5623000 File: 2-J C.N.

EDWARDS AFB CALIFORNIA

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 5623

5623001

FINAL

SITE INSPECTION FOR AQUEOUS FILM FORMING FOAM AREAS AT EDWARDS AIR FORCE BASE, CALIFORNIA

Contract No.: W912BV-15-C-0082

Submitted to:

U.S. Army Corps of Engineers, Tulsa District

Prepared for:

Air Force Civil Engineer Center

Prepared by:

Oneida Total Integrated Enterprises, LLC
9601 McAllister Freeway, Suite 310
San Antonio, Texas 78216

AUGUST 2018

5623002

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
INSTALLATION SUPPORT SECTION
EDWARDS AIR FORCE BASE, CALIFORNIA

9 August 2018

MEMORANDUM FOR DISTRIBUTION

FROM: AFCEC/CZOW
120 N. Rosamond Blvd., Suite A
Edwards AFB CA 93524-8600

SUBJECT: Final Site Inspection of Aqueous Film Forming Foam Usage at Edwards Air Force Base, California

1. Transmitted herein are the hard copy changes pages and complete electronic file for the final subject document, a Primary Document under the 1990 Edwards Federal Facility Agreement (FFA).

2. The document presents the sampling completed, analytical results, pathways and receptors, discussion, and recommendations. The Site Inspection (SI) effort involved installation of temporary monitoring wells, groundwater, surface water, sediment and soil sampling, and sample analysis to confirm if a release of Per- and Polyfluoroalkyl Substances (PFAS) has occurred at these locations.

3. If you have any questions or comments, please call me at (661) 277-1469 or Julia Tseng at (661) 277-1415.

PAUL A. SCHIFF, GS-13, DAF
Edwards AFB Remedial Project Manager

Attachment:
Final Site Inspection of Aqueous Film Forming Foam Usage at Edwards Air Force Base, California, change pages for hard copy and complete electronic file per Distribution List

DISTRIBUTION:
Mr. Christopher Dirscherl, U.S. EPA Region 9
Mr. Kevin Depies, California DTSC Office of Military Facilities
Mr. Thomas Skaug, California DTSC Office of Military Facilities
Mr. Bruce Lewis, California DTSC Office of Military Facilities
Mr. Alonzo Poach, California RWQCB, Lahontan Region
Ms. Amanda Lopez, California RWQCB, Lahontan Region
Ms. Karla Brasaemle, TechLaw, Inc.

Final
Site Inspection for Aqueous Film Forming Foam Areas at
Edwards Air Force Base, California
August 2018

DISTRIBUTION LIST

AFCEC/ CZTE Dr. Richard (Hunter) Anderson richard.anderson.55@us.af.mil	Upload to SharePoint, notify by email.
AFCEC/ CZTE Guy (Cornell) Long guy.long@us.af.mil	Upload to SharePoint, notify by email.
AFCEC Laquita (Joy) Lozano laquita.lozano.ctr@us.af.mil	Upload to SharePoint, notify by email.
USACE Cynthia Khan Cynthia.K.Khan@usace.army.mil	Upload to SharePoint, notify by email.
USACE Robert Thurman Robert.Thurman@usace.army.mil	Upload to SharePoint, notify by email.
AFCEC Paul Schiff, Base RPM Paul.schiff@us.af.mil	Upload to SharePoint, notify by email.
AFCEC C/O: Maribel Harms Julia Tseng, RPM julia.tseng@us.af.mil	Upload to SharePoint, notify by email. 1 Hard Copy[a] with 1 CD[b] for RPM 3 CDs[b] for Information Repositories 1 Hard Copy[a] with 1 CD[b] for Administrative Record 1 Hard Copy[a] with 1 CD[b] for Edwards Library
AFCEC/CZRW Eric Barefoot eric.barefoot.1@us.af.mil	Upload to SharePoint, notify by email. 1 CD[b]
AFMC 412 AMDS/SGPB Major Christopher Bates christopher.bates.1@us.af.mil	Upload to SharePoint, notify by email. 1 Hard Copy[c] with 1 CD[b]
AFMC 412 MDG/SGPB Rachel Ford Rachel.ford@us.af.mil	Upload to AMRDEC SAFE, notify by email.
AEGISS Claudia Basura claudia.basura.ctr@us.af.mil	Upload to SharePoint, notify by email.
AFCEC Peter Robles peter.robles.1.ctr@us.af.mil	Upload to SharePoint, notify by email.
EPA Attn: Christopher Dirscherl Dirscherl.christopher@epa.gov	Upload to AMRDEC SAFE, notify by email. 1 Hard Copy[a] with 2 CDs[b]
Techlaw for EPA Attn: Karla Brasaemle KBrasaemle@TechLawInc.com	Upload to AMRDEC SAFE, notify by email. 1 Hard Copy[a] with 1 CD[b]
Cal-DTSC - Department of Toxic Substances Attn: Kevin Depies kevin.depies@dtsc.ca.gov	Upload to AMRDEC SAFE, notify by email. 1 Hard Copy[a] with 1 CD[b] in standard-sized plastic case

Final
Site Inspection for Aqueous Film Forming Foam Areas at
Edwards Air Force Base, California
August 2018

DISTRIBUTION LIST

Cal-DTSC - Department of Toxic Substances Attn: Thomas Skaug Thomas.skaug@dtsc.ca.gov	Upload to AMRDEC SAFE, notify by email.
Cal-DTSC - Department of Toxic Substances Attn: Bruce Lewis Bruce.lewis@dtsc.ca.gov	Upload to AMRDEC SAFE, notify by email.
California Regional Water Quality Control Board Attn: Alonzo Poach alonzo.poach@waterboards.ca.gov	Upload to GeoTracker, notify by email.
California Regional Water Quality Control Board Attn: Amanda Lopez Amanda.Lopez@Waterboards.ca.gov	Upload to GeoTracker, notify by email.

Notes:

a. Hard copy will contain change pages only.

b. CDs will contain complete Final SI with all appendices.

c. Hard copy for Major Christopher Bates will be a complete binder with cover, text, figures, and Appendix K printed and Appendices A through J on the CD as part of the complete pdf included with the binder.

5623005

FINAL

SITE INSPECTION FOR AQUEOUS FILM FORMING FOAM AREAS AT EDWARDS AIR FORCE BASE, CALIFORNIA

Contract No.: W912BV-15-C-0082

Submitted to:

U.S. Army Corps of Engineers, Tulsa District

Prepared for:

Air Force Civil Engineer Center

Prepared by:

Oneida Total Integrated Enterprises, LLC
9601 McAllister Freeway, Suite 310
San Antonio, Texas 78216

AUGUST 2018

This page intentionally left blank.

5623007

FINAL

SITE INSPECTION FOR AQUEOUS FILM FORMING FOAM AREAS AT EDWARDS AIR FORCE BASE, CALIFORNIA

Contract Number: W912BV-15-C-0082

Submitted to:
U.S. Army Corps of Engineers, Tulsa District

Prepared for:
Air Force Civil Engineer Center

REVIEWED BY:

Oscar Martinez
Project Manager

08/09/2018
Date

REGISTERED PROFESSIONAL ENGINEER
JENNIFER B. HARTING
No. C58000
Exp. 6/30/20
CIVIL
STATE OF CALIFORNIA

Jennifer Harting, PE
Edwards AFB Project Manager

8/9/18
Date

OTIE
An Oneida Nation Company
9601 McAllister Freeway, Suite 310
San Antonio, TX 78216

This page intentionally left blank.

TABLE OF CONTENTS

FIGURES

FIGURES (CONTINUED)

TABLES (IN-TEXT)

APPENDICES

This page intentionally left blank.

ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AAA	Actual AFFF Contamination Area
AFB	Air Force Base
AFFF	Aqueous Film Forming Foam
AFRC	Armstrong Flight Research Center
AFRL	Air Force Research Laboratory
AST	above-ground storage tank
ASTM	American Society for Testing and Materials
BRAC	Base Realignment and Closure
btoc	below top of casing
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CE	Civil Engineering
CID	Controlled Impact Demonstration
CMBTP	Current Main Base Sewage treatment Plant
DoD	Department of Defense
DQO	data quality objective
DTW	depth to water
DWR	Department of Water Resources
EC	Emerging Contaminant
ELLE	Eurofins Laboratories of Lancaster
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
FD	field duplicate sample
FMBTP	Former Main Base Sewage Treatment Plant
ft bgs	feet below ground surface
FTA	fire training area
GETS	groundwater extraction and treatment system
GIS	Geographical Information System
HA	Health Advisory
HDPE	High-density polyethylene
HSA	hollow stem auger
ID	identification
IDW	Investigation-Derived Waste
LRWQCB	Lahontan Regional Water Quality Board
N	normal duplicate sample
NA	not applicable
NAD83	North American Datum of 1983
NASA	National Aeronautics and Space Administration

NAVD88	North American Vertical Datum of 1988
OTIE	Oneida Total Integrated Enterprises
OU	Operable Unit
OWS	Oil Water Separator
PA	Preliminary Assessment
PAA	Potential AFFF Contamination Area
PAL	Project Action Limit
PFAS	Per- and polyfluoroalkyl substance
PFBS	Perfluorobutane sulfonic acid
PFC	Perfluorinated Compound
PFOA	Perfluorooctoanoic Acid
PFOS	Perfluorooctane sulfonate
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RSL	Regional Screening Level
SAF/IE	Assistant Secretary of the Air Force for Installation, Environment & Logistics
SI	Site Inspection
SOP	Standard Operating Procedure
UFP	Uniform Federal Policy
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WDR	Waste Discharge Requirement
WGS	World Geodetic System

1.0 INTRODUCTION

Oneida Total Integrated Enterprises (OTIE), under contract to the United States (U.S.) Army Corps of Engineers (USACE) Tulsa District (Contract No. W912BV-15-C-0082), has conducted site inspections (SIs) at 24 areas located on Edwards Air Force Base (AFB) in Kern County, California (**Figures 1-1, 1-2,** and **Figures 2-1a** through **2-1d**). The purpose of this SI Report is to evaluate the potential presence of select per- and polyfluoroalkyl substances (PFAS) in environmental samples collected from aqueous film-forming foam (AFFF) release areas at concentrations that exceed the Project Action Limits (PALs) discussed below and to identify potential exposure pathways with immediate impacts to human health. PFAS are a class of synthetic fluorinated chemicals used in industrial and consumer products, and were included in defense-related applications, primarily AFFF.

The U.S. Air Force (USAF) began using *perfluorooctane sulfonate* (PFOS)-based AFFF firefighting agents to extinguish petroleum fires in 1970. AFFF may have entered the environment during routine firefighting training, equipment maintenance, storage, and use. The U.S. Environmental Protection Agency (EPA) continues to permit the use of PFOS-based AFFF; however, manufacturers have reformulated AFFF to eliminate PFOS and minimize (if not eliminate) *perfluorooctoanoic acid* (PFOA). The USAF currently has an excess inventory of PFOS-based AFFF, but is actively replacing it with formulations containing shorter chain-length PFAS. PFOS-based AFFF will be referred to as AFFF in this report; any exceptions (e.g. C6 AFFF) are clearly identified as such.

Per the Department of Defense (DoD) Instruction 4715.18, "*Emerging Contaminants (ECs)*" (DoD, 2009) and the Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations (USAF, 2012), and the Assistant Secretary of the Air Force for Installation, Environment & Logistics (SAF/IE) Policy on Perfluorinated Compounds of Concern (USAF, 2016) the USAF will:

- Identify locations where there is a reasonable expectation that there may have been a release of PFAS associated with USAF actions;
- Determine if there is unacceptable risk to human health and the environment; and
- Address releases that pose an unacceptable risk including offsite migration.

The work described in this SI report is a part of the initial phase of investigation performed by the USAF in fulfillment of these objectives.

This work was performed in accordance with the *Revised Final Uniform Federal Policy-Quality Assurance Project Plan* (UFP-QAPP) Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in EPA Regions 6 & 9 (QAPP, [OTIE, 2016]) and the UFP-QAPP Addendum, *Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB* (QAPP Addendum, [OTIE, 2017a]).

1.1 PROJECT OBJECTIVES

The objectives of this SI are to:

- Evaluate whether PFAS are present in environmental media (groundwater, soil, and/or sediment) at Air Force-mediated AFFF release areas selected for inspection;
- Evaluate whether detected concentrations of PFAS are present above the respective PALs (defined in the following paragraph); and

- Identify potential exposure pathways with immediate impacts to human health.

Although not a specific purpose of the SI, ecological receptors were identified in accordance with CERCLA guidance for SIs.

In accordance with Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (USAF, August 2012) and EPA's 2016 Lifetime Health Advisory (HA) for PFOS (EPA, May 2016b) and PFOA (EPA, May 2016a), a release will be considered for further evaluation if the following concentrations are exceeded:

PFOS:	0.070 micrograms per liter (µg/L) in groundwater and/or 126 micrograms per kilogram (µg/kg) in soil and/or sediment
PFOA:	0.070 µg/L in groundwater and/or 126 µg/kg in soil and/or sediment
Sum of PFOS and PFOA:	0.070 µg/L in groundwater and/or surface water
***Perfluorobutane sulfonic acid* (PFBS):**	40 µg/L in groundwater and/or surface water and/or 130,000 µg/kg in soil and/or sediment

However, due to the limitations of the investigation, not detecting these compounds above the PALs does not constitute the absence of releases to the environment.

The AFFF Areas where PFAS concentrations exceed the PALs will be defined as "*Actual AFFF Contamination Areas*" (AAA), and the AFFF Areas where PFAS concentrations that did not exceed the PALs will be defined as "*Potential AFFF Contamination Areas*" (PAA).

The PALs were derived from the following sources:

Groundwater:

- The PFOS and PFOA PALs are the EPA's 2016 Lifetime HA(EPA, 2016a, b); and
- The PFBS PAL is the EPA Tapwater Regional Screening Level (RSL) (EPA, 2018).

Soil and Sediment:

- The PFOS and PFOA PALs for soils and sediment were derived from the EPA Superfund program's risk-based RSL calculator using a total hazard quotient of 0.1, default residential and direct contact parameters, reference dose and cancer ingestion slope factor from EPA (EPA 2016c, d) health effects support documents for PFOS and PFOA; and
- The PFBS PAL is the EPA Residential Soil RSL (EPA, 2018).

Additionally, in accordance with EPA Fact Sheet (EPA, 2016e), when both PFOA and PFOS are found in drinking water, the combined concentrations of PFOA and PFOS will be compared with the 0.070 µg/L HA level.

1.2 PROJECT SCOPE

AFFF areas and proposed sampling locations were selected for further inspection during the SI process based on site-specific information provided in the Preliminary Assessment (PA) (conducted July 2015), the Site Visit (March 2016), and Record Search, Interviews, and Scoping Meetings (May 2016), and are summarized in Tables 17.1 and 17.2 of the Edwards AFB QAPP Addendum (OTIE, 2017a). Sampling

locations are as close as practicable to the presumed release locations. The 24 AFFF areas selected for this SI and the rationale for further inspection are listed in **Section 3.0**.

Media evaluated the 24 AFFF areas included:

- surface soil, collected at 0 to 0.5 feet below ground surface (ft bgs);
- subsurface soil or bedrock, collected from an interim depth;
- deep soil sample, collected from the vadose zone immediately above the water table or at approximately 25 ft bgs, whichever was shallower;
- deep bedrock sample, collected from below the water table at bedrock sites;
- groundwater collected from temporary monitoring wells and existing monitoring wells; and
- sediment collected at o to 0.5 ft bgs from drainage channels or low-lying accumulation areas.

Sonic drilling technology was needed to collect samples from and install temporary monitoring wells in the bedrock at several sites. The field geologist collected the deep soil (bedrock) samples based on field observations during drilling. A summary of bedrock samples and depth relative to groundwater is provided in **Appendix I**. Discussion of representativeness of the bedrock samples collected from below the water table is included in **Section 3.1.3**.

Soil, sediment, and groundwater samples were collected from the AFFF areas, as applicable, to evaluate whether PFAS compounds are present and, if so, whether detected concentrations exceed the PALs. Sample locations were chosen by targeting areas with the highest potential concentrations of PFAS based on the entire weight of evidence in accordance with the UFP-QAPP and the Site-specific UFP-QAPP Addendum for Edwards AFB (OTIE, 2016, 2017a).

Soil samples were collected using a stainless steel trowel, hand auger, and/or truck-mounted hollow-stem auger (HSA) or sonic drilling rig equipped with a core barrel sampler. Groundwater grab samples were collected using stainless steel bailers. Sediment grab samples were collected using a stainless steel trowel. A detailed description of field sampling activities can be found in **Section 3.0**.

Samples were analyzed for a total of 16 PFAS species as well as two species of fluorotelomer sulfonates. While there are no regulatory advisory limits for thirteen of the PFAS species or either of the fluorotelomer sulfonates, the data may be useful in the future for mass balance and species transformation studies expected to be performed if a Remedial Investigation is required. This SI report does not include discussion of the analytical results for the 15 compounds that do not have established PALs, but analytical results for all 18 compounds are provided in **Appendix F**.

This page intentionally left blank.

2.0 AFFF AREA BACKGROUND

2.1 AREA LOCATION, SETTING, AND HISTORY

The following provides a description and history of Edwards AFB and the 24 AFFF SI areas.

2.1.1 Edwards Air Force Base

Location and Setting

Edwards AFB occupies approximately 470 square miles of land located in Kern County, California, approximately 22 miles northeast of the City of Lancaster, California and 15 miles east of Rosamond, California (**Figure 1-1**). The Base was established in 1933 to serve as a bombing and gunnery range and in 1942 it was activated as a separate post and designated the Muroc Army Air Base. In December 1949, the installation was renamed Edwards AFB (OTIE, 2017a).

Edwards AFB is divided into four main areas (North Base, Main Base, South Base, and Air Force Research Laboratory [AFRL]), and is further divided into 10 operable units (OUs). North Base, Main Base, and South Base are located on the west side of Rogers Dry Lake, an ephemeral lake (playa). The OUs are shown on **Figure 1-2**, Base Map and OU Boundaries, and Base area maps, **Figures 2-1a** through **2-1d**. The AFRL is located near Leuhman Ridge on the east side of Rogers Dry Lake. Edwards AFB is not designated as a federal wilderness area/wildlife preserve.

Area History

A PA for PFAS at Edwards AFB was prepared by CH2M HILL on behalf of Air Force Civil Engineer Center in 2015 as part of a USAF enterprise-wide response to possible release of PFAS per DoD Instruction 4715.18, ECs, in general accordance with Comprehensive Environmental Response Compensation & Liability Act (CERCLA). The PA provides initial findings from research conducted to evaluate the storage, handling, use, and potential release of AFFF, containing PFAS, at Edwards AFB (CH2M HILL, 2015). Research conducted during the PA included record searches, interviews, and site visits. The information in the PA was augmented during the 2016 Site Visit, SI Scoping Meetings, and follow-up interviews and record searches during preparation of the QAPP Addendum (OTIE 2017a); the revised CSM was included in Table 17.1 of the QAPP Addendum (OTIE 2017a). Based on the research conducted during the PA and subsequent activities conducted in 2016 and 2017 during preparation of the QAPP Addendum, 24 potential AFFF areas were identified that required further investigation. Summaries of the 24 potential AFFF areas are presented in the following report sections. For detailed descriptions of the AFFF areas, see the Table 17.1 of the QAPP Addendum (OTIE 2017a).

2.1.2 AFFF Area 1 – Environmental Restoration Program Site 14 (Current/Former Fire Training Area)

Location and Setting

Environmental Restoration Program (ERP) Site 14 is the Current/Former fire training area (FTA), located approximately 800 feet south of the South Base runway in OU2 (**Figure 2-1b**).

Area History

Two former FTAs were constructed at ERP Site 14 around 1960 on bare ground with no containment lining. The FTA encompassed an area of approximately 51 acres. The former FTAs were reportedly 70

feet in diameter with a 6-inch earthen berm. In 1988, the eastern bare-ground FTA was replaced with a 140-foot-diamter lined fire training facility (the current FTA). The western former FTA was demolished during the reconstruction activities in 1988 (Earth Tech, 2001a).

AFFF and water were used to extinguish the fires used during training activities prior to 1992. After 1992, approximately 50 gallons of AFFF were used during each training exercise, which occurred approximately once per month. Although the FTA was bermed, the 6-inch berm was primarily used to keep the fuel from spreading. When AFFF was sprayed, it was regularly released outside the berm due to high winds. Following training exercises, the nozzles were washed out at the FTA (CH2M HILL, 2015).

2.1.3 AFFF Area 2 – Environmental Restoration Program Site 26 (Former Air Force Research Lab Fire Training Area)

Location and Setting

ERP Site 26, the former AFRL FTA, is located approximately 3,000 feet east of the intersection of Mercury and Mars Boulevards in OUs 4 and 9 (**Figure 2-1d**). The FTA was approximately 80 feet in diameter with the burned-out remnants of an aircraft surrounded by a soil berm. A 2,860-gallon above-ground storage tank (AST) was located approximately 300 feet southwest of the FTA. It is not documented whether the chemical foam used was AFFF. JP-4 was transferred from the AST via underground piping to two aboveground nozzles inside the FTA (Earth Tech, 2001b).

Area History

Although there is no specific record of AFFF being used at the ERP Site 26, it is reported that chemical foam was used as the fire extinguishing agent during training exercises between 1970 and 1975 (Earth Tech, 2001b). Since AFFF was introduced in 1970, it is likely; the chemical foam used was AFFF. If AFFF was used, it would have been discharged to the ground. Although there was a berm at this location, the FTA was not lined and, therefore, the AFFF would infiltrate into the subsurface.

2.1.4 AFFF Area 3 - Hangar Buildings 151/160

Location and Setting

Hangar Building 151 is located at the southeast end of Taxiway G and north of the South Base runway in OU2 (**Figure 2-1b**). The building was constructed in 1987 with an AFFF fire suppression system that remains in use. The suppression system is located outdoors on the northeast corner of the building and consists of two metal tanks containing AFFF with a capacity of 1,500 gallons each (CH2M HILL, 2015).

Area History

AFFF that may have been discharged within the Hangar Building 151 would have been captured by the floor drains/trenches, collected in a nearby AST, and then pumped into an unlined holding pond (CH2M HILL, 2015). In October 2010, Civil Engineering (CE) was testing the AFFF suppression system when approximately 100 gallons of water and AFFF were spilled. Some of the water and AFFF reached the unpaved area east of the hangar and seeped into the ground. However, the spill reports also stated that approximately one cup of AFFF was in the solution (CH2M HILL, 2015)

The primary release of AFFF was from a rupture in the plumbing running from Hangar Buildings 151 and 160 to the AFFF recovery tank that occurred in an unpaved area east of Hangar Building 151 and north of Hangar Building 160 (**Figure 3-3**).

2.1.5 AFFF Area 4 – Hangar Building 1600

Location and Setting

Building 1600 is located east of the intersection of Popson Avenue and Yeager Boulevard on the Main Base in OU1 (**Figure 2-1a**). In 1995, a water deluge fire suppression system was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in a 5,000-gallon tank located in the mechanical room in the southeast corner of the building.

Area History

There have been multiple releases of AFFF. A large release occurred around 2014, when several thousand gallons of AFFF accidently filled the hangar. There are no floor drains in the hangar, so the AFFF was pushed out the east door towards Ramp 4 to a storm drain that leads to PAD 7 (OTIE, 2017a). Approximately 5 to 10 years before the 2014 release, another AFFF fire suppression system activation occurred when the entire AFFF tank was emptied. Up to 5,000 gallons of AFFF were discharged inside the hangar and then pushed out the bay door to the same storm drain (CH2M HILL, 2015).

2.1.6 AFFF Area 5 – Hangar Building 1608

Location and Setting

Building 1608 is located approximately 1,000 feet east of the intersection of Wolfe Avenue and Yeager Boulevard on Main Base (**Figure 2-1a**). Building 1608 was constructed in 1980 with an AFFF fire suppression system that remains in use. At Building 1608, AFFF is stored outdoors in one 500-gallon tank.

Area History

There are no reported releases of AFFF inside Building 1608; however, minor leaks from the AFFF piping were observed during the PA visit in May 2015. Because the AFFF system at Building 1608 is located outdoors, AFFF was released directly to the environment (CH2M HILL, 2015).

2.1.7 AFFF Area 6 – Hangar Building 1624 Location and Setting

Location and Setting

Building 1624 is located approximately 1,200 feet east of the intersection of Popson Avenue and Yeager Boulevard and north of Fire Station 1 on Main Base (**Figure 2-1a**). Building 1624 was constructed in 1994 with an AFFF fire suppression system that remains in use. The AFFF is stored in a 1,300-gallon tank located on the southwest corner of the building within the mechanical room.

Area History

Before the construction of Building 1624, the fire department used the grounds as a nozzle spray test area and AFFF drum storage area. On a weekly basis, approximately 10 gallons of AFFF were released per test conducted per truck used. In addition, there were reported releases in the drum storage area. The amount of AFFF released beneath Building 1624 is unknown (CH2M HILL, 2015). Two accidental releases of AFFF, caused by a malfunction of the fire suppression system, were reported since 1995. In each case, the foam did not reach the outside of the building, but rather went into drains leading to a since-removed oil/water separator (OTIE, 2017a).

2.1.8 AFFF Area 7 – Hangar Building 1870

Location and Setting

Building 1870 is located approximately 700 feet east of the intersection of Forbes Avenue and Wolf Avenue on Main Base (**Figure 2-1a**). Building 1870 was constructed in 1958 with a water deluge fire suppression system. Around 1992 or 1993, it was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in two 1,000-gallon tanks located in the pump house northwest of Building 1870 (CH2M HILL, 2015).

Area History

Two AFFF releases are reported from Building 1870, in addition to reported releases from routine tests of the fire suppression system. One release of 400 gallons occurred in October 2014 from the AFFF tank and pump house located outside the northwest corner of Hangar 1870 (CH2M HILL, 2015) (**Figure 3-5**), where the AFFF migrated from the pump house to the adjacent asphalt (OTIE, 2017a).

A second release of the newer "C6" (non-PFOS-based) variety of AFFF occurred in 2015, again north of the pump house, adjacent to the northwestern wall of the hangar. The release reportedly flowed northwest away from the building to an unpaved area beyond the pavement. Yellow staining was observed on the pavement (OTIE, 2017a).

In addition, the facilities manager reported that AFFF was also released to the asphalt from the AFFF system discharge piping during routine fire suppression flow testing (OTIE, 2017a), at two points where the discharge piping exits the building exterior, both adjacent to the AFFF Tank house, and at the north-central portion of the building (**Figure 3-5**). Staining was observed on the pavement near each of the discharge pipes (OTIE, 2017a).

2.1.9 AFFF Area 8 – Hangar Building 1874

Location and Setting

Building 1874 is located approximately 800 feet southeast of the intersection of Forbes Avenue and Wolfe Avenue on Main Base (**Figure 2-1a**). Building 1874 was constructed in 1958 with a water deluge fire suppression system. It was converted to an AFFF fire suppression system in the 1980s that remains in use. The AFFF is stored in a 1,000-gallon tank located in the pump house near the south-central portion of Building 1874 (CH2M HILL 2015).

Area History

An AFFF release of approximately 2,000 gallons was reported in January 2013 from the AFFF Tank Number T3 storage house south of the building (**Figure 3-5**) when a seal in the AFFF fire suppression system failed (CH2M HILL 2015, OTIE 2017a). Staining was observed on the pavement south of the building. Cracks in the asphalt were also observed within the stained areas that would allow a direct pathway to underlying soils and groundwater (OTIE 2017a).

2.1.10 AFFF Area 9 – Hangar Building 1881

Location and Setting

Building 1881 is located approximately 1,300 feet east of the intersection of Forbes Avenue and Wolfe Avenue on Main Base (**Figure 2-1a**). The building was constructed in 1958 with a water deluge fire

suppression system. In the 1980's the system was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in two 500-gallon tanks located in two pump houses south of Building 1881. Storm drains inside the hangar flow into a central trench inside Hangar 1881, and then flow easterly to Rogers Dry Lake.

Area History

The facilities manager reported that AFFF was released to the asphalt southeast of the building during fire suppression flow testing (OTIE, 2017a). Staining and cracks were observed on the pavement south of the building.

2.1.11 AFFF Area 10 – Hangar Building 4801

Location and Setting

Building 4801 is located approximately 550 feet southeast of the intersection of Lily Avenue and Forbes Avenue within the National Aeronautics and Space Administration (NASA) Armstrong Flight Research Center (AFRC) complex (**Figure 2-1a**). Building 4801 contains an AFFF fire suppression system, which consists of two 1,000-gallon polyethylene tanks containing AFFF located inside the mechanical room. In addition, within the hangar are two small 30 to 40-gallon tanks of AFFF with hand hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015).

Area History

One tank containing AFFF was observed on concrete flooring (OTIE, 2017a). The concrete was in good condition, with no cracks or joints. One AFFF release occurred and was contained within 10 feet of the building, but never reached the unpaved area beyond the hangar. The AFFF and water dried on the tarmac and eventually migrated to the storm drains during precipitation events (CH2M HILL, 2015). Floor drains inside the hangar drain to an unlined retention basin at the eastern edge of the tarmac (**Figure 3-6**) (OTIE, 2017a). The amount of AFFF released per test in unknown but tests were performed approximately every five years (CH2M HILL, 2015).

2.1.12 AFFF Area 11 – Hangar Building 4802

Location and Setting

Building 4802 is located approximately 550 feet south of the intersection of Lily Avenue and Forbes Avenue within the south-central portion of the AFRC (**Figure 2-1a**). Building 4802 contained an AFFF fire suppression system, which consisted of two 1,500-gallon polyethylene tanks containing AFFF located inside the mechanical room. The AFFF fire suppression system has been removed and is currently being converted to high-expansion foam. However, within the hangar are eight 40-gallon tanks of AFFF with hand hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015).

Area History

One release of AFFF was reported to have occurred outside of Building 4802 on the concrete (OTIE, 2017a). The spill was contained before it reached the unlined drainage swale. The concrete was observed to be in good condition, with no cracks or joints. Stormwater lines drain to an outfall southeast of Hangar 4802, and outwash flows to Rogers Dry Lake.

2.1.13 AFFF Area 12 – Hangar Building 4826

Location and Setting

Hangar Building 4826 is located approximately 1,800 feet northeast of the intersection of Lily Avenue and Forbes Avenue in the northern portion of the AFRC (**Figure 2-1a**). The building contains an AFFF fire suppression system, which consists of two 1,300-gallon tanks containing AFFF located in the mechanical room. In addition, within the hangar, there are six small 30-gallon AFFF tanks with hand-held hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015).

Area History

More than 10 years ago when the AFFF system was tested, hoses were connected to the headers and AFFF was released onto the tarmac and allowed to evaporate. The amount of AFFF released per test is unknown but tests were performed approximately every 5 years. In December 2007, the majority of the approximately 200 gallons of AFFF leaked into a floor drain discharging to the Main Base sewer treatment plant during a test of the fire suppression system when the overflow control valve failed. However, an unreported amount flowed into a separate storm drain that flows to an unlined evaporation pond and ultimately discharges to Rogers Dry Lake (OTIE, 2017a).

