 mg/kg (YPG-AOPI-05-03-SO-0-2) and 3.3 mg/kg (YPG-AOPI-05-02-SO-0-2). The concentration in YPG-AOPI-05-02-SO-0-2 (3.3 mg/kg) also exceeded the industrial/commercial soil OSD risk screening levels. The PFOS concentration in deeper samples did not exceed industrial/commercial soil OSD risk screening levels.

PFOA was detected in all six samples at the Old FTP. In the three samples collected from 0 to 2 ft bgs, all exceeded the residential soil OSD risk screening levels and two exceeded the industrial/commercial soil OSD risk screening levels. In the three samples taken from deeper intervals, two exceeded the industrial/commercial soil OSD risk screening levels. Concentrations of PFOA were detected ranging from 1.2 J mg/kg (YPG-AOPI-05-01-SO-10-12) to 6.2 mg/kg (YPG-AOPI-05-02-SO-0-2).

PFBS was detected in soil in all six samples at the Old FTP, ranging from 0.0016 J mg/kg (YPG-AOPI-05-01-SO-10-12) to 0.14 mg/kg (YPG-AOPI-05-02-SO-0-2). PFBS was not detected above the residential or industrial/commercial OSD risk screening levels in any of the sample locations at this AOPI.

7.1.6 Drafting Pit (YPG-AOPI-06)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Drafting Pit (YPG-AOPI-06). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.6.1 Soil

Soil sampling was conducted at the Drafting Pit at four locations. Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-8** shows the analytical results for soil sampling locations at the Drafting Pit. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at two of the sample locations at the Drafting Pit, ranging from 0.00041 J mg/kg (YPG-AOPI-06-04-SO) to 0.00079 mg/kg (YPG-AOPI-06-03-SO). PFOS was not detected above the residential or industrial/commercial OSD risk screening levels in any of the sample locations at this AOPI.

PFOA was detected at two of the four sample locations at the Drafting Pit ranging from 0.00057 J mg/kg (YPG-AOPI-06-03-SO) to 0.00058 ng/L (YPG-AOPI-06-04-SO). None of the concentrations of PFOA exceeded the residential or industrial/commercial OSD risk screening level.

PFBS was not detected in soil at any of the four sample locations at the Drafting Pit.

7.1.7 C-130 Fuel Spill Response (YPG-AOPI-07)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with C-130 Fuel Spill Response (YPG-AOPI-07).

7.1.7.1 Soil

Soil sampling was conducted at the C-130 Fuel Spill Response at three locations. Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-9** shows the analytical results for soil sampling locations at the C-130 Fuel Spill Response. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at one of the three sample locations at the C-130 Fuel Spill Response at 0.0013 mg/kg (YPG-AOPI-07-01-SO). PFOS was not detected above the residential or industrial/commercial OSD risk screening levels in any of the samples at this AOPI.

PFOA was detected at all three of the sample locations at the C-130 Fuel Spill Response ranging from 0.00042 J mg/kg (YPG-AOPI-07-01-SO) to 0.0013 mg/kg (YPG-AOPI-07-02-SO). PFOA was not detected above the residential or industrial/commercial OSD risk screening levels in any of the sample locations at this AOPI.

PFBS was not detected in soil at any of the three sample locations at the C-130 Fuel Spill Response.

7.1.7.2 Groundwater

Groundwater sampling was conducted at the C-130 Fuel Spill Response at one location. The groundwater sample was collected from an existing supply well (Well B) via a low-flow bladder pump. **Figure 7-9** shows the analytical results for groundwater sampling. The groundwater sample was collected in the middle of the screen, at 60 feet bgs.

PFOS, PFOA, and PFBS, were not detected in groundwater at the C-130 Fuel Spill Response AOPI.

7.1.8 Fire Station 1 (YPG-AOPI-08)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 1 (YPG-AOPI-08). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.8.1 Soil

Soil sampling was conducted at the Fire Station 1 at one location. A composite soil sample was collected from 0 to 2 feet bgs using a hand auger and a second sample was collected via DPT from 10 to 12 feet bgs at the same location. **Figure 7-7** shows the analytical results for the soil sampling location at the Fire Station 1. Concentrations of PFOS, PFOA, and PFBS in samples taken from 0 to 2 ft bgs were compared to the residential and the industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in both soil samples at Fire Station 1. PFOS was detected at 2.0 mg/kg (YPG-AOPI-08-01-SO) in the 0 to 2 feet bgs sample, which exceeds the residential and the industrial/commercial soil OSD risk screening levels. PFOS was detected at 0.18 J mg/kg (YPG-AOPI-08-01-SO-10-12) in the 10 to 12 feet bgs sample, which is below the industrial/commercial soil OSD risk screening levels.

PFOA was detected in both soil samples at the Fire Station 1. PFOA was detected at 1.3 mg/kg (YPG-AOPI-08-01-SO) at 0 to 2 feet bgs, which is above the residential OSD residential risk screening level. PFOA was detected at 0.17 J mg/kg (YPG-AOPI-08-01-SO-10-12) at 10 to 12 feet bgs, which is below the industrial/commercial soil OSD risk screening levels.

PFBS was detected in soil at both sample depths at the Fire Station 1, ranging from 0.0040 J mg/kg (YPG-AOPI-08-01-SO-10-12) in the 10 to 12 feet bgs sample to 0.015 mg/kg (YPG-AOPI-08-01-SO) in the 0 to 2 feet bgs sample. PFBS was not detected above the residential or industrial/commercial OSD risk screening levels in either sample at this AOPI.

7.1.9 Fire Station 4 (YPG-AOPI-09)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 4 (YPG-AOPI-09). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.9.1 Soil

Soil sampling was conducted at the Fire Station 4 at two locations. Composite soil samples were collected from 0 to 2 feet bgs at each using a hand auger. **Figure 7-7** shows the analytical results for soil sampling at the Fire Station 4. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at both sample locations at the Fire Station 4. PFOS exceeded the residential OSD risk screening level at one location at 0.69 mg/kg (YPG-AOPI-09-01-SO).

PFOA was detected at both sample locations at the Fire Station 4. PFOA exceeded the residential OSD risk screening level at one location at 0.47 mg/kg (YPG-AOPI-09-01-SO).

PFBS was detected in soil at one of the two sample locations at the Fire Station 4. PFBS was not detected above the residential OSD risk screening levels in either sample location at this AOPI.

7.1.10 Turret Testing Area (YPG-AOPI-10)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Turret Testing Area (YPG-AOPI-10). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.10.1 Soil

Soil sampling was conducted at the Turret Testing Area at five locations, one of which (YPG-AOPI-10-03-SO) included two soil sample depths: one collected from 0 to 2 feet bgs and one collected from 10 to 12 feet bgs. Composite soil samples were collected using a hand auger for the shallow samples and DPT for

the deeper sample. **Figure 7-7** shows the analytical results for soil sampling locations at the Turret Testing Area. Concentrations of PFOS, PFOA, and PFBS taken from 0 to 2 ft bgs were compared to the residential and industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in all six samples at the Turret Testing Area. PFOS exceeds the residential OSD risk screening level in two of the five samples taken from 0 to 2 ft bgs, with concentrations of 0.29 mg/kg (YPG-AOPI-10-01-SO-0-2) and 2.3 mg/kg (YPG-AOPI-10-02-SO). One sample (YPG-AOPI-10-02-SO) taken from 0 to 2 ft bgs also exceeded the industrial/commercial OSD risk screening level. The PFOS concentration (0.27 J) in the 10 to 12 ft bgs sample did not exceed the industrial/commercial OSD industrial risk screening level.

PFOA was detected in all six samples at the Turret Testing Area. PFOA exceeds the residential OSD risk screening level in one of the five samples taken from 0 to 2 ft bgs, with a concentration of 1.4 D mg/kg in sample YPG-AOPI-10-02-SO. The PFOA concentration (0.018 J) in the 10 to 12 ft bgs sample did not exceed the industrial/commercial OSD industrial risk screening level.

PFBS was detected in soil at two of the six sample locations at the Turret Testing Area. PFBS was not detected above the residential or industrial/commercial OSD risk screening levels in any of the samples at this AOPI.

7.1.11 Fire Station 3 (YPG-AOPI-11)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Fire Station 3 (YPG-AOPI-11). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.

7.1.11.1 Soil

Soil sampling was conducted at the Fire Station 3 at three locations, one of which (YPG-AOPI-11-03) included two soil samples: one collected from 0 to 2 feet bgs and one collected from 10 to 12 feet bgs. Composite soil samples from 0 to 2 feet bgs were collected using a hand auger and the soil sample from 10 to 12 feet bgs was collected using DPT. **Figure 7-5** shows the analytical results for soil sampling locations at the Fire Station 3. Concentrations of PFOS, PFOA, and PFBS in samples taken from 0 to 2 ft bgs were compared to the residential and industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in all three samples taken from 0 to 2 ft bgs at Fire Station 3, ranging from 0.0025 mg/kg (YPG-AOPI-11-01-SO) to 0.017 mg/kg (YPG-AOPI-11-02-SO), which did not exceed the residential OSD risk screening level. PFOS was not detected in the sample taken from 10 to 12 ft bgs.

PFOA was detected in all four samples at the Fire Station 3, ranging from 0.0011 mg/kg in the 0 to 2 feet bgs sample at YPG-AOPI-11-01-SO to 0.0030 mg/kg in the 10 to 12 feet bgs sample at YPG-AOPI-11-03-SO-10-12. Concentrations of PFOA did not exceed the applicable residential or industrial/commercial OSD risk screening levels at any sample location at this AOPI.

PFBS was detected in soil in two of the four samples taken at the Fire Station 3, ranging from 0.00051 J mg/kg (YPG-AOPI-11-01-SO) to 0.0015 J mg/kg (YPG-AOPI-11-02-SO). PFBS was not detected above the applicable residential or industrial/commercial OSD risk screening levels in any of the sample locations at this AOPI.

7.1.12 Aberdeen Road Vehicle Fire Response (YPG-AOPI-12)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Aberdeen Road Vehicle Fire Response (YPG-AOPI-12). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.

7.1.12.1 Soil

Soil sampling was conducted at the Aberdeen Road Vehicle Fire Response at three locations, one of which (YPG-AOPI-12-03) included two soil samples: one collected from 0 to 2 feet bgs and one collected from 10 to 12 feet bgs. Composite soil samples from 0 to 2 feet bgs were collected using a hand auger and samples from 10 to 12 feet bgs were collected with DPT. **Figure 7-5** shows the analytical results for soil sampling locations at the Aberdeen Road Vehicle Fire Response. Concentrations of PFOS, PFOA, and PFBS in samples taken from 0 to 2 ft bgs were compared to the residential and industrial/commercial soil OSD risk screening levels. Soil samples collected from greater than 2 feet but less than 15 feet bgs were compared to the industrial/commercial risk screening levels only.

PFOS was detected in two of the three samples taken from 0 to 2 ft bgs at the Aberdeen Road Vehicle Fire Response, ranging from 0.0008 mg/kg (YPG-AOPI-12-01-SO) to 0.0018 mg/kg (YPG-AOPI-12-03-SO). PFOS was not detected in the sample taken from 10 to 12 ft bgs. Concentrations of PFOS did not exceed the residential or industrial/commercial OSD risk screening levels at any sample location at this AOPI.

PFOA was detected in one of the four samples at the Aberdeen Road Vehicle Fire Response at 0.00036 J mg/kg (YPG-AOPI-12-01-SO). The concentration of PFOA did not exceed the applicable residential or industrial/commercial OSD risk screening levels at any sample location at this AOPI.

PFBS was not detected at any of the sample locations at the Aberdeen Road Vehicle Fire Response.

7.1.13 Combined Maintenance Facility (YPG-AOPI-13)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Combined Maintenance Facility (YPG-AOPI-13). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 300 ft bgs.

7.1.13.1 Soil

Soil sampling was conducted at the Combined Maintenance Facility at three locations. Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-6** shows the analytical results for soil sampling locations at the Combined Maintenance Facility. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at all three sample locations at the Combined Maintenance Facility, ranging from 0.00033 J mg/kg (YPG-AOPI-13-01-SO) to 0.0098 mg/kg (YPG-AOPI-13-03-SO). Concentrations of PFOS did not exceed the residential or industrial/commercial OSD risk screening levels at any sample location at this AOPI.

PFOA was detected at all three sample locations at the Combined Maintenance Facility, ranging from 0.0003 J mg/kg (YPG-AOPI-13-01-SO) to 0.0066 mg/kg (YPG-AOPI-13-03-SO). Concentrations of PFOA did not exceed the residential or industrial/commercial OSD risk screening level at any sample location at this AOPI.

PFBS was not detected at any of the sample locations at the Combined Maintenance Facility.

7.1.14 Building 105 (YPG-AOPI-14)

The subsections below summarize the groundwater PFOS, PFOA, and PFBS analytical results associated with Building 105 (YPG-AOPI-14). Soil was not sampled at Building 105 due to the fact that the Building 105 floor is fully paved without drains or other conduits to the subsurface. Surface water samples taken from Gila Gravity Main Canal that were associated with the Former Combined Maintenance Facility may also be relevant to Building 105. Building 105 is proximate to the Former Combined Maintenance Facility and the Gila Gravity Main Canal is downgradient of both.

7.1.14.1 Groundwater

Groundwater sampling was conducted at Building 105 at one location. The sample (YPG-AOPI-01-02-GW) was originally associated with the Former Combined Maintenance Facility AOPI, but after evaluation of groundwater and surface water flow directions, has been associated with the Building 105 AOPI, which was added as an AOPI based on Army direction on AFFF storage areas. The groundwater sample was collected via a rotary sonic boring. **Figure 7-2** shows the analytical results for groundwater sampling at Building 105. The groundwater sample was collected at the first encountered groundwater, at 45 feet bgs.

PFOS exceeded the OSD tap water risk screening level at the one sample location (YPG-AOPI-01-02-GW) at 190 ng/L.

PFOA was detected at 37 ng/L (YPG-AOPI-01-02-GW). The PFOA concentration did not exceed the OSD tap water risk screening level.

PFBS was detected at 33 ng/L (YPG-AOPI-01-02-GW). The PFBS concentration did not exceed the OSD tap water risk screening level.

7.1.15 Trap Mission Training Support (YPG-AOPI-15)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Trap Mission Training Support (YPG-AOPI-15). Groundwater was not collected at this AOPI due to arid climate and depth to groundwater. In this type of environment, evaporation of precipitation is prevalent, net infiltration is minimal, and depth to groundwater is estimated to be greater than 200 ft bgs.

7.1.15.1 Soil

Soil sampling was conducted at the Trap Mission Training Support at five locations. Composite soil samples were collected from 0 to 2 feet bgs using a hand auger. **Figure 7-4** shows the analytical results

for soil sampling locations at the Trap Mission Training Support. Concentrations of PFOS, PFOA, and PFBS were compared to the residential and industrial/commercial soil OSD risk screening levels.

PFOS was detected at all five sample locations at the Trap Mission Training Support. PFOS was detected above the residential OSD risk screening level at three of the five sample locations, ranging from 0.25 mg/kg (YPG-AOPI-15-04-SO) to 0.41 mg/kg (YPG-AOPI-15-03-SO).

PFOA was detected at all five sample locations at the Trap Mission Training Support ranging from 0.00042 J mg/kg (YPG-AOPI-15-05-SO) to 0.0028 mg/kg (YPG-AOPI-15-01-SO). Concentrations of PFOA did not exceed the residential or industrial/commercial OSD risk screening level at any sample location at this AOPI.

PFBS was detected at two of the five sample locations at the Trap Mission Training Support ranging from 0.00055 J mg/kg (YPG-AOPI-15-03-SO) to 0.0008 J mg/kg (YPG-AOPI-15-02-SO). Concentrations of PFBS did not exceed the residential or industrial/commercial OSD risk screening level at any sample location at this AOPI.

7.2 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data, as they may be useful in future fate and transport studies. The TOC in the soil samples ranged from 527 to 23,500 mg/kg. The TOC at this installation was within range of typical organic content in soil (topsoil: 5,000 to 30,000 mg/kg, desert: less than 5,000 mg/kg, organic: more than 120,000 mg/kg). The percent moisture of the soil ranged from 0% to 7% which was typical for sandy soil (0% to 10%). The combined percentage of fines in soils at YPG ranged from 56% to 82.6% with an average of 62%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The pH of the soil was slightly alkaline (7 to 9). Based on the geochemical data obtained during the SI at YPG, PFAS constituents may be relatively less mobile than in soils with less fines and less TOC content.

7.3 Blank Samples

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

7.4 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-10** through **7-12** 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 are shown on the same figure.

Many of the PFAS constituents found in AFFF are surfactants (which do not volatilize) and are found in a charged or ionic state at environmentally-relevant pH (i.e., pH 5 to 9 standard units). PFOS, PFOA, and PFBS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS releases at Army installations are soil, groundwater, surface water, and sediment. Once released to the environment, a primary factor that inhibits the movement of PFAS constituents is

the presence of organic matter and organic co-constituents in soils and sediments. Generally, PFAS constituents are mobile in the potentially affected media, and they are not known to be fully broken down by natural processes.

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment, and for some AOPIs, may include surface water and sediment of the Gila Gravity Main Canal.

Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment. Generic categories of potential human receptors and their associated exposure scenarios that are typically evaluated in a CERCLA human health risk assessment were considered and include on-installation site workers (e.g., industrial/commercial workers, utility workers, or future construction workers who could be exposed to chemicals in soil at an AOPI or to chemicals in tap water in an industrial/commercial building), on-installation residents (e.g., adults and children who could be exposed to chemicals in tap water in a residence), and on-installation recreational users (e.g., hikers or hunters who could be exposed to chemicals in waterways at an installation). Off-installation receptor types could include drinking water receptors (i.e., commercial/industrial workers or residents) and recreational users.

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

Following the SI sampling, all 15 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 is based on the comparison of analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**).

CSMs were developed for each individual AOPI 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:

- The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, for CSMs that include soil as a potential exposure medium, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete.
- 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 flows off-post through the installation’s western or southwestern boundary. Drinking water for off-post users is primarily supplied by surface water; however, there are receptors that receive drinking water from groundwater or a combination of

groundwater and surface water (Yuma County Department of Development Services 2012). Due to the absence of land use controls preventing potable use of the off-post groundwater, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete.

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

Figure 7-10 shows the CSM for AOPIs Former Combined Maintenance Facility, Fire Station 2, and Former Fire Station. AFFF was historically sprayed to soil and paved surfaces during fire training exercises, pump testing activities, and annual hose pressure testing at these AOPIs.

- PFOS, PFOA, and/or PFBS were detected in soil 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.
- PFOS, PFOA, and/or PFBS were detected in groundwater, and the AOPIs are upgradient of drinking water wells used to supply potable water at YPG. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- Surface water bodies on-post are not used for drinking water or recreation. On-installation site workers and residents are not likely to otherwise contact surface water and sediment in the on-post surface water bodies. Therefore, the surface water and sediment exposure pathways for on-installation site workers, residents, and recreational users are incomplete.
- Surface water bodies flow off-post to the Gila Gravity Main Canal. Drinking water for off-post users is primarily supplied by surface water; however, there are receptors that receive water from groundwater or a combination of groundwater and surface water (Yuma County Department of Development Services 2012). Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation drinking water receptors is potentially complete. Recreational users off-post could contact constituents in Gila Gravity Main Canal through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Figure 7-11 shows the CSM for AOPIs Old FTP, New FTP, Drafting Pit, C-130 Fuel Response, Fire Station 1, Fire Station 4, Fire Station 3, Aberdeen Road Fire Response, Combined Maintenance Facility, Turret Testing Area, and Trap Mission Training Support. AFFF was historically sprayed to extinguish fires from fire-fighting training activities at these AOPIs.

- PFOS, PFOA, and/or PFBS were detected in soil 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.
- PFOS, PFOA, and/or PFBS were detected in groundwater at all of these AOPIs, except Trap Mission Training Support, where groundwater samples were not collected. The AOPIs are upgradient of drinking water wells used to supply potable water at YPG. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.

Figure 7-12 shows the CSM for the Building 105 AOPI. AFFF was historically stored within the building on a concrete pad.

- Releases to soil at this AOPI are not expected, therefore soil is not a potential exposure medium.
- PFOS, PFOA, and/or PFBS were detected in groundwater, and the AOPIs are upgradient of water wells used to supply potable water at YPG. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- Surface water bodies on-post are not used for drinking water or recreation. On-installation site workers and residents are not likely to otherwise contact surface water and sediment in the on-post surface water bodies. Therefore, the surface water and sediment exposure pathways for on-installation site workers, residents, and recreational users are incomplete.
- Surface water bodies flow off-post to the Gila Gravity Main Canal. Drinking water for off-post users is primarily supplied by surface water; however, there are receptors that receive water from groundwater or a combination of groundwater and surface water (Yuma County Department of Development Services 2012). Therefore, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation drinking water receptors is potentially complete. Recreational users off-post could contact constituents in Gila Gravity Main Canal through incidental ingestion and dermal contact; therefore, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at YPG 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, and PFBS to the environment occurred.

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, and PFBS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, and PFBS in soil (**Appendix A**). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, and PFBS use, storage, and/or disposal at YPG. Based on the evaluation, 15 AOPIs were identified.

Drinking water supply wells and treatment facilities were sampled quarterly for PFOS, PFOA, and PFBS beginning in the fourth quarter of 2016. PFOS, PFOA, and/or PFBS was detected in two potable wells (Wells W and Z) proximate to the Gila Main Canal downgradient of the majority of YPG with results ranging from non-detect to 30 ng/L (or ppt) for PFOA and from non-detect to 17 ng/L for PFOS. Results were not available for PFBS. It cannot be verified that historical sample collection or laboratory analysis for PFAS constituents was conducted in accordance with best practices (SOPs) for PFAS sampling in order to obtain technically defensible/usable data (i.e., not affected by sampling methods and procedures).

All 15 of the AOPIs were sampled during the SI at YPG to identify presence or absence of PFOS, PFOA, and/or PFBS. The SI Scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the YPG QAPP Addendum (Arcadis 2020). Ten of the 15 AOPIs sampled had detections of PFOS, PFOA, and/or PFBS which exceeded OSD risk screening levels. The maximum concentrations of PFOS, PFOA, and PFBS detected in soil, groundwater, and surface water samples from YPG were:

Soil

- PFOS: 3.3 mg/kg at the Old FTP AOPI in sample YPG-AOPI-05-02-SO-0-2.
- PFOA: 6.2 mg/kg at the Old FTP AOPI in sample YPG-AOPI-05-02-SO-0-2.
- PFBS: 0.14 mg/kg at the Old FTP AOPI in sample YPG-AOPI-05-02-SO-0-2.

Groundwater

- PFOS: 650 J ng/L at the Former Fire Station AOPI in sample YPG-FD-GW-092920-01/YPG-AOPI-02-01-GW.
- PFOA: 37 ng/L at the Building 105 AOPI in sample YPG-AOPI-01-02-GW.
- PFBS: 33 ng/L at the Building 105 AOPI in sample YPG-AOPI-01-02-GW.

Surface Water

- PFOS: 5.6 J- ng/L in Gila Gravity Main Canal (Former Combined Maintenance Facility AOPI) in sample YPG-AOPI-01-02-SW.

- PFOA: 2.3 BJ+ ng/L in Gila Gravity Main Canal (Former Combined Maintenance Facility AOPI) in sample YPG-FD-SW-080320-01/YPG-AOPI-01-03-SW.
- PFBS: 1.2 J ng/L in Gila Gravity Main Canal (Former Combined Maintenance Facility AOPI) in sample YPG-AOPI-01-01-SW.

Following the SI sampling, 15 AOPIs with confirmed PFOS, PFOA, and/or PFBS presence were considered to have complete or potentially complete exposure pathways. Soil exposure pathways for installation site workers are complete at 15 AOPIs. There are 15 AOPIs at which the groundwater exposure pathways for on-post receptors are complete or potentially complete. The groundwater exposure pathways for downgradient, off-installation receptors are also potentially complete for 15 AOPIs. Surface water is not used for drinking water at YPG, 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.

Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at YPG; PFOS, PFOA, and PFBS sampling results; and recommendations for each AOPI. Further investigation is warranted at YPG. 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, and PFBS Sampling at YPG and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Y/N/ND/NS)			Recommendation
	GW	SO	SW	
Former Combined Maintenance Facility (YPG-AOPI-01)	No	Yes	No	Further study in a remedial investigation
Former Fire Station (YPG-AOPI-02)	Yes	No	NS	Further study in a remedial investigation
Fire Station 2 (YPG-AOPI-03)	Yes	No	NS	Further study in a remedial investigation
New FTP (YPG-AOPI-04)	NS	Yes	NS	Further study in a remedial investigation
Old FTP (YPG-AOPI-05)	NS	Yes	NS	Further study in a remedial investigation
Drafting Pit (YPG-AOPI-06)	NS	No	NS	No action at this time
C-130 Fuel Response (YPG-AOPI-07)	ND	No	NS	No action at this time

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Y/N/ND/NS)			Recommendation
	GW	SO	SW	
Fire Station 1 (YPG-AOPI-08)	NS	Yes	NS	Further study in a remedial investigation
Fire Station 4 (YPG-AOPI-09)	NS	Yes	NS	Further study in a remedial investigation
Turret Testing Area (YPG-AOPI-10)	NS	Yes	NS	Further study in a remedial investigation
Fire Station 3 (YPG-AOPI-11)	NS	No	NS	No action at this time
Aberdeen Road Fire Response (YPG-AOPI-12)	NS	No	NS	No action at this time
Combined Maintenance Facility (YPG-AOPI-13)	NS	No	NS	No action at this time
Building 105 (YPG-AOPI-14)	Yes	NS	NS	Further study in a remedial investigation
Trap Mission Training Support (YPG-AOPI-15)	NS	Yes	NS	Further study in remedial investigation

Notes:
Light gray shading – detection greater than the OSD risk screening level.
ND – non-detect
NS – not sampled
SO – soil
SW – surface water

Data collected during the PA (**Sections 3** through **5**) and SI (**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, and PFBS at YPG are discussed below.

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

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

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

Finally, the available PFOS, PFOA, and PFBS analytical data is limited to results from on-post drinking water well sources, not residential wells. Available data, including PFOS, PFOA, and PFBS, is listed in **Appendix N**.