2.1.14 AFFF Area 13 – Hangar Building 4840

Location and Setting

Hangar Building 4840 is located approximately 1,200 feet northeast of the intersection of Lily Avenue and Forbes Avenue in the central portion of the AFRC (**Figure 2-1a**). The AFFF fire suppression system consisted of two 1,300-gallon tanks containing AFFF located inside the mechanical room. The system was converted to a high-expansion foam system in late 2015.

Area History

One test was performed 6 to 8 years ago when the headers were tested; hoses were connected to the headers and AFFF was released onto the tarmac and allowed to evaporate. The amount of AFFF released per test in unknown. In addition, there have been minor leaks/drips from the suppression system; however, these leaks were cleaned up and no AFFF was released to the floor drains or the environment. A large inadvertent discharge of the fire suppression released AFFF to the evaporation pond. The pond was lined at one time, but the liner has degraded over time (OTIE, 2017a).

2.1.15 AFFF Area 14 – Fire Station #3 (Building 250)

Location and Setting

Fire Station 3 is located approximately 800 feet east of Building 182 (**Figure 2-1b**). The fire station was constructed in 1988 and houses four fire engines that carry AFFF ranging from 25 to 500 gallons. The two larger crash trucks (P-23s) are parked outside on dirt because they do not fit through the bay doors (CH2M HILL, 2015).

Area History

After nozzle spray tests, training exercises, and responses, the fire engines are washed outside east of the building. AFFF residue on the trucks is washed off and runs into the nearby dirt areas. Additionally, on January 30, 2010, an approximately 500-gallon release of AFFF occurred when a pipe burst inside a P-

23 crash truck parked outside the building, and the contents spilled onto the unpaved ground adjacent to Building 250. The spill flowed downslope in an easterly directions away from the fire station across the road (OTIE, 2017a).

2.1.16 AFFF Area 15 – Fire Station #5 (Building 4456)

Location and Setting

Fire Station #5 was constructed in 1954. It is located on North Base at the end of North Base Road (**Figure 2-1c**). Fire Station #5 houses three fire engines that carry between 56 and 110 gallons of AFFF. One of the crash trucks is parked outdoors on the gravel lot (CH2M HILL, 2015).

Area History

At Fire Station #5, AFFF is stored in three fire engines and occasionally AFFF is stored in 5-gallon buckets inside the station. After nozzle spray tests, training exercises, and responses, the fire engines are washed on the cement pad outside the fire station. Cracks or staining was not observed on the concrete. Runoff water ponds and evaporates on the cement and does not flow to unpaved area, as the dirt is upslope from the cement pad (OTIE, 2017a).

2.1.17 AFFF Area 16 – Former Fire Station (Building 1850)

Location and Setting

The former fire station was constructed in 1954. It is located in the northern portion of Main Base, off Forbes Avenue and south of the NASA Complex boundary (**Figure 2-1a**). When the fire station was active, it housed two or three fire engines that carried between 56 to 500 gallons of AFFF. The fire station was closed in the 1990s and is currently occupied by CE (CH2M HILL, 2015).

Area History

After nozzle spray tests, training exercises, and responses, the fire engines were washed indoors and outdoors. If the trucks were washed outdoors, AFFF residue would have run off east of the building into the surrounding unpaved surfaces. Also, fire trucks were used to wash down and re-service fire trucks on the concrete driveway/apron located east of the building. Large cracks were observed at the seam between the concrete and the asphalt on the driveway/apron providing a direct pathway to underlying soils and groundwater (OTIE, 2017a).

2.1.18 AFFF Area 17 – 1970 Aero Spacelines 377MGT

Location and Setting

The Aero Spacelines 377MGT crash site is located at the southwest terminus of the Runway (**Figure 2-1b**), within OU2. The Aero Spacelines 377 MGT was a converted Boeing Stratoliner that crashed on May 12, 1970. The wind was reportedly approximately 200 degrees at approximately 10 knots (CH2M HILL, 2015). The Location of the crash site can be found on **Figure 2-1b**.

Area History

The Edwards AFB Fire Department likely responded to the 1970 crash at the terminus of runway in what is known as he “overrun area” (CH2M HILL, 2015). It is unknown how much AFFF was used to extinguish the fire. The AFFF was allowed to dissipate in place or run off into dirt area. There was potential for AFFF

to migrate with the stormwater from rain events into the adjacent unpaved areas. Two storm drains were observed at either end of the runway (OTIE, 2017a).

2.1.19 AFFF Area 18 – 1984 Boeing 720 Controlled Impact Demonstration

Location and Setting

On December 1, 1984 a Boeing 720 was used in a Controlled Impact Demonstration (CID) to test fuel fire retardant. The aircraft was controlled by remote and crashed upon landing on the east side of Rogers Dry Lake, bursting into flames as part of the planned demonstration (CH2M HILL, 2015). The location of the CID can be found in **Figure 2-1a**.

Area History

AFFF was used to extinguish the fire. The amount used is unknown. The AFFF applied to the fire was allowed to dry on the surface of Rogers Dry Lake, and likely infiltrated into the subsurface surrounding the crash site(OTIE, 2017a).

2.1.20 AFFF Area 19 – Former Main Base Sewage Treatment Plant

Location and Setting

The Former Main Base Sewage Treatment Plant (FMBTP) is located approximately 2 miles southeast of the intersection of Jones Road and Lancaster Boulevard and west of County Road (**Figure 2-1b**). The FMBTP included a wastewater pretreatment system, clarifier, sludge digesters, sludge drying beds, and evaporation ponds. The plant was constructed from late 1940s to the early 1950s; the treatment plant was designed to manage domestic wastewater, wastewater from an Oil Water Separator (OWS), and stormwater and floor drains.

Area History

The FMBTP operated until 1992. Releases of AFFF into the floor drains from hangars or fire stations where the drains are connected to the sewer system would have been treated at the FMBTP. The evaporation ponds and sludge drying beds are likely locations contaminated with AFFF (CH2M HILL, 2015).

2.1.21 AFFF Area 20 – Current Main Base Sewage treatment Plant

Location and Setting

The Current Main Base Sewage treatment Plant (CMBTP) is located approximately 1.5 miles east of the intersection of Lancaster Boulevard and Work Road (**Figure 2-1b**). Constructed in the mid-1990's the tertiary STP includes biological treatment, a clarifier pond, chlorine contact, a sludge dewatering plant, and a concrete sludge drying pad. The CMBTP manages domestic wastewater, wastewater from OWS, and floor drains from North Base, Main Base, and South Base. Muroc Golf Course (specifically Muroc Lake, the pond at the Golf Course) is the primary recipient of treated wastewater from the plant and used for irrigation. The baseball fields and the grass surrounding the Community Center are the other recipients (OTIE 2017a). During the wet winter months when irrigation water is not needed, the treated effluent is pumped to five evaporation ponds, identified as Ponds 3 through 7 (CH2M HILL, 2015) (**Figure 3-14)**.

Area History

The Waste Discharge Requirements (WDR) issued for Edwards AFB, by the Lahontan Regional Water Quality Board (LRWQCB), Board Order No. 6-86-54, indicates that wastewater containing AFFF from the Former FTA was authorized to discharge to the Edwards Main Base AFB Wastewater Treatment Plant (LRWQCB 1986).

The Current Main Base Evaporation Ponds (identified as Ponds 3 through 7) were constructed of native on-site playa materials in 1986 (LRWQCB 1994). Recycled water use from the STP was authorized in 1994 (LRWQCB 1994). Therefore, wastewater containing AFFF may have been discharged to Evaporation Ponds 3 through 7 between 1986 and 1994.

2.1.22 AFFF Area 21 – Former Nozzle Spray Test Area

Location and Setting

In the 1980s, fire engines from Fire Station 1 were tested to verify that the vehicles and equipment were functioning properly. As part of the weekly test, the fire engines would drive to a dirt field located approximately 400 feet east of the control tower and 1,100 fee east-northeast of Fire Station 1 (**Figure 2-1a**) and perform a quick nozzle spray test onto the dirt field (CH2M HILL, 2015).

Area History

Approximately 10 gallons of AFFF and water were released during each test. The AFFF was left in place and allowed to infiltrate into the ground. It is unknown when the practice began and ceased; therefore, the volume of AFFF applied to the area cannot be estimated.

2.1.23 AFFF Area 22 – Refractometer Spray Test Area

Location and Setting

The Refractometer Spray Test Area encompasses approximately 200 feet of an abandoned runway. The Edwards AFB Fire Department performs annual refractometers tests on an abandoned taxiway approximately 1,000 feet south of the west end of the South Base runway (**Figure 2-1b**). Fire engines are parked facing southeast and spray onto the abandoned taxiway, which is marked in 50-foot increments with cones and paint from the spray origin point to measure the spray distance and pattern (OTIE, 2017a).

Area History

Each test used approximately 25 gallons of AFFF and water. The majority of the runoff occurs between the 100 and 200 foot marks. AFFF was allowed to dissipate in place or run off into dirt areas, seeping through the cracks of the weathered taxiway or flowed into the dirt areas on either side of the taxiway (OTIE, 2017a). The site continues to be used for AFFF refractometer testing.

2.1.24 AFFF Area 23 – Muroc Golf Course

Location and Setting

Muroc Golf Course is located in the southern portion of the housing area, northwest of Rosamond Boulevard and east of Forbes Avenue (**Figure 2-1a**). The supervisor of the CMBTP indicated that Muroc Golf Course is the primary recipient of reclaimed water. Water from the effluent of the CMBTP is pumped into a storage tank near the golf course, and then released into Muroc Lake, also known as the

Golf Course Pond. Treated wastewater from the lake is used for irrigation of the golf course, especially during the dry months (OTIE, 2017a).

Area History

AFFF that would have reached the CMBTP may have remained in the wastewater. AFFF in the wastewater could infiltrate the subsurface from the lake or golf course (CH2M HILL, 2015).

2.1.25 AFFF Area 24 – Pad 7 Outfall and Stormwater Detention Pond

Location and Setting

Most of the surface runoff in the southern portion of Main Base is discharged to an outfall at Pad 7 (**Figure 2-1a**). Historically, the water would flow from the outfall along an unlined drainage ditch to a large unlined stormwater detention pond. Some stretches of the drainage ditch are heavily vegetated. the vegetation has been periodically removed in the past (CH2M HILL, 2015). The unlined drainage channel leading to the Detention Pond associated with Pad 7 Outfall was diverted from the Detention Pond between 2006 and 2007 until 2017. During that period, the stormwater drainage channel flowed to Rogers Dry Lake adjacent to ERP Site 19 (OTIE, 2017a).

Area History

Releases of AFFF from the hangars adjacent to the Flightline, such as from Hangar Buildings 1600, 1624, and 1608, as well as from the nozzle spray test areas near Fire Station 1 would have entered storm drains and conveyed to the Pad 7 outfall channel and detention pond.

3.0 FIELD ACTIVITIES, SAMPLING RATIONALE, ANALYTICAL PROTOCOL, AND ANALYTICAL RESULTS

OTIE conducted SI activities at Edwards AFB between 20 March and 26 July 2017 at 24 AFFF Areas based on areas identified for further inspection during the PA (CH2M HILL, 2015) (conducted July 2015), the Site Visit (March 2016), and Record Search, Interviews, and Scoping Meetings (May 2016), and summarized in Tables 17.1 and 17.2 of the Edwards AFB QAPP Addendum (OTIE 2017a). AFFF Area locations are shown on **Figures 2-1a** through **2-1d**. Media sampled during the 2017 SI included soil, sediment, and groundwater. The most likely locations where PFAS constituents would concentrate were identified and used as the rationale for locating soil borings/temporary wells and sediment samples and selecting existing wells for gauging and sampling, and are referred to throughout this report as either release areas or accumulation areas. Specific sample location rationale for each AFFF area was determined during site walks and careful evaluation of all available information, as well as discussions with Base personnel and scoping meetings with regulatory agencies. Groundwater gradients presented on **Figures 3-1** through **3-18** were obtained from one of three sources:

1. Interpreted from depth to water measured in existing monitoring wells on-site during SI field event (April or May 2017),
2. Obtained from recent published reports or figures, or
3. Interpreted from regional groundwater flow directions shown on OU1 Regional Groundwater Plumes in Relation to the Antelope Valley 6-44 DWR Hydrologic Basins with USGS Subbasins, Figure 2.2-2 from the *Final Operable Unit 1 Groundwater Monitoring and Sampling Report for 2012* (AECOM 2015) (**Appendix J**).

Groundwater elevations from temporary wells are presented on figures and in Appendix H, Table H-2. However, the groundwater elevations from temporary wells are not suitable for groundwater gradient calculations and present uncertainty for groundwater flow directions at AFFF areas.

At the six AFFF areas listed below, there were fewer than three appropriately screened wells or permanent groundwater monitoring wells were not positioned in a manner that facilitated groundwater flow direction calculations, or groundwater data was old.

- 1970 Aero Spacelines 377 MGT (**Figure 3-11**) – no permanent wells exist nearby.
- 1984 Boeing 720 CID (**Figure 3-12**) - no permanent wells exist nearby.
- FMBTP (**Figure 3-13**) - most recent contour data is 10 years old, and nearby permanent monitoring wells are not suitably located.
- FNSTA (**Figure 3-15**) - no permanent wells exist nearby.
- RSTA (**Figure 3-16**) - no permanent wells exist nearby.
- Muroc Golf Course (**Figure 3-17**) – only one permanent well at this area.

The references used for this purpose are cited on applicable Figures, included in **Section 7.0** of this report, and listed below:

- 2008 Biennial Groundwater Monitoring Report, Site 29. AECOM Technical Services, Inc. (AECOM, 2009).
- 2016 Groundwater Monitoring Report, South Air Force Research Laboratory Groundwater Area, Operable Unit 4/9, Final. (Tetra Tech, Inc. 2018).
- Operable Unit 1 Groundwater Monitoring and Sampling Report for 2012 (AECOM, 2015).
- Sites 5/14 Groundwater Contaminant Plume Annual Remedial Action Status Report, October 2015 through September 2016, South Base, Operable Unit 2 (AECOM, 2017a).
- Remedial Performance and Groundwater Monitoring Report, Site 25, Operable Unit 6, Edwards Air Force Base, California (Figure 1) (AECOM, 2017b).
- Feasibility Study Addendum, North Base, Operable Unit 5/10 (Tetra Tech, Inc. [Tetra Tech], 2015).

For the purposes of this report, release areas are defined as specific locations that received PFOS-based AFFF releases from fire suppression, equipment testing, equipment leaks, spillage or any other release of AFFF into the environment. Accumulation areas are defined as topographically depressed locations susceptible to runoff and subsequent accumulation of AFFF. Field activities were conducted in accordance with the QAPP (OTIE, 2016), QAPP Addendum (OTIE, 2017a), the Work Plan (OTIE, 2015), and the Site-specific Safety and Health Plan (OTIE, 2017b). A summary of the quantity of samples collected by media type (excluding field duplicates and quality control samples) is presented in **Table 3.1**.

Table 3.1 SI Sample Summary

AFFF Area	Soil	Sediment	Groundwater
AFFF Area 1: ERP Site 14 (Former/Current FTA)	10	--	6
AFFF Area 2: ERP Site 26 (Former AFRL FTA)	10	--	5
AFFF Area 3: Hangar Buildings 151/160	11	--	4
AFFF Area 4: Hangar Building 1600	4	--	3
AFFF Area 5: Hangar Building 1608	4	--	3
AFFF Area 6: Hangar Building 1624	4	--	3
AFFF Area 7: Hangar Building 1870	7	1	3
AFFF Area 8: Hangar Building 1874	10	--	4
AFFF Area 9: Hangar Building 1881	7	--	4
AFFF Area 10: Hangar Building 4801	--	3	1
AFFF Area 11: Hangar Building 4802	4	--	2
AFFF Area 12: Hangar Building 4826	10	--	3
AFFF Area 13: Hangar Building 4840	7	1	4
AFFF Area 14: Fire Station #3 (Building 250)	10	--	4
AFFF Area 15: Fire Station #5 (Building 4456)	--	--	3
AFFF Area 16: Former Fire Station (Building 1850)	8	--	1
AFFF Area 17: 1970 Aero Spacelines 377MGT	10	2	3
AFFF Area 18: 1984 Boeing 720 Controlled Impact Demonstration	9	--	3
AFFF Area 19: Former Main Base Sewage Treatment Plant	9	--	3
AFFF Area 20: Current Main Base Sewage Treatment Plant	--	2	4

AFFF Area 21: Former Nozzle Spray Test Area	9	--	3
AFFF Area 22: Refractometer Spray Test Area	9	--	3
AFFF Area 23: Muroc Golf Course	--	3	1
AFFF Area 24: Pad 7 Outfall and Stormwater Detention Pond	3	4	5
Totals	155	16	78

NOTE:
Sample summary quantities include field duplicate samples.

ACRONYMS:
"--" = not applicable
AFFF = aqueous film-forming foam
ERP = Environmental Restoration Program
FTA = fire training area

3.1 FIELD ACTIVITIES

All field records are provided in **Appendix A**. Records of daily field activities are provided in **Appendix A-1**. Sampling of environmental media for PFAS analysis was conducted in accordance with specific procedures to reduce the risk of cross-contamination. The procedures and prohibited items are detailed in Standard Operating Procedure (SOP) Addendum No. 1 for PFAS Sampling in Appendix C of the QAPP Addendum (OTIE, 2017a). Field personnel reviewed this SOP prior to field operations. Prohibited items included Teflon®, Gore-Tex™, Tyvek®, low-density polyethylene, fast food wrappers, and select personal care products, clothing, and packaging. Prior to sample collection, field personnel completed a daily checklist to document that sampling equipment, personal protective equipment, and tools and materials in the vicinity of the sampling locations were free from materials that may be a source of PFAS contamination. The completed Daily PFC Protocol Checklists are included with the field forms in **Appendix A-2**.

Reusable sampling equipment was cleaned in accordance with the QAPP and QAPP Addendum to prevent cross-contamination. Prior to sample collection, each piece of equipment was washed using a three stage process: 1) scrub with mixture of laboratory-grade detergent and potable water, 2) rinsed with potable water, 3) rinse with laboratory-provided, laboratory-certified PFAS-free water.

3.1.1 Mobilization

Base-specific subsurface utility clearance requirements and Dig Safe practices were completed prior to the initiation of invasive activities. The following permits were completed and approved prior to field mobilization:

- **Air Force Form 332 and 103 Permits:** Edwards AFB Civil Engineer Work Clearance Request (USAF Forms 103 and 332) – Permit Number 16-0485/103 and 17-0271/103;
- **AFRC Excavation and Digging Permit:** AFRC Excavation and Digging Permit Form AFRC 80808 and approved 30 January 2017; and
- **Air Force Airfield Waiver:** Federal Aviation Administration Airfield Waiver Request, under Aeronautical Study Numbers 2016-AWP-9440-OE through 2016-AWP-9461-OE and Department of the Air Force Headquarters 412th Test Wing Temporary Airfield Waiver dated 08 March 2017.

3.1.2 Soil Boring Advancement

Soil boring activities were performed by Cascade Drilling of Claremont, California. The upper five feet of each soil boring was cleared for utilities or other subsurface obstructions by hand digging using a hand auger or post-hole digger prior to drilling. Twenty-three soil borings were advanced using a CME-95 truck-mounted hollow-stem auger drill rig equipped with 8-inch outside-diameter augers. Twenty-four soil borings were advanced using a Gus Pesh RS400 sonic rig equipped with 6-inch outside diameter core barrel, and three soil borings were advanced using a hand auger.

Each boring was continuously cored and logged by the OTIE field geologist using the Unified Soil Classification System, in general conformance with American Society for Testing and Materials (ASTM) D2488-17, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM 2018). Bedrock descriptions were logged in general conformance with ASTM D5434-12, "Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock" (ASTM 2018), and the Munsell Color System.

A detailed boring log was constructed for each boring. The soil type and changes in lithology were noted and recorded on the boring logs. In general, borings were advanced until groundwater was encountered, and terminated approximately eight feet below the groundwater surface. However, minor adjustments were made by the Field Geologist based on site conditions. Boring logs are presented in **Appendix A-3**. A photographic log is provided in **Appendix A-4**. Temporary wells were installed in 42 of the 50 borings (**Section 3.1.6**).

Soil borings and temporary wells were destroyed after groundwater sampling was completed. Well casings and screens were removed, and cement-bentonite grout was placed using a tremie pipe, beginning at the bottom of the boring. Surfaces were restored to match the surrounding existing surface. Filter pack sand was left in place. The temporary wells were destroyed by grouting without removing the sand because they were viewed as being more similar to borings with a discrete depth sample than to a well without an annular seal. This approach was presented in the approved QAPP Addendum (OTIE 2017).

3.1.3 Soil Sample Collection

Soil samples were collected for laboratory analysis from soil cores obtained from hand augers or core barrels using a clean stainless steel trowel. Soil sample depths at each boring generally followed guidelines outlined in the QAPP Addendum (OTIE, 2017a) as listed below, with the exception of hand auger borings 1850-SB02, 1850-SB03, and 160-SB04, where only one or two soil samples were collected:

- One surface soil sample (approximately 0-0.5 ft bgs);
- One mid-level sample between the surface and 25 ft bgs, biased toward any lithologic change observed in the field; and,
- One sample from approximately 25 ft bgs.

The maximum soil sample depth of 25 ft bgs was selected based on historical typical distribution of PFAS concentrations detected at AFFF areas at numerous Air Force Installations. Concentrations are typically highest in surface soil samples and decrease significantly with depth. Since the goal of the SI is to confirm the presence or absence of PFAS from AFFF releases at the SI areas, deeper soil samples were not proposed in the QAPP Addendum (OTIE 2017a).

Solid media was collected in the unsaturated zone from the soil column and bedrock, where applicable. Due to the slow recharge in bedrock, some deep samples of bedrock were collected and below the water table. Table I-1 in Appendix I lists bedrock samples, their relationship to the water table, and whether they were collected from weathered or unweathered bedrock. While soil samples collected in bedrock and below the water table are more likely to contain PFAS concentrations indicative of groundwater than the solid matrix, PAL exceedances occurred in some mid-level bedrock samples, but not in deep bedrocks samples from the same boring (e.g. AFFF Area 8 Hangar Building 1874). The subsurface soil exceedances by area and media do not change based on inclusion or exclusion of PFAS concentrations deep bedrock samples. Therefore, the conclusions and recommendations would not change.

Soil samples were collected from laboratory-provided high-density polyethylene (HDPE) containers with unlined lids. Samples from weathered bedrock were placed directly in sample containers and samples from unweathered bedrock were pulverized before being placed in sample containers. Sample containers were sealed, labeled, packed into ice-filled coolers and delivered under chain-of-custody procedures to Maxxam Analytics of Ontario, Canada. Chain-of-custody records are provided in **Appendix A-5**. Analytical reports are provided in **Appendix B.**

3.1.4 Physiochemical Samples

A representative composite soil sample was collected from distinct horizons at up to three depth intervals (surface soil [0 to 0.5 ft bgs], mid-depth [6 to 18 ft bgs], and deep [20 to 25 ft bgs]) at each AFFF area. Soil samples collected for physiochemical properties were analyzed for pH, total organic carbon, and particle-size analysis by Eurofins Laboratories of Lancaster (ELLE), Pennsylvania. The physiochemical property results will be used during future investigations to facilitate PFAS fate and transport evaluation. Physiochemical analytical reports are provided in **Appendix B**.

3.1.5 Sediment Sample Collection

Sediment samples were collected from the surface of drainage features located in accumulation areas, downslope from source areas, or discharge points from drain systems, using a stainless steel trowel. Sediment samples were stored in laboratory-provided HDPE containers with unlined lids. Sample containers were sealed, labeled, packed into ice-filled coolers and delivered under chain-of-custody procedures to Maxxam Analytics of Ontario, Canada. Chain-of-custody records are provided in **Appendix A-5**. Analytical reports are provided in **Appendix B.**

3.1.6 Temporary Well Installation

Temporary wells were constructed in 42 of the 50 borings advanced during the SI field activities. Temporary wells were not installed in borings 1850-SB02 and 1850-SB03 because bedrock was encountered at 3 and 4 ft bgs, respectively, which constituted refusal in these hand auger borings (**Section 3.17**). A temporary well was not installed in boring 160-SB04 per the QAPP Addendum because this hand auger boring is in a steep-sided retention basin (OTIE, 2017a). Temporary wells were not installed in borings 1874-SB01 and 4826-SB03 per the QAPP, because groundwater samples from these locations were not needed to meet the SI data quality objectives (DQOs) (OTIE, 2017a).

Final temporary well design was determined in the field by the OTIE Geologist based on depth to water and geologic conditions. In accordance with the QAPP Addendum (OTIE, 2017a), temporary wells were constructed using 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and 0.010-inch slotted 2-inch diameter Schedule 40 PVC well screens with a 2-inch diameter PVC cap. The 10-feet screen was

generally placed with approximately two feet of screen above the water table and eight feet of screen below the water table. Filter pack sand (clean #2/16 sand) was placed in the annulus around the screen from the bottom of the boring to approximately 2 feet above the top of screen. Well construction details are provided on Well Construction Diagrams included on boring logs in **Appendix A-3.** Well construction information and depth to water are provided in **Appendix H**.

After sampling, temporary wells were properly destroyed in accordance with the California Well Standards (California Department of Water Resources, 1981 and 1991) by punching out end cap at the bottom of the well, then removing well casings and screen while simultaneously placing neat cement grout with 5 percent bentonite from the bottom up using the casing as tremie pipe.

3.1.7 Groundwater Sampling

Groundwater in temporary wells was allowed to stabilize for a minimum of 24 hours following well construction prior to gauging and sampling, when possible. Due to closure of the runway at 1970 Aero Spacelines 377 MGT, a limited window was provided for groundwater sampling; this required the three groundwater samples from this area to be collected before 24 hours had elapsed. Per the QAPP, temporary wells were not developed due to their temporary nature and the short time frame between installation and destruction. Low-flow sampling techniques were not used for purging and sampling of the temporary wells due to high levels of settleable solids that prevented use of a downhole pump. Groundwater grab samples were collected using a stainless steel bailer. Groundwater samples were not collected from temporary wells 1850-SB01 and 4826-SB01 because the wells were dry (**Sections 3.1.11, 3.13, and 3.17**). A groundwater sample was not collected from 61-MW40A because it did not meet the DQOs (**Section 3.1.11**).

All existing wells in an area or in a group of adjacent areas (e.g. Hangar Buildings 1600, 1608, and 1624) selected for gauging or sampling were gauged before purging any of these existing monitoring wells. Existing monitoring wells were gauged using a PFAS-free Durham Slope Indicator water level meter. Groundwater was purged and sampled using a pump or bailer free of Teflon and low-density polyethylene; HDPE tubing was used with the pump. When a large enough water column was present in the well, a Proactive SS pump™ was used to purge the well. When the water column in the well was too small to sample with the Proactive SS pump™, a stainless steel bailer was used. Field parameters were measured during purging and samples were collected following stabilization, when possible. Purge records and gauging records for existing monitoring wells are provided in **Appendix A-6**.

Groundwater samples were collected from laboratory-provided HDPE containers with unlined lids. Sample containers were sealed, labeled, packed into ice-filled coolers and delivered under chain-of-custody procedures to Maxxam Analytics of Ontario, Canada. Chain-of-custody records are provided in **Appendix A-5**. Analytical reports are provided in **Appendix B.** Well construction information and depth to water are provided in **Appendix H**.

3.1.8 Laboratory Analysis

Soil, groundwater, and sediment samples were analyzed by Maxxam Analytics of Ontario, Canada for PFAS by EPA Method 537 Modified (groundwater) and ASTM Method D7968-14. Maxxam Analytics has current accreditations from Department of Defense Environmental Laboratory Accreditation Program for PFAS analysis by these methods. EPA Method 537 Modified is a modification of EPA Method 537, which is used to analyze drinking water for 14 PFAS compounds. The modification of the method was developed for solids, groundwater, and other matrices. The Maxxam modification of the method is proprietary; however, in general the changes have to do with the preparation of the samples using solid

phase extraction, expanding the number of analytes that can be reported by the method (18 under this contract) and the use of Isotope Dilution instead of surrogates. More information related to the method can be found in the QAPP (OTIE, 2016b). The Data Validation Report is provided in **Appendix C**.

Composite soil samples were analyzed by ELLE, in Lancaster, Pennsylvania, for physiochemical properties including pH by Method SW9045C, total organic carbon by Method SM5310B, and particle-size analysis by ASTM Method D422.

Investigation-derived waste (IDW) samples were analyzed by ELLE, in Lancaster, Pennsylvania. ELLE is accredited under the DoD Environmental Laboratory Accreditation Program. Soil and water IDW samples were analyzed for volatile organic compounds by EPA Method SW85260B, Full Range total petroleum hydrocarbons by EPA Method SW8015B, and California Assessment Method 17 metals by EPA Methods SW6010B and SW7471A/7470A by ELLE. In addition, IDW water samples were analyzed for Flash Point by ASTM Method D93-07 and pH by Method SM4500.

3.1.9 Surveying

The locations of soil borings, temporary wells, and sediment samples were surveyed by California-licensed surveyor J.E. Miller & Associates between 30 May and 6 June 2017. Blue top stakes were placed near the temporary wells and the top of those stakes were surveyed to provide a gross approximation of the top of casing of the temporary wells. The coordinates were surveyed in The North American Datum of 1983 (NAD 83) and North American Vertical Datum of 1988 (NAVD 88) for mapping and Environmental Restoration Program Information Management System submission and in Universal Transverse Mercator (UTM) World Geodetic System (WGS) 84 for submission to the Base Geographical Information System (GIS) Department. Survey coordinates and approximate top of casing elevations are presented in **Appendix D**.

3.1.10 Investigation-Derived Waste Disposal

IDW generated during SI field activities was temporarily stored on Edwards AFB at approved IDW staging areas. Soil IDW from soil boring activities was stored in five 20-yard bins. Water IDW from decontamination and well installation, purging, and sampling activities was stored in eleven 300-gallon totes (approximately 2,650 gallons). Samples were collected from each IDW container and composited by area and media for laboratory analysis per applicable local, State, and Federal requirements. The IDW analytical results indicated that the soil and water were non-hazardous waste. Between 12 and 18 July 2017, 38.78 tons of IDW soil was transported by Haz Mat Trans Inc. of San Bernardino California to Waste Management landfill in Simi Valley, California for disposal. The IDW water was transported to Crosby and Overton Inc. in Long Beach, California for disposal.

The IDW characterization laboratory analytical reports are provided in **Appendix B** and IDW disposal profiles and manifests are provided in **Appendix E**. The Final IDW Inventory Record is in **Appendix A-7**, Field Forms.