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

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ACRONYMS

°F	degrees Fahrenheit
%	percent
6:2 FTSA	6:2 fluorotelomer sulfonate
8:2 FTSA	8:2 fluorotelomer sulfonate
AFFF	aqueous film-forming foam
AMC	Army Materiel Command
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
DoD	Department of Defense
DPT	direct-push technology
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
ESD	Environmental Services Division
FTA	fire training area
FTP	Fire-Fighting Training Pit
GIS	geographic information system
GPS	global positioning system
GW	groundwater
IDW	investigation-derived waste
IMCOM	Installation Management Command
installation	United States Army or Reserve installation

IRP	Installation Restoration Program
KFR	Kofa Firing Range
LAAF	Laguna Army Air Field
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
mg/kg	milligram per kilogram (parts per million)
NA	not available
NCR	non-conformance report
ng/L	nanogram per liter (parts per trillion)
NS	not sampled
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	part per million
ppt	part 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
SE	sediment
SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan

SW	surface water
TGI	technical guidance instruction
TOC	total organic carbon
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
WWTP	wastewater treatment plant
YPG	Yuma Proving Ground

TABLES

Table 2-1 On Post Water Wells
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

Site ID	Well No.	Well Type	Year Installed/Upgraded	Boring Depth (ft bgs)	Screened Interval[a] (ft bgs)	TOC Elevation (ft amsl)
Former Combined Maintenance Facility	MW1	Monitoring	1997[b]	UNK	UNK - UNK	UNK
	MW5	Monitoring	2000[b]	UNK	UNK - UNK	UNK
C-130 Fuel Spill Response	Well B	Production	2014	300	225 - 271	373.82
Aberdeen Road Vehicle Fire Response	Well I	Production	2007	501	462 - 501	410.43

Acronyms:
[a] - listed screened interval is estimated from available data from the Arizona Department of Water Resources
[b] - listed year is approximate based on available data

-- - not available
amsl - above mean sea level
bgs - below ground surface
ft - feet
TOC - top of casing
UNK - unknown

Table 2-2 - Historical PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

Location		Well W		Well Z		Plant - Finished Water					
Sample ID		Unknown		Unknown		Unknown					
Sample Date		12/20/2016	6/13/2017	12/20/2016	6/13/2017	12/20/2016	6/13/2017	12/19/2017	3/22/2018	6/20/2018	9/20/2018
Chemical name	OSD Risk Screening Level* (ng/L)	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	40	5.12	4.6	30	17	2.03	2.2	2.3	2.4	<2.0	<1.9
Perfluorobutanesulfonic acid (PFBS)	600	-	-	-	-	-	-	-	-	-	-
Perfluorooctane sulfonate (PFOS)	40	<2.0	2.0	<2.0	17	<2.0	<2.0	<2.0	<2.0	<2.0	<1.9

Notes and Acronyms:
Units are provided in nanograms per liter
* risk screening level for tap water. To be conservative, the OSD tap water risk screening levels will be used to compare all groundwater and potable-use surface water for this Army PFAS PA/SI program.
NA - not available
ng/L - nanogram per liter
OSD - Office of the Secretary of Defense

Table 6-1 Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

Site ID	Well No.	Well Type	Year Installed/Upgraded	Boring Depth (ft bgs)	Screened Interval[a] (ft bgs)	TOC Elevation (ft AMSL)
Former Combined Maintenance Facility	MW1	Monitoring	1997[b]	UNK	UNK - UNK	UNK
	MW5	Monitoring	2000[b]	UNK	UNK - UNK	UNK
C-130 Fuel Spill Response	Well B	Production	2014	300	225 - 271	373.82
Aberdeen Road Vehicle Fire Response	Well I	Production	2007	501	462 - 501	410.43

Acronyms:

[a] - listed screened interval is estimated from available data from the Arizona Department of Water Resources

[b] - listed year is approximate based on available data

-- - not available
AMSL - above mean sea level
bgs - Below Ground Surface
ft - Feet
TOC - Top of Casing
UNK - unknown
USGS - United States Geological Survey

Table 7-1
Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
			OSD Tapwater Risk Screening Level		40		40		600	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
C-130 Fuel Spill Response (YPG-AOPI-07)	YPG-AOPI-07-WellB	YPG-AOPI-07-WELLB-GW	08/06/2020	N	1.8	U	1.8	U	1.8	U
Former Combined Maintenance Facility (YPG-AOPI-01)	YPG-AOPI-01-01	YPG-AOPI-01-01-GW	9/29/2020	N	**1.9**		**20**		**9.1**	
	YPG-AOPI-01-MW1	YPG-AOPI-01-MW1-GW	8/7/2020	N	**3.4**		**10**		**2.5**	
Building 105	YPG-AOPI-01-02	YPG-AOPI-01-02-GW	9/30/2020	N	**190**		**37**		**33**	
Former Fire Station (YPG-AOPI-02)	YPG-AOPI-02-01	YPG-AOPI-02-01-GW	9/29/2020	N	**630**	J	**24**	J	**11**	J
		YPG-FD-GW-092920-01 / YPG-AOPI-02-01-GW	9/29/2020	FD	**650**	J	**23**	J	**11**	J
Fire Station 2 (YPG-AOPI-03)	YPG-AOPI-03-01	YPG-AOPI-03-01-GW	9/30/2020	N	**47**		**15**	J	19	U

Notes:

1. Bolded values indicate the result was detected

2. Grey shaded values indicate the result was detected greater than the 2021 Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program.September.)

3. One sample (YPG-AOPI-01-02-GW) was originally associated with the Former Combined Maintenance Facility AOPI, but after evaluation of groundwater and surface water flow directions, has been associated with the Building 105 AOPI, which was added based on updated Army guidance on AFFF storage areas.

Acronyms/Abbreviations:

AOPI = Area of Potential Interest
FD = field duplicate sample
GW = Groundwater
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
YPG = Yuma Proving Ground

Qualifiers:

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

Table 7-2
Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

AOPI	Location	Sample ID / Parent Sample ID	Sample Depth Interval	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level		1.6		1.6		25	
				OSD Residential Risk Screening Level		0.13		0.13		1.9	
				Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Aberdeen Road Vehicle Fire Response (YPG-AOPI-12)	YPG-AOPI-12-01	YPG-AOPI-12-01-SO	0-2 feet	08/11/2020	N	**0.00080**		**0.00036**	J	0.0019	U
	YPG-AOPI-12-02	YPG-AOPI-12-02-SO	0-2 feet	08/11/2020	N	0.00062	U	0.00062	U	0.0021	U
	YPG-AOPI-12-03	YPG-AOPI-12-03-SO	0-2 feet	08/05/2020	N	**0.0018**		0.00061	U	0.0020	U
		YPG-AOPI-12-03-SO-10-12	10-12 feet	08/05/2020	N	0.00059	UJ	0.00059	UJ	0.0020	UJ
C-130 Fuel Spill Response (YPG-AOPI-07)	YPG-AOPI-07-01	YPG-AOPI-07-01-SO	0-2 feet	08/10/2020	N	**0.0013**		**0.00042**	J	0.0019	U
	YPG-AOPI-07-02	YPG-AOPI-07-02-SO	0-2 feet	08/10/2020	N	0.00058	U	**0.0013**		0.0019	U
	YPG-AOPI-07-03	YPG-AOPI-07-03-SO	0-2 feet	08/05/2020	N	0.00062	U	**0.00049**	J	0.0021	U
Combined Maintenance Facility (YPG-AOPI-13)	YPG-AOPI-13-01	YPG-AOPI-13-01-SO	0-2 feet	08/11/2020	N	**0.00033**	J	**0.00030**	J	0.0020	U
	YPG-AOPI-13-02	YPG-AOPI-13-02-SO	0-2 feet	08/11/2020	N	**0.0010**		**0.00087**		0.0021	U
	YPG-AOPI-13-03	YPG-AOPI-13-03-SO	0-2 feet	08/05/2020	N	**0.0098**		**0.0066**		0.0019	U
		YPG-AOPI-FD-SO-080520-04 / YPG-AOPI-13-03-SO	0-2 feet	08/05/2020	FD	**0.0085**		**0.0046**		0.0020	U
Drafting Pit (YPG-AOPI-06)	YPG-AOPI-06-01	YPG-AOPI-06-01-SO	0-2 feet	08/03/2020	N	0.00059	U	0.00059	U	0.0020	U
	YPG-AOPI-06-02	YPG-AOPI-06-02-SO	0-2 feet	08/03/2020	N	0.00060	U	0.00060	U	0.0020	U
	YPG-AOPI-06-03	YPG-AOPI-06-03-SO	0-2 feet	08/03/2020	N	**0.00079**		**0.00057**	J	0.0020	U
	YPG-AOPI-06-04	YPG-AOPI-06-04-SO	0-2 feet	08/04/2020	N	**0.00041**	J	**0.00058**		0.0019	U
Former Combined Maintenance Facility (YPG-AOPI-01)	YPG-AOPI-01-01	YPG-AOPI-01-01-SO	0-2 feet	08/06/2020	N	**0.00047**	J	**0.0043**		0.0021	U
	YPG-AOPI-01-02	YPG-AOPI-01-02-SO	0-2 feet	08/10/2020	N	**0.023**		**0.030**		**0.0006**	J
	YPG-AOPI-01-03	YPG-AOPI-01-03-SO	0-2 feet	08/10/2020	N	**0.051**		**0.24**		**0.0057**	
Former Fire Station (YPG-AOPI-02)	YPG-AOPI-02-01	YPG-AOPI-02-01-SO	0-2 feet	08/06/2020	N	**0.00093**		0.00061	U	0.0020	U
	YPG-AOPI-02-02	YPG-AOPI-02-02-SO	0-2 feet	08/06/2020	N	**0.00047**	J	**0.00022**	J	0.0019	U
		YPG-AOPI-FD-SO-080620-01 / YPG-AOPI-02-02-SO	0-2 feet	08/06/2020	FD	**0.00082**		**0.00022**	J	0.0020	U
Fire Station 1 (YPG-AOPI-08)	YPG-AOPI-08-01	YPG-AOPI-08-01-SO	0-2 feet	08/05/2020	N	***2.0***		**1.3**		**0.015**	
		YPG-AOPI-08-01-SO-10-12	10-12 feet	08/05/2020	N	**0.18**	J	**0.17**	J	**0.0040**	J
Fire Station 2 (YPG-AOPI-03)	YPG-AOPI-03-01	YPG-AOPI-03-01-SO	0-2 feet	08/06/2020	N	0.00061	U	0.00061	U	0.0020	U
	YPG-AOPI-03-02	YPG-AOPI-03-02-SO	0-2 feet	08/06/2020	N	**0.0025**		**0.00071**		0.0021	U
		YPG-AOPI-FD-SO-080620-02 / YPG-AOPI-03-02-SO	0-2 feet	08/06/2020	FD	**0.0015**		**0.00052**	J	0.0020	U
Fire Station 3(YPG-AOPI-11)	YPG-AOPI-11-01	YPG-AOPI-11-01-SO	0-2 feet	08/11/2020	N	**0.0025**		**0.0011**		**0.00051**	J
	YPG-AOPI-11-02	YPG-AOPI-11-02-SO	0-2 feet	08/11/2020	N	**0.017**		**0.0028**		**0.0015**	J
	YPG-AOPI-11-03	YPG-AOPI-11-03-SO	0-2 feet	08/04/2020	N	**0.013**		**0.0015**		0.0020	U
		YPG-AOPI-11-03-SO-10-12	10-12 feet	08/04/2020	N	0.00062	U	**0.0030**		0.0021	U
Fire Station 4 (YPG-AOPI-09)	YPG-AOPI-09-01	YPG-AOPI-09-01-SO	0-2 feet	08/10/2020	N	**0.69**		**0.47**		**0.030**	
	YPG-AOPI-09-02	YPG-AOPI-09-02-SO	0-2 feet	08/05/2020	N	**0.033**		**0.016**		0.0020	U
New Fire-Fighting Training Pit (YPG-AOPI-04)	YPG-AOPI-04-01	YPG-AOPI-4-01-SO	0-2 feet	08/03/2020	N	**0.22**		**0.43**		0.0020	U
		YPG-AOPI-FD-SO-080320-03 / YPG-AOPI-4-01-SO	0-2 feet	08/03/2020	FD	**0.31**		**0.46**		0.0020	U
	YPG-AOPI-04-02	YPG-AOPI-04-02-SO	0-2 feet	08/04/2020	N	**0.029**		**0.11**		**0.0075**	
		YPG-AOPI-04-02-SO-10-12	10-12 feet	08/04/2020	N	**0.0068**		**0.023**		0.0018	U

Table 7-2
Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

AOPI	Location	Sample ID / Parent Sample ID	Sample Depth Interval	Analyte		PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level		1.6		1.6		25	
				OSD Residential Risk Screening Level		0.13		0.13		1.9	
				Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Old Fire-Fighting Training Pit (YPG-AOPI-05)	YPG-AOPI-05-01	YPG-AOPI-05-01-SO-0-2	0-2 feet	08/04/2020	N	**0.0011**		**1.6**		**0.0032**	
		YPG-AOPI-05-01-SO-10-12	10-12 feet	08/04/2020	N	**0.0017**	J	**1.2**	J	**0.0016**	J
	YPG-AOPI-05-02	YPG-AOPI-05-02-SO-0-2	0-2 feet	08/04/2020	N	***3.3***		***6.2***		**0.14**	
		YPG-AOPI-05-02-SO-5-10	5-10 feet	08/04/2020	N	**0.014**	J	***1.9***	J	**0.025**	J
	YPG-AOPI-05-03	YPG-AOPI-05-03-SO-0-2	0-2 feet	08/04/2020	N	**0.98**		***2.6***		**0.0057**	
		YPG-AOPI-05-03-SO-5-10	5-10 feet	08/04/2020	N	**0.10**	J	***1.7***	J	**0.0055**	J
Trap Mission Training Support (YPG-AOPI-15)	YPG-AOPI-15-01	YPG-AOPI-15-01-SO	0-2 feet	08/11/2020	N	**0.27**		**0.0028**		0.0020	U
	YPG-AOPI-15-02	YPG-AOPI-15-02-SO	0-2 feet	08/11/2020	N	**0.045**		**0.0018**		**0.00080**	J
	YPG-AOPI-15-03	YPG-AOPI-15-03-SO	0-2 feet	08/11/2020	N	**0.41**		**0.0016**		**0.00055**	J
	YPG-AOPI-15-04	YPG-AOPI-15-04-SO	0-2 feet	08/11/2020	N	**0.25**		**0.0011**		0.0019	U
	YPG-AOPI-15-05	YPG-AOPI-15-05-SO	0-2 feet	08/11/2020	N	**0.019**		**0.00042**	J	0.0019	U
Turret Testing Area (YPG-AOPI-10)	YPG-AOPI-10-01	YPG-AOPI-10-01-SO-0-2	0-2 feet	08/10/2020	N	**0.29**		**0.12**		**0.0052**	
	YPG-AOPI-10-02	YPG-AOPI-10-02-SO	0-2 feet	08/10/2020	N	***2.3***		**1.4**		**0.011**	
	YPG-AOPI-10-03	YPG-AOPI-10-03-SO	0-2 feet	08/05/2020	N	**0.048**		**0.024**		0.0020	U
		YPG-AOPI-10-03-SO-10-12	10-12 feet	08/05/2020	N	**0.027**	J	**0.018**	J	0.0020	UJ
	YPG-AOPI-10-04	YPG-AOPI-10-04-SO	0-2 feet	08/10/2020	N	**0.026**		**0.031**		0.0020	U
	YPG-AOPI-10-05	YPG-AOPI-10-05-SO	0-2 feet	08/10/2020	N	**0.00081**		**0.0016**		0.0019	U

Notes:

1. Bolded values indicate the result was detected

2. All laboratory reported results in nanograms per gram (ng/g) were converted to milligrams per kilogram (mg/kg).

3. Grey shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2021).
4. Grey 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 2021).