3.1.11 Variances

Variances from the sampling plan presented in the QAPP Addendum are listed below:

- Groundwater was not sampled from boring 1850-SB01 because water was not present in the temporary well. A replacement well (1850-SB04) was constructed on the east side Taxiway E, on the edge of the lake bed and a groundwater sample was collected from that well instead

(**Figure 3-10**). The replacement well location was selected because it was downgradient of AFFF Area 16 based on available groundwater flow direction information.

- Existing monitoring well 61-MW40A at Hangar Building 1870 was not sampled, as it did not meet the DQO stated in the QAPP Addendum. Well 61-MW40A, although upgradient, was originally thought to be in a potential accumulation area topographically downslope from Hangar 1870, but it was actually located topographically upslope from the AFFF release area. Therefore, a groundwater sample was not collected from well 61-MW40A (**Figure 3-5**).
- Surface water sampling locations 4826-SW01 and PAD7-SW01, located at Hangar 4826 and Pad 7 Outfall and Detention Basin, respectively (**Figures 3-7** and **3-18**), were dry and not sampled.
- Temporary well 4826-SB01 was dry and a groundwater sample was not collected (**Figure 3-7**).
- Existing monitoring well N9-MW02, located northwest of Hangar 4826, was not gauged. The well could not be located because the well was destroyed.
- Gauging of existing monitoring well 19-MW16 at Pad 7 Outfall and Stormwater Retention Basin was inadvertently omitted. However, this does not change the conclusions or interpretations presented in this report.

The following borings were moved based on access limitations or to avoid damage to infrastructure:

- 160-SB01 Infrastructure (utilities)
- 160-SB04 Infrastructure (utilities)
- 1624-SB01 Infrastructure (utilities)
- 1850-SB02 Subsurface conditions (rocks for erosion control)
- 1874-SB01 Infrastructure (utilities)
- 1874-SB02 Infrastructure (utilities)
- 1874-SB03 Infrastructure (utilities)
- 1874-SB04 Infrastructure (utilities)
- 4802-SB01 Infrastructure (drainage culvert)
- 4826-SB01 Access (moved downslope to accommodate drill rig)
- 4826-SB03 Infrastructure (utilities)
- 250-SB01 Infrastructure (utilities)
- FNSTA-SB01 Access (brush) Muroc Golf Course: Sediment locations were not placed in the center of the pond due to logistical constraints.

The numbers of samples collected varied from those proposed in the QAPP Addendum as follows:

- Hangar Building 151/160: 12 soil samples were proposed, however 10 were collected (in the QAPP Addendum 3 soil samples were proposed for 160-SB04 and only one was collected); 4 groundwater samples were proposed, however 3 were collected (no groundwater was encountered in 160-SB04);
- Hangar Building 1870: 3 groundwater samples were proposed, however 2 were collected (well 61-MW40A did not meet DQOs);
- Hangar Building 1881: 5 groundwater samples are listed in Worksheet 18; however, the note clarifies that only one of the two wells 18-T02 and 18-T04 would be sampled. Therefore, 4 were collected in accordance with the QAPP Addendum (OTIE 2017);
- Hangar Building 4826: 3 groundwater samples were proposed, however 2 were collected (4826-SB01 was dry);

3.2 AFFF AREA 1 – ERP SITE 14 (FORMER/CURRENT FTA)

3.2.1 Sample Locations and Rationale

ERP Site 14 is the Former/Current FTA, located approximately 800 feet south of the South Base runway (**Figures 2-1b and 3-1**). AFFF and water were used to extinguish the fires at the FTA used during training activities prior to 1992. After 1992, approximately 50 gallons of AFFF were used during each training exercise, which occurred approximately once per month. Although the FTA was bermed, the 6-inch berm was primarily used to keep the fuel from spreading. When AFFF was sprayed, it was regularly released outside the berm due to high winds. Following training exercises, the nozzles were washed out at the FTA (CH2M HILL, 2015).

3.2.1.1 Soil Samples

Three soil borings, 14-SB01, 14-SB02, and 14-SB03, were advanced to depths ranging from 58 to 67.5 ft bgs for lithologic logging and soil sample collection on 14 and 17 April 2017. Bedrock was not encountered in the SI borings at the Former/Current FTA (**Appendix A-3**). Soil boring 14-SB01 was positioned in the area of the Former FTA; a potential source area. Soil borings 14-SB02 and 14-SB03 were positioned adjacent to existing berm of the Current FTA, also a potential source area (OTIE, 2017a), to avoid puncturing the existing liner (OTIE, 2017a). Three soil samples were collected from each boring, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.2.1.1.**

Table 3.2.1.1 AFFF AREA 1 – ERP Site 14 (Former/Current FTA) Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
14-SB01	EGG327	0.5	Surface sampling
	EGG328		Field duplicate
	EGG329	12.5	Lithologic change (sand-silt interface)
	EGG330	25	Deep soil sample
14-SB02	EGG324	0.5	Surface sampling
	EGG325	18	Lithologic change (decreased grain size)
	EGG326	25	Deep soil sample

14-SB03	EGG321	0.5	Surface sampling
	EGG322	18	Lithologic change (silty sand-clean sand interface)
	EGG323	25	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-1**.

3.2.1.2 Groundwater Samples

Each of the three soil borings 14-SB01, 14-SB02, and 14-SB03 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Two permanent monitoring wells, 14-MW04 and 14-MW05, were also sampled. Monitoring well 14-MW04 is located downgradient of the Current FTA, while 14-MW05 is located west of and downgradient from the Former FTA. Well construction information is presented in **Table 3.2.1.2.**

Table 3.2.1.2 AFFF AREA 1 – ERP Site 14 (Former/Current FTA) Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
14-SB01	EGG335	49.5	47.0-57.0	4/18/2017
	EGG336 (duplicate)			
14-SB02	EGG334	58.6	57.0-67.0	4/18/2017
14-SB03	EGG333	59.1	56.3-66.5	4/18/2017
14-MW04	EGG331	60.80	45.0-65.0	4/17/2017
14-MW05	EGG332	52.79	45.0-65.0	4/18/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

The groundwater sample locations and groundwater elevations are presented on **Figure 3-1**.

3.2.2 Analytical Results

3.2.2.1 Soil Results

Three of the nine soil samples collected from ERP Site 14 (Former/Current FTA) contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.2.2.1**.

Table 3.2.2.1 AFFF AREA 1 – ERP Site 14 (Former/Current FTA) Soil Sample Results

Sample Location	Sample Depth (ft bgs)	Sample Type	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
14-SB01	0.5	N	59 U	**6,400**	59 U
		FD	58 U	**6,600**	58 U
	12.5	N	0.74 J	110	1.5
	25.0	N	0.60 U	1.4	0.60 U
14-SB02	0.5	N	27 J	**14,000**	54 U
	18.0	N	0.44 J	7.7	0.66 U
	25.0	N	0.60 U	1.0	0.60 U
14-SB03	0.5	N	99	**18,000**	52 U
	18.0	N	30	2.4	0.82 J
	25.0	N	0.84 J	2.2	0.52 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-1 presents the soil boring locations.

Table F-1 in **Appendix F** presents all PFAS soil results.

3.2.2.2 Groundwater Results

Four of five groundwater samples collected from ERP Site 14 (Former/Current FTA) contained concentrations of at least one PFAS constituent or sum of PFOA and PFOS above the PAL. Groundwater sample results are presented in **Table 3.2.2.2**.

Table 3.2.2.2 AFFF AREA 1 – ERP Site 14 (Former/Current FTA) Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]			0.07	0.07	0.07	40
14-SB01	N	49.5	**0.091**	**2.7**	**2.791**	0.36
	FD		**0.075**	**3.2**	**3.275**	0.34
14-SB02	N	58.6	**0.88**	**23**	**23.88**	0.60
14-SB03	N	59.1	**5.7**	**34**	**39.7**	3.0
14-MW04	N	60.80	0.056	0.067	**0.123**	0.061
14-MW05	N	52.79	0.010 U	0.010 U	NA	0.022

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
NA = not applicable
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-1 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.2.3 Conclusions

Surface soil samples from 14-SB01, 14-SB02, and 14-SB03 contained PFOS concentrations above the PAL of 126 mg/kg at concentrations ranging from 6,400 to 18,000 mg/kg. PFOA and PFBS were not detected at concentrations above the PALs in soil. Groundwater samples collected from one well (14-MW05) did not contain PFAS concentrations above any PAL. The groundwater samples collected from each of the temporary wells contained concentrations of both PFOA and PFOS above the PALs, and one groundwater sample, collected from the downgradient extraction well 14-MW04, did not contain individual concentrations of PFOA or PFOS in excess of the HA of 0.07 µg/L, however, the sum of PFOA and PFOS concentrations exceeded the PAL. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

The ERP Site 14 groundwater extraction and treatment system (GETS) is located at the south side of the current and former fire training facilities. The Site 14 GETS treats groundwater contaminated with volatile organic compounds (primarily trichloroethene). Treated groundwater is re-injected cross and downgradient of the GETS, because the granular activated carbon does not treat all species of PFAS the re-injection of groundwater may further complicate and aid in migration of PFAS. Therefore, sampling of monitoring wells and GETS reinjection wells downgradient of ERP Site 14 is recommended in **Section 6.3**.

3.3 AFFF AREA 2 – ERP SITE 26 (FORMER AFRL FTA)

3.3.1 Sample Locations and Rationale

ERP Site 26 (Former AFRL FTA) is located approximately 3,000 feet east of the intersection of Mercury and Mars Boulevards (**Figures 2-1a, 2-1d, and 3-2**). The FTA was approximately 80 feet in diameter with the burned-out remnants of an aircraft surrounded by a soil berm. A 2,860-gallon AST was located approximately 300 feet southwest of the FTA. There is no specific record of AFFF being used at the ERP Site 26, but it is reported that chemical foam was used as the fire extinguishing agent during training exercises between 1970 and 1975 (Earth Tech, 2001b). Since AFFF was introduced in 1970, it is likely; the AFFF was used and it would have been discharged to the ground.

3.3.1.1 Soil and Bedrock Samples

Three soil borings, 26-SB01, 26-SB02, and 26-SB03, were advanced to depths ranging from 35 to 50 ft bgs for lithologic logging and soil sample collection on 24 and 27 March 2017. Bedrock was encountered in the SI borings at depths ranging from 5 to 7.5 ft bgs (**Appendix A-3**). Soil boring 26-SB01 is positioned near the center of the former circular bermed area of the Former FTA; a potential source area. Soil borings 26-SB02 and 26-SB03 were positioned downslope from the FTA in potential accumulation areas (OTIE, 2017a). Three soil and weathered bedrock samples were collected from each of the soil borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.3.1.1.**

Table 3.3.1.1 AFFF AREA 2 – ERP Site 26 (Former AFRL FTA) Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
26-SB01	EDK921	0.5	Surface sampling
	EDK924		Field duplicate
	EDK922	12.5	Soil (bedrock) Midpoint
	EDK923	25.0	Deep soil (bedrock) sample
26-SB02	EDK918	0.5	Surface sampling
	EDK919	12.5	Soil (bedrock) Lithologic Change (Weathered-unweathered bedrock interface)
	EDK920	25.0	Deep soil (bedrock) sample
26-SB03	EDK925	0.5	Surface sampling
	EDK926	10	Soil (bedrock) Lithologic change (fracture zone)
	EDK927	25.0	Deep soil (bedrock) sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-2**.

3.3.1.2 Groundwater Samples

Each of the three soil borings 26-SB01, 26-SB02, and 26-SB03 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. One permanent

well, 26-MW08, was also sampled. Monitoring well 26-MW08 is located near the center of the Former FTA in a potential source area. Well construction information is presented in **Table 3.3.1.2.**

Table 3.3.1.2 AFFF AREA 2 – ERP Site 26 (Former AFRL FTA) Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
26-SB01	EDM696	30.9	32.0-42.0	3/27/2017
	EDM697 (duplicate)			
26-SB02	EDM698	31.0	29.5-49.5	3/27/2017
26-SB03	EDM699	23.7	24.0-34.0	3/28/2017
26-MW08	EDM701	32.51	25.0-35.0	3/28/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-2**.

3.3.2 Analytical Results

3.3.2.1 Soil Results

One of nine samples collected from ERP Site 26 contained PFAS concentrations above the PAL. Soil sample results are presented in **Table 3.2.2.1**.

Table 3.3.2.1 AFFF AREA 2 – ERP Site 26 (Former AFRL FTA) Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
26-SB01	N	0.5	9.9 J	**1,300 J**	6.0 U
	FD		12 J	**830 J**	5.9 U
	N	12.5	33	3.1	6.2
	N	25.0	3.1	1.3	0.35 J
26-SB02	N	0.5	27	3.0	0.53 U
	N	12.5	0.60 U	0.49 J	2.2
	N	25.0	0.84 J	0.31 J	0.27 J
26-SB03	N	0.5	0.52 J	8.4	0.66 U
	N	10	0.60 U	0.60 U	0.60 U
	N	25.0	0.49 J	0.32 J	0.49 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-2 presents the soil boring locations.

Table F-1 in **Appendix F** presents all PFAS soil results.

The soil (bedrock) sample 26-SB03-25 was collected from below the static water level. However, because moisture content measured by the laboratory was low (1.7%), the PFAS concentrations detected in this sample are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.3.2.2 Groundwater Results

All four groundwater samples collected from ERP Site 26 (Former AFRL FTA) contained at least one PFAS constituent with a concentration above the PALs. Groundwater sample results are presented in **Table 3.3.2.2.**

Table 3.3.2.2 AFFF AREA 2 – ERP Site 26 (Former AFRL FTA) Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]			0.07	0.07	0.07	40
26-SB01	N	30.9	**0.79**	**0.80**	**1.59**	0.15
	FD		**0.77**	**0.83**	**1.6**	0.16
26-SB02	N	31.0	**7.7**	**1.9**	**9.6**	1.2
26-SB03	N	23.7	**0.21**	0.061	**0.271**	0.014 J
26-MW08	N	32.51	**1.4**	**1.5**	**2.9**	0.54

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown

Figure 3-2 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.3.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of nine soil samples (26-SB01-0.5), and 3 of 4 groundwater samples collected at Site 26 (Former AFRL FTA). Concentrations of PFOA exceeded the PAL in all four groundwater samples, but no soil samples had concentrations above the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.4 AFFF AREA 3 – HANGAR BUILDINGS 151/160

3.4.1 Sample Locations and Rationale

Hangar Building 151 is located at the southeast end of Taxiway G and north of the South Base runway in the Birk Flight Test Facility (**Figures 2-1b and 3-3**). The building was constructed in 1987 with an AFFF fire suppression system that remains in use. The suppression system is located outdoors on the northeast corner of the building and consists of two metal tanks containing AFFF with a capacity of 1,500 gallons each (CH2M HILL 2015). Three (3) soil boring locations (160-SB01 through 160-SB03) were chosen near the release of AFFF from a rupture in the plumbing running from Hangars 151 and 160 to the AFFF recovery tank that occurred in an unpaved area east of Hangar 151 and north of Hangar 160 (**Figure 3-3**). A fourth soil boring (160-SB04) was advanced at the base of a retention pond east of the AFFF recovery tank (**Figure 3-3**).

3.4.1.1 Soil Samples

Three soil borings, 160-SB01, 160-SB02, and 160-SB03 were advanced to depths ranging from 59 to 61 ft bgs for lithologic logging and soil sample collection on 19 April and 20 April 2017. A fourth soil boring, 160-SB04, was advanced using a hand auger to a depth of 0.5 ft bgs for soil sample collection. Bedrock was not encountered in the SI borings at Hangars 151/160 (**Appendix A-3**). Soil boring 160-SB01 was positioned in the excavation footprint of the pipe rupture, west of the recovery tank. Soil borings 160-SB02 and 160-SB03 were positioned in a potential accumulation area in a drainage swale west of the rupture and east of the paved area. Soil boring 160-SB04 was positioned in a retention pond east of the AFFF recovery tank. Three soil samples were collected from each of the soil borings, except for 160-SB01, which only 1 sample was collected. A total of 10 soil samples were collected. The rationale for the soil sampling depths is presented in **Table 3.4.1.1.**

Table 3.4.1.1 AFFF AREA 3 – Hangar Buildings 151/160 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
160-SB01	EGG289	0.5	Surface sampling
	EGG290		Field duplicate
	EGG291	12.5	Lithologic change (interface between fine- and coarse-grained sand)
	EGG292	25.0	Deep soil sample
160-SB02	EGG293	0.5	Surface sampling
	EGG294	12.5	Lithologic change (sand-silt interface)
	EGG295	25.0	Deep soil sample
160-SB03	EGG296	0.5	Surface sampling
	EGG297	12.5	Lithologic change (sand-silt interface)
	EGG298	25.0	Deep soil sample
160-SB04	EGG299	0.5	Surface sampling

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-3**.

3.4.1.2 Groundwater Samples

Three of the soil borings, 160-SB01, 160-SB02, and 160-SB03 were converted to temporary monitoring wells. One groundwater sampled was collected from each temporary monitoring well. Temporary well construction information is presented in **Table 3.4.1.2.**

Table 3.4.1.2 AFFF AREA 3 – Hangar Buildings 151/160 Well Information

Sample Location	Sample Id	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
160-SB01	EHI003	53.5	50.0-60.0	4/21/2017
	EHI004 (duplicate)			
160-SB02	EHI005	50.7	49.0-59.0	4/21/2017
160-SB03	EHI006	50.8	48.0-58.0	4/21/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-3**.

3.4.2 Analytical Results

3.4.2.1 Soil Results

PFAS concentrations detected in soil samples collected from Hangar Buildings 151/160 were below the PALs.

Figure 3-3 presents the soil boring locations.

Table F-1 in **Appendix F** presents all PFAS soil results.

3.4.2.2 Groundwater Results

All three groundwater samples collected from Hangar Buildings 151/160 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.4.2.2**.

Table 3.4.2.2 AFFF AREA 3 – Hangar Buildings 151/160 Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]			0.07	0.07	0.07	40
160-SB01	N	53.5	0.070	**2.4**	**2.47**	0.17
	FD		0.059	**2.6**	**2.66**	0.17
160-SB02	N	50.7	0.031	**0.64**	**0.671**	0.11
160-SB03	N	50.8	0.031	**0.096**	**0.127**	1.0

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit

Figure 3-3 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.4.3 Conclusions

None of the soil samples collected from Hangar Buildings 151/160 contained PFAS constituents with concentrations above their respective PALs. All three groundwater samples contained PFOS concentrations above the PAL. PFOA concentrations did not exceed the PAL in groundwater from this AFFF area. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.5 AFFF AREA 4 – HANGAR BUILDING 1600

3.5.1 Sample Locations and Rationale

Hangar Building 1600 is located east of the intersection of Popson Avenue and Yeager Boulevard on main base (**Figures 2-1a and 3-4**). In 1995 a water deluge fire suppression system was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in a 5,000-gallon tank located in the mechanical room in the southeast corner of the building. There were two releases of AFFF: several thousand gallons released and pushed out the bay door to Ramp 4 to a storm drain in 2014 (OTIE, 2017a) and up to 5,000 gallons discharged inside the hangar and pushed out the bay door to the same storm drain 5 to 10 years earlier (CH2M HILL, 2015)

3.5.1.1 Soil Samples

One soil boring, 1600-SB01, was advanced to a depth of 49 ft bgs for lithologic logging and soil sample collection on 24 April 2017. Bedrock was encountered 38 ft bgs in boring 1600-SB01 (**Appendix A-3**). Soil boring 1600-SB01 was positioned in a wide crack in the asphalt on the easterly downslope side of Hangar 1600 towards the storm drain. Three soil samples were collected from this soil boring. The rationale for the soil sampling depths is presented in **Table 3.5.1.1.**

Table 3.5.1.1 AFFF AREA 4 – Hangar Building 1600 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1600-SB01	EHH803	0.5	Surface sampling
	EHH804		Field duplicate
	EHH805	12.0	Lithologic change (sand-silt interface)
	EHH806	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

The soil boring locations is presented on **Figure 3-4**.

3.5.1.2 Groundwater Samples

The soil boring 1600-SB01 was converted to a temporary monitoring well. One groundwater sample was collected from the temporary monitoring well. Two permanent monitoring wells, 49-MW03 and 48-MW16 were also sampled. Monitoring well 49-MW03 is located downgradient from Hangar 1600. Monitoring well 48-MW16 is located in a downslope accumulation area. Monitoring well construction information is presented in **Table 3.5.1.2.**

Table 3.5.1.2 AFFF AREA 4 – Hangar Building 1600 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1600-SB01	EHH807	38.9	38.0-48.0	4/27/2017
49-MW03	EJE941	44.75	36.0-51.0	5/5/2017
48-MW16	EJE942	40.32	29.3-44.3	5/5/2014

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-4.**

3.5.2 Analytical Results

3.5.2.1 Soil Results

One of the four soil samples collected from Hangar 1600 contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.5.2.1**.

Table 3.5.2.1 AFFF AREA 4 – Hangar Building 1600 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1600-SB01	N	0.5	0.53 U	**250 J**	0.25 J
	FD		1.6	11 J	0.76 J
	N	12.0	1.1 J	3.5	0.19 J
	N	25.0	2.0	0.69 J	0.77 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-4 presents the soil boring location.

Table F-1 in **Appendix F** presents all PFAS soil results.

3.5.2.2 Groundwater Results

All three of the groundwater samples collected from Hangar contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.5.2.2**.

Table 3.5.2.2 AFFF AREA 4 – Hangar Building 1600 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
1600-SB01	38.9	**0.15**	**0.40**	**0.55**	0.62
49-MW03	44.75	**62**	**110**	**172**	8.6
48-MW16	40.32	0.010 U	**0.077**	**0.077**	0.26

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.
Where PFOS or PFOA is non-detect (i.e. U or UJ-qualified), the sum of PFOS and PFOA concentrations (PFOA + PFOS) includes only the concentration of the detected compound.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
U = non-detect at reporting limit shown

Figure 3-4 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.5.3 Conclusions

None of the soil samples collected from Hangar 1600 contained PFAS constituents with concentrations above their respective PALs. All three groundwater samples contained PFOS concentrations above the PAL, while two groundwater samples contained PFOA concentrations above the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.6 AFFF AREA 5 – HANGAR BUILDING 1608

3.6.1 Sample Locations and Rationale

Hangar Building 1608 is located approximately 1,000 feet east of the intersection of Wolfe Avenue and Yeager Boulevard on Main Base (**Figures 2-1a and 3-4**). Hangar Building 1608 was constructed in 1980 with an AFFF fire suppression system that remains in use. At Hangar Building 1608, AFFF is stored outdoors in one 500-gallon tank. Minor leaks from the AFFF piping were observed during the PA visit in May 2015. Because the AFFF system at Building 1608 is located outdoors, AFFF was released directly to the environment (CH2M HILL, 2015).

3.6.1.1 Soil Samples

One soil boring, 1608-SB01, was advanced to a depth of 49 ft bgs for lithologic logging and soil sample collection on 25 April 2016. Bedrock was encountered 47 ft bgs in boring 1608-SB01 (**Appendix A-3**). Soil boring 1608-SB01 was positioned in the unpaved area adjacent to the AFFF-containing fire suppression system, near where orange staining was observed on the concrete pad. Three soil samples were collected from the soil boring. The rationale for the soil sampling depths is presented in **Table 3.6.1.1.**

Table 3.6.1.1 AFFF AREA 5 – Hangar Building 1608 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1608-SB01	EHH827	0.5	Surface sampling
	EHH828		Field duplicate
	EHH829	12.5	Midpoint
	EHH830	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

The soil boring location is presented on **Figure 3-5**.

3.6.1.2 Groundwater Samples

The soil boring 1608-SB01 was converted to a temporary monitoring well. One groundwater sample was collected from the temporary monitoring well. One permanent monitoring well, 17-MW02, was also sampled. Monitoring well 17-MW02 is located adjacent to Hangar 1608 in an approximate downgradient location. Monitoring well construction information is presented in **Table 3.6.1.2.**

Table 3.6.1.2 AFFF AREA 5 – Hangar Building 1608 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1608-SB01	EHH831	38.0	38.0-48.0	4/27/2017
	EHH832 (duplicate)			
17-MW02	EIJ306	40.31	26.0-41.0	5/2/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-4**.

3.6.2 Analytical Results

3.6.2.1 Soil Results

One of the three soil samples collected from Hangar 1608 contained PFAS concentrations above the PAL. Soil sample results are presented in **Table 3.6.2.1**.

Table 3.6.2.1 AFFF AREA 5 – Hangar Building 1608 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1608-SB01	N	0.5	35	**2,100**	6.3 U
	FD		89	**2,200**	6.1 U
	N	12.5	0.85 J	14	1.2
	N	25.0	0.65 U	0.77 J	0.71 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-4 presents the soil boring location.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.6.2.2 Groundwater Results

One of the two groundwater samples collected from Hangar 1608 contained one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.6.2.2**.

Table 3.6.2.2 AFFF AREA 5 – Hangar Building 1608 Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]			0.07	0.07	0.07	40
1608-SB01	N	38.0	0.052	**0.46**	**0.512**	0.72
	FD		0.050	**0.38**	**0.43**	0.72
17-MW02	N	40.31	0.028	0.024	0.052	0.54

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit

Figure 3-4 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.6.3 Conclusions

Concentrations of PFOS exceeded the PAL in the surface soil sample and the groundwater sample from 1608-SB01 from Hangar 1608. Concentrations of PFOA did not exceed the PAL in any of the soil or groundwater samples. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.7 AFFF Area 6 – Hangar Building 1624

3.7.1 Sample Locations and Rationale

Hangar Building 1624 is located approximately 1,200 feet east of the intersection of Popson Avenue and Yeager Boulevard and north of Fire Station 1 on Main Base (**Figures 2-1a and 3-4**). Hangar Building 1624 was constructed in 1994 with an AFFF fire suppression system that remains in use. The AFFF is stored in a 1,300-gallon tank located on the southwest corner of the building within the mechanical room. Releases include approximately 10 gallons AFFF released weekly per truck during spray nozzle testing and reported releases in a drum storage area (CH2M HILL, 2015).

3.7.1.1 Soil Samples

One soil boring, 1624-SB01, was advanced to a depth of 50 ft bgs for lithologic logging and soil sample collection on 25 April 2017. Bedrock was encountered 45.5 ft bgs in boring 1624-SB01 (**Appendix A-3**). Soil boring 1624-SB01 was positioned northeast of the Hangar Building 1624 structure in an unpaved location in a potential source area. The rationale for the soil sampling depths is presented in **Table 3.7.1.1.**

Table 3.7.1.1 AFFF AREA 6 – Hangar Building 1624 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1624-SB01	EHH878	0.5	Surface sampling
	EHH879		Field duplicate
	EHH880	12.5	Midpoint (No lithologic change)
	EHH881	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

The soil boring location is presented on **Figure 3-4**.

3.7.1.2 Groundwater Samples

Soil boring 1624-SB01 was converted to a temporary monitoring well. One groundwater sample was collected from the temporary monitoring well. Two permanent monitoring wells, 49-MW04 and 54-MW15, were also sampled. Monitoring well 49-MW04 is located in the source area near the temporary well location. Monitoring well 54-MW15 is located downgradient from the source area. Monitoring well construction information is presented in **Table 3.7.1.2.**

Table 3.7.1.2 AFFF AREA 6 – Hangar Building 1624 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1624-SB01	EHH883	42.2	40.0-50.0	4/27/2017
49-MW04	EHH882	41.40	31.0-46.0	4/25/2017
52-MW15	EIJ307	46.19	33.0-48.0	5/1/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-6**.

3.7.2 Analytical Results

3.7.2.1 Soil Results

Two of the four soil samples collected from Hangar 1624 contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.7.2.1**.

Table 3.7.2.1 AFFF AREA 6 – Hangar Building 1624 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1624-SB01	N	0.5	4.8 U	**240 J**	4.8 U
	FD		1.2	93 J	0.84 J
	N	12.5	**180**	3.7	1.8
	N	25.0	9.5	12	9.0

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-4 presents the soil boring location.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.7.2.2 Groundwater Results

All of the three groundwater samples collected from Hangar 1624 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.7.2.2**.

Table 3.7.2.2 AFFF AREA 6 – Hangar Building 1624 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
1624-SB01	42.2	**0.19**	**0.90**	**1.09**	0.55
49-MW04	41.40	**0.093**	**0.78**	**0.873**	0.34
52-MW15	46.19	**0.094**	**0.19**	**0.284**	0.59

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit

Figure 3-4 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.7.3 Conclusions

None of the soil samples collected from Hangar 1624 contained PFAS constituents with concentrations above their respective PALs. All three groundwater samples contained PFOS and PFOA at a concentration above the PAL. PFBS did not exceed the PAL in any samples collected at this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.8 AFFF AREA 7 – HANGAR BUILDING 1870

3.8.1 Sample Locations and Rationale

Hangar Building 1870 is located approximately 700 feet east of the intersection of Forbes Avenue and Wolf Avenue on Main Base (**Figures 2-1a and 3-5**). Hangar Building 1870 was constructed in 1958 with a water deluge fire suppression system. Around 1992 or 1993, it was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in two 1,000-gallon tanks located in the pump house northwest of Hangar Building 1870 (CH2M HILL, 2015).

Two AFFF releases are reported from Building 1870, in addition to reported releases from routine tests of the fire suppression system. One release occurred in October 2014 from the AFFF tank and pump house located outside the northwest corner of Hangar 1870 (CH2M HILL, 2015).

In addition, the facilities manager reported that AFFF was also released to the asphalt from the AFFF system discharge piping during routine fire suppression flow testing (OTIE, 2017a), at two points where

the discharge piping exits the building exterior, both adjacent to the AFFF Tank house, and at the north-central portion of the building (**Figure 3-5**). Staining was observed on the pavement near each of the discharge pipes (OTIE, 2017a).

3.8.1.1 Soil (Bedrock) and Sediment Samples

Two soil borings, 1870-SB01 and 1870-SB02, were advanced to depths ranging from 38 to 40 ft bgs for lithologic logging and soil sample collection on 3 May 2017. Bedrock was encountered at the surface in both SI borings (**Appendix A-3**). Soil boring 1870-SB01 was positioned in the unpaved area adjacent to the AFFF-containing fire suppression system, near where orange staining was observed on the concrete pad. Boring 1870-SB02 was positioned in the unpaved area in the potential accumulation area from the C6 AFFF release from the pump house. Three soil (weathered bedrock) samples were collected from each of the soil borings, for a total of six soil (bedrock) samples. One sediment sample, F22-SS01, was collected at a potential accumulation area for Hangar Buildings 1870, 1874, and 1881. The rationale for the soil (bedrock) sampling depths is presented in **Table 3.8.1.1.**

Table 3.8.1.1 AFFF AREA 7 – Hangar Building 1870 Soil and Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1870-SB01	EIJ206	0.5	Surface soil (bedrock) sample
	EIJ207		Field duplicate
	EIJ208	12.5	Soil (bedrock) Midpoint (No lithologic change)
	EIJ209	25.0	Deep soil (bedrock) sample
1870-SB02	EIJ203	0.5	Surface soil (bedrock) sample
	EIJ204	12.5	Soil (bedrock) Midpoint
	EIJ205	25.0	Deep soil (bedrock) ample
F22-SS01	EJK067	0.5	Sediment sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring and sediment sample locations are presented on **Figure 3-5**.