Acronyms/Abbreviations:

AOPI = Area of Potential Interest

FD = field duplicate sample

ID = identification

N = primary sample

mg/kg = milligrams per kilogram (parts per million)

PFAS = per- and polyfluoroalkyl substances

PFBS = perfluorobutane sulfonic acid

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonic acid

Qual = qualifier

SO = Soil

YPG = Yuma Proving Ground

Qualifiers:

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).

UJ = The analyte was analyzed for but was not detected. The limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise.

Table 7-3 - Surface Water PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Yuma Proving Ground, Arizona

AOPI	Location	Sample ID / Parent Sample ID	Analyte		PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
			OSD Tapwater Risk Screening Level		40		40		600	
			Sample Date	Sample Type	Result	Qual	Result	Qual	Result	Qual
Former Combined Maintenance Facility (YPG-AOPI-01)	YPG-AOPI-01-01	YPG-AOPI-01-01-SW	8/3/2020	N	2.1	U	2.1	UB	**1.2**	J
	YPG-AOPI-01-02	YPG-AOPI-01-02-SW	8/3/2020	N	**5.6**	J-	**2.0**	BJ+	1.9	U
	YPG-AOPI-01-03	YPG-AOPI-01-03-SW	8/3/2020	N	2.4	U	2.4	UB	2.4	U
		YPG-FD-SW-080320-01 / YPG-AOPI-01-03-SW	8/3/2020	FD	**1.4**	J	**2.3**	BJ+	2.1	U

Notes:
1. Bolded values indicate the result was detected
2. Grey shaded values indicate the result was detected greater than the 2021 Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.)

Acronyms/Abbreviations:
AOPI = Area of Potential Interest
FD = field duplicate sample
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
SW = Surface Water
YPG = Yuma Proving Ground

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.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
UB = The analyte is considered nondetect at the listed value due to associated blank contamination.

FIGURES

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 2-1
Site Location

Installation Boundary

State Boundary

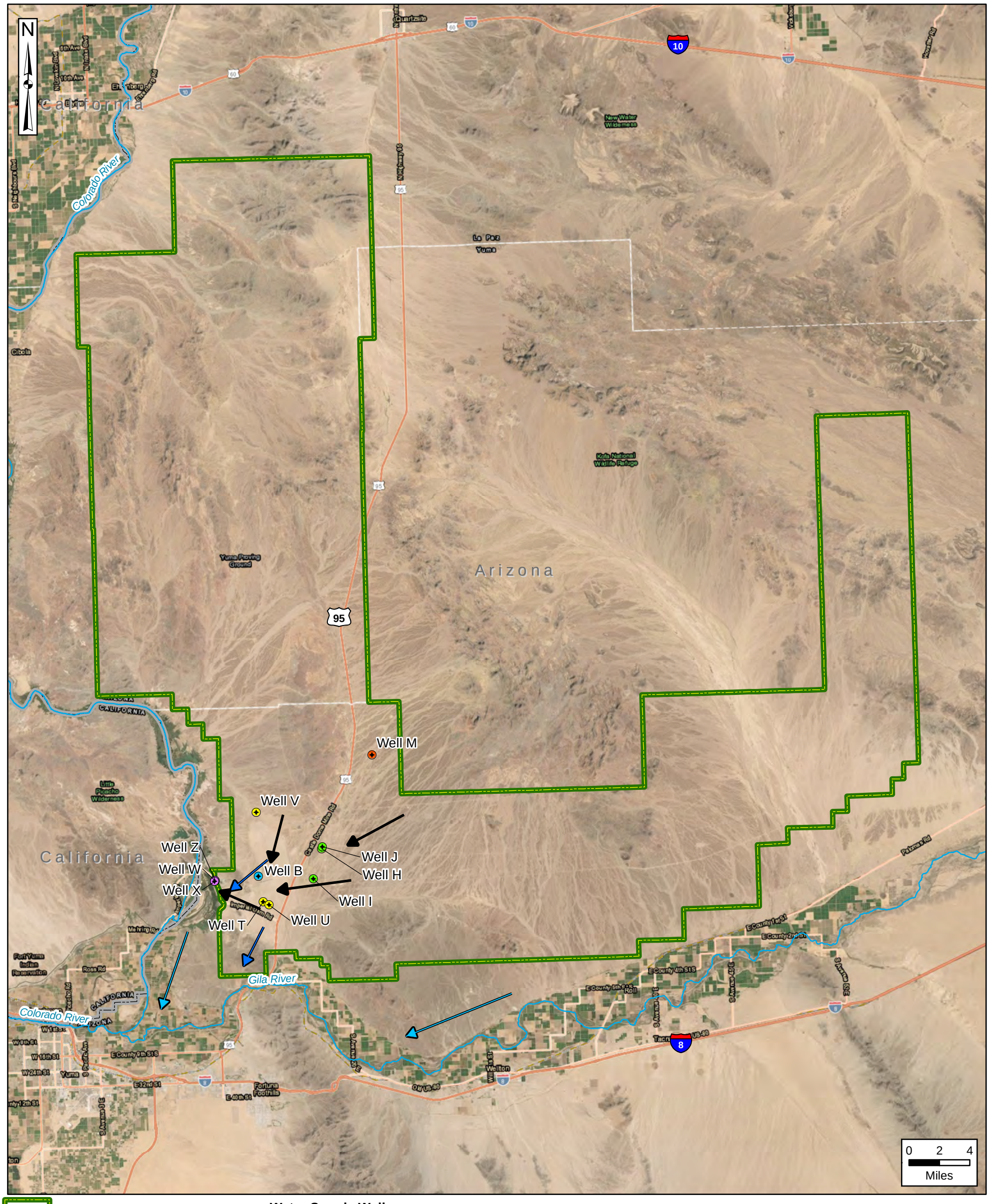
River

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 2-2
Site Layout



Installation Boundary
State Boundary
River
Surface Runoff Flow Direction
Surface Water Flow Direction
Groundwater Flow Direction

Water Supply Wells

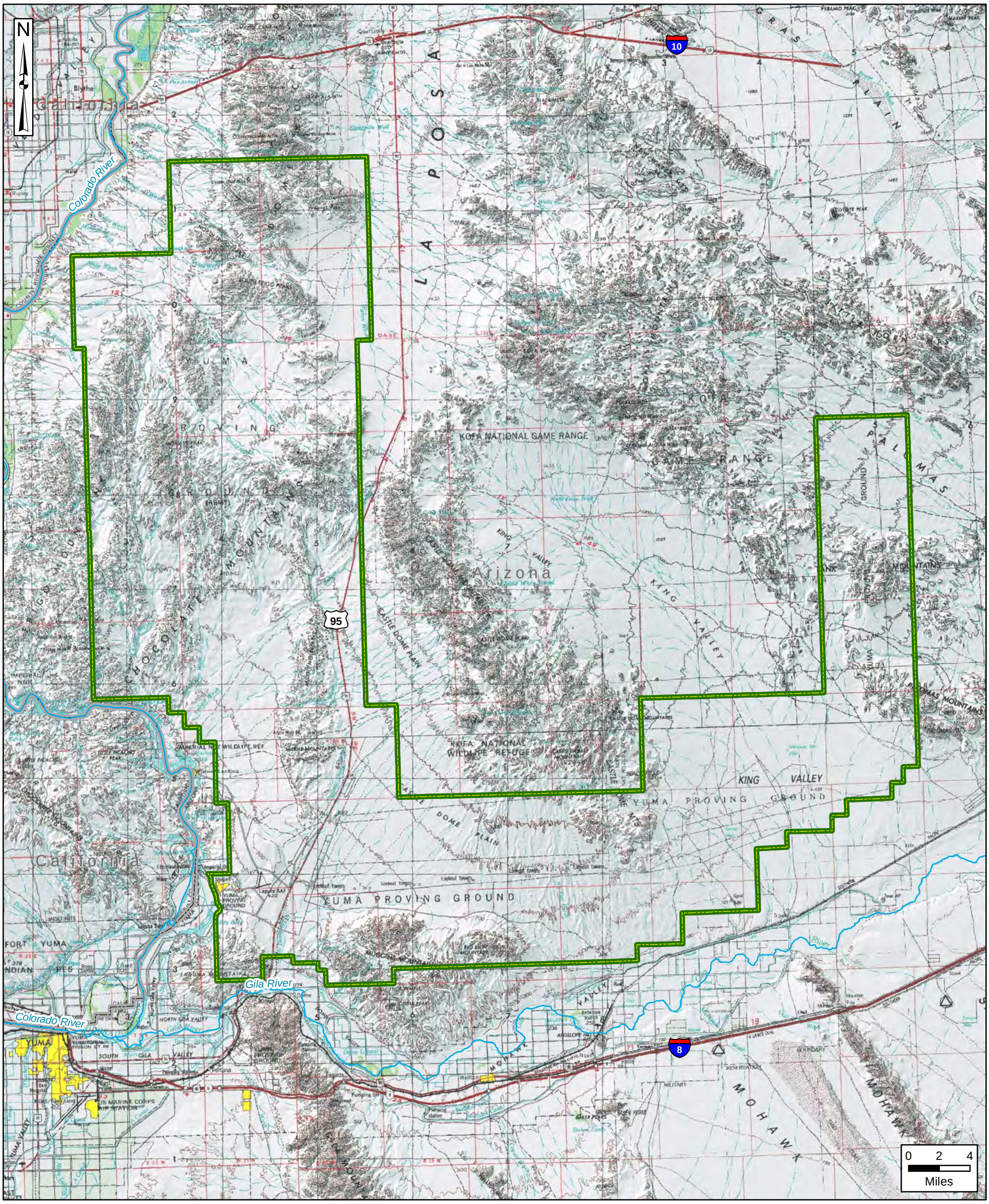
- Castle Dome Heliport
- Kofa Firing Range
- Laguna Army Airfield
- Main Administrative Area
- Yuma Test Center and Laguna Army Airfield

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 2-3
Topographic Map



Installation Boundary

State Boundary

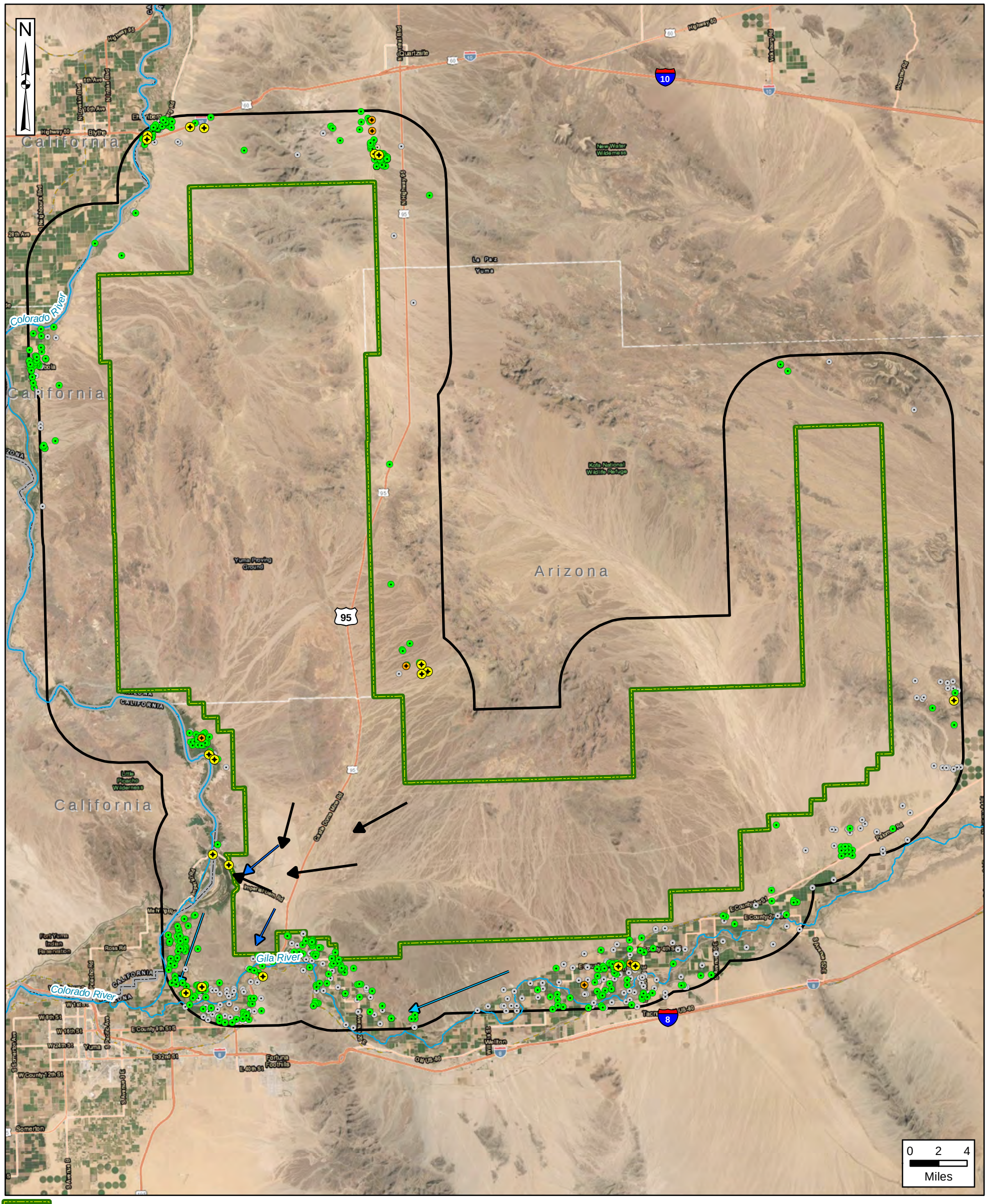
River

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI ArcGIS Online, USA Topo Maps

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 2-4
Off-Post Potable Supply and Agricultural Wells



Installation Boundary
5-Mile Radius
State Boundary
River
Surface Runoff Flow Direction
Surface Water Flow Direction
Groundwater Flow Direction
Public Water Supply System Well
Municipal/Utility Well
Domestic Well
Other Designated Use Well *

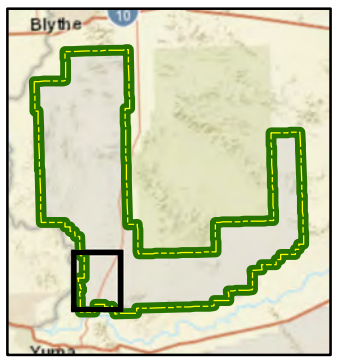
* Other designated use wells includes commercial, irrigation, recreation, stock, other-production, and wells with unknown use.

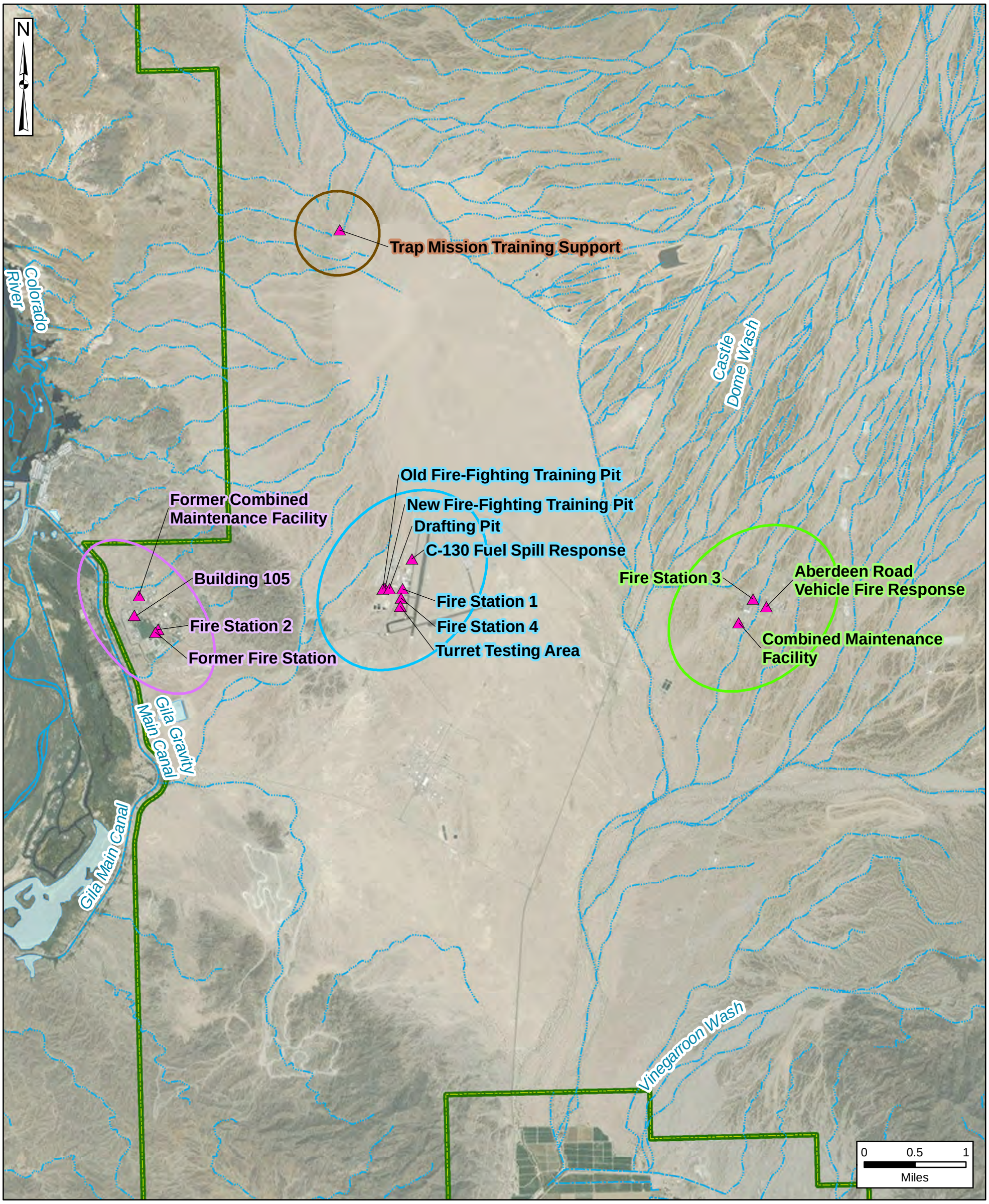
Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
EDR, Well Data, 2018
ADWR, Well Data, 2018
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 5-2
AOPI Locations





Installation Boundary
AOPI Location
Stream (Perennial)
Stream (Ephemeral)
Canal/Ditch
Water Body

Proximate AOPIs
Desert March
Kofa Firing Range
Laguna Army Airfield
Main Post / Howard Cantonment Area
Trap Mission Training Support

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

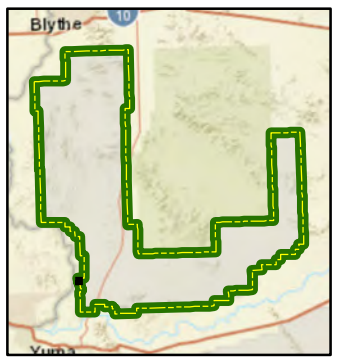


Figure 5-3
Aerial Photo of AOPI
Former Combined Maintenance Facility and Building 105

N

Former Combined Maintenance Facility

Building 105

Gila Gravity Main Canal

0 100 200
Feet

Installation Boundary
AOPI
Stream (Ephemeral)
Surface Water Flow Direction
Surface Runoff / Groundwater Flow Direction
Production Well
Monitoring Well

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

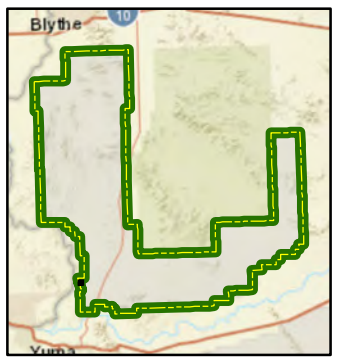


Figure 5-4
Aerial Photo of AOPIs
Fire Station 2 and Former Fire Station

Installation Boundary

AOPI

Surface Runoff / Groundwater Flow Direction

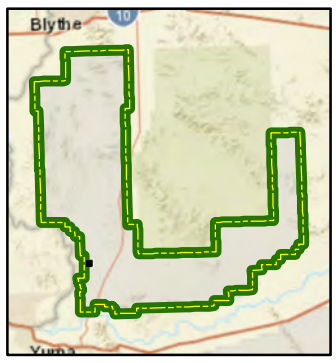
AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 5-5
Aerial Photo of AOPI
Trap Mission Training Support



Installation Boundary

AOPI

Stream (Ephemeral)

Surface Runoff / Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

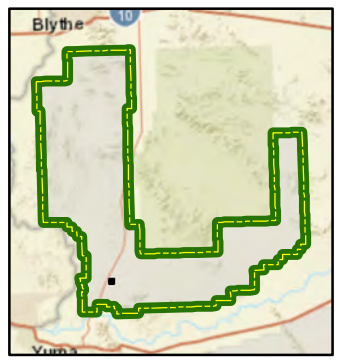


Figure 5-6
Aerial Photo of AOPIs
Aberdeen Road Fire Response and Fire Station 3

Installation Boundary
AOPI
Stream (Ephemeral)
Surface Runoff / Groundwater Flow Direction
Production Well

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

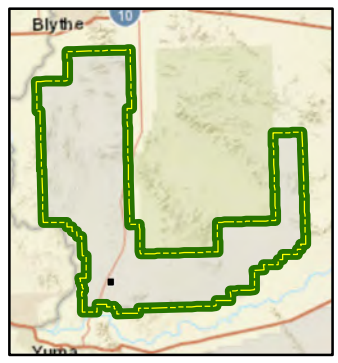


Figure 5-7
Aerial Photo of AOPI
Combined Maintenance Facility

Installation Boundary

AOPI

Surface Runoff / Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

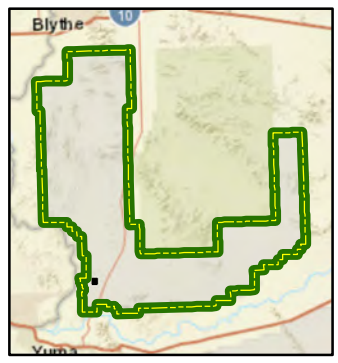


Figure 5-8
Aerial Photo of AOPIs Laguna Army Air Field, Fire Station 1, Fire Station 4, and Turret Testing Area

Installation Boundary

AOPI

Surface Runoff / Groundwater Flow Direction

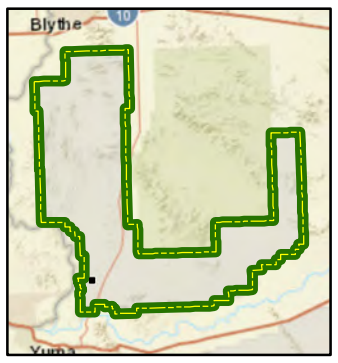
AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 5-9
Aerial Photo of AOPIs
Old Fire-Fighting Training Pit, New Fire-Fighting Training Pit, and Drafting Pit



Installation Boundary

AOPI

Surface Runoff / Groundwater Flow Direction

AOPI = area of potential interest

Data Sources:
USACE, GIS Data, 2020
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