3.8.1.2 Groundwater Samples

Both soil borings, 1870-SB01 and 1870-SB02, were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary well construction information is presented in **Table 3.8.1.2.**

Table 3.8.1.2 AFFF AREA 7 – Hangar Building 1870 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1870-SB01	EJK065	18.4	30.0-40.0	5/9/2017
1870-SB02	EJK063	23.6	28.0-38.0	5/9/2017
	EJK064 (duplicate)			

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-5**.

3.8.2 Analytical Results

3.8.2.1 Soil and Sediment Results

Two of six soil samples and one sediment sample collected from Hangar Building 1870 contained PFAS concentrations above the PALs. PFAS were not detected in the sediment sample at concentrations above the PALs. Soil and sample results are presented in **Table 3.8.2.1**.

Table 3.8.2.1 AFFF AREA 7 – Hangar Building 1870 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1870-SB01	N	0.5	4.3 J	**530**	2.2 J
	FD		6.0 J	**590**	4.1 J
	N	12.5	0.35 J	32	0.57 U
	N	25.0	0.54 U	0.47 J	1.1
1870-SB02	N	0.5	11	**2,200**	1.5 J
	N	12.5	1.3	4.9	0.20 J
	N	25.0	0.50 U	1.3	0.50 U
F22-SS01	N	0.5	0.67 J	6.5	0.51 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-5 presents the soil boring locations.

Tables F-1 and **F-3** in **Appendix F** presents all PFAS soil and sediment results, respectively.

The soil (bedrock) samples 1870-SB01-25 and 1870-SB02-25 were collected from below the static water level. However, because moisture contents measured by the laboratory were low (7.4 and 0.3%,

respectively), the PFAS concentrations detected in these samples are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.8.2.2 Groundwater Results

Both groundwater samples collected from Hangar Building 1870 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.8.2.2**.

Table 3.8.2.2 AFFF AREA 7 – Hangar Building 1870 Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]			0.07	0.07	0.07	40
1870-SB01	N	18.4	**2.9**	**4.7**	**7.6**	4.0
1870-SB02	N	23.6	**14**	**9.5**	**23.5**	**56**
	FD		**14**	**10**	**24**	**56**

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit

Figure 3-5 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.8.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of six soil samples (1870-SB02-0.5), and in both groundwater samples collected from Hangar Building 1870. Concentrations PFOA exceeded the PAL in both groundwater samples, but no soil samples had concentrations above the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. PFAS concentrations in sediment samples were below the PALs. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.9 AFFF AREA 8 – HANGAR BUILDING 1874

3.9.1 Sample Locations and Rationale

Hangar Building 1874 is located approximately 800 feet southeast of the intersection of Forbes Avenue and Wolfe Avenue on Main Base (**Figures 2-1a and 3-5**). Hangar Building 1874 was constructed in 1958 with a water deluge fire suppression system. It was converted to an AFFF fire suppression system in the 1980s that remains in use. The AFFF is stored in a 1,000-gallon tank located in the pump house south of Hangar Building 1874 and toward the center (CH2M HILL 2015). An AFFF release of approximately 2,000 gallons was reported in January 2013 from the AFFF Tank Number T3 storage house south of the building (**Figure 3-5**). Staining was observed on the pavement south of the building. Cracks in the asphalt

were also observed within the stained areas that would allow a direct pathway to underlying soils and groundwater (OTIE 2017a).

3.9.1.1 Soil Samples

Three soil borings, 1874-SB01, 1874-SB02, 1874-SB03, were advanced to depths ranging from 29 to 32 ft bgs for lithologic logging and soil sample collection on 8 May 2017. On 9 May 2017 a fourth soil boring, 1874-SB04, was advanced to a depth of 32 ft bgs for collection of a groundwater sample; no soil samples were collected. Bedrock was encountered in the SI borings at Hangar 1874 at depths ranging from 2 to 5 ft bgs (**Appendix A-3**). Soil borings 1874-SB01 and 1874-SB02 were positioned in significant cracks in the asphalt in areas of staining, near the south of the pump house where the release occurred. Soil boring 1874-SB03 was positioned in the F-22 facility parking lot south of the facility fence and where cracks in the asphalt were observed in a potential accumulation area downgradient of the pump house. Soil boring 1874-SB04 was positioned upgradient of Hangar 1881 and downgradient of Hangar 1874 to determine whether detections in groundwater samples from Hangar 1881 borings were associated with Hangar 1881 or Hangar 1874. Three soil (soil and weathered bedrock) samples were collected from three of four soil borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.9.1.1.**

Table 3.9.1.1 AFFF AREA 8 – Hangar Building 1874 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1874-SB01	EJK040	0.5	Surface soil sample
	EJK041	5.0	Soil (bedrock) sample, Lithologic change (sand-weathered bedrock interface)
	EJK042		Field duplicate
	EJK043	25.0	Deep soil (bedrock) sample
1874-SB02	EJK044	0.5	Surface soil sample
	EJK045	5.0	Soil (bedrock) sample, Lithologic change (sand-weathered bedrock interface)
	EJK046	25.0	Deep soil (bedrock) sample
1874-SB03	EJK047	0.5	Surface soil sample
	EJK048	5.0	Intermediate soil sample, depth similar to SB01 and SB02
	EJK049	25.0	Deep soil (bedrock) sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-5**.

3.9.1.2 Groundwater Samples

Three of the four soil borings, (1874-SB02, 1874-SB03, and 1874-SB04) were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. A groundwater sample was not collected from 1874-SB01 because of its close proximity to 1874-SB02.

One permanent monitoring well, 24-MW09, was also sampled. Monitoring well 24-MW09 is located beneath the potential accumulation area. Monitoring well construction information is presented in **Table 3.9.1.2.**

Table 3.9.1.2 AFFF AREA 8 – Hangar Building 1874 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1874-SB02	EJK050	20.2	18.2-28.2	5/9/17
1874-SB03	EKJ051	20.3	19.0-29.0	5/9/17
1874-SB04	EKJ052	21.2	20.1-30.1	5/10/17
24-MW09	ELI190	18.74	7.0-27.0	5/25/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-5**.

3.9.2 Analytical Results

3.9.2.1 Soil Results

Six of the nine soil samples collected from Hangar Building 1874 contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.9.2.1**

Table 3.9.2.1 AFFF AREA 8 – Hangar Building 1874 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1874-SB01	N	0.5	6.4	**260**	26
	N	5.0	21	**330 J**	12 J
	FD		27	**460 J**	19 J
	N	25.0	0.52 U	0.72 J	0.52 U
1874-SB02	N	0.5	41	**1,800**	110
	N	5.0	32	**790**	49
	N	25.0	0.37 J	2.9	0.99
1874-SB03	N	0.5	13	**2,900**	40
	N	5.0	19	**2,400**	13
	N	25.0	0.59 U	1.9	0.59 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-5 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

The soil (bedrock) samples 1874-SB02-25 and 1874-SB03-25 were collected from below the static water level. However, because moisture contents measured by the laboratory were low (0.6 and 1.9%, respectively), the PFAS concentrations detected in these samples are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.9.2.2 Groundwater Results

All four groundwater samples collected from Hangar Building 1874 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.9.2.2**.

Table 3.9.2.2 AFFF AREA 8 – Hangar Building 1874 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
1874-SB02	20.2	**2.7**	**39**	**41.7**	7.5
1874-SB03	20.3	**1.0**	**55**	**56**	3.3
1874-SB04	21.2	**1.7**	**1.1**	**2.8**	3.2
24-MW09	18.74	**0.088**	0.010 U	**0.088**	0.11

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
U = non-detect at reporting limit shown

Figure 3-5 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.9.3 Conclusions

Concentrations of PFOS exceeded the PAL in three of nine soil samples, and three of four groundwater samples collected from Hangar Building 1874. One of the soil sample exceedances was in the 5 ft bgs

sample from boring 1874-SB03; this is the only exceedance in subsurface soil. Concentrations of PFOA exceeded the PAL in all four groundwater samples, but no soil samples had PFOA concentrations above the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

The purpose of boring 1874-SB04 was to determine whether detections in groundwater samples from Hangar Building 1881 borings are associated with Hangar Building 1881 or Hangar Building 1874 (OTIE, 2017a). Based on a comparison of the sum of PFOA and PFOS concentrations detected in boring 1874-SB04 (2.8 µg/L) with concentrations detected in borings at Hangar Building 1874 (1874-SB02 [41.7 µg/L] and 1874-SB03 [56 µg/L]) and the concentrations detected in borings at Hangar Building 1881, (1881-SB01 [0.65 µg/L] and 1881-SB02 [0.63 µg/L]), which are downgradient from 1874-SB04, the PFAS concentrations detected in groundwater at Hangar 1881 are more likely to be associated with Hangar Building 1874 (**Figure 3-5**). However, it should also be noted that sum of PFOA and PFOS concentrations detected in borings 1870-SB01 (7.6 µg/L) and 1870-SB02 (23.5 µg/L), located cross-gradient from Hangar Building 1881, are also higher than those detected in 1874-SB04 (2.8 µg/L).

3.10 AFFF AREA 9 – HANGAR BUILDING 1881

3.10.1 Sample Locations and Rationale

Hangar Building 1881 is located approximately 1,300 feet east of the intersection of Forbes Avenue and Wolfe Avenue on Main Base (**Figures 2-1a and 3-5**). The building was constructed in 1958 with a water deluge fire suppression system. In the 1980's the system was converted to an AFFF fire suppression system that remains in use. The AFFF is stored in two 500-gallon tanks located in two pump houses south of Hangar Building 1881. The facilities manager reported that AFFF was released to the asphalt southeast of the building during fire suppression flow testing (OTIE, 2017a). Staining and cracks were observed on the pavement south of the building.

3.10.1.1 Soil Samples

Two soil borings, 1881-SB01 and 1881-SB02, were each advanced to a depth of 32 ft bgs for lithologic logging and soil sample collection on 5 May 2017. Bedrock was encountered in the SI borings at 16.5 and 17 ft bgs (**Appendix A-3**). Soil borings 1881-SB01 and 1881-SB02 were positioned in significant cracks in the asphalt in areas of staining where the release occurred and staining was observed on the pavement (OTIE, 2017a). Three soil (soil and weathered bedrock) samples were collected from each of the borings, for a total of six soil samples. The rationale of the soil sampling depths is presented in **Table 3.10.1.1**.

Table 3.10.1.1 AFFF AREA 9 – Hangar Building 1881 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1881-SB01	EJK081	0.5	Surface soil sample
	EJK082	12.5	Midpoint soil sample
	EJK083		Field duplicate
	EJK084	25.0	Deep soil (bedrock) sample
1881-SB02	EJK085	0.5	Surface soil sample
	EJK086	12.5	Midpoint soil sample
	EJK087	25.0	Deep soil (bedrock) sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-5**.

3.10.1.2 Groundwater Samples

Each of the two soil borings, 1881-SB01 and 1881-SB02, were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Two permanent monitoring wells, 18-T04 and 18-MW47, were also sampled. Monitoring well 18-T04 is located downgradient of Hangar of 1881. Monitoring well 18-MW47 is located in the vicinity of the AFFF system discharge pipe. Monitoring well construction information is presented in **Table 3.10.1.2**.

Table 3.10.1.2 AFFF AREA 9 – Hangar Building 1881 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1881-SB01	EJK088	24.2	20.0-30.0	5/9/2017
1881-SB02	EJK089	22.2	21.5-31.5	5/9/2017
18-T04	ELH639	18.96	10.0-20.0	5/25/2017
18-MW47	ELH640	21.85	7.0-27.0	5/25/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-5**.

3.10.2 Analytical Results

3.10.2.1 Soil Results

All six soil samples collected from Hangar 1881 contained PFAS concentrations below the PALs.

Figure 3-5 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results. The soil (bedrock) samples 1881-SB01-25 and 1881-SB02-25 were collected from below the static water level. However, because moisture contents measured by the laboratory were low (3.3 and 3.5%, respectively), the PFAS concentrations detected in these samples are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.10.2.2 Groundwater Results

Each of the four groundwater samples collected from Hangar Building 1881 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.10.2.2**.

Table 3.10.2.2 AFFF AREA 9 – Hangar Building 1881 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
1881-SB01	24.2	**0.39**	**0.26**	**0.65**	0.88 J
1881-SB02	22.2	**0.51**	**0.12 J**	**0.63**	3.9
18-T04	18.96	**0.18**	0.032	**0.212**	0.43
18-MW47	21.85	**1.0 J**	**5.4**	**6.4**	2.7

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown

Figure 3-5 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.10.3 Conclusions

None of the soil samples collected from Hangar Building 1881 contained PFAS constituents with concentrations above their respective PAL. Concentrations of PFOS exceeded the PAL in three of four groundwater samples collected. All four groundwater samples collected had concentrations of PFOA that exceeded the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.11 AFFF AREA 10 – HANGAR BUILDING 4801

3.11.1 Sample Locations and Rationale

Hangar Building 4801 is located approximately 550 feet southeast of the intersection of Lily Avenue and Forbes Avenue within the NASA complex (**Figures 2-1a and 3-6**). Hangar Building 4801 contains an AFFF fire suppression system, which consists of two polyethylene tanks containing AFFF with a capacity of 1,000-gallons each located inside the mechanical room. In addition, within the hangar are two small 30 to 40-gallon tanks of AFFF with hand hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015). One AFFF release occurred and was contained within 10 feet of the building, but never reached the unpaved area beyond the hangar. The AFFF and water dried on the tarmac and eventually migrated to the storm drains during precipitation events (CH2M HILL, 2015). Floor drains inside the hangar drain to an unlined retention basin at the eastern edge of the tarmac (**Figure 3-6**) (OTIE, 2017a).

3.11.1.1 Sediment Samples

Two sediment samples, 4801-SS01 and 4801-SS02, were collected between 0 and 0.5 ft bgs. Sediment sample 4801-SS01 was collected in an unpaved area downslope and southwest of the pavement in the direction of surface runoff from Hangar Buildings 4801 and 4802 to Rogers Dry Lake. Sediment sample 4801-SS02 was collected at the discharge point from the drain system from Hangar Buildings 4801 and 4802 to Rogers Dry Lake via storm water lines (OTIE, 2017a). The rationale for the sediment sampling depths is presented in **Table 3.11.1.1**.

Table 3.11.1.1 AFFF AREA 10 – Hangar Building 4801 Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
4801-SS01	EKK124	0.5	Sediment Sample
	EKK125		Field duplicate
4801-SS02	ELH495	0.5	Sediment Sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Sediment sample locations are presented on **Figure 3-6**.

3.11.1.2 Groundwater Samples

No temporary monitoring wells were constructed at Hangar Building 4801. One groundwater sample was collected at a permanent monitoring well, N1-MW06. Monitoring well N1-MW06 is located downgradient of Hangar Building 4801. Monitoring well construction information is presented in **Table 3.11.1.2**.

Table 3.11.1.2 AFFF AREA 10 – Hangar Building 4801 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
N1-MW06	ELH497	9.83	7.0-22.0	5/23/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-6**.

3.11.2 Analytical Results

3.11.2.1 Sediment Results

One of the two sediment samples collected from Hangar Building 4801 contained PFAS concentrations above the PALs. Sediment sample results are presented in **Table 3.11.2.1**.

Table 3.11.2.1 AFFF AREA 10 – Hangar Building 4801 Sediment Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
4801-SS01	N	0.5	1.8 J	40 J	1.8
	FD	0.5	1.3 J	28 J	1.7
4801-SS02	N	0.5	2.5	**240**	4.2

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown

Figure 3-6 presents the sediment sample locations.

Table F-3 in **Appendix F** presents all detected PFAS sediment results.

3.11.2.2 Groundwater Results

The groundwater sample collected from Hangar Building 4801 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.11.2.2**.

Table 3.11.2.2 AFFF AREA 10 – Hangar Building 4801 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
N1-MW06	9.83	**1.2**	**25**	**26.2**	4.2

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit

Figure 3-6 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.11.3 Conclusions

None of the sediment samples collected from Hangar Building 4801 contained PFAS constituents with concentrations above their respective PALs. Concentrations of PFOA and PFOS exceeded the PAL in the groundwater sample collected. PFBS concentrations did not exceed the PAL in the sample collected from the AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.12 AFFF AREA 11 – HANGAR BUILDING 4802

3.12.1 Sample Locations and Rationale

Hangar Building 4802 is located approximately 550 feet south of the intersection of Lily Avenue and Forbes Avenue within the NASA complex (**Figures 2-1a and 3-6**). Hangar Building 4802 contained an AFFF fire suppression system, which consisted of two polyethylene tanks containing AFFF with a capacity of 1,500-gallons each located inside the mechanical room. The AFFF fire suppression system has been removed and is currently being converted to a high-expansion foam system. However, within the hangar are eight 40-gallon tanks of AFFF with hand hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015). One release of AFFF was reported to have occurred outside of Building 4802 on the concrete (OTIE, 2017a). The spill was contained before it reached the unlined drainage swale. The concrete was observed to be in good condition, with no cracks or joints. Stormwater lines drain to an outfall southeast of Hangar 4802, and outwash flows to Rogers Dry Lake.

3.12.1.1 Soil Samples

One soil boring, 4802-SB01, was advanced to a depth of 21.5 ft bgs for lithologic logging and soil sample collection on 18 May 2017. Bedrock was encountered 5 ft bgs in boring 4802-SB01 (**Appendix A-3**). Soil boring 4802-SB01 was positioned at the discharge point from the drain system to Rogers Dry Lake via storm water lines. A total of three soil (soil and weathered bedrock) samples were collected from the boring. The rationale for the soil sampling depths is presented in **Table 3.12.1.1**.

Table 3.12.1.1 AFFF AREA 11 – Hangar Building 4802 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
4802-SB01	EKK127	0.5	Surface soil sample
	EKK128		Field duplicate
	EKK129	6.0	Soil (bedrock), Lithologic change (weathered bedrock-bedrock interface)
	EKK130	20.0	Deep soil (bedrock) sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

The soil boring location is presented on **Figure 3-6**.

3.12.1.2 Groundwater Samples

The soil boring 4802-SB01 was converted to a temporary monitoring in which one groundwater sample was collected. One permanent monitoring well, N4-MW03, was also sampled. Monitoring well N4-MW03 is located nearby soil boring 4802-SB01.

Table 3.12.1.2 AFFF AREA 11 – Hangar Building 4802 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
4802-SB01	ELH494	20.7	6.0-21.0	5/19/2017
N4-MW03	ELH496	13.60	5.0-20.0	5/23/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-6**.

3.12.2 Analytical Results

3.12.2.1 Soil Results

One of the three soil samples collected from Hangar Building 4802 contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.12.2.1**.

Table 3.12.2.1 AFFF AREA 11 – Hangar Building 4802 Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
4802-SB01	N	0.5	21 J	**2,800**	5.8 U
	FD		14 J	**2,100**	4.9 U
	N	6.0	0.49 U	4.4	0.49 U
	N	20.0	0.50 U	1.5	0.50 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-6 presents the soil boring location.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.12.2.2 Groundwater Results

Both groundwater samples collected from Hangar Building 4802 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.12.2.2**.

Table 3.12.2.2 AFFF AREA 11 – Hangar Building 4802 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
4802-SB01	20.7	**0.43**	**20**	**20.43**	0.40
N4-MW03	13.60	**17**	**260**	**277**	23

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit

Figure 3-6 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.12.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of three soil samples (surface soil from 4802-SB01), and in both groundwater samples collected from Hangar Building 4802. Concentrations of PFOA exceeded the PAL in both groundwater samples, but no soil samples had PFOA concentrations above the PAL. PFBS concentrations did not exceed the PAL in any groundwater samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.13 AFFF AREA 12 – HANGAR BUILDING 4826

Hangar Building 4826 is located approximately 1,800 feet northeast of the intersection of Lily Avenue and Forbes Avenue within the NASA complex (**Figures 2-1a and 3-7**). The building contains an AFFF fire suppression system, which consists of two tanks containing AFFF with a capacity of 1,300-gallons each located in the mechanical room. In addition, within the hangar, there are six small 30-gallon AFFF tanks with hand-held hoses to address small fires without activating the hangar's AFFF system (CH2M HILL, 2015).

3.13.1 Sample Locations and Rationale

More than 10 years ago when the AFFF system was tested, hoses were connected to the headers and AFFF was released onto the tarmac and allowed to evaporate. The amount of AFFF released per test is unknown but tests were performed approximately every 5 years. In December 2007, the majority of the approximately 200 gallons of AFFF leaked into a floor drain discharging to the Main Base sewer treatment plant during a test of the fire suppression system when the overflow control valve failed.

However, an unreported amount flowed into a separate storm drain that flows to an unlined evaporation pond and ultimately discharges to Rogers Dry Lake (OTIE, 2017a).

3.13.1.1 Soil Samples

Three soil borings, 4826-SB01, 4826-SB02, and 4826-SB03, were advanced to depths ranging from 18 to 20 ft bgs for lithologic logging and soil sample collection on 16, 17, and 18 May 2017. Bedrock was encountered in the SI borings at Building 4826 at depths ranging from 5 to 6 ft bgs (**Appendix A-3**). Soil borings 4826-SB01 and 4826-SB02 were positioned in the front of the drain outfalls conveyed from Hangar 4826 into the evaporation pond. Soil boring 4826-SB03 was positioned downslope of the pavement on the south side of the fence of the side of Rogers Dry Lake (OTIE, 2017a). Three soil (soil and weathered bedrock) samples were collected from each of the borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.13.1.1**.

Table 3.13.1.1 AFFF AREA 12 – Hangar Building 4826 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
4826-SB01	EKK076	0.5	Surface soil sample
	EKK077	6.0	Soil (bedrock), Lithologic change (weathered bedrock-bedrock interface)
	EKK078	20.0	Deep soil (bedrock) sample
4826-SB02	EKK072	0.5	Surface soil sample
	EKK073		Field duplicate
	EKK074	6.0	Soil (bedrock), Lithologic change (weathered bedrock-bedrock interface)
	EKK075	20.0	Deep soil (bedrock) sample
4826-SB03	EKK079	0.5	Surface soil sample
	EKK080	6.0	Soil (bedrock), Lithologic change (soil-weathered bedrock interface and similar depth as 4826-SB01 and 1826-SB02)
	EKK081	20.0	Deep soil (bedrock) sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-7**.

3.13.1.2 Groundwater Samples

Two of the three soil borings, 4826-SB01 and 4826-SB02 were converted to temporary monitoring wells. Only one groundwater sample was collected from the temporary monitoring wells (4826-SB02) because no water was present in the temporary well installed in soil boring 4826-SB01. One permanent monitoring well, N1-MW01, was also sampled. Monitoring well N1-MW01 is located adjacent to boring location 4826-SB03. Monitoring well construction information is presented in **Table 3.13.1.2**.

Table 3.13.1.2 AFFF AREA 12 – Hangar Building 4826 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
4826-SB02	EKK082	12.6	7.0-17.0	5/18/2017
	EKK083 (duplicate)			
N1-MW01	ELH537	18.32	5.0-20.0	5/23/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-7**.

3.13.2 Analytical Results

3.13.2.1 Soil Results

All nine soil samples collected from Hangar 4826 contained PFAS concentrations below the PALs.

Figure 3-7 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results. The soil (bedrock) sample 4826-SB02-20 was collected from below the static water level. However, because moisture content measured by the laboratory was low (3.0%), the PFAS concentrations detected in this sample are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.13.2.2 Groundwater Results

Both groundwater samples collected from Hangar Building 4826 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.13.2.2**.

Table 3.13.2.2 AFFF AREA 12 – Hangar Building 4826 Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]			0.07	0.07	0.07	40
4826-SB02	N	12.6	**3.4**	1.0 U	**3.4**	1.0 U
	FD		**4.1**	1.0 U	**4.1**	1.0 U
N1-MW01	N	18.32	**1.6 J**	**37**	**38.6**	1.7 J

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
DTW = depth to water
btoc = below top of casing
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-7 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

Due to high concentrations of the target analytes, the sample required a 100-fold dilution, which increased the detection limit by a 100 times; therefore the sample detection limits were adjusted accordingly. The elevated detection limits in the groundwater sample 4826-SB02 resulted in a detection limit above the PAL. Therefore, it is uncertain whether PFOS is present at concentrations between 0.07 and 1.0 µg/L.

3.13.3 Conclusions

None of the soil samples collected from Hangar Building 4826 contained PFAS constituents with concentrations above their respective PAL. Concentrations of PFOS exceeded the PAL in one of two groundwater samples collected (N1-MW01). Both groundwater samples collected had concentrations of PFOA above the PAL. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.14 AFFF Area 13 – Hangar Building 4840

Hangar Building 4840 is located approximately 1,200 feet northeast of the intersection of Lily Avenue and Forbes Avenue within the NASA complex (**Figures 2-1a and 3-7**). The AFFF fire suppression system consisted of two tanks containing AFFF with a capacity of 1,300-gallons each located inside the mechanical room. The system was converted to a high-expansion foam system in late 2015.

3.14.1 Sample Locations and Rationale

One test was performed 6 to 8 years ago when the headers were tested; AFFF was released onto the tarmac and allowed to evaporate. A large inadvertent discharge of the fire suppression released AFFF to the evaporation pond. The pond was lined at one time, but the liner has degraded over time (OTIE, 2017a).

3.14.1.1 Soil and Sediment Samples

Two soil borings, 4840-SB01 and 4840-SB02, were advanced to a depth of 20 ft bgs for lithologic logging and soil sample collection on 15 and 16 May 2017. Bedrock was encountered in the SI borings at Building 4840 at 5.5 and 6 ft bgs (**Appendix A-3**). Soil borings 4840-SB01 and 4840-SB02 were positioned in front of the drain outfalls conveyed from Hangar 4840 into the evaporation pond (OTIE, 2017a). Three soil (soil and weathered bedrock) samples were collected from each of the borings, for a total of six samples. One sediment sample, 4840-SS01, was collected in a topographically low area of the evaporation pond/detention basin east of Hangar Building 4840. The rationale for the soil and sediment sampling depths is presented in **Table 3.14.1.1**.

Table 3.14.1.1 AFFF AREA 13 – Hangar Building 4840 Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
4840-SB01	EKF531	0.5	Surface soil sample
	EKF532		Field duplicate
	EKF533	5.0	Soil, Lithologic change (soil-weathered bedrock interface and similar depth as 4840-SB02
	EKF534	20.0	Deep soil (bedrock) sample
4840-SB02	EKF535	0.5	Surface soil sample
	EKF536	5.0	Soil (bedrock), Lithologic change (soil-weathered bedrock interface)
	EKF537	20.0	Deep soil (bedrock) sample
4840-SS01	EKF537	0.5	Sediment sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring and sediment sample locations are presented on **Figure 3-7**.

3.14.1.2 Groundwater Samples

Each of the two soil borings 4840-SB01 and 4840-SB02 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Two permanent monitoring wells, N6-MW01 and N1-MW04, were also sampled. Monitoring well N6-MW01 is located topographically downslope in a potential runoff/accumulation area from potential release area Hangar Building 4840. Monitoring well N1-MW04 is located hydraulically downgradient of drainage outfall from potential release area Hangar Building 4826.

Table 3.14.1.2 AFFF AREA 13 – Hangar Building 4840 Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
4840-SB01	EKF539	7.3	4.6-19.6	5/16/2017
4840-SB02	EKF540	8.0	4.6-19.6	5/17/2017
N6-MW01	ELH650	7.64	10.0-20.0	5/22/2017
N1-MW04	ELH651	13.99	5.0-20.0	5/23/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-7**.

3.14.2 Analytical Results

3.14.2.1 Soil and Sediment Results

One of the seven soil samples collected from Hangar Building 4840 contained PFAS concentrations above the PALs. The sediment sample collected from Hangar 4840 contained PFAS concentrations below the PALs. Soil and sediment sample results are presented in **Table 3.14.2.1**.

Table 3.14.2.1 AFFF AREA 13 – Hangar Building 4840 Soil and Sediment Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	1,300,000
4840-SB01	N	0.5	0.60 J	20	0.22 J
	FD		0.97	23	0.22 J
	N	5.0	0.55 U	2.0	0.55 U
	N	20.0	0.59 U	0.59 U	0.59 U
4840-SB02	N	0.5	1.6	**710**	0.28 J
	N	5.0	4.2	110	0.21 J
	N	20.0	0.60 U	0.50 J	0.60 U
4840-SS01	N	0.5	0.21 J	78	0.21 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-7 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results. The soil (bedrock) samples 4840-SB01-20 and 4840-SB02-20 were collected from below the static water level. However, because moisture contents measured by the laboratory were low (6.5 and 7.9%, respectively), the PFAS concentrations detected in these samples are from the solid matrix, which is soil (bedrock), and not the groundwater.

3.14.2.2 Groundwater Results

All four groundwater samples collected from Hangar Building 4840 contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.14.2.2**.

Table 3.14.2.2 AFFF AREA 13 – Hangar Building 4840 Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
4840-SB01	7.3	**0.18**	**2.0**	**2.18**	0.053
4840-SB02	8.0	**1.1**	**30**	**31.1**	1.6
N6-MW01	7.64	**2.1**	**5.7**	**7.8**	9.6
N1-MW04	13.99	**7.7**	**140**	**147.7**	7.5

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit

Figure 3-7 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.14.3 Conclusions

None of the soil samples collected from Hangar Building 4840 contained PFAS constituents with concentrations above their respective PAL. Concentrations of PFOS and PFOA exceeded the PAL in all four groundwater samples collected. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.15 AFFF AREA 14 – FIRE STATION #3 (BUILDING 250)

Fire Station #3 is located approximately 800 feet east of Building 182 (**Figures 2-1b and 3-8**). The fire station was constructed in 1988 and houses four fire engines that carry AFFF ranging from 25 to 500 gallons. The two larger crash trucks are parked outside on dirt because they do not fit through the bay doors (CH2M HILL, 2015).

3.15.1 Sample Locations and Rationale

After nozzle spray tests, training exercises, and responses, the fire engines are washed outside east of the building. AFFF residue on the trucks is washed off and runs into the nearby dirt areas. Additionally, a release of AFFF occurred when a pipe burst inside a P-23 crash truck parked outside the building, and the contents spilled onto the unpaved ground adjacent to Building 250. The spill flowed downslope in an easterly directions away from the fire station across the road (OTIE, 2017a).