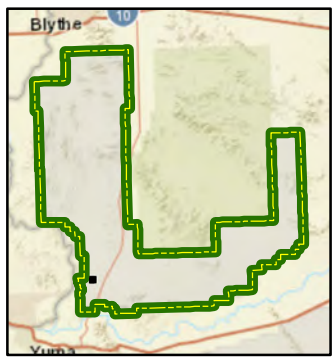


Figure 5-10
Aerial Photo of AOPI
C-130 Fuel Spill Response

Installation Boundary

AOPI

Surface Runoff / Groundwater Flow Direction

Production Well

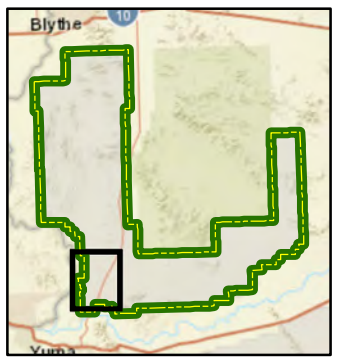
AOPI = area of potential interest

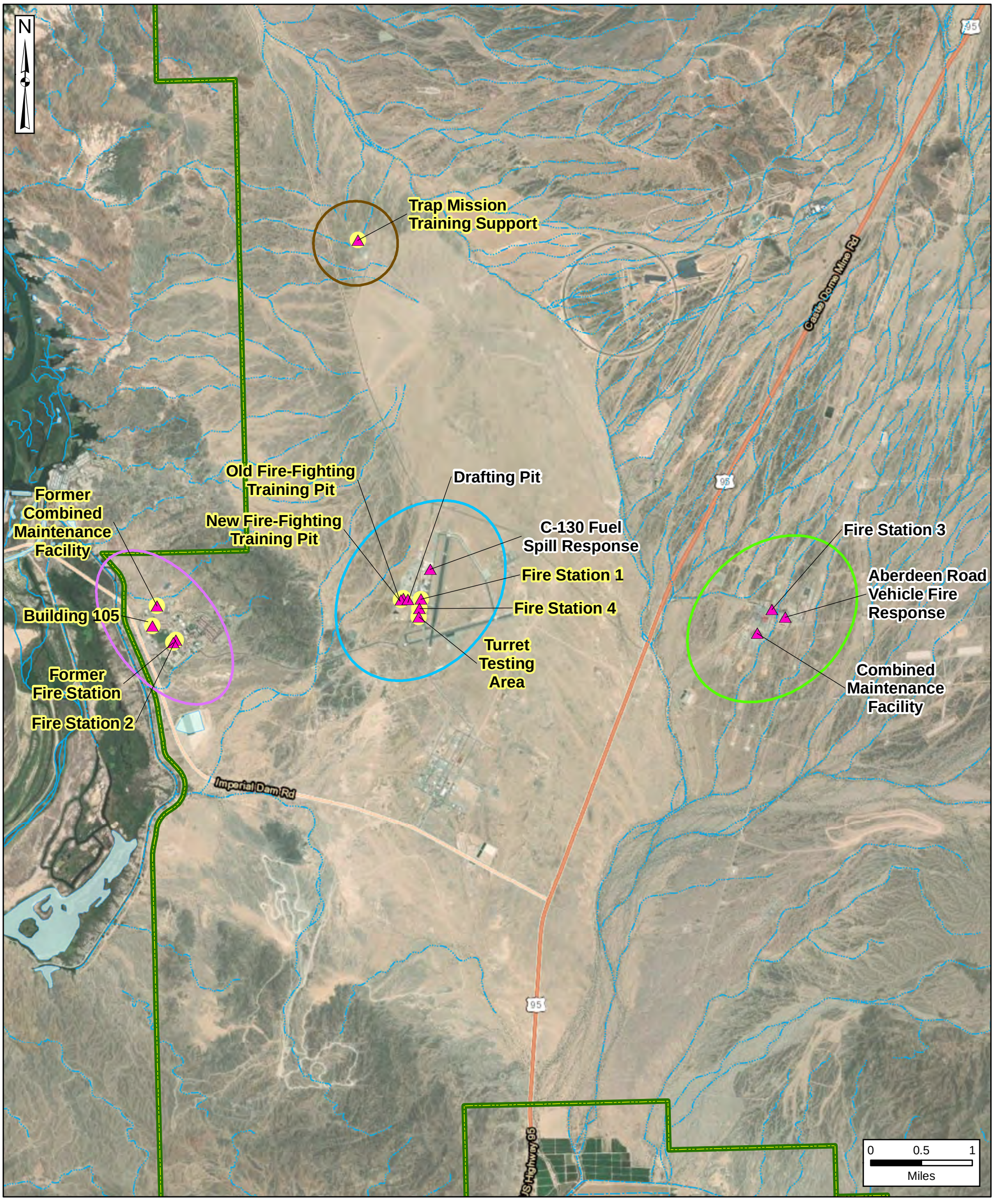
Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

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





- Installation Boundary
- AOPI Location
- AOPI with OSD Risk Screening Level Exceedance
- Stream (Perennial)
- Stream (Ephemeral)
- Canal/Ditch
- Water Body

Proximate AOPIs

- Desert March
- Kofa Firing Range
- Laguna Army Airfield
- Main Post / Howard Cantonment Area
- Trap Mission Training Support

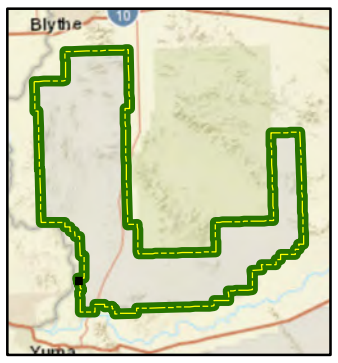
AOPI = area of potential interest
OSD = Office of the Secretary of Defense

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-2
AOPI Former Combined Maintenance Facility and Building 105
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Groundwater and surface water results (shown in blue data boxes) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green data boxes) are reported in milligrams per kilogram (mg/kg).
3. Duplicate results are shown in brackets.
4. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L or residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
6. Sample YPG-AOPI-01-02-GW was originally associated with the Former Combined Maintenance Facility, but was re-associated with AOPI Building 105 upon updated Army guidance.

Qualifiers:
B = The compound has been found in the sample as well as its associated blank; its presence in the sample may be suspect.
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.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

YPG-AOPI-01-03-SW	
Date	8/3/2020
PFOS	2.4 U **[1.4 J]**
PFOA	2.4 UB **[2.3 BJ+]**
PFBS	2.4 U [2.1 U]

YPG-AOPI-01-02-SW	
Date	8/3/2020
PFOS	**5.6 J-**
PFOA	**2 BJ+**
PFBS	1.9 U

YPG-AOPI-01-01-SO	
Date	8/6/2020
Depth	0-2 ft
PFOS	**0.00047 J**
PFOA	**0.0043**
PFBS	0.0021 U

YPG-AOPI-01-01-GW	
Date	9/29/2020
PFOS	**1.9**
PFOA	**20**
PFBS	**9.1**

Former Combined Maintenance Facility

YPG-AOPI-01-MW1-GW	
Date	8/7/2020
PFOS	**3.4**
PFOA	**10**
PFBS	**2.5**

YPG-AOPI-01-02-SO	
Date	8/10/2020
Depth	0-2 ft
PFOS	**0.023**
PFOA	**0.03**
PFBS	**0.0006 J**

YPG-AOPI-01-03-SO	
Date	8/10/2020
Depth	0-2 ft
PFOS	**0.051**
PFOA	**0.24**
PFBS	**0.0057**

Building 105

Gila Gravity Main Canal

YPG-AOPI-01-01-SW	
Date	8/3/2020
PFOS	2.1 U
PFOA	2.1 UB
PFBS	**1.2 J**

YPG-AOPI-01-02-GW	
Date	9/30/2020
PFOS	**190**
PFOA	**37**
PFBS	**33**

N

0 100 200
Feet

Installation Boundary
AOPI
Stream (Ephemeral)
Surface Water Flow Direction
Surface Runoff / Groundwater Flow Direction
Production Well
Monitoring Well
Grab Groundwater Sampling Location
Groundwater Sampling Location (Sonic)
Shallow Soil Sampling Location
Surface Water Sampling Location
Groundwater Sampling Location - Existing Well

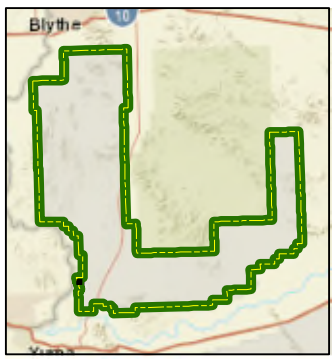
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

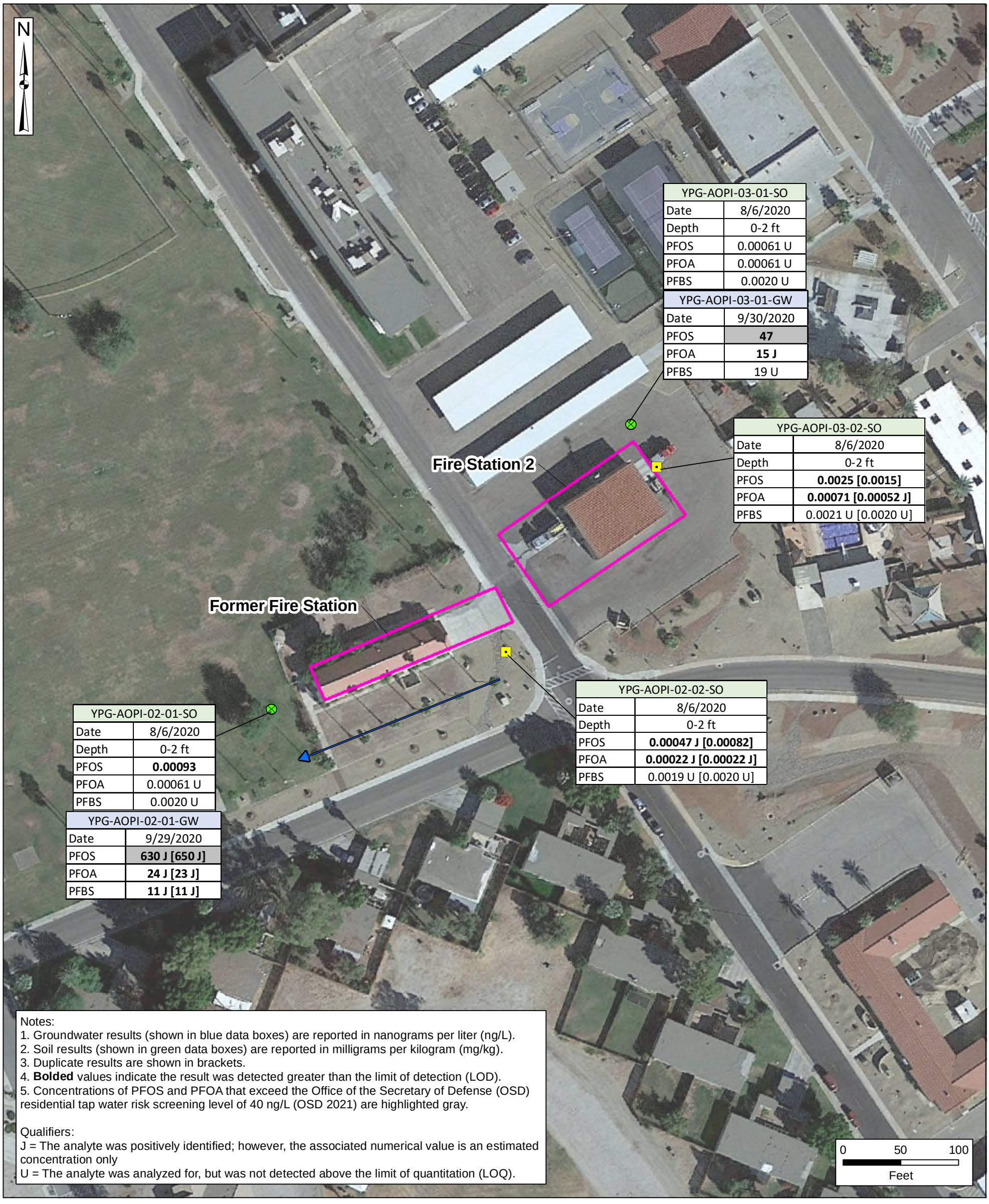
Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-3
AOPIs Fire Station 2 and Former Fire Station
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater results (shown in blue data boxes) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green data boxes) are reported in milligrams per kilogram (mg/kg).
3. Duplicate results are shown in brackets.
4. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 40 ng/L (OSD 2021) are highlighted gray.

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

Installation Boundary
AOPI
Surface Runoff / Groundwater Flow Direction
Grab Groundwater Sampling Location
Shallow Soil Sampling Location

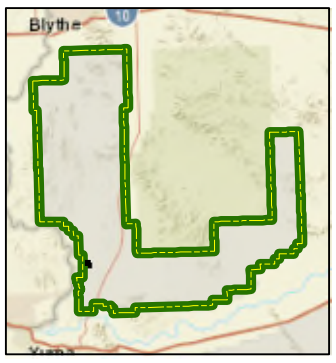
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
USACE, GIS Data, 2020
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-4
AOPI Trap Mission Training Support
PFOS, PFOA, and PFBS Analytical Results



N

YPG-AOPI-15-05-SO	
Date	8/11/2020
Depth	0-2 ft
PFOS	**0.019**
PFOA	**0.00042 J**
PFBS	0.0019 U

YPG-AOPI-15-01-SO	
Date	8/11/2020
Depth	0-2 ft
PFOS	**0.27**
PFOA	**0.0028**
PFBS	0.0020 U

Trap Mission Training Support

YPG-AOPI-15-02-SO	
Date	8/11/2020
Depth	0-2 ft
PFOS	**0.045**
PFOA	**0.0018**
PFBS	**0.0008 J**

YPG-AOPI-15-04-SO	
Date	8/11/2020
Depth	0-2 ft
PFOS	**0.25**
PFOA	**0.0011**
PFBS	0.0019 U

YPG-AOPI-15-03-SO	
Date	8/11/2020
Depth	0-2 ft
PFOS	**0.41**
PFOA	**0.0016**
PFBS	**0.00055 J**

0 50 100
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.

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

Installation Boundary
AOPI
Stream (Ephemeral)
Shallow Soil Sampling Location
Surface Water / Groundwater Flow Direction

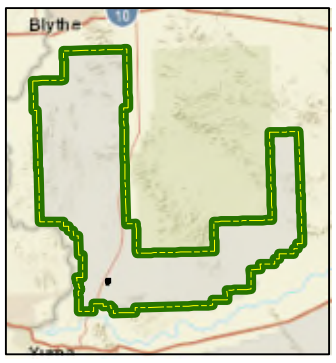
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

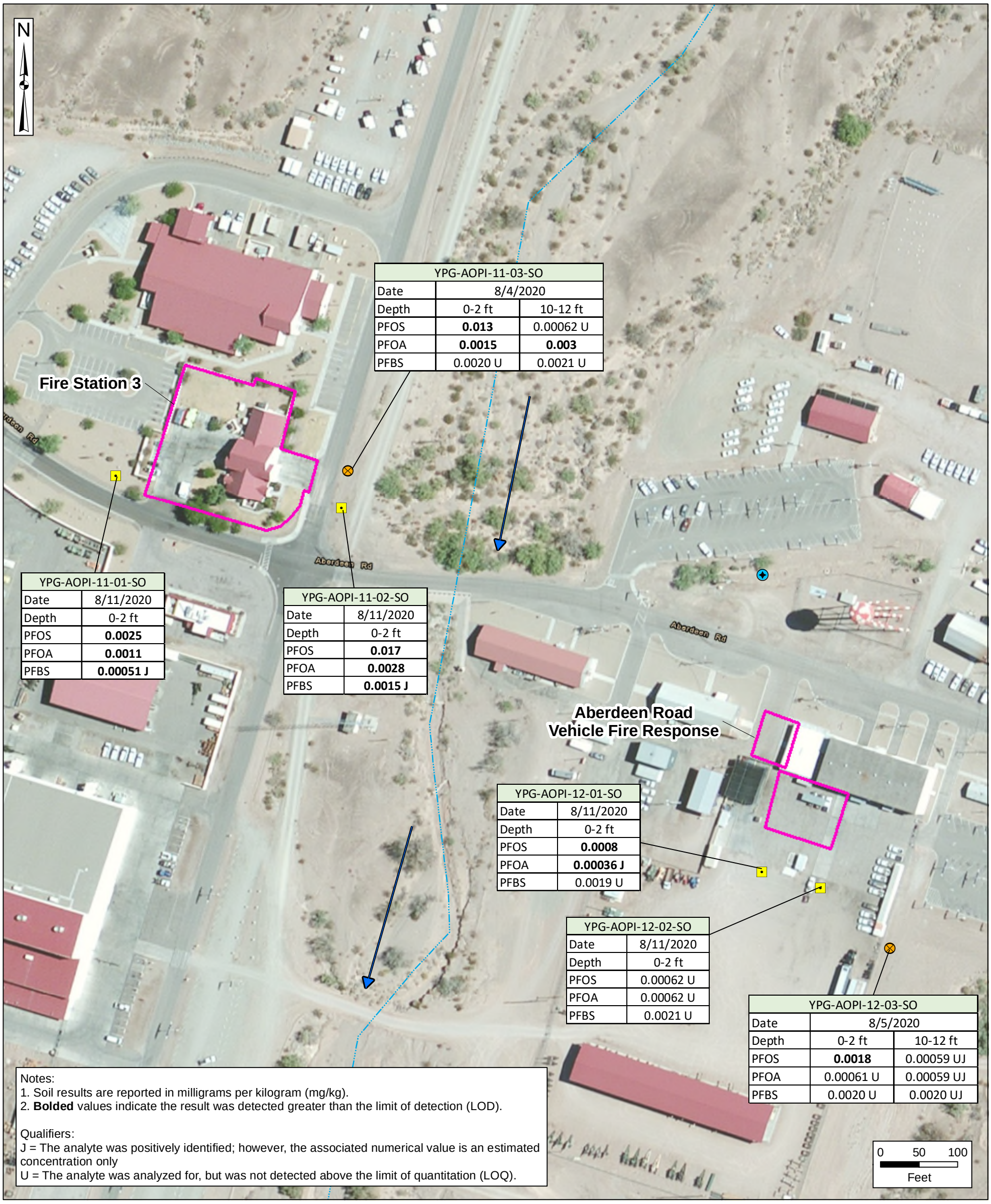
Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-5
AOPIs Aberdeen Road Fire Response and Fire Station 3
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).

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

Installation Boundary
AOPI
Stream (Ephemeral)
Surface Runoff / Groundwater Flow Direction
Production Well
Shallow Soil Sampling Location
Soil Boring

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

Data Sources:
USACE, GIS Data, 2020
USGS, NHD Data, 2018
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

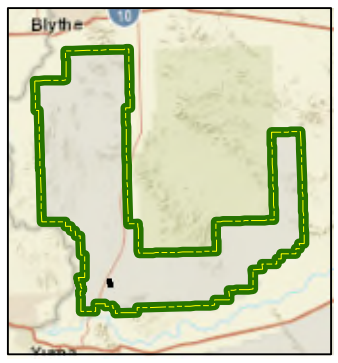
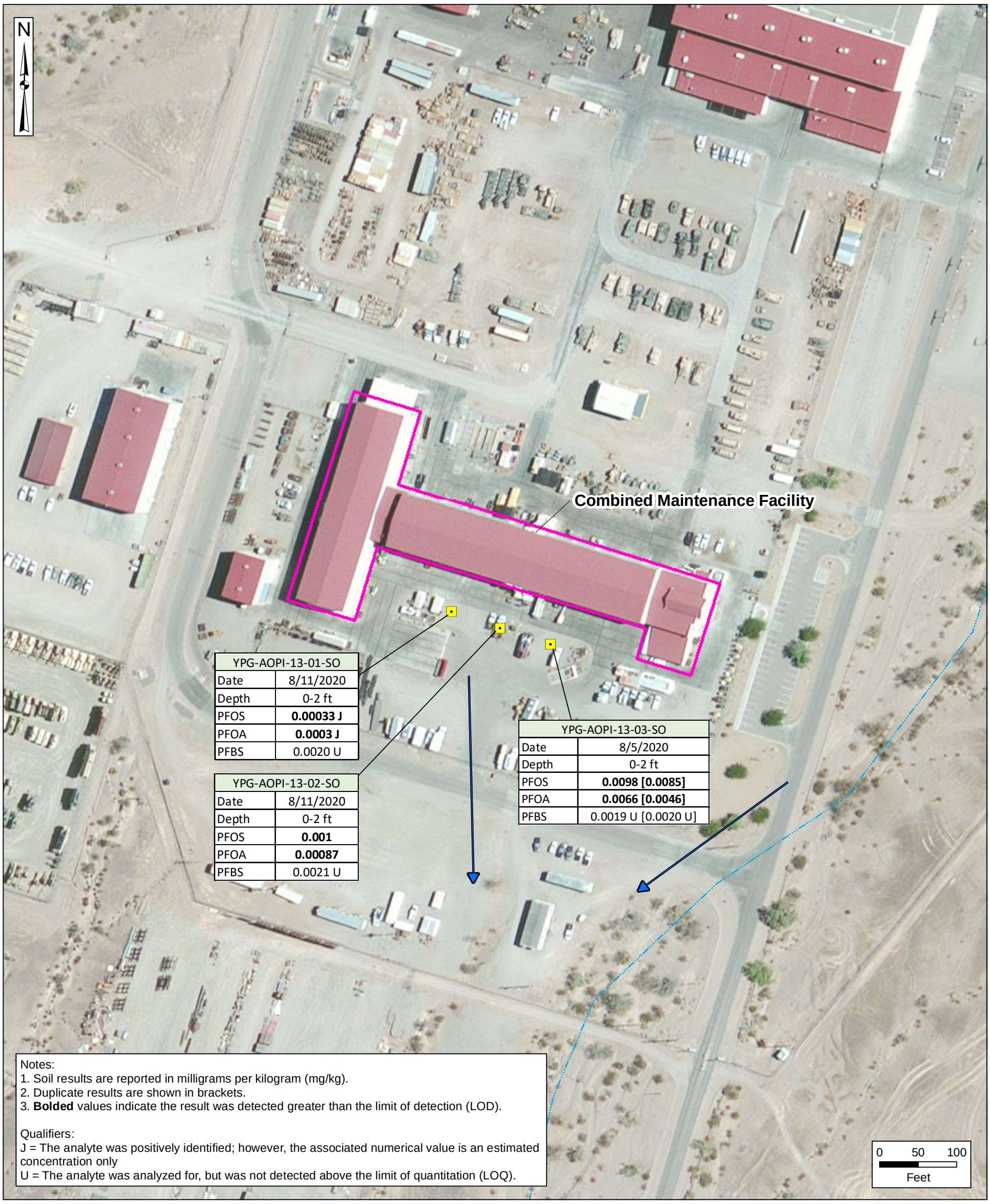


Figure 7-6
AOPI Combined Maintenance Facility
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Duplicate results are shown in brackets.
3. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).

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

Installation Boundary

AOPI

Shallow Soil Sampling Location

Surface Runoff / Groundwater Flow Direction

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

Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

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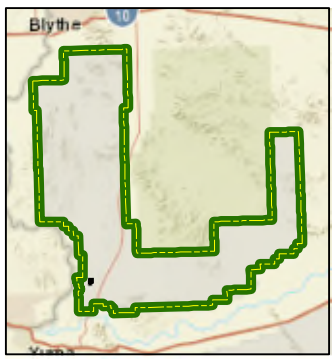
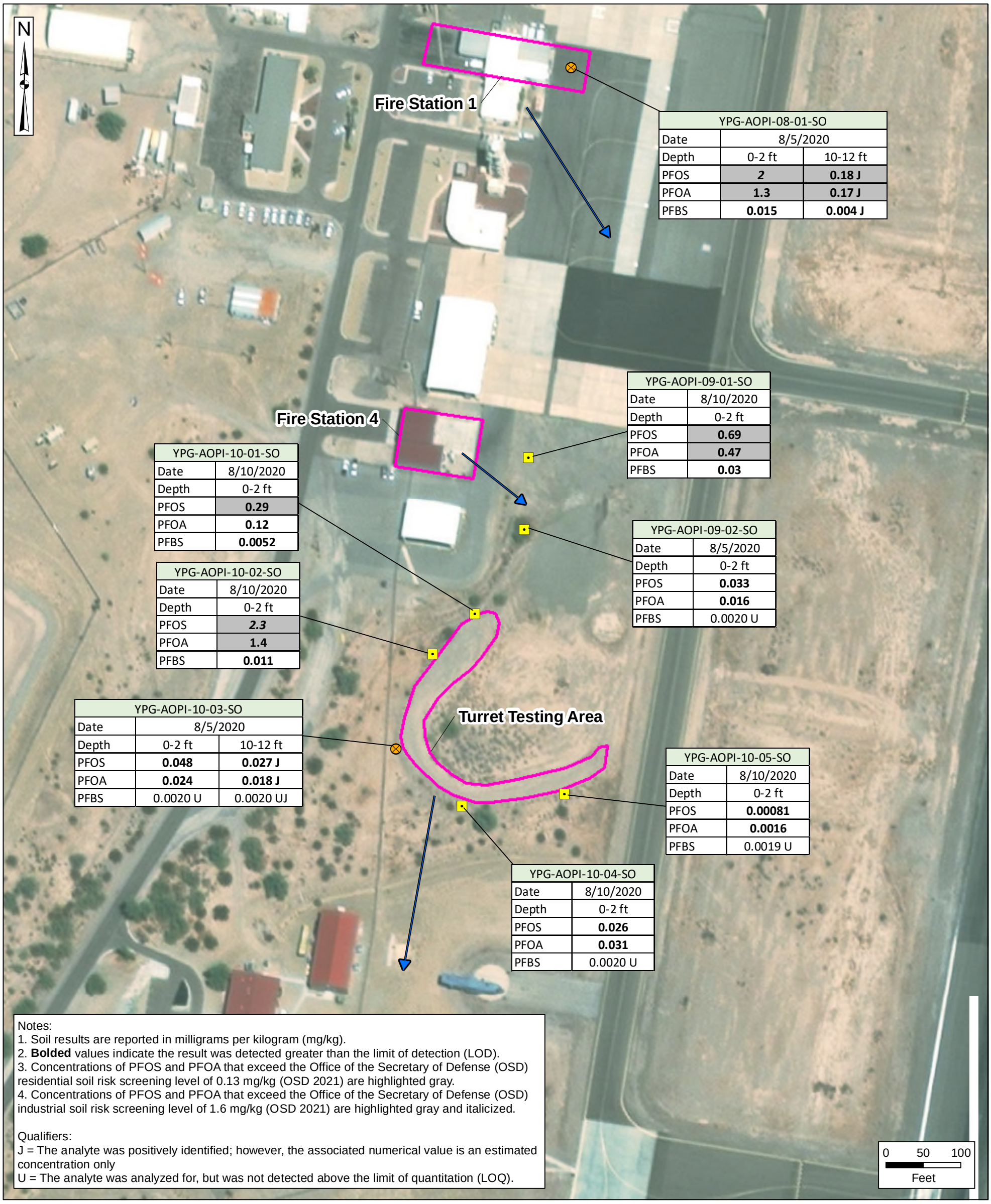
Yuma Proving Ground, AZ

Figure 7-7
AOPIs Laguna Army Air Field, Fire Station 1, Fire Station 4, and Turret Testing Area
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.

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

Installation Boundary
AOPI
Surface Runoff / Groundwater Flow Direction
Shallow Soil Sampling Location
Soil Boring

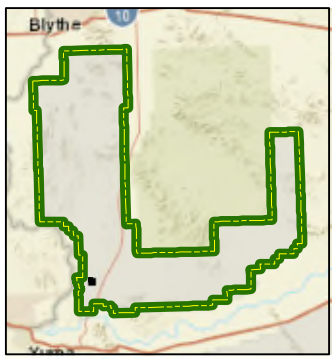
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