3.15.1.1 Soil Samples

Three soil borings, 250-SB01 and 250-SB02, and 250-SB03, were advanced to depths ranging from 60 to 62 ft bgs for lithologic logging and soil sample collection on 6, 7, and 10 April 2017. Bedrock was not encountered in the SI borings at Fire Station #3 (**Appendix A-3**). Soil boring 250-SB01 was positioned in

the gravel landscaping adjacent to the parking space of the P-23 fire truck, where the rupture of the pipe conveying AFFF occurred causing the 500-gallon release of AFFF in 2010. Soil borings 250-SB02 and 250-SB03 were positioned easterly of the road in potential accumulation areas of the natural downslope drainage from the vehicle staging area where the initial release occurred (OTIE, 2017a). Three soil samples were collected from each of the borings, for a total of nine samples. The rationale for the soil sampling depths is presented in **Table 3.15.1.1**.

Table 3.15.1.1 AFFF AREA 14 – Fire Station #3 (Building 250) Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
250-SB01	EFG948	0.5	Surface sampling
	EFG949		Field duplicate
	EFG950	7.5	Lithologic change (sand-silt interface)
	EFG951	25.0	Deep soil sample
250-SB02	EFG952	0.5	Surface sampling
	EFG953	7.5	Intermediate sample (similar depth as 250-SB01)
	EFG954	25.0	Deep soil sample
250-SB03	EFG955	0.5	Surface sampling
	EFG956	7.5	Lithologic change (Distinctive clean sand at similar depth as 250-SB01 and 250-SB02)
	EFG957	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-8**.

3.15.1.2 Groundwater Samples

Each of the three soil borings 250-SB01, 250-SB02, and 250-SB03 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary monitoring well construction information is presented in **Table 3.15.1.2**.

Table 3.15.1.2 AFFF AREA 14 – Fire Station #3 (Building 250) Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
250-SB01	EFG960	52.1	51.7-61.7	4/11/2017
	EFG961 (duplicate)			
250-SB02	EFG958	47.7	45.0-55.0	4/11/2017
250-SB03	EFG959	49.2	47.0-57.0	4/11/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-8**.

3.15.2 Analytical Results

3.15.2.1 Soil Results

Five of the nine soil samples collected from Fire Station #3 contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.15.2.1**.

Table 3.15.2.1 AFFF AREA 14 – Fire Station #3 (Building 250) Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
250-SB01	N	0.5	**230 J**	**32,000 J**	190 J
	FD		**330 J**	**17,000 J**	430 J
	N	7.5	1.5	90	5.0
	N	25.0	0.60 U	2.6	0.43 J
250-SB02	N	0.5	10	**2,300**	9.4 J
	N	7.5	80	**770**	440
	N	25.0	0.47 U	0.63 J	0.27 J
250-SB03	N	0.5	1.5	**430**	1.5
	N	7.5	6.1 J	**430**	10
	N	25.0	0.56 U	1.4	0.74 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-8 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.15.2.2 Groundwater Results

All three groundwater samples collected from Fire Station #3 contained at least one PFAS constituent with one concentration above the PAL. Groundwater results are presented in **Table 3.15.2.2**.

Table 3.15.2.2 AFFF AREA 14 – Fire Station #3 (Building 250) Groundwater Sample Results

Sample Location	Sample Type	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]			0.07	0.07	0.07	40
250-SB01	N	52.1	0.065	**3.5**	**3.565**	0.22
	FD	52.1	**0.079**	**3.6**	**3.679**	0.21
250-SB02	N	47.7	0.051	**1.9**	**1.951**	0.31
250-SB03	N	49.2	0.011 J	**0.36**	**0.371**	0.19

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-8 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.15.3 Conclusions

Concentrations of PFOS exceeded the PAL in two of nine soil samples, and all three groundwater samples collected at Fire Station #3. Concentrations of PFOA exceeded the PAL in the duplicate groundwater sample from 250-SB01 but not the normal sample. PFBS did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.16 AFFF Area 15 – Fire Station #5 (Building 4456)

3.16.1 Sample Locations and Rationale

Fire Station #5, located on North Base at the end of North Base Road (**Figures 2-1c and 3-9**), was constructed in 1954 and houses three fire engines that carry between 56 and 110 gallons of AFFF. While no spills or releases were reported for this area, the potential exists for minor drips and spills from the fire trucks onto the concrete outside the fire station.

3.16.1.1 Soil Samples

No soil borings were advanced in this AFFF area. The nearest unpaved area is topographically upslope from the Fire Station.

3.16.1.2 Groundwater Samples

Groundwater samples were collected from each of three (3) permanent monitoring wells, 240-MW22, 240-MW-31, and 240-MW37 (**Figure 3-15**), located hydraulically downgradient from the potential AFFF release area at Fire Station #5. Well construction information is presented in **Table 3.16.1.2**.

Table 3.16.1.2 AFFF AREA 15 – Fire Station #5 (Building 4456) Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
240-MW22	EMM483	101.50	92.0-112.0	5/31/2017
240-MW31	EMM482	101.35	95.0-115.0	5/31/2017
240-MW37	EMM481	101.11	96.0-116.0	5/31/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-9**.

3.16.2 Analytical Results

3.16.2.1 Soil Results

No soil samples were collected at Fire Station #5.

3.16.2.2 Groundwater Results

All three groundwater samples collected from Fire Station #5 contained at least one PFAS constituent with a concentration above the PAL. Groundwater results are presented in **Table 3.16.2.2**.

Table 3.16.2.2 AFFF AREA 15 – Fire Station #5 (Building 4456) Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
240-MW22	101.50	**2.0 J**	0.0083 J	**2.0083**	0.30 J
240-MW31	101.35	**9.2 J**	0.10 UJ	**9.2**	2.5 J
240-MW37	101.11	**25 J**	0.10 UJ	**25**	10 J

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.
Where PFOS or PFOA is non-detect (i.e. U or UJ-qualified), the sum of PFOS and PFOA concentrations (PFOA + PFOS) includes only the concentration of the detected compound.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-9 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.16.3 Conclusions

No soil samples were collected at Fire Station #5. Concentrations of PFOS did not exceed the PAL in any groundwater samples. Concentrations of PFOA exceeded the PAL in all three groundwater samples. PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area.

3.17 AFFF AREA 16 – FORMER FIRE STATION (BUILDING 1850)

3.17.1 Sample Locations and Rationale

The former fire station was constructed in 1954. It is located in the northern portion of Main Base, off Forbes Avenue and south of the NASA Complex boundary (**Figures 2-1a and 3-10**). When the fire station was active, it housed two or three fire engines that carried between 56 to 500 gallons of AFFF. The fire station was closed in the 1990s (CH2M HILL, 2015) and is currently occupied by Land Mobile Radio (LMR) CH2M HILL.

After nozzle spray tests, training exercises, and responses, the fire engines were washed indoors and outdoors. If the trucks were washed outdoors, AFFF residue would have run off east of the building into the surrounding unpaved surfaces. Also, fire trucks were used to wash down and re-service fire trucks on the concrete driveway/apron located east of the building. Large cracks were observed at the seam between the concrete and the asphalt on the driveway/apron providing a direct pathway to underlying soils and groundwater (OTIE, 2017a).

3.17.1.1 Soil Samples

Three soil borings, 1850-SB01, 1850-SB02, and 1850-SB03, were advanced to depths ranging from 3 to 25 ft bgs for lithologic logging and soil sample collection on 22 March 2017. Soil boring 1850-SB01 was located in a large crack observed in the concrete driveway/apron where vehicles were refilled and washed. Soil borings 1850-SB02 and 1850-SB03 were advanced using a hand auger at accumulation points in the permanent drainage features on either side of the driveway/apron, downslope from the vehicle refilling and wash down area. Three soil (soil and weathered bedrock) samples were collected from 1850-SB01 and two samples were collected from both 1850-SB02 and 1850-SB03, for a total of seven soil samples. A fourth soil boring (1850-SB04) was advanced to 40 ft bgs on 10 May 2017 to collect a groundwater sample because no water was present in the temporary well installed in boring 1850-SB01 . No soil samples were collected from this boring. Soil boring 1850-SB04 was located on the east side of Taxiway E on the edge of Rogers Dry Lake. Bedrock was encountered in the SI borings at the Former Fire Station at depths ranging from 2 to 7 ft bgs (**Appendix A-3**).

Table 3.17.1.1 AFFF AREA 16 – Former Fire Station (Building 1850) Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
1850-SB01	EDK779	0.5	Surface soil sample
	EDK780		Field duplicate
	EDK781	12.5	Soil (bedrock) sample, Lithologic change (weathered bedrock-bedrock interface) soil sample
	EDK782	25.0	Deep soil (bedrock) sample
1850-SB02	EDK783	0.5	Surface soil sample
	EDK784	3.0	Soil (bedrock) sample, Terminus of boring
1850-SB03	EDK785	0.5	Surface soil sample
	EDK786	4.0	Soil (bedrock) sample, Terminus of boring

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-10**.

3.17.1.2 Groundwater Samples

Two of four soil borings, 1850-SB01 and 1850-SB04, were converted to temporary monitoring wells; borings 1850-SB02 and 1850-SB03 were hand auger borings. Since temporary monitoring well 1850-SB01 (screened between 10 and 20 ft bgs) was dry, only one groundwater sample was collected at 1850-SB04. Temporary monitoring well construction information is presented in **Table 3.17.1.2**.

Table 3.17.1.2 AFFF AREA 16 – Former Fire Station (Building 1850) Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
1850-SB04	ELI202	12.8	10.0-40.0	5/19/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

The groundwater sample location and groundwater elevations are presented on **Figure 3-10**.

3.17.2 Analytical Results

3.17.2.1 Soil Results

Four of the seven (1850-SB01-0.5) soil samples collected from the Former Fire Station contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.17.2.1**.

Table 3.17.2.1 AFFF AREA 16 – Former Fire Station (Building 1850) Soil Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
1850-SB01	N	0.5	25	**3,300**	7.3 J
	FD		23	**2,600**	5.7 J
	N	12.5	45	5.9	5.8
	N	25.0	0.28 J	0.44 J	0.68 J
1850-SB02	N	0.5	0.86 J	82	0.33 J
	N	3.0	0.66 J	**170**	0.32 J
1850-SB03	N	0.5	5.9	**350**	1.2 J
	N	4.0	0.91 J	**170**	0.34 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
FD = field duplicate
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown

Figure 3-10 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.17.2.2 Groundwater Results

The groundwater sample collected from the Former Fire Station contained at least one PFAS constituent with a concentration above the PAL. Groundwater sample results are presented in **Table 3.17.2.2**.

Table 3.17.2.2 AFFF AREA 16 – Former Fire Station (Building 1850) Groundwater Sample Results

Sample Location	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]		0.07	0.07	0.07	40
1850-SB04	12.8	**7.0**	**3.4**	**10.4**	2.5

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-10 presents the groundwater sample location.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.17.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of seven soil samples (1850-SB01-0.5), and in the groundwater sampled collected at the Former Fire Station. Concentrations of PFOA exceeded the PAL in the groundwater sample, but not in soil samples. PFBS concentration did not exceed the PAL in any of the samples collected from this AFFF area.

3.18 AFFF AREA 17 – 1970 AERO SPACELINES 377 MGT

3.18.1 Sample Locations and Rationale

The Aero Spacelines 377MGT crash site is located at the southwest terminus of the Runway (**Figures 2-1b and 3-11**). The Aero Spacelines 377 MGT was a converted Boeing Stratoliner that crashed on 12 May 1970 during the sixth takeoff following the scheduled shutdown of engine number 1. The wind was reportedly approximately 200 degrees at approximately 10 knots (CH2M HILL, 2015). The Location of the crash site can be found in **Figure 2-1b**. AFFF was used to extinguish the fire. The AFFF was allowed to dissipate in place or run off into dirt area. There was potential for AFFF to migrate with the stormwater from rain events into the adjacent unpaved areas. Two storm drains were observed at either end of the runway (OTIE, 2017a).

3.18.1.1 Soil and Sediment Samples

Three soil borings 377MGT-SB01, 377MGT-SB02, and 377MGT-SB03 were advanced to depths ranging from 64 to 72 ft bgs for lithologic logging and soil sample collection on 13 and 14 May 2017. Soil borings 377MGT-SB01 and 377MGT-SB02 were located on the north end of the runway, in the downwind area of the reported 200 degree wind direction. Soil boring 377MGT-SB03 was located on the south end for gradient information and spatial coverage (OTIE, 2017a). Bedrock was not encountered in the SI borings (**Appendix A-3**). Three soil samples were collected from each of the borings, for a total of nine soil samples. One sediment sample, 377MGT-SS01, was collected at the discharge point from the drain system leading northward from the overrun area to unpaved soil. The rationale for the soil and sediment sampling depths is presented in **Table 3.18.1.1**.

Table 3.18.1.1 AFFF AREA 17 – Aero Spacelines 377 MGT Soil and Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
377MGT-SB01	EKF514	0.5	Surface sampling
	EKF515		Field duplicate
	EKF516	6.0	Lithologic change (leached secondary mineralization observed and similar depth as 377MGT-SB02 and 377MGT-SB03)
	EKF517	25.0	Deep soil sample
377MGT-SB02	EKF511	0.5	Surface sampling
	EKF512	6.0	Lithologic change (silty sand-clean sand interface)
	EKF513	25.0	Deep soil sample
377MGT-SB03	EKF518	0.5	Surface sampling
	EKF519	6.0	Intermediate sample (Sample depth similar to SB01 and SB02
	EKF520	25.0	Deep soil sample
377MGT-SS01	EKF524	0.5	Sediment sample
	EKF525		Field duplicate

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring and sediment sample locations are presented on **Figure 3-11**.

3.18.1.2 Groundwater Samples

Each of the three soil borings 377MGT-SB01, 377MGT-SB02, and 377MGT-SB03 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary monitoring well construction information is presented in **Table 3.18.1.2**.

Table 3.18.2.2 AFFF AREA 17 – Aero Spacelines 377 MGT Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
377MGT-SB01	EKF522	59.4	56.3-66.3	5/14/2017
377MGT-SB02	EKF521	58.3	61.7-71.7	5/13/2017
377MGT-SB03	EKF523	55.6	53.5-63.5	5/14/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-11**.

3.18.2 Analytical Results

3.18.2.1 Soil and Sediment Results

All nine soil samples and sediment sample collected from Aero Spacelines 377 MGT contained PFAS concentrations below the PALs.

Figure 3-11 presents the soil boring and sediment sample locations.

Table F-1 and F-3 in **Appendix F** presents all detected PFAS soil and sediment sample results, respectively.

3.18.2.2 Groundwater Results

All three groundwater samples collected from Aero Spacelines 377 MGT contained at least one PFAS constituent with a concentration above the PAL. Groundwater results are presented in **Table 3.18.2.2**.

Table 3.18.2.2 AFFF AREA 17 – Aero Spacelines 377 MGT Groundwater Sample Results

Sample Location	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]		0.07	0.07	0.07	40
377MGT-SB01	59.4	0.034	**0.34**	**0.374**	0.015 J
377MGT-SB02	58.3	0.020 J	**0.22**	**0.24**	0.010 U
377MGT-SB03	55.6	0.0086 J	**0.11**	**0.1186**	0.010 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-11 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.18.3 Conclusions

None of the soil or sediment samples collected from Aero Spacelines 377 MGT contained PFAS constituents with concentrations above their respective PAL. Concentrations of PFOS exceeded the PAL in all three groundwater samples collected. Concentrations of PFOA and PFBS did not exceed the PALs in any of the groundwater samples. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.19 AFFF AREA 18 – BOEING 720 CONTROLLED IMPACT DEMONSTRATION

3.19.1 Sample Locations and Rationale

On 1 December 1984 a Boeing 720 was used in a CID to test fuel fire retardant. The aircraft was controlled by remote and controlled aircraft purposefully crashed on upon landing on the east side of Rogers Dry Lake, and bursting into flames as part of the planned demonstration (CH2M HILL, 2015). The location area of the CID can be found in **Figures 2-1a and 3-12**. AFFF was used to extinguish the fire. The AFFF applied to the fire was allowed to dry on the surface of Rogers Dry Lake, and likely infiltrated into the subsurface surrounding the crash site (OTIE, 2017a).

3.19.1.1 Soil Samples

Three soil borings, B720-SB01, B720-SB02, and B720-SB03, were advanced to depths ranging from 105.5 to 115 ft bgs for lithologic logging and soil sample collection between 29 and 30 March and 4 April 2017. Soil borings B720-SB01, B720-SB02, and B720-SB03 were positioned to provide spatial coverage of the area, but biased towards locations of observed drainage channels or natural accumulation points distributed evenly across the SI area (OTIE, 2017a). Bedrock was not encountered in the SI borings (**Appendix A-3**). Three soil samples were collected from each of the boring, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.19.1.1**.

Table 3.19.1.1 AFFF AREA 18 – Boeing 720 Controlled Impact Demonstration Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
B720-SB01	EDL252	0.5	Surface sampling
	EDL253	12.5	Intermediate sample: Lithologic change (clay-silt interface)
	EDL254	25.0	Deep soil sample
B720-SB02	EEU716	0.5	Surface sampling
	EEU717	12.5	Midpoint (No lithologic change)
	EEU718	25.0	Deep soil sample
B720-SB03	EDL255	0.5	Surface sampling
	EDL256	12.5	Midpoint (No lithologic change)
	EDL257	25	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-12**.

3.19.1.2 Groundwater Samples

Each of the three soil borings B720-SB01, B720-SB02, and B720-SB03 were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary monitoring well construction information is presented in **Table 3.19.1.2**.

Table 3.19.1.2 AFFF AREA 18 – Boeing 720 Controlled Impact Demonstration Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
B720-SB01	EEU719	98.0	96.0-106.0	4/5/2017
B720-SB02	EEU720	97.7	94.7-104.7	4/5/2017
B720-SB03	EEU721	97.4	94.7-105.7	4/5/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-12**.

3.19.2 Analytical Results

3.19.2.1 Soil Results

PFAS concentrations detected in nine soil samples collected from Boeing 720 CID were below the PALs.

Figure 3-12 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.19.2.2 Groundwater Results

The three groundwater samples collected from Boeing 720 CID contained PFAS concentrations below the PALs.

Figure 3-12 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.19.3 Conclusions

None of the samples collected from Boeing 720 CID contained PFAS constituents with concentrations above their respective PALs. Laboratory results and signed chain-of-custodies are provided in **Appendix B**.

3.20 AFFF AREA 19 – FORMER MAIN BASE SEWAGE TREATMENT PLANT

3.20.1 Sample Locations and Rationale

The FMBTP is located approximately 2 miles southeast of the intersection of Jones Road and Lancaster Boulevard and west of County Road (**Figures 2-1b and 3-13**). The STP included a wastewater pretreatment system, clarifier, sludge digesters, sludge drying beds, and evaporation ponds. The plant was constructed in the late 1940s and early 1950s; the STP was designed to manage domestic wastewater, wastewater from an OWS, and storm and floor drains. The FMBTP potentially received wastewater from fire stations and hangars containing AFFF. Therefore, three soil borings (FMBTP-SB01 through FMBTP SB03) were drilled were triangulated for spatial coverage within the northern sludge unlined evaporation pond.

3.20.1.1 Soil Samples

Three soil borings, FMBTP-SB01, FMBTP-SB02, and FMBTP-SB03, were all advanced to a depth of 25 ft bgs for lithologic logging and soil sample collection on 26 April 2017. All three soil borings were triangulated for spatial coverage within the northern sludge unlined evaporation pond. Bedrock was not encountered in the SI borings (**Appendix A-3**). Three soil samples were collected from each of the borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.20.1.1**.

Table 3.20.1.1 AFFF AREA 19 – Former Main Base Sewage Treatment Plant Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
FMBTP-SB01	EH199	0.5	Surface sampling
	EH200	12.5	Midpoint (No lithologic change)
	EH201	25.0	Deep soil sample
FMBTP-SB02	EH202	0.5	Surface sampling
	EH203	12.5	Midpoint
	EH204	25.0	Deep soil sample
FMBTP-SB03	EH205	0.5	Surface sampling
	EH206	12.5	Midpoint
	EH207	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-13**.

3.20.1.2 Groundwater Samples

The depth to groundwater in this location was reported to be greater than the maximum scoped drilling depth of 100 feet, therefore none of the soil borings were converted into temporary monitoring wells. Three permanent wells, 29-MW07, 29-MW09, and 110-MW01, were sampled instead. One groundwater sample was collected at each monitoring well. The three monitoring wells were located in the vicinity and potentially downgradient of the soil boring locations. Monitoring well construction information is presented in **Table 3.20.1.2** (OTIE, 2017a).

Table 3.20.1.2 AFFF AREA 19 – Former Main Base Sewage Treatment Plant Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
29-MW07	EEU670	104.97	95.0-115.0	4/4/2017
29-MW09	EEU671	113.76	99.5-115.5	4/5/2017
110-MW01	EEU672	108.99	96.5-116.5	4/4/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-13**.

3.20.2 Analytical Results

3.20.2.1 Soil Results

One of the nine soil samples collected from FMBTP contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.20.2.1**.

Table 3.20.2.1 AFFF AREA 19 – Former Main Base Sewage Treatment Plant Soil Sample Results

Sample Location	Sample Depth (ft bgs)	Sample Type	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
FMBTP-SB01	0.5	N	7.1	13	0.25 J
	12.5	N	0.33 J	0.32 J	0.50 U
	25.0	N	0.65 U	0.65 U	0.65 U
FMBTP-SB02	0.5	N	4.7	120	0.65 U
	12.5	N	0.50 U	0.50 U	0.50 U
	25.0	N	0.62 U	0.62 U	0.62 U
FMBTP-SB03	0.5	N	11	**300**	0.64 U
	12.5	N	0.56 U	0.56 U	0.56 U
	25.0	N	0.72 U	0.72 U	0.72 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-13 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.20.2.2 Groundwater Results

The three groundwater samples collected from FMBTP contained PFAS concentrations below the PALs.

Figure 3-13 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.20.3 Conclusions

None of the samples collected from FMBTP contained PFAS constituents with concentrations above their respective PALs. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.21 AFFF Area 20 – Current Main Base Sewage Treatment Plant

3.21.1 Sample Locations and Rationale

The CMBTP is located approximately 1.5 miles east of the intersection of Lancaster Boulevard and Work Road (**Figures 2-1b and 3-14**). Constructed in the mid-1990s, the tertiary STP includes biological treatment, clarifier pond, chlorine contact, sludge dewatering plant, and a concrete sludge drying pad. The CMBTP manages domestic wastewater, wastewater from OWS, and floor drains from North Base, Main Base, and South Base. Muroc Golf Course (Golf Course Pond) is the primary recipient of treated wastewater from the plant and used for irrigation. The baseball fields and the grass surrounding the Community Center are the other recipients.

The WDR issued for Edwards AFB, Board Order No. 6-86-54, indicate that wastewater containing AFFF from the Former FTA was authorized to discharge to the Edwards Main Base AFB Wastewater Treatment Plant (LRWQCB 1986).

The Current Main Base Evaporation Ponds (identified as Ponds 3 through 7) were constructed of native on-site playa materials in 1986 (LRWQCB 1994). Recycled water use from the STP was authorized in 1994 (LRWQCB 1994). Therefore, wastewater containing AFFF may have been discharged to Evaporation Ponds 3 through 7 between 1986 and 1994.

3.21.1.1 Sediment Samples

No soil borings were advanced in this AFFF area. Two sediment samples, CMBTP-SS01 and CMBTP-SS02, were collected within the northern boundaries of Evaporation Ponds 3 and 4.

Table 3.21.1.1 AFFF AREA 20 – Current Main Base Sewage Treatment Plant Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
CMBTP-SS01	EIJ281	0.5	Sediment sample
CMBTP-SS02	EIJ282	0.5	Sediment sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Sediment sample locations are presented on **Figure 3-14**.

3.21.1.2 Groundwater Samples

Three permanent monitoring wells, 110-MW02, 110-MW03, and 110-MW04, were sampled in the absence of temporary monitoring wells. One groundwater sample was collected at each monitoring well. Monitoring wells 110-MW02, 110-MW03, and 110-MW04 are located immediately adjacent to and upgradient of CMBTP evaporation ponds.

Table 3.21.1.2 AFFF AREA 20 – Current Main Base Sewage Treatment Plant Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
110-MW02	EET637	105.50	91.5-111.5	4/5/2017
	EET638 (duplicate)			
110-MW03A	EET639	103.27	90.5-110.5	4/5/2017
110-MW04	EET640	102.39	89.5-110.0	4/5/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-14**.

3.21.2 Analytical Results

3.21.2.1 Sediment Results

PFAS concentrations detected in both sediment samples collected from CMBTP were below the PALs.

Figure 3-14 presents the sediment sample locations.

Table F-3 in **Appendix F** presents all detected PFAS sediment sample results.

3.21.2.2 Groundwater Results

The three groundwater samples collected from CMBTP contained PFAS concentrations below the PALs.

Figure 3-14 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.21.3 Conclusions

None of the samples collected from CMBTP contained PFAS constituents with concentrations above their respective PALs. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.22 AFFF AREA 21 – FORMER NOZZLE SPRAY TEST AREA

3.22.1 Sample Locations and Rationale

In the 1980s, fire engines from Fire Station 1 were tested to ensure proper functioning of vehicles and equipment (CH2M HILL, 2015). A weekly nozzle spray test of each fire engine was conducted on a dirt field located approximately 400 feet east of the control tower and 1,100 feet east-northeast of Fire Station 1 (**Figures 2-1a and 3-15**). Approximately 10 gallons of AFFF and water were released during each test. The AFFF was left in place and allowed to infiltrate into the ground.

3.22.1.1 Soil Samples

Three soil borings, FNSTA-SB01, FNSTA-SB02, and FNSTA-SB03 were advanced to depths ranging from 54 to 60 ft bgs for lithologic logging and soil sample collection on 1 and 2 May 2017. The three soil borings were positioned in an approximate triangle for spatial coverage in the area where the AFFF was sprayed. Boring FNSTA-SB01 was positioned at the lowest point of the elevation near the tree located at the northern SI area boundary (OTIE, 2017a). Bedrock was encountered in the SI borings at depths ranging from 39 ft bgs (FNSTA-SB03) to 45.5 ft bgs (FNSTA-SB02) (**Appendix A-3**). Three samples were collected from each of the borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.22.1.1**.

Table 3.22.1.1 AFFF AREA 21 – Former Nozzle Spray Test Area Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
FNSTA-SB01	EIJ351	0.5	Surface sampling
	EIJ352	12.5	Midpoint (No lithologic change)
	EIJ353	25.0	Deep soil sample
FNSTA-SB02	EIJ354	0.5	Surface sampling
	EIJ355	12.5	Midpoint (No lithologic change)
	EIJ356	25.0	Deep soil sample
FNSTA-SB03	EIJ357	0.5	Surface sampling
	EIJ358	12.5	Midpoint
	EIJ359	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-15**.

3.22.1.2 Groundwater Samples

Each of the three soil borings, FNSTA-SB01, FNSTA-SB02, and FNSTA-SB03, were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary monitoring well construction information is presented in **Table 3.22.1.2**.

Table 3.22.1.2 AFFF AREA 21 – Former Nozzle Spray Test Area Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
FNSTA-SB01	EIJ360	44.5	46.0-56.0	5/4/2017
FNSTA-SB02	EIJ362	44.6	43.5-53.5	5/4/2017
FNSTA-SB03	EIJ377	44.3	44.0-54.0	5/4/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-15**.

3.22.2 Analytical Results

3.22.2.1 Soil Results

Four of the nine soil samples collected from FNSTA (FNSTA-SB02-0.5) contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.22.2.1**.

Table 3.22.2.1 AFFF AREA 21 – Former Nozzle Spray Test Area Soil Sample Results

Sample Location	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]		126	126	130,000
FNSTA-SB01	0.5	5.9 U	**650**	5.9 U
	12.5	0.62 U	1.1	0.84 J
	25.0	0.47 U	0.27 J	1.0
FNSTA-SB02	0.5	27	**2,200**	5.8 U
	12.5	13	45	7.7
	25.0	0.49 U	0.22 J	3.2
FNSTA-SB03	0.5	36	**710**	5.6 U
	12.5	3.6 J	**600**	1.9 J
	25.0	8.9	110	2.2

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-15 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.22.2.2 Groundwater Results

All three groundwater samples collected from the FNSTA contained at least one PFAS constituent with concentrations above the PAL. Groundwater sample results are presented in **Table 3.22.2.2**.

Table 3.22.2.2 AFFF AREA 21 – Former Nozzle Spray Test Area Groundwater Sample Results

Sample Location	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]		0.07	0.07	0.07	40
FNSTA-SB01	44.5	**0.11**	**0.78**	**0.89**	0.36
FNSTA-SB02	44.6	**0.50**	**4.9**	**5.4**	0.59
FNSTA-SB03	44.3	**0.58**	**11**	**11.58**	0.41

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bold**ed** = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-15 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.22.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of nine soil samples (FNSTA-SB02-0.5), and all 3 groundwater samples collected from the FNSTA. Concentrations of PFOA exceeded the PAL in all three groundwater samples, but not in soil samples. PFBS did not exceed the PAL in any samples collected from this AFFF area. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.23 AFFF Area 22 – Refractometer Spray Test Area

3.23.1 Sample Locations and Rationale

The Refractometer Spray Test Area encompasses approximately 200 feet of an abandoned runway. The Edwards AFB Fire Department performs annual refractometers tests on an abandoned taxiway approximately 1,000 feet south of the west end of the South Base runway (**Figures 2-1b and 3-16**). Fire engines are parked facing southeast and spray onto the taxiway, which is marked in 50-foot increments with cones and paint from the spray point to measure the spray distance and pattern (OTIE, 2017a). Each test used approximately 25 gallons of AFFF and water. The majority of the runoff occurs between the 100 and 200 foot marks. AFFF was allowed to dissipate in place or run off into dirt areas, seeping through the cracks of the weathered taxiway or flowed into the dirt areas on either side of the taxiway (OTIE, 2017a).

3.23.1.1 Soil Samples

Three soil borings, RSTA-SB01, RSTA-SB02, and RSTA-SB03, were advanced to depths of 65 and 69 ft bgs for lithologic logging and soil sample collection on 11 and 12 April 2017. Soil borings RSTA-SB01 and RSTA-SB02 were positioned at distance markers approximately 130 ft and 180 ft from initial spray point, in large cracks observed in the asphalt. Soil boring RSTA-SB03 was positioned in the unpaved area

downslope and southwest of the pavement in a potential accumulation area in the direction of the primary flow of runoff, as indicated by a fire department representative (OTIE, 2017a). Bedrock was not encountered in the SI borings at the Refractometer Spray Test Area (**Appendix A-3**). Three soil samples were collected from each of the borings, for a total of nine soil samples. The rationale for the soil sampling depths is presented in **Table 3.23.1.1**.

Table 3.23.1.1 AFFF AREA 22 – Refractometer Spray Test Area Soil Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
RSTA-SB01	EFG977	0.5	Surface sampling
	EFG978	6.5	Lithologic change (Fill-native contact)
	EFG979	25.0	Deep soil sample
RSTA-SB02	EFG974	0.5	Surface sampling
	EFG975	6.5	Lithologic change (Fill-native contact)
	EFG976	25.0	Deep soil sample
RSTA-SB03	EFG980	0.5	Surface sampling
	EFG981	5.5	Lithologic change (Fill-native contact)
	EGG986	25.0	Deep soil sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring locations are presented on **Figure 3-16**.

3.23.1.2 Groundwater Samples

Each of the three soil borings, RSTA-SB-01, RSTA-SB02, and RSTA-SB03, were converted to temporary monitoring wells. One groundwater sample was collected from each temporary monitoring well. Temporary monitoring well construction information is presented in **Table 3.23.1.2**.

Table 3.23.1.2 AFFF AREA 22 – Refractometer Spray Test Area Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
RSTA-SB01	EFG983	54.2	52.2-62.2	4/13/2017
RSTA-SB02	EFG982	54.0	53.0-63.0	4/12/2017
RSTA-SB03	EFG984	51.8	52.0-62.0	4/13/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID – identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-16**.

3.23.2 Analytical Results

3.23.2.1 Soil Results

Four of the nine soil samples collected from the RSTA (RSTA-SB01-0.5) contained PFAS concentrations above the PALs. Soil sample results are presented in **Table 3.23.2.1**.

Table 3.23.2.1 AFFF AREA 22 – Refractometer Spray Test Area Soil Sample Results

Sample Location	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]		126	126	130,000
RSTA-SB01	0.5	28 J	**5,900**	50 U
	6.5	14	**200**	27
	25.0	0.66 U	0.46 J	0.66 U
RSTA-SB02	0.5	16	**660**	6.3 J
	6.5	0.66 U	7.9	0.90 J
	25.0	0.60 U	0.60 U	0.60 U
RSTA-SB03	0.5	53	**980**	5.4 J
	5.5	0.55 U	5.8	0.55 U
	25.0	0.66 U	0.35 J	0.66 U

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-16 presents the soil boring locations.

Table F-1 in **Appendix F** presents all detected PFAS soil results.

3.23.2.2 Groundwater Results

All three groundwater samples collected from the RSTA contained at least one PFAS constituent with concentrations above the PAL. Groundwater sample results are presented in **Table 3.23.2.2**.

Table 3.23.2.2 AFFF AREA 22 – Refractometer Spray Test Area Groundwater Sample Results

Sample Location	DTW (ft btoc)	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[1]		0.07	0.07	0.07	40
RSTA-SB01	54.2	0.047 J	**1.6 J**	**1.647 J**	0.030
RSTA-SB02	54.0	0.014 J	**0.21 J**	**0.224 J**	0.011 J
RSTA-SB03	51.8	0.022 J	**0.49 J**	**0.512 J**	0.0063 J

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-16 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.23.3 Conclusions

Concentrations of PFOS exceeded the PAL in one of nine soil samples (RSTA-SB01-0.5), and in all three groundwater samples collected at the Refractometer Spray Test Area. PFOA and PFBS concentrations did not exceed the PAL in any samples collected from this AFFF area. Laboratory and chain-of-custodies are provided in **Appendix B**.

3.24 AFFF AREA 23 – MUROC GOLF COURSE

3.24.1 Sample Locations and Rationale

Muroc Golf Course is located in the southern portion of the house area, northwest of Rosamond Boulevard and east of Forbes Avenue (**Figures 2-1a and 3-17**). Since the mid-1990s, treated wastewater from the CMBTP has been pumped directly to the unlined Muroc Lake, located in the center of the golf course. Treated wastewater from the lake is used for irrigation during the dry months (CH2M HILL, 2015). Muroc Golf Course receives treated wastewater from current Main Base STP; this treated wastewater potentially contains AFFF. Water from the plant is pumped into a storage tank near the golf course, and then released into Muroc Lake, also known as Golf Course Pond (OTIE 2017). Therefore, three sediment samples were collected from the bottom of Golf Course Pond as far into the pond as feasible along the northeast trending side of the pond to determine a potential profile of sediment accumulation from the outfall pipe. Sediment locations were not placed in the center of the pond due to logistical and safety constraints.

3.24.1.1 Sediment Samples

No soil borings were advanced in this AFFF area. Three sediment samples, MGC-SS01, MGC-SS02, and MGC-SS03, were collected from the bottom of golf course pond, Muroc Lake. Sediment sample

MGC-SS01 was collected from front of the outfall where the pipe from the tank filled with reclaimed water from the Sewage Treatment System fills the pond.

Table 3.24.1.1 AFFF AREA 23 – Muroc Golf Course Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
MGC-SS01	EMM565	0.5	Sediment sample
MGC-SS02	EMM564	0.5	Sediment sample
MGC-SS03	EMM563	0.5	Sediment sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Sediment sample locations are presented on **Figure 3-17**.

3.24.1.2 Groundwater Samples

One permanent monitoring well, 259-MW01, was sampled in the absence of temporary monitoring wells. Monitoring well 259-MW01 is located downgradient from the Muroc Golf Course pond. Monitoring well construction information is presented in **Table 3.24.1.2**.

Table 3.24.1.2 AFFF AREA 23 – Muroc Golf Course Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
259-MW01	EMM561	10.69	5.0-20.0	5/25/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

The groundwater sample location and groundwater elevation are presented on **Figure 3-17**.

3.24.2 Analytical Results

3.24.2.1 Sediment Results

PFAS concentrations detected in the three sediment samples collected from Muroc Golf Course were below the PALs.

Figure 3-17 presents the sediment sample locations.

Table F-3 in **Appendix F** presents all detected PFAS sediment sample results.

3.24.2.2 Groundwater Results

The groundwater sample collected from Muroc Gold Course contained PFAS concentrations below the PALs; however, the sum of PFOA and PFOS exceeded the PAL.

Table 3.24.2.2 AFFF AREA 23 – Muroc Golf Course Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
259-MW01	10.69	0.063 J	0.018 J	**0.081**	0.21 J

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-17 presents the groundwater sample location.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.24.3 Conclusions

Individual concentrations of PFOS and PFOA in groundwater did not exceed their respective PAL; however, the sum of PFOA and PFOS concentrations (0.081 µg/L) is greater than the PAL of 0.07 µg/L, exceeding the PAL. Laboratory results are provided in **Appendix B** and signed chain-of-custodies are provided in **Appendix A-5**.

3.25 AFFF AREA 24 – PAD 7 OUTFALL AND STORMWATER DETENTION POND

3.25.1 Sample Locations and Rationale

Most of the surface runoff in the southern portion of Main Base is discharged to an outfall at Pad 7 (**Figures 2-1a and 3-18**). Historically, the water would flow from the outfall along an unlined drainage ditch to a large unlined stormwater detention pond. Some stretches of the drainage ditch are heavily vegetated, the vegetation has been periodically removed in the past (CH2M HILL, 2015). Releases of AFFF from the hangars adjacent to the Flightline, such as from Hangar Buildings 1600, 1624, and 1608, as well as from the nozzle spray test areas near Fire Station 1 would have entered storm drains and conveyed to the Pad 7 outfall channel and detention pond.

3.25.1.1 Soil and Sediment Samples

One soil boring, PAD7-SB01, was advanced to a depth of 49.5 ft bgs for lithologic logging and soil sample collection on 28 April 2017. Soil boring PAD7-SB01 was positioned at the terminus of the new drainage channel where it enters Rogers Dry Lake (OTIE, 2017a). Bedrock was not encountered in PAD7-SB01 (**Appendix A-3**). Three soil samples were collected from this boring. Four sediment samples, PAD7-SS01, PAD7-SS02, PAD7-SS03, and PAD7-SS04, were also collected at this AFFF area. Sediment sample PAD7-SS01 was collected at the westernmost drainage outfall nearest to the hangar facilities. Three sediment samples, PAD 7-SS01, PAD7-SS02, and PAD7-SS03, were collected from the main PAD 7 Outfall Detention Pond east of the hangar facilities.

Table 3.25.1.1 AFFF AREA 24 – Pad 7 Outfall and Stormwater Detention Pond Soil and Sediment Samples

Sample Location	Sample ID	Depth (ft bgs)	Reasoning
PAD7-SB01	EIJ262	0.5	Surface sampling
	EIJ263	12.5	Midpoint
	EIJ264	25.0	Deep soil sample
PAD7-SS01	ELH483	0.5	Sediment sample
PAD7-SS02	EIJ265	0.5	Sediment sample
PAD7-SS03	EIJ266	0.5	Sediment sample
PAD7-SS04	EIJ267	0.5	Sediment sample

DEFINITIONS:
bgs = below ground surface
ft = feet
ID = identification

Soil boring and sediment sample locations are presented on **Figure 3-18**.

3.25.1.2 Groundwater Samples

Soil boring PAD7-SB01 was converted to a temporary monitoring well. One groundwater sample was collected from this temporary monitoring well. Four permanent wells, 11-MW16, 19-MW06, 19-MW14, and 19-MW15, were also sampled. Monitoring well 11-MW16 is located hydraulically downgradient of potential release area Pad 7 Outfall. Monitoring wells 19-MW06 and 19-MW14 are located hydraulically downgradient of potential release area Pad 7 Outfall and Stormwater Detention Pod. Monitoring wells 19-MW15 is located near potential release area Pad 7 Outfall and Stormwater Detention Pond.

Table 3.25.1.2 AFFF AREA 24 – Pad 7 Outfall and Stormwater Detention Pond Well Information

Sample Location	Sample ID	DTW (ft btoc)[1]	Screened Interval (ft btoc)	Sample Date
PAD7-SB01	EIJ268	39.1	39.0-49.0	5/4/2017
11-MW16	EJE943	36.73	24.5-44.5	5/5/2017
19-MW06	ELH480	38.71	23.5-43.5	5/24/2017
19-MW14	ELH482	41.96	50.0-60.0	5/24/2017
19-MW15	ELH481	37.70	45.0-55.0	5/24/2017

NOTE:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
ID = identification

Groundwater sample locations and groundwater elevations are presented on **Figure 3-18**.

3.25.2 Analytical Results

3.25.2.1 Soil and Sediment Results

One of the three soil samples and three of the four sediment samples collected from Pad 7 Outfall and Stormwater Detention Pond contained PFAS concentrations above the PALs. Soil and sediment sample results are presented in **Table 3.25.2.1**.

Table 3.25.2.1 AFFF AREA 24 – Pad 7 Outfall and Stormwater Detention Pond Soil and Sediment Sample Results

Sample Location	Sample Type	Sample Depth (ft bgs)	PFOA	PFOS	PFBS
PAL[1]			126	126	130,000
PAD7-SB01	N	0.5	10	**140**	2.8
	N	12.5	0.38 J	0.52 U	0.30 J
	N	25.0	9.7	2.9	0.24 J
PAD7-SS01	N	0.5	6.6	56	0.97
PAD7-SS02	N	0.5	4.6	**880**	0.58 J
PAD7-SS03	N	0.5	13	**970**	0.31 J
PAD7-SS04	N	0.5	**240**	**13,000**	14

NOTES:
[1]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PAL
Concentrations are presented in micrograms per kilogram.
For analyte abbreviations refer to **Appendix F.**

DEFINITIONS:
bgs = below ground surface
ft = feet
N = normal
PAL = Project Action Limit
J = Estimated detect at concentration shown
U = non-detect at reporting limit shown

Figure 3-17 presents the soil boring and sediment sample locations.

Tables F-1 and F-3 in **Appendix F** presents all detected PFAS soil and sediment sample results, respectively.

3.25.2.2 Groundwater Results

All five groundwater samples collected from the Pad 7 Outfall and Stormwater Detention Pond contained PFOS and PFOA at concentrations above the PAL. Groundwater sample results are presented in **Table 3.25.2.2**.

Table 3.25.2.2 AFFF AREA 24 – Pad 7 Outfall and Stormwater Detention Pond Groundwater Sample Results

Sample Location	DTW (ft btoc)[1]	PFOA	PFOS	PFOA+PFOS	PFBS
PAL[2]		0.07	0.07	0.07	40
PAD7-SB01	39.1	**3.2**	**5.5**	**8.7**	4.1
11-MW16	36.73	**1.7**	**1.2**	**2.9**	1.4
19-MW06	38.71	**2.0**	**4.1**	**6.1**	3.1
19-MW14	41.96	**0.69**	**1.5**	**2.19**	0.37
19-MW15	37.70	**0.86**	**1.2**	**2.06**	0.2

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
[2]PALs are explained in **Section 1.1** of this report.
Bolded = Concentration exceeds the PALs
Concentrations are presented in micrograms per liter.

DEFINITIONS:
btoc = below top of casing
DTW = depth to water
ft = feet
PAL = Project Action Limit
J = Estimated detect at concentration shown

Figure 3-18 presents the groundwater sample locations.

Table F-2 in **Appendix F** presents all PFAS groundwater results.

3.25.3 Conclusions

None of the soil samples collected from Pad 7 Outfall and Stormwater Detention Pond contained PFAS constituents with concentrations above their respective PALs. Concentrations of PFOS exceeded the PAL in one of four sediment samples (PAD7-SS04), and in all five groundwater samples. Concentrations of PFOA exceeded the PAL in all four groundwater samples, but not in the sediment samples. PFBS did not exceed the PAL in any samples collected from this AFFF

This page intentionally left blank.

4.0 MIGRATION PATHWAYS AND EXPOSURE TARGETS

Migration pathways and exposure targets were evaluated in the PA Report (CH2M HILL, 2015) in accordance with the Guidance for Performing PAs under CERCLA (EPA, 1991) and are presented below in accordance with the Guidance for Performing SIs under CERCLA (EPA, 1992). Some additional information was obtained from the Base during the preparation of this SI Report.

4.1 GROUNDWATER MIGRATION PATHWAY

4.1.1 Local Hydrogeologic Setting

Information regarding the hydrogeology and water supply at Edwards AFB is presented in the PA Report for Perfluorinated Compounds (CH2M HILL, 2015), and the information is summarized below.

Edwards AFB is situated in the Antelope Valley within the Mojave Desert section of the Basin and Range Physiographic Province, bounded to the northwest by the Tehachapi Mountains and to the south-southwest by the San Gabriel Mountains. The Antelope Valley is one of the largest closed groundwater basins in Southern California. The Antelope Valley Groundwater Basin is subdivided into a series of 12 subbasins that function as interconnected but hydrogeologically distinct zones based on faults and other structural features. The unconsolidated deposits that underlie the Antelope Valley and comprise the aquifer formations include younger and older alluvium, older fan deposits, windblown dune sand, and playa deposits (Duell, Lowell F.W. Jr, 1987). The older alluvium of Pleistocene age is the principal aquifer and underlies most of the valley floor at depth. The younger alluvium of Holocene age remains unweathered near the hills and consists predominantly of poorly sorted gravel and sand. The thickness of the younger alluvium is less than 100 feet.

Edwards AFB lies within the Antelope Valley Watershed Basin, which has no outlet. Rainfall, which is the primary source of surface water runoff, averages approximately 5 inches per year. Stormwater drainage flows toward the three dry lakebeds of Rosamond, Buckhorn, and Rogers Dry Lakes. Water reaching these dry lakes is trapped and eventually evaporates. No consistent overland or channel flow erosion patterns or surface waterbodies have been identified (CH2M HILLCH2M HILL, 2015).

Edwards AFB overlies portions of three subbasins of the Antelope Valley Groundwater Basin: the North Muroc, Lancaster, and Gloster subbasins. All of the AFFF SI Areas and well fields supplying drinking water to the Base are in the Lancaster subbasin. The Lancaster and North Muroc subbasins are separated by a transient groundwater divide. This transient groundwater divide is the result of pumping groundwater from the South Base well field at Edwards AFB.

The North Muroc subbasin is the smaller of the two primary groundwater subbasins supplying water to Edwards AFB, covering an area of approximately 80 square miles. The known thickness of unconsolidated deposits in this subbasin is at least 500 feet. Groundwater primarily occurs in an unconfined condition in the older alluvium unit. Groundwater recharge in the North Muroc subbasin from the highlands is relatively minor and is less than the current withdrawals.

The Lancaster subbasin is the largest in the Antelope Valley, covering an area of approximately 800 square miles. The thickness of unconsolidated deposits in this subbasin can exceed 1,500 feet. The two major water-bearing units in the Lancaster subbasin, the principal and the deep aquifer, are separated by a series of overlapping lacustrine layers which are mostly clay (Duell, Lowell F.W. Jr, 1987). Previously, groundwater has been shown to move downward from the principal aquifer into the deep aquifer along the west and south edges of the lacustrine deposits, and upward from the deep aquifer

into the principal aquifer in areas of heavy pumping from the principal aquifer (Duell, Lowell F.W. Jr, 1987).

Recharge to the Lancaster subbasin is primarily through infiltration of runoff water from the highlands and onto the basin margins. The playa areas are characterized by low permeability and fine-grained sediments and therefore do not provide substantial infiltration. Base groundwater flow directions in the Lancaster subbasin are heavily influenced by pumping within the South Base water supply well field. Groundwater flows south from about the location of the old South Base water supply well field toward the cone of depression at the current South Base water supply well field. Groundwater flows north from a high water table area located south of the Los Angeles-Kern County line toward the South Base well field. Groundwater also flows away from the Rosamond- Bissell and Hi Vista areas. Depth to water measured during drilling activities conducted for this SI ranged from approximately 7 to 98 ft bgs.

Drinking water sources at Edwards AFB west of Rogers Dry Lake (North Base, Main Base, and South Base) are from surface water supplied by the Antelope Valley East Kern Water Agency, supplemented by the South Base well field. Currently, groundwater from nine on-Base supply wells is pumped from the Antelope Valley aquifer (Edwards AFB, 2014a) with approximately 300- to 500-feet screens and total depths ranging from approximately 580 to 840 feet bgs (CH2M HILL, 2015). The groundwater is pumped to a booster station where it is chlorinated. The source of water from the Antelope Valley East Kern Water Agency is primarily from the California Aqueduct and is supplied in finished drinking water quality from this agency (Edwards AFB, 2014a). The two water sources are blended to ensure the supply meets all drinking water requirements and the water is stored in large tanks (up to 1 million gallons) near the Housing Area (west of Main Base).

The drinking water source at the AFRL is from the Lower well field located approximately 8 miles southwest of ERP Site 26 (Former AFRL FTA). Groundwater from three of the four supply wells is currently pumped from the Antelope Valley aquifer (Edwards AFB, 2014b) with approximately 400-foot screens and total depths ranging from approximately 620 to 730 feet bgs (CH2M HILL, 2015). Groundwater is pumped to a booster station where it is chlorinated (Edwards AFB, 2014b). The Lower well field draws groundwater from the middle aquifer of the Lancaster subbasin.

4.1.2 Actual or Potential Releases to Groundwater

The severity of PFAS impacts at Edwards AFB varies by type of AFFF Area. The AFFF Areas where PFAS concentrations exceed the PALs have been defined below as "*Actual AFFF Contamination Areas*" (AAA), and the AFFF Areas where no PFAS concentrations exceed the PALs have been defined below as "*Potential AFFF Contamination Areas*" (PAAs).

PFAS concentrations detected in groundwater samples from 21 of the 24 potential AFFF release areas were above the PALs. Below is a summary of the Actual and Potential PFAS-impacted Areas for groundwater evaluated during this site inspection:

- **AFFF Area 1 – AAA ERP Site 14 (Former/Current FTA)** – PFOS, PFOA, and/or the sum of PFOA and PFOS concentrations exceeded the PAL in four groundwater samples;
- **AFFF Area 2 – AAA ERP Site 26(Former AFRL FTA)** – PFOA concentrations exceeded the PAL in four groundwater samples, while PFOS concentrations exceeded the PAL in three groundwater samples;

- **AFFF Area 3 – AAA Hangar Buildings 151/160** – PFOS concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 4 – AAA Hangar Building 1600** – PFOS concentrations exceeded the PAL in three groundwater samples, while PFOA concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 5 – AAA Hangar Building 1608** – PFOS concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 6 – AAA Hangar Building 1624** – PFOS and PFOA concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 7 – AAA Hangar Building 1870** – PFOS and PFOA concentrations exceeded the PAL in two groundwater samples and PFBS concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 8 – AAA Hangar Building 1874** – PFOA concentrations exceeded the PAL in four groundwater samples, while PFOS concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 9 – AAA Hangar Building 1881** – PFOA concentrations exceeded the PAL in four groundwater samples, while PFOS concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 10 – AAA Hangar Building 4801** – PFOS and PFOA concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 11 – AAA Hangar Building 4802** – PFOS and PFOA concentrations exceeded the PAL in two groundwater samples;
- **AFFF Area 12 – AAA Hangar Building 4826** - PFOA concentrations exceeded the PAL in two groundwater samples, while PFOS concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 13 – AAA Hangar Building 4840** – PFOS and PFOA concentrations exceeded the PAL in four groundwater samples;
- **AFFF Area 14 – AAA Fire Station #3 (Building 250)** - PFOS concentrations exceeded the PAL in three groundwater samples and PFOA exceeded the PAL in one duplicate sample;
- **AFFF Area 15 – AAA Fire Station #5 (Building 4456)** – PFOA concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 16 – AAA Former Fire Station (Building 1850)** – PFOS and PFOA concentrations exceeded the PAL in one groundwater sample;
- **AFFF Area 17 – AAA 1970 Aero Spacelines 377MGT** – PFOS concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 18 – PAA 1984 Boeing 720 CID** – PFAS concentrations in the groundwater sample collected from this area were below the PALs;

- **AFFF Area 19 – AAA Former Main Base Sewage Treatment Plant** – PFAS concentrations in the groundwater sample collected from this area were below the PALs. However, one PFOS concentration in soil was above the PAL, so this area is designated as an AAA;
- **AFFF Area 20 – PAA Current Main Base Sewage Treatment Plant** – PFAS concentrations in the groundwater sample collected from this area were below the PALs;
- **AFFF Area 21 – AAA Former Nozzle Spray Test Area** – PFOS and PFOA concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 22 – AAA Refractometer Spray Test Area** – PFOS concentrations exceeded the PAL in three groundwater samples;
- **AFFF Area 23 – AAA Muroc Golf Course** – Individual concentrations of PFOS and PFOA did not exceed their respective PALs in the groundwater sample collected at Muroc Gold Course. However, the sum of PFOA and PFOS concentrations (0.081 µg/L) is greater than 0.07 µg/L, exceeding the PAL.; and
- **AFFF Area 24 – AAA Pad 7 Outfall and Stormwater Detention Pond** – PFOS and PFOA concentrations exceeded the PAL in five groundwater samples.

4.1.3 On-Base Water Supply Well Sampling Results

Edwards AFB Bioenvironmental Department sampled the raw water from the following on-Base water supply wells in August 2016 in accordance with the Third Unregulated Contaminant Monitoring Rule (UCMR 3) under the Safe Drinking Water Act (EPA, 2012): C-1, C-4, S-5, S-10, AFRL Well B, and AFRL Well C. Additional samples were collected for Mary's Well (Booster Station), treated water (well C-1 and well C-4 tanks), water lines (Building 791 Well Line A), and blending sites (Building 791). At the Main Base, the Bioenvironmental Department sampled three working potable wells of S-5, S-10 and C-4, and one non-potable well, C-1, for PFAS (**Table G-1** in **Appendix G**). At the AFRL, the Bioenvironmental Department sampled two working potable wells, AFRL Well B and AFRL Well C, and also sampled treated water at the booster station called Mary's Well for PFAS. Water from AFRL wells fills tanks 1 through 3 and then the water is pumped via the booster station to tanks 4 and 5 near the AFRL Fire Station (Edwards 2018). Samples were analyzed for the six UCMR 3 PFAS compounds, including PFOS, PFOA, and PFBS. Analytical laboratory results from samples collected from August 2016 were non-detect for all PFAS compounds at a reporting limit of 0.002 µg/L. Base water supply wells are shown on **Figure 4-1**. Available information for on-Base water supply wells is summarized in **Table G-1** in **Appendix G**. Analytical results are included in **Appendix G**.

4.1.4 Groundwater Targets

The Edwards AFB water treatment and distribution system officially serves a population of over 11,000 consumers through 953 service connections (Tseng, 2017). The population served by individual water supply wells at Edwards AFB and off-Base water supply wells is unknown. The Guidance for Performing SIs under CERCLA (EPA, 1992) specifies a 4-mile radius as the Target Distance Limit for Groundwater Migration Pathways. Edwards AFB water supply water well targets and off-Base water supply well targets within a 4-mile radius of the AFFF Areas included in this SI are presented in **Table 4.1**, and

depicted in **Figures 4-1 and 4-2**. The rows in **Table 4.1** are shaded the same as **Table 6.1** to indicate the magnitude of the PAL exceedance in groundwater.

Information provided in the PA (CH2M Hill, 2015) and information provided by USAF personnel at Edwards AFB (Tseng, 2017) indicated 18 water supply water well targets on-Base. Seven of these targets were sampled in August 2016 (**Section 4.1.3**).

Information provided by USAF personnel at Edwards AFB identified several drinking water wells north of California State Route 58 and potentially downgradient of Actual AFFF Area 15 Fire Station #5 (Tseng, 2017), located near the North Base runway at Edwards AFB (**Figure 4-2**). In addition, Edwards AFB personnel provided United States Geological Survey (USGS) GIS data with locations of water supply wells sourced from the USGS database. OTIE then performed a records search using the State of California Department of Water Resources (DWR) website (Statewide Well Completion Report Map) to verify the locations of these wells; identify other potential drinking water targets within 4 miles of AFFF Area 15 Fire Station #5; and to obtain additional information including well construction, usage, and flow-rate data.

Information obtained from the above-listed sources indicated that several water supply wells exist within 4 miles of AFFF Area 15 Fire Station #5 (**Figure 4-2**). However, the information obtained from the DWR is generally inadequate to confirm the locations, well constructions or current operation of many of the wells identified by Edwards AFB and the USGS; therefore, their potential impact from an upgradient source cannot be adequately assessed at this time. Three wells, 240-MW22, 240-MW-31, and 240-MW37, downgradient of AFFF Area 15 Fire Station #5 were sampled during the SI (**Section 3.16**). Recommendations for additional sampling activities related to AFFF Area 15 are presented in **Section 6.3**.

Table 4.1 Summary of Groundwater Water Supply Well Targets

AFFF Area	Water Supply Wells Within 4 Mile Radius	Nearest Water Supply Well(s) & Approximate Distance
AFFF Area 1: ERP Site 14 (Former/Current FTA)	6 wells: • AFRL-A (active-needs repair, potable); • AFRL-B (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7 (active --needs repair, can be potable)	S-1 (inactive), 1.0 mile southwest S-2 (active --needs repair, can be potable), 2.5 miles south-southeast
AFFF Area 2: ERP Site 26 (Former AFRL FTA)	None	Mary's Wells 9/8-6H1 and 9/8-6J1 (inactive), 4.6 miles west-southwest
AFFF Area 3: Hangar Buildings 151/160	6 wells: • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7 (active --needs repair, can be potable);	S-1 (inactive), 1.6 miles south S-2 (active --needs repair, can be potable), 2.8 miles south

AFFF Area	Water Supply Wells Within 4 Mile Radius	Nearest Water Supply Well(s) & Approximate Distance
	• AFRL-A (active --needs repair, potable)	
AFFF Area 4: Hangar Building 1600	S-1 (inactive)	S-1 (inactive), 3.1 miles south S-2 (active --needs repair, can be potable), 4.2 miles south
AFFF Area 5: Hangar Building 1608	S-1 (inactive)	S-1 (inactive), 3.3 miles south S-2 (active --needs repair, can be potable), 4.3 miles south
AFFF Area 6: Hangar Building 1624	S-1 (inactive)	S-1 (inactive), 3.1 miles south S-2 (active --needs repair, can be potable), 4.2 miles south
AFFF Area 7: Hangar Building 1870	None	S-1 (inactive), 4.5 miles south S-2 (active --needs repair, can be potable), 5.5 miles south
AFFF Area 8: Hangar Building 1874	None	S-1 (inactive), 4.4 miles south S-2 (active --needs repair, can be potable), 5.4 miles south
AFFF Area 9: Hangar Building 1881	None	S-1 (inactive), 4.4 miles south S-2 (active --needs repair, can be potable), 5.4 miles south
AFFF Area 10: Hangar Building 4801	None	S-1 (inactive), 5.1 miles south S-2 (active --needs repair, can be potable), 6 miles south
AFFF Area 11: Hangar Building 4802	None	S-1 (inactive), 5.1 miles south S-2 (active --needs repair, can be potable), 6 miles south
AFFF Area 12: Hangar Building 4826	None	S-1 (inactive), 5.4 miles south S-2 (active --needs repair, can be potable), 6.4 miles south
AFFF Area 13: Hangar Building 4840	None	S-1 (inactive), 5.2 miles south S-2 (active --needs repair, can be potable), 6.3 miles south
AFFF Area 14: Fire Station #3 (Building 250)	5 wells: • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7 (active --needs repair, can be potable); • AFRL-A (active --needs repair, potable)	S-1 (inactive), 1.8 miles south-southwest S-2 (active --needs repair, can be potable), 3 miles south-southwest
AFFF Area 15: Fire Station #5 (Building 4456)	17 wells: • Agnus Greene (unknown); • Anderson (active); • BNSF RR (unknown); • Burgess (unknown) • Chanceler (active); • Desert Palms Trailer Park (active); • Dunes Apartments (active); • Edgemont Acres (active); • Fountain Trailer Park (active);	Fountain Trailer Park (active), 1.8 miles northeast

AFFF Area	Water Supply Wells Within 4 Mile Radius	Nearest Water Supply Well(s) & Approximate Distance
	• Hobbs Water System (2 wells, active); • Jay's Trailer Park (inactive/out of service); • North Edwards Water District #1 (active); • North Edwards Water District #2 (active); • Pacific Coast Borax #37 (unknown); • Pacific Coast Borax #38 (unknown); • Saylor (active) • 22 additional wells identified on USGS database and DWR website (status unknown), shown on **Figure 4-2.**	
AFFF Area 16: Former Fire Station (Building 1850)	None	S-1 (inactive), 4.8 miles south S-2 (active --needs repair, can be potable), 5.8 miles south
AFFF Area 17: 1970 Aero Spacelines 377MGT	6 wells: • C-3 (active, abandonment planned); • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7 (active --needs repair, can be potable)	S-1 (inactive), 2.2 miles southeast C-4 (active, potable), 2.2 miles southwest
AFFF Area 18: 1984 Boeing 720 Controlled Impact Demonstration	7 wells: • S-1 (inactive); • S-2 (active --needs repair, can be potable); • AFRL-A (active --needs repair, potable); • AFRL-B (active, potable); • AFRL-C (active, potable); • AFRL-D (active – standby, listed as potable but arsenic above MCL); • Mary's Wells 9/8-6H1 and 9/8-6J1 (inactive),	AFRL-A (active --needs repair, potable), 1 mile southeast

AFFF Area	Water Supply Wells Within 4 Mile Radius	Nearest Water Supply Well(s) & Approximate Distance
AFFF Area 19: Former Main Base Sewage Treatment Plant	13 wells: • C-1 (active --needs repair, non-potable); • C-3 (active, abandonment planned); • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-4 (active --needs repair, potable); • S-5 (active, potable); • S-6 (active --needs repair, non-potable); • S-7 (active --needs repair, can be potable); • S-10 (active, potable); • NST-1 (active --needs repair, potable); • NST-2 (active --needs repair, potable)	S-2 (active --needs repair, can be potable), 0.1 mile southwest
AFFF Area 20: Current Main Base Sewage Treatment Plant	16 wells: • C-1 (active --needs repair, non-potable); • C-3 (active, abandonment planned); • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-4 (active --needs repair, potable); • S-5 (active, potable); • S-6 (active --needs repair, non-potable); • S-7 (active --needs repair, can be potable); • S-10 (active, potable); • AFRL-A (active --needs repair, potable); • AFRL-B (active, potable); • AFRL-C (active, potable); • NST-1 (active --needs repair, potable); • NST-2 (active --needs repair, potable)	S-2 (active --needs repair, can be potable), 0.4 miles west
AFFF Area 21: Former Nozzle Spray Test Area	S-1 (inactive)	S-1 (inactive), 3.1 miles south S-2 (active --needs repair, can be potable), 4.3 miles south

AFFF Area	Water Supply Wells Within 4 Mile Radius	Nearest Water Supply Well(s) & Approximate Distance
AFFF Area 22: Refractometer Spray Test Area	6 wells: • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7(active --needs repair, can be potable); • AFRL-A (active --needs repair, potable)	S-1 (inactive), 0.9 miles south S-2 (active --needs repair, can be potable), 2.2 miles south-southwest
AFFF Area 23: Muroc Golf Course	6 wells: • C-3 (active, abandonment planned); • C-4 (active, potable); • S-1 (inactive); • S-2 (active --needs repair, can be potable); • S-3 (active --needs repair, can be potable); • S-7 (active --needs repair, can be potable)	C-3 (active, abandonment planned) & C-4 (active, potable), 2.3 miles south
AFFF Area 24: Pad 7 Outfall and Stormwater Detention Pond	S-1 (inactive)	S-1 (inactive), 3.4 miles south S-2 (active --needs repair, can be potable), 4.6 miles south

NOTES:

No shading with "PFOS" and/or "PFOA" indicated exceedances below the PAL
Between PAL and 9.9x the PAL
Between 10x and 99x the PAL
Between 100x and 999x the PAL
≥ 1,000x the PAL

The Edwards AFB water supply wells are screened in the deep aquifer at various depth intervals ranging from 160 ft bgs to 833 ft bgs.