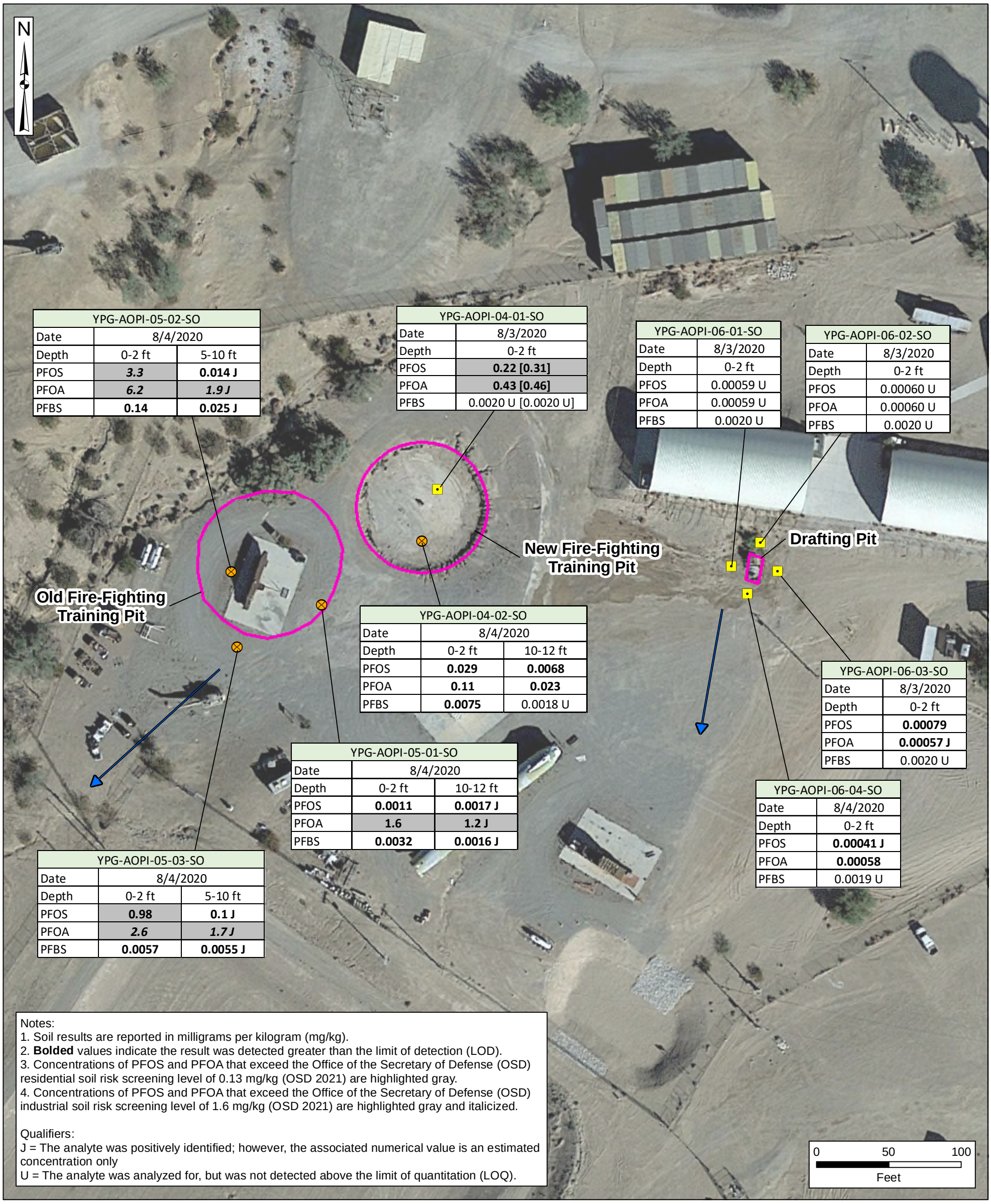
Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-8
AOPIs Old Fire-Fighting Training Pit, New Fire-Fighting Training Pit, and Drafting Pit PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.

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

Installation Boundary
AOPI
Surface Runoff / Groundwater Flow Direction
Shallow Soil Sampling Location
Soil Boring

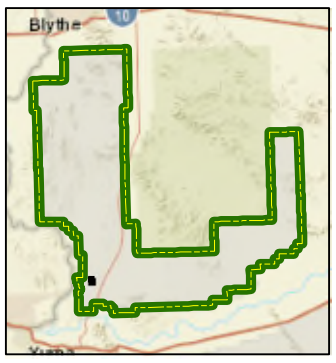
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

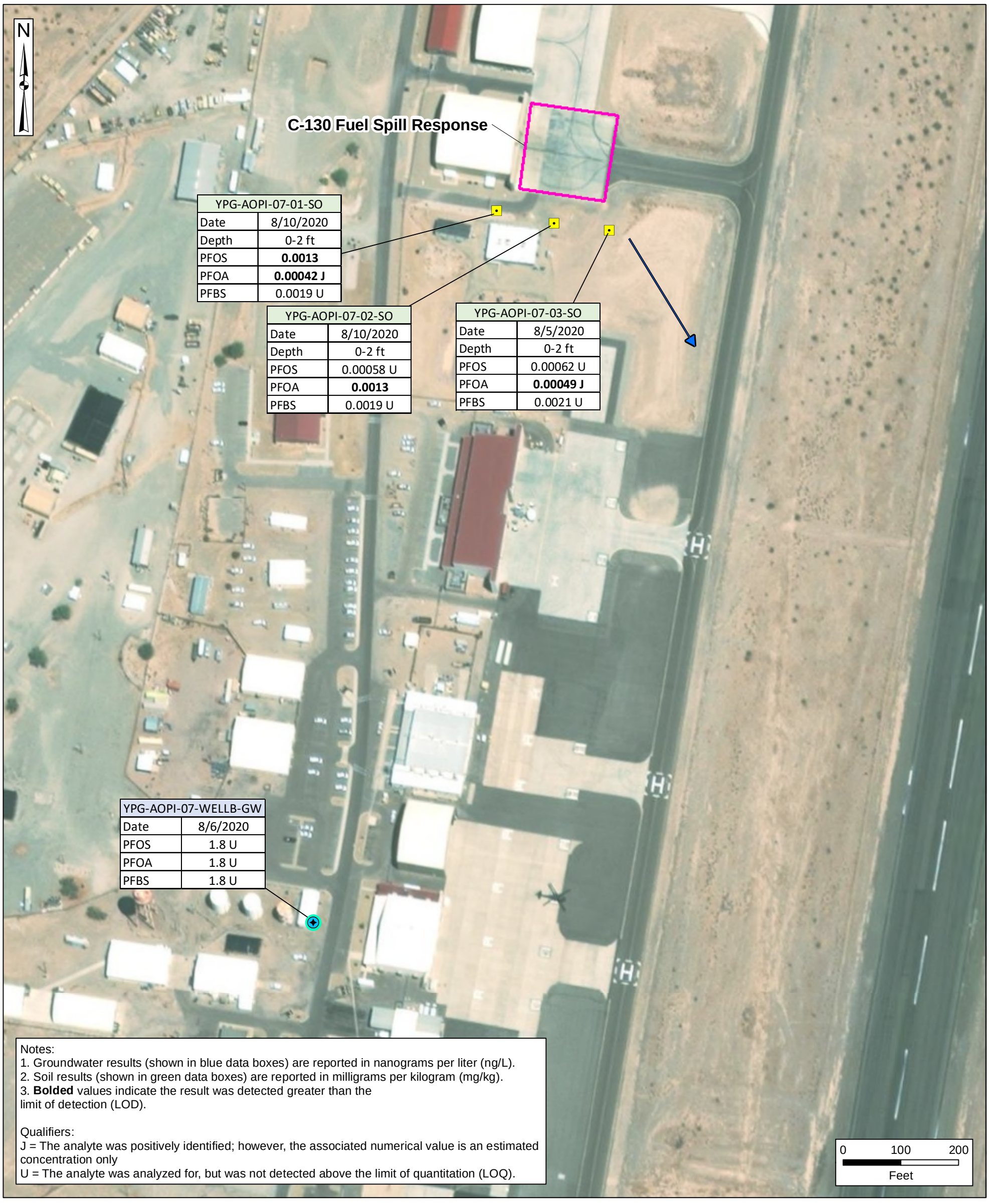
Data Sources:
USACE, GIS Data, 2020
Google Earth, Aerial Imagery, 2017

Coordinate System:
WGS 1984, UTM Zone 11 North

USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, AZ

Figure 7-9
AOPI C-130 Fuel Spill Response
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater results (shown in blue data boxes) are reported in nanograms per liter (ng/L).
2. Soil results (shown in green data boxes) are reported in milligrams per kilogram (mg/kg).
3. **Bolded** values indicate the result was detected greater than the limit of detection (LOD).

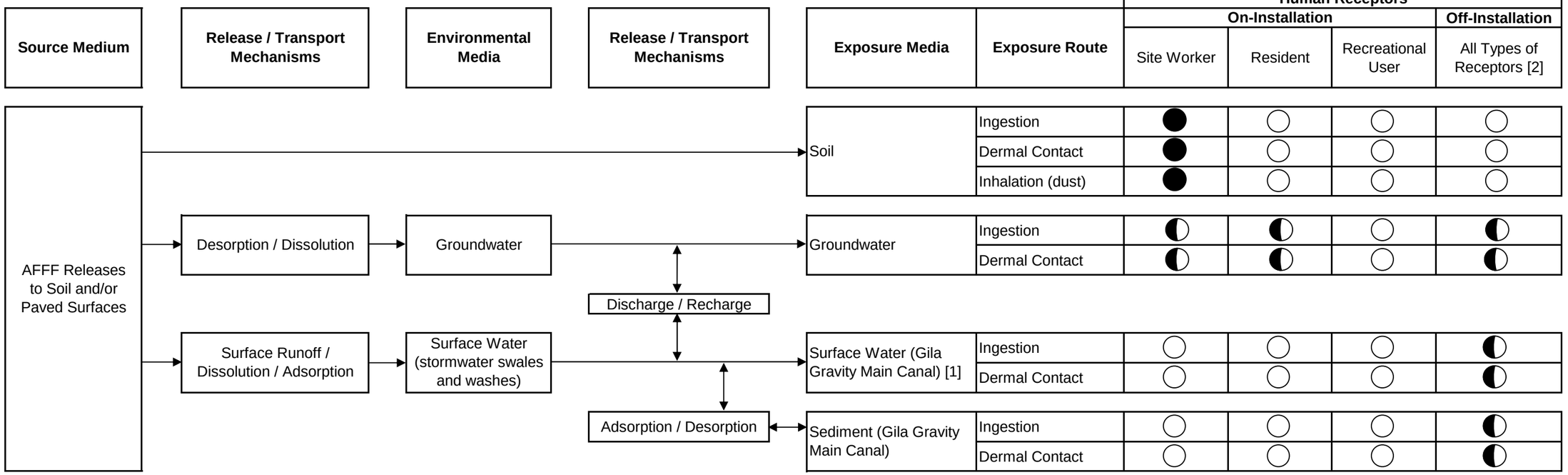
Qualifiers:
J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Production Well
Shallow Soil Sampling Location
Groundwater Sampling Location - Existing Well

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

Data Sources:
USACE, GIS Data, 2020
ESRI, ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 11 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.

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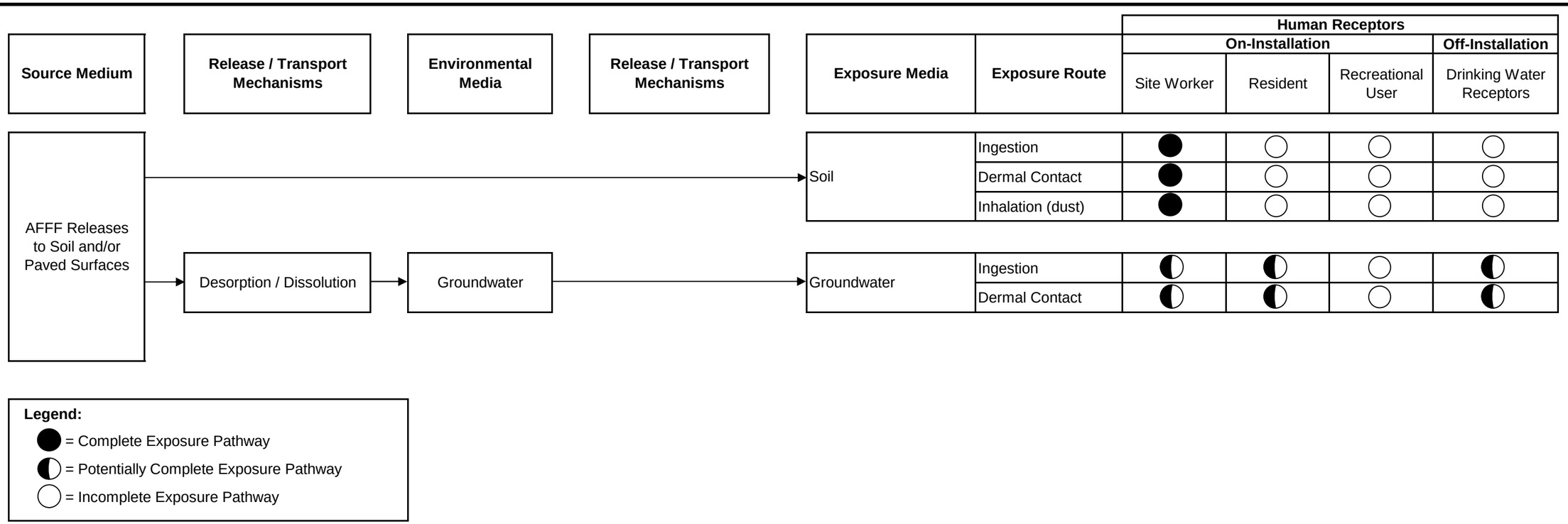
Conceptual Site Model for AOPI Grouping: Former Combined Maintenance Facility, Fire Station 2, and Former Fire Station
USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, Arizona

Figure 7-10



Conceptual Site Model for AOPI Grouping: Old Fire-Fighting Training Pit, New Fire-Fighting Training Pit, Drafting Pit, C-130 Fuel Response, Fire Station 1, Fire Station 4, Fire Station 3, Turret Testing Area, Aberdeen Road Fire Response, Combined Maintenance Facility, and Trap Mission Training Support

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Yuma Proving Ground, Arizona

Figure 7-11

Source Medium	Release / Transport Mechanisms	Environmental Media	Release / Transport Mechanisms	Exposure Media	Exposure Route	Human Receptors: On-Installation: Site Worker	On-Installation: Resident	On-Installation: Recreational User	Off-Installation: All Types of Receptors [2]
AFFF Releases to Soil and/or Paved Surfaces	Desorption / Dissolution	Groundwater		Groundwater	Ingestion	◐	◐	○	◐
					Dermal Contact	◐	◐	○	◐
			Discharge / Recharge						
	Surface Runoff / Dissolution / Adsorption	Surface Water (stormwater swales and washes)		Surface Water (Gila Gravity Main Canal) [1]	Ingestion	○	○	○	◐
					Dermal Contact	○	○	○	◐
			Adsorption / Desorption	Sediment (Gila Gravity Main Canal)	Ingestion	○	○	○	◐
					Dermal Contact	○	○	○	◐

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 AOPI Grouping: Building 105
USAEC PFAS Preliminary Assessment / Site Inspection
Yuma Proving Ground, Arizona

Figure 7-12

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