4.2 SURFACE WATER MIGRATION PATHWAY

There are no perennial surface water features on or near Edwards AFB, and there are no identified surface water intakes or downstream fisheries adjacent to the surface water pathway within 15 miles downstream of the AFFF Areas. Periods of heavy rainfall are infrequent, and the Base lies outside of the 500-year floodplain (FEMA, 2008). Stormwater drainage in the vicinity of the AFFF areas flows toward the ephemeral Rogers Dry Lake; water reaching the dry lake collects and eventually evaporates (CH2M HILL, 2015). Due to the lack of surface water at Edwards AFB and surface water pathways and targets identified during the PA (CH2M HILL, 2015), surface water samples were not collected during the SI at Edwards AFB. Sediment samples were collected to evaluate the potential for contaminant transport via overland flow pathways. PFAS concentrations exceeded the PAL in only one sediment sample, collected from AFFF Area 24: Pad 7 Outfall and Stormwater Detention Pond. No complete exposure pathways with immediate impacts to human health were identified for PFAS in surface water.

4.3 SOIL AND SEDIMENT EXPOSURE PATHWAY

4.3.1 Local Geology

Information regarding the geology in the vicinity of Edwards AFB is presented in the PA report (CH2M HILL, 2015), and the information is summarized below.

The geologic setting of the Edwards AFB area is characterized by three major geologic complexes: a basement complex of igneous and metamorphic rocks, an intermediate complex of continental volcanic and sedimentary rocks, and unconsolidated deposits. The unconsolidated deposits are either alluvial or lacustrine, based on the mode of deposition. The Quaternary alluvial fan deposits generally grade toward, and interbed with, older and younger playa lacustrine deposits at the center of the valley. The alluvium is heterogeneous in composition and ranges in thickness from a feather-edge where it overlies older deposits to several hundred feet at the center of the basin. The unconsolidated material consists of fine grained, feldspathic, quartzose and rock-fragment sand derived from the exposed and underlying bedrock complex. Varying percentages of clay, silt, sand, and gravel contribute to the localized character of the deposits. Deposits are loose to very dense and typically dry to slightly moist. The lacustrine deposits that form the playa surface of Rogers Dry Lake consist of very fine-grained sediments predominantly composed of montmorillonite and illite clays.

Soil encountered in borings drilled at the South Base and the southern portion of the Main Base was primarily silt or sand with varying amounts of silt. Soil encountered in borings on the northern portions of Main Base, the AFRC, and the AFRL were comprised of silt, sand and clay, underlain by granitic bedrock at depths ranging from approximately 6 inches to 6 feet bgs. The maximum depth of exploration was 115 feet, (**Appendix A-3**).

4.3.2 Actual or Potential Releases to Soil and Sediment

Soil samples from 10 of the potential AFFF release areas assessed during the SI had concentrations of PFAS that exceeded their respective PALs. One sediment sample from one of the potential AFFF release areas assessed during the SI had PFAS concentrations that exceeded the PALs. Below is a summary of the AAAs and PAAs for soil and sediment evaluated during this SI:

- **AFFF Area 1 – AAA ERP Site 14 (Former/Current FTA)** – PFOS concentrations exceeded the PAL in three surface soil samples collected;
- **AFFF Area 2 – AAA ERP Site 26 (Former AFRL FTA)** – PFOS concentrations exceeded the PAL in one surface soil sample collected;
- **AFFF Area 3 – AAA Hangar Buildings 151/160** – PFAS concentrations in the soil samples collected from this area were below the PALs. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**);
- **AFFF Area 4 – AAA Hangar Building 1600** – PFOS concentrations exceeded the PAL in one surface soil sample collected;
- **AFFF Area 5 – AAA Hangar Building 1608** – PFOS concentrations exceeded the PAL in the one surface soil sample collected;

- **AFFF Area 6 – AAA Hangar Building 1624** – PFOS concentrations exceeded the PAL in one surface soil sample and one subsurface soil sample collected;
- **AFFF Area 7 – AAA Hangar Building 1870** – PFOS concentrations exceeded the PAL in two surface soil samples collected;
- **AFFF Area 8 – AAA Hangar Building 1874** – PFOS concentrations exceeded the PAL in three surface soil samples and three mid-level soil samples collected ;
- **AFFF Area 9 – AAA Hangar Building 1881** – PFAS concentrations in the soil samples collected from this area were below the PALs. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**);
- **AFFF Area 10 – AAA Hangar Building 4801** – No soil samples were collected from this area. PFOS concentrations exceeded the PAL in one sediment sample collected.;
- **AFFF Area 11 – AAA Hangar Building 4802** – PFOS concentrations exceeded the PAL in one surface soil sample collected;
- **AFFF Area 12 – AAA Hangar Building 4826** - PFAS concentrations in the soil samples collected from this area were below the PALs. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**);
- **AFFF Area 13 – AAA Hangar Building 4840** – PFOS concentrations exceeded the PAL in one surface soil sample collected;
- **AFFF Area 14 – AAA Fire Station #3 (Building 250)** - PFOS concentrations exceeded the PAL in three surface soil samples and two mid-level soil samples collected;
- **AFFF Area 15 – AAA Fire Station #5 (Building 4456)** – No soil or sediment samples were collected from this area. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**);
- **AFFF Area 16 – AAA Former Fire Station (Building 1850)** – PFOS concentrations exceeded the PAL in two surface soil samples and two shallow subsurface samples collected;
- **AFFF Area 17 – AAA 1970 Aero Spacelines 377MGT** – PFAS concentrations in the soil samples collected from this area were below the PALs. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**);
- **AFFF Area 18 – PAA 1984 Boeing 720 CID** – PFAS concentrations in the soil samples collected from this area were below the PALs;
- **AFFF Area 19 – PAA Former Main Base Sewage Treatment Plant** – PFOS concentrations exceeded the PAL in one surface soil sample collected;

- **AFFF Area 20 – PAA Current Main Base Sewage Treatment Plant** – No soil samples were collected from this area. PFAS concentrations in the sediment samples collected from this area were below the PALs;
- **AFFF Area 21 – AAA Former Nozzle Spray Test Area** – PFOS concentrations exceeded the PAL in three surface soil samples and one mid-level soil sample collected;
- **AFFF Area 22 – AAA Refractometer Spray Test Area** – PFOS concentrations exceeded the PAL in three surface soil samples and one mid-level soil sample collected;
- **AFFF Area 23 – AAA Muroc Golf Course** – No soil samples were collected from this area. PFAS concentrations in the sediment sample collected from this area were below the PALs. However, this area is considered an AAA based on the detection of PFAS at concentrations above PALs in groundwater samples collected from this area (**Section 4.1.2**); and
- **AFFF Area 24 – AAA Pad 7 Outfall and Stormwater Detention Pond** – PFOS concentrations exceeded the PAL in one surface soil sample collected. PFOS concentrations exceeded the PAL in three sediment samples collected.

4.3.3 Soil Exposure Targets

4.3.3.1 Human Targets

Information gathered during the PA process did not identify resident populations, schools or daycares, terrestrial sensitive environments[1], or resources within 200 feet of any of the 24 potential AFFF areas included in the SI.

Muroc Golf Course is located within 1 mile of residential populations. The golf course is located adjacent to the south boundary of the Edwards family housing area, which consists of approximately 2,300 residents in 741 family housing units (Tseng, 2017). Soil borings were not advanced in this AFFF area during the SI. However, three sediment samples were collected and PFAS concentrations from Muroc Golf Course were below the PALs.

The dormitory housing, consisting of 340 residents, is located in the Main Base area bounded by Airman's Drive, Yeager Blvd., Muroc Drive, and Popson Ave. The dormitory housing is located within 1 mile of AFFF Area 4 Hangar 1600, and AFFF Area 5 Hangar 1608. All three soil samples collected from Hangar 1600 contained PFAS concentrations below the PALs. One of the three soil samples collected from Hangar 1608 (the surface soil sample) contained PFAS concentrations above the PAL.

The AFFF areas with PFAS soil concentrations that exceeded the PALs are located in multiple areas of the Base, adjacent to active buildings, hangars, and runways (**Section 4.3.2**). The exact worker population located in areas with PFAS contamination is unknown. The entire worker population of Edwards AFB is approximately 10,500 individuals (Tseng, 2017) and human soil exposure targets are assumed to include some portion of the worker population – particularly construction or maintenance workers performing

[1] The U.S. EPA defines a sensitive environment as a terrestrial or aquatic resource, fragile natural setting, or other area with unique or highly-valued environmental or cultural features. Typically, areas that fall within the definition of "sensitive environment" are established and/or protected by State or Federal law. Examples include National Parks, National Monuments, habitats of threatened or endangered species, and wildlife refuges (EPA, 1991).

ground-disturbing activities. Visitors to Edwards AFB and the approximately 1,000 civilian residents also represent potential human targets.

4.3.3.2 Ecological Receptors

Edwards AFB is home to the threatened desert tortoise and its designated critical habitat. Several additional federal and state listed endangered and threatened species are reported to exist on Edwards AFB including; but, not limited to (CH2M HILL, 2015):

- Flycatcher, Southwestern Willow – Bird
- Flycatcher, Willow – Bird
- Least Tern, California – Bird
- Snowy Plover, Western – Bird
- Ground Squirrel, Mohave – Mammal

No perennial surface water bodies are present within 2-miles of sources at Edwards AFB and the property is located outside the 500-year floodplain; therefore, the Surface Water Migration pathway is of limited concern. No wetlands are present in the area; however, there are several State Parks located to the south and west, as well as State Wildlife Reserves located to the northeast. The absence of perennial surface water features on or near Edwards AFB limits the ecological impacts of the Surface Water Migration Pathway.

4.4 AIR MIGRATION PATHWAY

4.4.1 Release to Air

Air exposure pathways account for hazardous substance migration through the air in gaseous or particulate form. Emissions of contaminated fugitive dust (e.g., contaminated soil particles) represent a potential contaminant release to air at the AFFF areas. Each of the AFFF Areas with PFAS concentrations in soil represents a potential air exposure pathway, especially since all concentrations exceeding the PALs in soil except one are from surface locations. No samples of air or fugitive dust were collected.

4.4.2 Air Targets

The human population within a 4-mile radius of the AFFF Areas includes the worker and residential population of Edwards AFB, approximately 11,600 individuals (Tseng, 2017). Civilian populations/towns are located greater than 4 miles from each of the AFFF areas.

This page intentionally left blank.

5.0 SAMPLING RESULTS

5.1 DATA SUMMARY TABLES

This section contains data summary tables for soil, sediment, and groundwater for PFBS, PFOA, PFOS and the sum of PFOS and PFOA concentrations in groundwater. Complete analytical results (18 analytes) are provided in **Appendix F**.

Table 5.1 Summary of Soil Analytical Results

				Analyte	PFBS	PFOA	PFOS
				PAL:	130,000	126	126
Location ID	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type	µg/kg	µg/kg	µg/kg
AFFF Area 1 ERP Site 14 (Current/Former FTA)							
14-SB01	14-SB01-0.5	4/17/2017	0.5	N	59 U	59 U	**6,400**
	S14DUP-0.5	4/17/2017	0.5	FD	58 U	58 U	**6,600**
	14-SB01-12.5	4/17/2017	12.5	N	1.5	0.74 J	110
	14-SB01-25	4/17/2017	25.0	N	0.60 U	0.60 U	1.4
14-SB02	14-SB02-0.5	4/17/2017	0.5	N	54 U	27 J	**14,000**
	14-SB02-18	4/17/2017	18.0	N	0.66 U	0.44 J	7.7
	14-SB02-25	4/17/2017	25.0	N	0.60 U	0.60 U	1.0
14-SB03	14-SB03-0.5	4/14/2017	0.5	N	52 U	99	**18,000**
	14-SB03-18	4/14/2017	18.0	N	0.82 J	30	2.4
	14-SB03-25	4/14/2017	25.0	N	0.52 U	0.84 J	2.2
AFFF Area 2 ERP 26 (Former AFRL FTA)							
26-SB01	26-SB01-0.5	3/24/2017	0.5	N	6.0 U	9.9 J	**1,300 J**
	S26DUP-0.5	3/24/2017	0.5	FD	5.9 U	12 J	**830 J**
	26-SB01-12.5	3/24/2017	12.5	N	6.2	33	3.1
	26-SB01-25	3/24/2017	25.0	N	0.35 J	3.1	1.3
26-SB02	26-SB02-0.5	3/23/2017	0.5	N	0.53 U	27	3.0
	26-SB02-12.5	3/23/2017	12.5	N	2.2	0.60 U	0.49 J
	26-SB02-25	3/23/2017	25.0	N	0.27 J	0.84 J	0.31 J
26-SB03	26-SB03-0.5	3/24/2017	0.5	N	0.66 U	0.52 J	8.4
	26-SB03-10	3/27/2017	10.0	N	0.60 U	0.60 U	0.60 U
	26-SB03-25	3/27/2017	25.0	N	0.49 U	0.49 J	0.32 J
AFFF Area 3 Hangar Buildings 151/160							
160-SB01	160-SB01-0.5	4/19/17	0.5	N	0.33 J	1.5	15
	S160DUP-0.5	4/19/17	0.5	FD	0.38 J	1.7	15
	160-SB01-12.5	4/19/17	12.5	N	0.60 U	0.60 U	0.60 U
	160-SB01-25	4/19/17	25.0	N	0.60 U	0.60 U	1.2
160-SB02	160-SB02-0.5	4/19/17	0.5	N	0.38 J	0.29 J	5.8
	160-SB02-12.5	4/19/17	12.5	N	0.72 U	0.72 U	8.2
	160-SB02-25	4/19/17	25.0	N	0.66 U	0.66 U	0.57 J
160-SB03	160-SB03-0.5	4/20/2017	0.5	N	0.59 U	0.59 U	1.7
	160-SB03-12.5	4/20/2017	12.5	N	0.55 U	0.55 U	9.2
	160-SB03-25	4/20/2017	25.0	N	0.66 U	0.66 U	1.1

				Analyte	PFBS	PFOA	PFOS
				PAL:	130,000	126	126
Location ID	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type	µg/kg	µg/kg	µg/kg
160-SB04	160-SB04-0.5	4/20/2017	0.5	N	0.58 U	0.58 U	14
AFFF Area 4 Hangar Building 1600							
1600-SB01	1600-SB01-0.5	4/24/2017	0.5	N	0.25 J	0.53 U	**250 J**
	S1600DUP-0.5	4/27/2017	0.5	FD	0.76 J	1.6	110 J
	1600-SB01-12	4/24/2017	12.0	N	0.19 J	1.1 J	3.5
	1600-SB01-25	4/24/2017	25.0	N	0.77 J	2.0	0.69 J
AFFF Area 5 Hangar Building 1608							
1608-SB01	1608-SB01-0.5	4/25/2017	0.5	N	6.3 U	35	**2,100**
	S1608DUP-0.5	4/25/2017	0.5	FD	6.1 U	89	**2,200**
	1608-SB01-12.5	4/25/2017	12.5	N	1.2	0.85 J	14
	1608-SB01-25	4/25/2017	25.0	N	0.71 J	0.65 U	0.77 J
AFFF Area 6 Hangar Building 1624							
1624-SB01	1624-SB01-0.5	4/25/2017	0.5	N	4.8 U	4.8 U	**240 J**
	S1624DUP-0.5	4/25/2017	0.5	FD	0.84 J	1.2	93 J
	1624-SB01-12.5	4/25/2017	12.5	N	1.8	**180**	3.7
	1624-SB01-25	4/25/2017	25.0	N	9.0	9.5	12
AFFF Area 7 Hangar Building 1870							
1870-SB01	1870-SB01-0.5	5/3/2017	0.5	N	2.2 J	4.3 J	**530**
	S1870DUP-0.5	5/3/2017	0.5	FD	4.1 J	6.0 J	**590**
	1870-SB01-12.5	5/3/2017	12.5	N	0.57 U	0.35 J	32
	1870-SB01-25	5/3/2017	25.0	N	1.1	0.54 U	0.47 J
1870-SB02	1870-SB02-0.5	5/3/2017	0.5	N	1.5 J	11	**2,200**
	1870-SB02-12.5	5/3/2017	12.5	N	0.20 J	1.3	4.9
	1870-SB02-25	5/3/2017	25.0	N	0.50 U	0.50 U	1.3
AFFF Area 8 Hangar Building 1874							
1874-SB01	1874-SB01-0.5	5/8/2017	0.5	N	26	6.4	**260**
	1874-SB01-5	5/8/2017	5.0	N	12 J	21	**330 J**
	S1874DUP-5	5/8/2017	5.0	FD	19 J	27	**460 J**
	1874-SB01-25	5/8/2017	25.0	N	0.52 U	0.52 U	0.72 J
1874-SB02	1874-SB02-0.5	5/8/2017	0.5	N	110	41	**1,800**
	1874-SB02-5	5/8/2017	5.0	N	49	32	**790**
	1874-SB02-25	5/8/2017	25.0	N	0.99	0.37 J	2.9
1874-SB03	1874-SB03-0.5	5/8/2017	0.5	N	40	13	**2,900**
	1874-SB03-5	5/8/2017	5.0	N	13	19	**2,400**
	1874-SB03-25	5/8/2017	25.0	N	0.59 U	0.59 U	1.9

					Analyte	PFBS	PFOA	PFOS
					PAL:	130,000	126	126
Location ID	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type		µg/kg	µg/kg	µg/kg
AFFF Area 9 Hangar Building 1881								
1881-SB01	1881-SB01-0.5	5/4/2007	0.5	N		0.91	1.0	110
	1881-SB01-12.5	5/4/2007	12.5	N		1.2 J	0.96 J	110 J
	S1881DUP-12.5	5/4/2007	12.5	FD		0.56 UJ	0.56 UJ	0.56 UJ
	1881-SB01-25	5/4/2007	25.0	N		0.51 U	0.51 U	0.51 U
1881-SB02	1881-SB02-0.5	5/5/2017	0.5	N		0.92	0.71 J	40
	1881-SB02-12.5	5/5/2017	12.5	N		0.51 U	0.51 U	0.51 U
	1881-SB02-25	5/5/2017	25.0	N		0.52 U	0.52 U	0.52 U
AFFF Area 11 Hangar Building 4802								
4802-SB01	4802-SB01-0.5	5/18/2017	0.5	N		5.8 U	21 J	**2,800**
	S4802DUP-0.5	5/18/2017	0.5	FD		4.9 U	14 J	**2,100**
	4802-SB01-6	5/18/2017	6.0	N		0.49 U	0.49 U	4.4
	4802-SB01-20	5/18/2017	20.0	N		0.50 U	0.50 U	1.5
AFFF Area 12 Hangar Building 4826								
4826-SB01	4826-SB01-0.5	5/17/2017	0.5	N		5.6 U	64	27
	4826-SB01-6	5/17/2017	6.0	N		6.7 U	21	13
	4826-SB01-20	5/17/2017	20.0	N		0.56 U	0.56 U	0.60 J
4826-SB02	4826-SB02-0.5	5/16/2017	0.5	N		1.2 J	7.8	26
	S4826DUP-0.5	5/16/2017	0.5	FD		1.9 J	7.5	22
	4826-SB02-6	5/16/2017	6.0	N		0.58 U	0.37 J	0.58 U
	4826-SB02-20	5/16/2017	20.0	N		0.56 U	0.30 J	1.3
4826-SB03	4826-SB03-0.5	5/18/2017	0.5	N		0.52 U	1.2	85
	4826-SB03-6	5/18/2017	6.00	N		0.55 U	0.55 U	9.0
	4826-SB03-20	5/18/2017	20.0	N		0.53 U	0.53 U	4.2
AFFF Area 13 Hangar Building 4840								
4840-SB01	4840-SB01-0.5	5/15/2017	0.5	N		0.22 J	0.60 J	20
	S4840DUP-0.5	5/15/2017	0.5	FD		0.22 J	0.97	23
	4840-SB01-5	5/15/2017	5.0	N		0.55 U	0.55 U	2.0
	4840-SB01-20	5/15/2017	20.0	N		0.59 U	0.59 U	0.59 U
4840-SB02	4840-SB02-0.5	5/16/2017	0.5	N		0.28 J	1.6	**710**
	4840-SB02-5	5/16/2017	5.0	N		0.21 J	4.2	110
	4840-SB02-20	5/16/2017	20.0	N		0.60 U	0.60 U	0.50 J
AFFF Area 14 Fire Station #3 (Building 250)								
250-SB01	250-SB01-0.5	4/6/2017	0.5	N		190 J	**230 J**	**32,000 J**
	S250DUP-0.5	4/6/2017	0.5	FD		430 J	**330 J**	**17,000 J**
	250-SB01-7.5	4/6/2017	7.5	N		5.0	1.5	90
	250-SB01-25	4/6/2017	25.0	N		0.43 J	0.60 U	2.6

				Analyte	PFBS	PFOA	PFOS
				PAL:	130,000	126	126
Location ID	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type	µg/kg	µg/kg	µg/kg
250-SB02	250-SB02-0.5	4/7/2017	0.5	N	9.4 J	10	**2,300**
	250-SB02-7.5	4/7/2017	7.5	N	440	80	**770**
	250-SB02-25	4/7/2017	25.0	N	0.27 J	0.47 U	0.63 J
250-SB03	250-SB03-0.5	4/10/2017	0.5	N	1.5	1.5	**430**
	250-SB03-7.5	4/10/2017	7.5	N	10	6.1 J	**430**
	250-SB03-25	4/10/2017	25.0	N	0.74 J	0.56 U	1.4
AFFF Area 16 Former Fire Station (Building 1850)							
1850-SB01	1850-SB01-0.5	3/22/2017	0.5	N	7.3 J	25	**3,300**
	S1850DUP-0.5	3/22/2017	0.5	FD	5.7 J	23	**2,600**
	1850-SB01-12.5	3/22/2017	12.5	N	5.8	45	5.9
	1850-SB01-25	3/22/2017	25.0	N	0.68 J	0.28 J	0.44 J
1850-SB02	1850-SB02-0.5	3/22/2017	0.5	N	0.33 J	0.86 J	82
	1850-SB02-3	3/22/2017	3.0	N	0.32 J	0.66 J	**170**
1850-SB03	1850-SB03-0.5	3/22/2017	0.5	N	1.2 J	5.9	**350**
	1850-SB03-4	3/22/2017	4.0	N	0.34 J	0.91 J	**170**
AFFF Area 17 1970 Aero Spacelines 377MGT							
377MGT-SB01	377MGT-SB01-0.5	5/13/2017	0.5	N	0.54 U	0.54 U	0.92
	S377DUP-0.5	5/13/2017	0.5	FD	0.58 U	0.58 U	0.48 J
	377MGT-SB01-6	5/13/2017	6.0	N	0.60 U	0.60 U	0.60 U
	377MGT-SB01-25	5/13/2017	25.0	N	0.59 U	0.59 U	0.59 U
377MGT-SB02	377MGT-SB02-0.5	5/13/2017	0.5	N	0.56 U	0.56 U	0.56 U
	377MGT-SB02-6	5/13/2017	6.0	N	0.54 U	0.54 U	0.54 U
	377MGT-SB02-25	5/13/2017	25.0	N	0.72 U	0.72 U	0.72 U
377MGT-SB03	377MGT-SB03-0.5	5/14/2017	0.5	N	0.56 U	0.56 U	3.0
	377MGT-SB03-6	5/14/2017	6.0	N	0.52 U	0.52 U	0.52 U
	377MGT-SB03-25	5/14/2017	25.0	N	0.66 U	0.66 U	0.66 U
AFFF Area 18 1984 Boeing 720 Controlled Impact Demonstration							
B720-SB01	B720-SB01-0.5	3/29/2017	0.5	N	0.58 U	0.58 U	0.58 U
	B720-SB01-12.5	3/29/2017	12.5	N	0.72 U	0.72 U	0.72 U
	B720-SB01-25	3/29/2017	25.0	N	0.72 U	0.72 U	0.40 J
B720-SB02	B720-SB02-0.5	4/4/2017	0.5	N	1.7	0.53 U	9.2
	B720-SB02-12.5	4/4/2017	12.5	N	0.60 U	0.60 U	0.60 U
	B720-SB02-25	4/4/2017	25.0	N	0.59 U	0.59 U	0.28 J
B720-SB03	B720-SB03-0.5	3/30/2017	0.5	N	0.72 U	0.72 U	0.72 U
	B720-SB03-12.5	3/30/2017	12.5	N	0.66 U	0.44 J	0.66 U
	B720-SB03-25	3/30/2017	25.0	N	0.60 U	0.60 U	0.60 U
AFFF Area 19 Former Main Base Sewage Treatment Plant							
FMBTP-SB01	FMBTP-SB01-0.5	4/26/2017	0.5	N	0.25 J	7.1	13
	FMBTP-SB01-12.5	4/26/2017	12.5	N	0.50 U	0.33 J	0.32 J
	FMBTP-SB01-25	4/26/2017	25.0	N	0.65 U	0.65 U	0.65 U

					Analyte	PFBS	PFOA	PFOS
					PAL:	130,000	126	126
Location ID	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type		µg/kg	µg/kg	µg/kg
FMBTP-SB02	FMBTP-SB02-0.5	4/26/2017	0.5	N		0.65 U	4.7	120
	FMBTP-SB02-12.5	4/26/2017	12.5	N		0.50 U	0.50 U	0.50 U
	FMBTP-SB02-25	4/26/2017	25.0	N		0.62 U	0.62 U	0.62 U
FMBTP-SB03	FMBTP-SB03-0.5	4/26/2017	0.5	N		0.64 U	11	**300**
	FMBTP-SB03-12.5	4/26/2017	12.5	N		0.56 U	0.56 U	0.56 U
	FMBTP-SB03-25	4/26/2017	25.0	N		0.72 U	0.72 U	0.72 U
AFFF Area 21 Former Nozzle Spray Test Area								
FNSTA-SB01	FNSTA-SB01-0.5	5/1/2017	0.5	N		5.9 U	5.9 U	**650**
	FNSTA-SB01-12.5	5/1/2017	12.5	N		0.84 J	0.62 U	1.1
	FNSTA-SB01-25	5/1/2017	25.0	N		1.0	0.47 U	0.27 J
FNSTA-SB02	FNSTA-SB02-0.5	5/2/2017	0.5	N		5.8 U	27	**2,200**
	FNSTA-SB02-12.5	5/2/2017	12.5	N		7.7	13	45
	FNSTA-SB02-25	5/2/2017	25.0	N		3.2	0.49 U	0.22 J
FNSTA-SB03	FNSTA-SB03-0.5	5/2/2017	0.5	N		5.6 U	36	**710**
	FNSTA-SB03-12.5	5/2/2017	12.5	N		1.9 J	3.6 J	**600**
	FNSTA-SB03-25	5/2/2017	25.0	N		2.2	8.9	110
AFFF Area 22 Refractometer Spray Test Area								
RSTA-SB01	RSTA-SB01-0.5	4/12/2017	0.5	N		50 U	28 J	**5,900**
	RSTA-SB01-6.5	4/12/2017	6.5	N		27	14	**200**
	RSTA-SB01-25	4/12/2017	25.0	N		0.66 U	0.66 U	0.46 J
RSTA-SB02	RSTA-SB02-0.5	4/11/2017	0.5	N		6.3 J	16	**660**
	RSTA-SB02-6.5	4/11/2017	6.5	N		0.90 J	0.66 U	7.9
	RSTA-SB02-25	4/11/2017	25.0	N		0.60 U	0.60 U	0.60 U
RSTA-SB03	RSTA-SB03-0.5	4/12/2017	0.5	N		5.4 J	53	**980**
	RSTA-SB03-5.5	4/12/2017	5.5	N		0.55 U	0.55 U	5.8
	RSTA-SB03-25	4/12/2017	25.0	N		0.66 U	0.66 U	0.35 J
AFFF Area 24 Pad 7 Outfall and Stormwater Detention Pond								
PAD7-SB01	PAD7-SB01-0.5	4/28/2017	0.5	N		2.8	10	**140**
	PAD7-SB01-12.5	4/28/2017	12.5	N		0.30 J	0.38 J	0.52 U
	PAD7-SB01-25	4/28/2017	25.0	N		0.24 J	9.7	2.9

NOTES:

Bolded = Concentration exceeds the PAL.

DEFINITIONS:

µg/kg = micrograms per kilogram
AFRL = Air Force Research Laboratory
ERP = Environmental Restoration Program
FD = Field Duplicate Sample
FTA = fire training area
ft bgs = feet below ground surface
ID = Identification
J = Estimated detect at concentration shown
N = Normal Field Sample

PAL = project action limit
RSL = Regional Screening Level
U = non-detect at reporting limit shown
UJ = Not detected, limit of detection approximate.

Table 5.2 Summary of Sediment Analytical Results

				Analyte	PFBS	PFOA	PFOS
				EPA RSL:	130,000	126	126
Location	Sample ID	Sample Date	Sample Depth (ft bgs)	Sample Type	µg/kg	µg/kg	µg/kg
AFFF Area 7 Hangar Building 1870							
F22-SS01	F22-SS01	5/11/2017	0.5	N	0.51 J	0.67 J	6.5
AFFF Area 10 Hangar Building 4801							
4801-SS01	4801-SS01	5/18/2017	0.5	N	1.8	1.8 J	40 J
	S4801DUP-0.5	5/18/2017	0.5	FD	1.7	1.3 J	28 J
4801-SS02	4801-SS02	5/19/2017	0.5	N	4.2	2.5	**240**
AFFF Area 13 Hangar Building 4840							
4840-SS01	4840-SS01	5/16/2017	0.5	N	0.21 J	0.82 J	78
AFFF Area 17 1970 Aero Spacelines 377MGT							
377MGT-SS01	377MGT-SS01	5/13/2017	0.5	N	0.47 U	0.47 U	4.1
	S377SSDUP-0.5	5/13/2017	0.5	FD	0.58 U	0.58 U	3.6
AFFF Area 20 Current Main Base Sewage Treatment Plant							
CMBTP-SS01	CMBTP-SS01	5/1/2017	0.5	N	1.3	13	36
CMBTP-SS02	CMBTP-SS02	5/1/2017	0.5	N	0.60 U	0.32 J	8.5
AFFF Area 23 Muroc Golf Course							
MGC-SS01	MGC-SS01	5/30/2017	0.5	N	0.58 U	0.58 U	0.58 U
MGC-SS02	MGC-SS02	5/30/2017	0.5	N	0.66 U	0.66 U	0.66 U
MGC-SS03	MGC-SS03	5/30/2017	0.5	N	0.60 U	0.60 U	0.28 J
AFFF Area 24 Pad 7 Outfall and Stormwater Detention Pond							
PAD7-SS01	PAD7-SS01	5/24/2017	0.5	N	0.97	6.6	56
PAD7-SS02	PAD7-SS02	4/28/2017	0.5	N	0.58 J	4.6	**880**
PAD7-SS03	PAD7-SS03	4/28/2017	0.5	N	0.31 J	13	**970**
PAD7-SS04	PAD7-SS04	4/28/2017	0.5	N	14	**240**	**13,000**

NOTES:
Bolded = Concentration exceeds the PAL.

DEFINITIONS:
µg/kg = micrograms per kilogram
AFRL = Air Force Research Laboratory
ERP = Environmental Restoration Program
FD = Field Duplicate Sample
FTA = fire training area
ft bgs = feet below ground surface
ID = Identification
J = Estimated detect at concentration shown

N = Normal Field Sample
PAL = project action limit
RSL = Regional Screening Level
U = non-detect at reporting limit shown

Table 5.3 Summary of Groundwater Analytical Results

					Analyte	PFBS	PFOA	PFOS	PFOA + PFOS
					PAL:	40	0.07	0.07	0.07
Location	Sample ID	Sample Date	Depth to GW (ft btoc)[1]	Sample Type		µg/L	µg/L	µg/L	µg/L
AFFF Area 1 ERP Site 14 (Current/Former FTA)									
14-SB01	14-SB01-W49	4/18/2017	49.5	N		0.36	**0.091**	**2.7**	**2.791**
	14DUP-W49	4/18/2017	49.5	FD		0.34	**0.075**	**3.2**	**3.275**
14-SB02	14-SB02-W58	4/18/2017	58.6	N		0.60	**0.88**	**23**	**23.88**
14-SB03	14-SB03-W59	4/18/2017	59.1	N		3.0	**5.7**	**34**	**39.7**
14-MW04	14-MW04	4/17/2017	60.80	N		0.061	0.056	0.067	**0.123**
14-MW05	14-MW05	4/18/2017	52.79	N		0.022	0.010 U	0.010 U	NA
AFFF Area 2 ERP 26 (Former AFRL FTA)									
26-SB01	26-SB01-W30.9	3/27/2017	30.9	N		0.15	**0.79**	**0.80**	**1.59**
	264DUP-W30.9	3/27/2017	30.9	FD		0.16	**0.77**	**0.83**	**1.6**
26-SB02	26-SB02-W31	3/27/2017	31.0	N		1.2	**7.7**	**1.9**	**9.6**
26-SB03	26-SB03-W23.7	3/28/2017	23.7	N		0.014 J	**0.21**	0.061	**0.271**
26-MW08	26-MW08	3/28/2017	32.51	N		0.54	**1.4**	**1.5**	**2.9**
AFFF Area 3 Hangar Buildings 151/160									
160-SB01	160-SB01-W53	4/21/2017	53.5	N		0.17	0.070	**2.4**	**2.47**
	151DUP-W53	4/21/2017	53.5	FD		0.17	0.059	**2.6**	**2.659**
160-SB02	160-SB02-W51	4/21/2017	50.7	N		0.11	0.031	**0.64**	**0.671**
160-SB03	160-SB03-W51	4/21/2017	50.8	N		1.0	0.031	**0.096**	**0.127**
AFFF Area 4 Hangar Building 1600									
1600-SB01	1600-SB01-W39	4/27/2017	38.9	N		0.62	**0.15**	**0.40**	**0.55**
49-MW03	49-MW03	5/5/2017	44.75	N		8.6	**62**	**110**	**172**
48-MW16	48-MW16	5/5/2014	40.32	N		0.26	0.010 U	**0.077**	**0.077**
AFFF Area 5 Hangar Building 1608									
1608-SB01	1608-SB01-W38	4/27/2017	38.0	N		0.72	0.052	**0.46**	**0.512**
	1608DUP-W38	4/27/2017	38.0	FD		0.72	0.050	**0.38**	**0.43**
17-MW02	17-MW02	5/2/2017	40.31	N		0.54	0.028	0.024	0.052
AFFF Area 6 Hangar Building 1624									
1624-SB01	1624-SB01-W42	4/27/2017	42.2	N		0.55	**0.19**	**0.90**	**1.09**
49-MW04	49-MW04	4/25/2017	41.40	N		0.34	**0.093**	**0.78**	**0.873**
52-MW15	52-MW15	5/1/2017	46.19	N		0.59	**0.094**	**0.19**	**0.284**

				Analyte	PFBS	PFOA	PFOS	PFOA + PFOS
				PAL:	40	0.07	0.07	0.07
Location	Sample ID	Sample Date	Depth to GW (ft btoc)[1]	Sample Type	µg/L	µg/L	µg/L	µg/L
AFFF Area 7 Hangar Building 1870								
1870-SB01	1870-SB01-W18	5/9/2017	18.4	N	4.0	**2.9**	**4.7**	**7.6**
1870-SB02	1870-SB02-W24	5/9/2017	23.6	N	**56**	**14**	**9.5**	**23.5**
	1870DUP-W24	5/9/2017	23.6	FD	**56**	**14**	**10**	**24**
AFFF Area 8 Hangar Building 1874								
1874-SB02	1874-SB02-W20	5/9/2017	20.2	N	7.5	**2.7**	**39**	**41.7**
1874-SB03	1874-SB03-W20	5/9/2017	20.3	N	3.3	**1.0**	**55**	**56**
1874-SB04	1874-SB04-W21	5/10/2017	21.2	N	3.2	**1.7**	**1.1**	**2.8**
24-MW09	24-MW09	5/25/2017	18.74	N	0.11	**0.088**	0.010 U	**0.088**
AFFF Area 9 Hangar Building 1881								
1881-SB01	1881-SB01-W24	5/9/2017	24.2	N	0.88 J	**0.39**	**0.26**	**0.65**
1881-SB02	1881-SB02-W22	5/9/2017	22.2	N	3.9	**0.51**	**0.12 J**	**0.63**
18-T04	18-T04	5/25/2017	18.96	N	0.43	**0.18**	0.032	**0.212**
18-MW47	18-MW47	5/25/2017	21.85	N	2.7	**1.0 J**	**5.4**	**6.4**
AFFF Area 11 Hangar Building 4801								
N1-MW06	N1-MW06	5/23/2017	9.83	N	4.2	**1.2**	**25**	**26.2**
AFFF Area 11 Hangar Building 4802								
4802-SB01	4802-SB01-W20	5/19/2017	20.7	N	0.40	**0.43**	**20**	**20.43**
N4-MW03	N4-MW03	5/23/2017	13.60	N	23	**17**	**260**	**277**
AFFF Area 12 Hangar Building 4826								
4826-SB02	4826-SB02-W13	5/18/2017	12.6	N	1.0 U	**3.4**	1.0 U	**3.4**
	4826DUP-W13	5/18/2017	12.6	FD	1.0 U	**4.1**	1.0 U	**4.1**
N1-MW01	N1-MW01	5/23/2017	18.32	N	1.7 J	**1.6 J**	**37**	**38.6**
AFFF Area 13 Hangar Building 4840								
4840-SB01	4840-SB01-W7	5/16/2017	7.3	N	0.053	**0.18**	**2.0**	**2.18**
4840-SB02	4840-SB02-W8	5/17/2017	8.0	N	1.6	**1.1**	**30**	**31.1**
N6-MW01	N6-MW01	5/22/2017	7.64	N	9.6	**2.1**	**5.7**	**7.8**
N1-MW04	N1-MW04	5/23/2017	13.99	N	7.5	**7.7**	**140**	**147.7**
AFFF Area 14 Fire Station #3 (Building 250)								
250-SB01	250-SB01-W52.14	4/11/2017	52.1	N	0.22	0.065	**3.5**	**3.565**
	250DUP-W52.14	4/11/2017	52.1	FD	0.21	**0.079**	**3.6**	**3.679**
250-SB02	250-SB02-W47.7	4/11/2017	47.7	N	0.31	0.051	**1.9**	**1.951**
250-SB03	250-SB03-W49.2	4/11/2017	49.2	N	0.19	0.011 J	**0.36**	**0.371**
AFFF Area 15 Fire Station 5 (Building 4456)								
240-MW22	240-MW22	5/31/2017	101.50	N	0.30 J	**2.0 J**	0.0083 J	**2.0083**

				Analyte	PFBS	PFOA	PFOS	PFOA + PFOS
				PAL:	40	0.07	0.07	0.07
Location	Sample ID	Sample Date	Depth to GW (ft btoc)[1]	Sample Type	µg/L	µg/L	µg/L	µg/L
240-MW31	240-MW31	5/31/2017	101.35	N	2.5 J	**9.2 J**	0.10 UJ	**9.2 J**
240-MW37	240-MW37	5/31/2017	101.11	N	10 J	**25 J**	0.10 UJ	**25 J**
AFFF Area 16 Former Fire Station (Building 1850)								
1850-SB04	1850-SB04-W13	5/19/2017	12.8	N	2.5	**7.0**	**3.4**	**10.4**
AFFF Area 17 1970 Aero Spacelines 377MGT								
377MGT-SB01	377MGT-SB01-W59	5/14/2017	59.4	N	0.015 J	0.034	**0.34**	**0.374**
377MGT-SB02	377MGT-SB02-W58	5/13/2017	58.3	N	0.010 U	0.020 J	**0.22**	**0.22**
377MGT-SB03	377MGT-SB03-W56	5/14/2017	55.6	N	0.010 U	0.0086 J	**0.11**	**0.1186**
AFFF Area 18 1984 Boeing 720 Controlled Impact Demonstration								
B720-SB01	B720-SB01-W98	4/5/2017	98.0	N	0.010 U	0.010 U	0.010 U	NA
B720-SB02	B720-SB02-W98	4/5/2017	97.7	N	0.010 U	0.0086 J	0.0097 J	0.0183 J
B720-SB03	B720-SB03-W97	4/5/2017	97.4	N	0.010 U	0.0068 J	0.011 J	0.0178 J
AFFF Area 19 Former Main Base Treatment Plant								
29-MW07	29-MW07	4/4/2017	104.97	N	0.010 U	0.010 U	0.010 U	NA
29-MW09	29-MW09	4/5/2017	113.76	N	0.010 U	0.010 U	0.010 U	NA
110-MW01	110-MW01	4/4/2017	108.99	N	0.019 J	0.010 U	0.010 U	NA
AFFF Area 20 Current Main Base Treatment Plant								
110-MW02	110-MW02	4/5/2017	105.50	N	0.016 J	0.010 U	0.010 U	NA
	CMBTPDUP-W111	4/5/2017	105.50	FD	0.010 J	0.010 U	0.010 U	NA
110-MW03A	110-MW03A	4/5/2017	103.27	N	0.010 U	0.010 U	0.010 U	NA
110-MW04	110-MW04	4/5/2017	102.39	N	0.010 U	0.010 U	0.010 U	NA
AFFF Area 21 Former Nozzle Spray Test Area								
FNSTA-SB01	FNSTA-SB01-W44	5/4/2017	44.5	N	0.36	**0.11**	**0.78**	**0.89**
FNSTA-SB02	FNSTA-SB02-W45	5/4/2017	44.6	N	0.59	**0.50**	**4.9**	**5.4**
FNSTA-SB03	FNSTA-SB03-W44	5/4/2017	44.3	N	0.41	**0.58**	**11**	**11.58**
AFFF Area 22 Refractometer Spray Test Area								
RSTA-SB01	RSTA-SB01-W54	4/13/2017	54.2	N	0.030	0.047 J	**1.6 J**	**1.647**
RSTA-SB02	RSTA-SB02-W54	4/12/2017	54.0	N	0.011 J	0.014 J	**0.21 J**	**0.224 J**
RSTA-SB03	RSTA-SB03-W51	4/13/2017	51.8	N	0.0063 J	0.022 J	**0.49 J**	**0.512 J**
AFFF Area 23 Muroc Golf Course								
259-MW01	259-MW01	5/25/2017	10.69	N	0.21 J	0.063 J	0.018 J	**0.081**

				Analyte	PFBS	PFOA	PFOS	PFOA + PFOS
				PAL:	40	0.07	0.07	0.07
Location	Sample ID	Sample Date	Depth to GW (ft btoc)[1]	Sample Type	µg/L	µg/L	µg/L	µg/L
AFFF Area 24 Pad 7 Outfall and Stormwater Detention Pond								
PAD7-SB01	PAD7-SB01-W39	5/4/2017	39.1	N	4.1	**3.2**	**5.5**	**8.7**
11-MW16	11-MW16	5/5/2017	36.73	N	1.4	**1.7**	**1.2**	**2.9**
19-MW06	19-MW06	5/24/2017	38.71	N	3.1	**2.0**	**4.1**	**6.1**
19-MW14	19-MW14	5/24/2017	41.96	N	0.37	**0.69**	**1.5**	**2.19**
19-MW15	19-MW15	5/24/2017	37.70	N	0.20	**0.86**	**1.2**	**2.06**

NOTES:
[1]DTW measured during gauging prior to purging at each area is presented for permanent wells.
Bolded = Concentration exceeds the PAL.

DEFINITIONS:
µg/L = micrograms per liter
AFRL = Air Force Research Laboratory
ERP = Environmental Restoration Program
FD = Field Duplicate Sample
FTA = fire training area
ft = feet
ID = Identification
J = Estimated detect at concentration shown
N = Normal Field Sample
NA = not applicable
PAL = project action limit
U = non-detect at reporting limit shown
UJ = Not detected, limit of detection approximate.

5.2 CONCLUSIONS

Twenty-four AFFF areas were sampled for PFAS in soil, sediment, and groundwater. **Table 5.4** summarizes the AFFF areas investigated and indicate where PFAS concentrations were detected above the PALs in samples from each media. PFAS were detected above PALs in soil samples from 10 AFFF areas, in groundwater samples from 21 AFFF areas. PFAS were detected above PALs in sediment samples from one AFFF area. Sampling depths and range of constituent concentrations are presented in **Appendix F**.

Table 5.4 Summary of Total Number of Samples with PAL Exceedances

AFFF Area	Surface Soil[1]	Subsurface Soil[2]	Sediment	Groundwater	PAL Exceedances?
AFFF Area 1: ERP Site 14 (Former/Current FTA)	3	---	ns	4	**Yes**
AFFF Area 2: ERP Site 26 (Former AFRL FTA)	1	---	ns	4	**Yes**
AFFF Area 3: Hangar Buildings 151/160	---	---	ns	3	**Yes**
AFFF Area 4: Hangar Building 1600	1	---	ns	3	**Yes**
AFFF Area 5: Hangar Building 1608	1	---	ns	1	**Yes**
AFFF Area 6: Hangar Building 1624	1	1	ns	3	**Yes**
AFFF Area 7: Hangar Building 1870	2	---	---	2	**Yes**
AFFF Area 8: Hangar Building 1874	3	3	ns	4	**Yes**
AFFF Area 9: Hangar Building 1881	---	---	ns	4	**Yes**
AFFF Area 10: Hangar Building 4801	ns	ns	1	1	**Yes**
AFFF Area 11: Hangar Building 4802	1	---	ns	2	**Yes**
AFFF Area 12: Hangar Building 4826	---	---	ns	2	**Yes**
AFFF Area 13: Hangar Building 4840	1	---	---	4	**Yes**
AFFF Area 14: Fire Station #3 (Building 250)	3	2	ns	3	**Yes**
AFFF Area 15: Fire Station #5 (Building 4456)	ns	ns	ns	3	**Yes**
AFFF Area 16: Former Fire Station (Building 1850)	2	2	ns	1	**Yes**
AFFF Area 17: 1970 Aero Spacelines 377MGT	---	---	---	3	**Yes**
AFFF Area 18: 1984 Boeing 720 Controlled Impact Demonstration	---	---	ns	---	**No**
AFFF Area 19: Former Main Base Sewage Treatment Plant	1	---	ns	---	**Yes**
AFFF Area 20: Current Main Base Sewage Treatment Plant	ns	ns	---	---	**No**
AFFF Area 21: Former Nozzle Spray Test Area	3	1	ns	3	**Yes**
AFFF Area 22: Refractometer Spray Test Area	3	1	ns	3	**Yes**
AFFF Area 23: Muroc Golf Course	ns	ns	---	1	**Yes**
AFFF Area 24: Pad 7 Outfall and Stormwater Detention Pond	1	---	3	5	**Yes**

NOTES:

*Quality control samples not presented this table. For the complete results, including duplicate samples, please refer to results tables in **Appendix F**.

[1]Soil 0 to 0.5 feet below ground surface

[2]Subsurface soil (collected from an interim depth and the vadose zone, immediately above the water saturated/unsaturated soil interface or at approximately 25 ft bgs, whichever was shallower). Deep bedrock subsurface samples were collected from below the water table.

--- = PFAS concentrations did not exceed the PALs in the media at this area; ns = media not sampled for PFAS at this area

This page intentionally left blank.

6.0 DISCUSSION OF RESULTS AND RECOMMENDATIONS

6.1 PAL EXCEEDANCES

PFOS were detected above the PAL in soil and sediment, while PFOS and PFOA were detected above the PAL in groundwater (**Table 6.1**). PFOS was detected most frequently in all media and at higher concentrations at most AFFF areas; exceptions include AFFF Area 2 ERP Site 26 (Former AFRL FTA), AFFF Area 7 Hangar Building 1870, AFFF Area 15 Fire Station #5 (Building 4456), and AFFF Area 16 Former Fire Station (Building 1850), where PFOA concentrations were greater than those of PFOS in groundwater samples. Additionally, PFBS was detected above the PAL in groundwater at one AFFF Area.

PFOS and PFOA were detected above the PAL in soil; PFOS concentrations exceeded the PAL in surface soil from 15 AFFF areas and PFOA exceeded the PAL in surface soil from 1 AFFF area, while PFOS concentrations exceeded the PAL in subsurface soil from 6 AFFF areas (**Table 6.1**). PFOS and PFOA concentrations in groundwater exceeded the PAL at 15 of 24 AFFF areas, while PFOS only exceeded the PAL at 4 of 24 AFFF areas, PFOA only exceeded the PAL in groundwater from 1 AFFF area (AFFF Area 15, Fire Station #5), PFBS exceeded the PAL in groundwater from 1 AFFF area (AFFF Area 7, Hangar Building 1870), the sum of PFOS and PFOA concentrations exceeded the PAL at 21 of the 24 AFFF Areas, including AFFF Area 23 Muroc Golf Course, where neither the PFOS nor PFOA concentrations individually exceeded their PALs. PFOS concentrations in sediment samples exceeded the PAL at two AFFF areas (AFFF Area 10: Hangar Building 4801 and AFFF Area 24, Pad 7 Outfall and Stormwater Detention Pond). PFOA concentrations in sediment samples exceeded the PAL at one AFFF area (AFFF Area 24, Pad 7 Outfall and Stormwater Detention Pond). Significant findings are summarized below:

Table 6.1 PAL Exceedances by Media and Compound

AFFF Area	Surface Soil	Subsurface Soil	Sediment	Groundwater
AFFF Area 1: ERP Site 14 (Former/Current FTA)	PFOS	---	ns	PFOS & PFOA
AFFF Area 2: ERP Site 26 (Former AFRL FTA)	PFOS	---	ns	PFOS & PFOA
AFFF Area 3: Hangar Buildings 151/160	---	---	ns	PFOS
AFFF Area 4: Hangar Building 1600	PFOS	---	ns	PFOS & PFOA
AFFF Area 5: Hangar Building 1608	PFOS	---	ns	PFOS
AFFF Area 6: Hangar Building 1624	PFOS	PFOA	ns	PFOS & PFOA
AFFF Area 7: Hangar Building 1870	PFOS	---	---	PFOS, PFOA, & PFBS
AFFF Area 8: Hangar Building 1874	PFOS	PFOS	ns	PFOS & PFOA
AFFF Area 9: Hangar Building 1881	---	---	ns	PFOS & PFOA
AFFF Area 10: Hangar Building 4801	ns	ns	PFOS	PFOS & PFOA
AFFF Area 11: Hangar Building 4802	PFOS	---	ns	PFOS & PFOA
AFFF Area 12: Hangar Building 4826	---	---	ns	PFOS & PFOA
AFFF Area 13: Hangar Building 4840	PFOS	---	---	PFOS & PFOA
AFFF Area 14: Fire Station #3 (Building 250)	PFOS & PFOA	PFOS	ns	PFOS & PFOA
AFFF Area 15: Fire Station #5 (Building 4456)	ns	ns	ns	PFOA
AFFF Area 16: Former Fire Station (Building 1850)	PFOS	PFOS	ns	PFOS & PFOA
AFFF Area 17: 1970 Aero Spacelines 377MGT	---	---	---	PFOS

AFFF Area	Surface Soil	Subsurface Soil	Sediment	Groundwater
AFFF Area 18: 1984 Boeing 720 Controlled Impact Demonstration	---	---	ns	---
AFFF Area 19: Former Main Base Sewage Treatment Plant	PFOS	---	ns	---
AFFF Area 20: Current Main Base Sewage Treatment Plant	ns	ns	---	---
AFFF Area 21: Former Nozzle Spray Test Area	PFOS	PFOS	ns	PFOS & PFOA
AFFF Area 22: Refractometer Spray Test Area	PFOS	PFOS	ns	PFOS
AFFF Area 23: Muroc Golf Course	ns	ns	---	Sum of PFOS + PFOA
AFFF Area 24: Pad 7 Outfall and Stormwater Detention Pond	PFOS	---	PFOS	PFOS & PFOA

NOTES:

--- = no PAL exceedances

No shading with "PFOS" and/or "PFOA" indicated exceedances below the PAL.
Between PAL and 9.9x the PAL
Between 10x and 99x the PAL
Between 100x and 999x the PAL
≥ 1,000x the PAL

6.2 PATHWAYS AND EXPOSURE TARGETS SUMMARY

Based on analytical results from SI sampling activities, potential PFAS exposure pathways exist for groundwater, soil, and air. With the exception of the AFFF areas on South Base, all other AFFF areas (including Hangar Buildings 151/160) are located in restricted location inaccessible to the public (visitors/ people in housing and dorms) as the flightline and the controlled movement areas are accessible to duty related personnel only.

Groundwater samples from 21 AFFF areas exceeded the PALs for at least one PFAS compound or the sum of PFOS and PFOA. The two AFFF areas closest to on-Base water supply wells are AFFF Area 19 Former Main Base Sewage Treatment Plant and AFFF Area 20 Current Main Base Sewage Treatment Plant, which have concentrations of PFAS below the PALs. The Edwards AFB water supply wells located in the southern portion of the Base are located within a 4-mile radius of several AFFF areas. In addition, 39 off-Base water supply wells are within a 4-mile radius of AFFF Area 15 Fire Station #5. The potential human targets for drinking water comprise the entire Edwards AFB population, or approximately 11,000 consumers, and the population potentially using water from off-Base water supply wells. The following AFFF Areas with PFAS concentrations in groundwater that exceeded PALs are located within a 4-mile radius of the Edwards AFB water supply wells or off-Base water supply wells (**Section 4.1.4**):

- AFFF Area 1 ERP Site 14 (Former/Current FTA)
- AFFF Area 3 Hangar Building 151/160
- AFFF Area 14 Fire Station #3
- AFFF Area 15 Fire Station #5

- AFFF Area 17 1970 Aero Spacelines MGT 377; and
- AFFF Area 22 Refractometer Spray Test Area.

Water samples collected by Edwards AFB Bioenvironmental from the on-Base water supply water supply wells C-1, C-4, S-5, S-10, AFRL Well B, AFRL Well C in August 2016 did not have detections of PFAS (**Section 4.1.3**).

Surface soil samples from ten AFFF areas and sediment samples from one AFFF area exceeded the PAL for PFOS. A potential soil pathway exists for the 10,500 human targets that work at Edwards AFB, particularly construction or maintenance workers performing ground-disturbing activities, and for the 1,000 civilian residents and visitors to the Base. A potential soil pathway also exists for the ecological receptors that inhabit the Base in the vicinity of the AFFF areas, including threatened and endangered species (**Section 4.3.3.2**).

Due to the surface soil PAL exceedance, potential air migration pathways exist for the human targets within four miles of the AFFF areas, including the 11,600 population of workers and residents at Edwards AFB.

6.3 SUMMARY AND RECOMMENDATIONS

The Air Force recommends the following additional sampling conducted during extended SIs at two AFFF areas:

- Sample monitoring wells and GETS reinjection wells downgradient of AFFF Area 1 (ERP Site 14) and analyze the samples for PFAS to further evaluate the extent of PFAS in groundwater in this area; and
- Sample additional monitoring wells downgradient of AFFF Area 15 Fire Station #5, including monitoring/sentinel wells located at the installation boundary (as appropriate) and analyze the samples for PFAS to further evaluate the extent of PFAS in groundwater in this area and the potential for off-installation migration.

Table 6.2 below summarize**s** exceedances by area and media, fulfilling the objectives of the SI.

This page intentionally left blank.

Table 6.2 Summary of Analytical Results, PAL Exceedances, and Recommendations

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 1 ERP Site 14 (Current/Former FTA)	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**18,000**	126	µg/kg	4/4	**Yes**	No	Advance Area to RI
	PFOA	99	126	µg/kg	4/0	No		
	PFBS	ND	130,000	µg/kg	4/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	110	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	30	126	µg/kg	6/0	No		
	PFBS	1.5	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	**34**	0.07	µg/L	6/4	**Yes**	Yes	Initiate Expanded SI Advance Area to RI
	PFOA	**5.7**	0.07	µg/L	6/4	**Yes**		
	PFOS+PFOA	**39.7**	0.07	µg/L	6/5	**Yes**		
	PFBS	3.0	40	µg/L	6/0	No		
AFFF Area 2 ERP 26 (Former AFRL FTA)	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**1,300 J**	126	µg/kg	4/2	**Yes**	No	Advance Area to RI
	PFOA	27	126	µg/kg	4/0	No		
	PFBS	ND	130,000	µg/kg	4/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	3.1	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	33	126	µg/kg	6/0	No		
	PFBS	6.2	130,000	µg/kg	6/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 2 ERP 26 (Former AFRL FTA) (cont.)	Groundwater							
	PFOS	**1.9**	0.07	µg/L	5/4	**Yes**	No	Advance Area to RI
	PFOA	**7.7**	0.07	µg/L	5/5	**Yes**		
	PFOS+PFOA	**9.6**	0.07	µg/L	5/5	**Yes**		
	PFBS	1.2	40	µg/L	5/0	No		
AFFF Area 3 Hangar Buildings 151/160	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	15	126	µg/kg	5/0	No	No	Further Evaluation Deferred
	PFOA	1.7	126	µg/kg	5/0	No		
	PFBS	0.38 J	130,000	µg/kg	5/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	9.2	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	6/0	No		
	PFBS	ND	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	**2.6**	0.07	µg/L	4/4	**Yes**	No	Advance Area to RI
	PFOA	0.070	0.07	µg/L	4/0	No		
	PFOS+PFOA	**2.659**	0.07	µg/L	4/4	**Yes**		
	PFBS	1.0	40	µg/L	4/0	No		
AFFF Area 4 Hangar Building 1600	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**250 J**	126	µg/kg	2/1	**Yes**	No	Advance Area to RI
	PFOA	1.6	126	µg/kg	2/0	No		
	PFBS	0.76 J	130,000	µg/kg	2/0	No		
	Subsurface Soil (12.0 to 25 feet bgs)							
	PFOS	3.5	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	2.0	126	µg/kg	2/0	No		
	PFBS	0.77 J	130,000	µg/kg	2/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 4 Hangar Building 1600 (cont.)	Groundwater							
	PFOS	**110**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	**62**	0.07	µg/L	3/2	**Yes**		
	PFOS+PFOA	**172**	0.07	µg/L	3/3	**Yes**		
	PFBS	8.6	40	µg/L	3/0	No		
AFFF Area 5 Hangar Building 1608	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**2,200**	126	µg/kg	2/2	**Yes**	No	Advance Area to RI
	PFOA	89	126	µg/kg	2/0	No		
	PFBS	ND	130,000	µg/kg	2/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	14	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	0.85 J	126	µg/kg	2/0	No		
	PFBS	1.2	130,000	µg/kg	2/0	No		
	Groundwater							
	PFOS	**0.46**	0.07	µg/L	3/2	**Yes**	No	Advance Area to RI
	PFOA	0.052	0.07	µg/L	3/0	No		
	PFOS+PFOA	**0.512**	0.07	µg/L	3/2	**Yes**		
	PFBS	0.72	40	µg/L	3/0	No		
AFFF Area 6 Hangar Building 1624	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**240 J**	126	µg/kg	2/1	**Yes**	No	Advance Area to RI
	PFOA	1.2	126	µg/kg	2/0	No		
	PFBS	0.84 J	130,000	µg/kg	2/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	12	126	µg/kg	2/0	No	No	Advance Area to RI
	PFOA	**180**	126	µg/kg	2/1	**Yes**		
	PFBS	9.0	130,000	µg/kg	2/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 6 Hangar Building 1624 (cont.)	Groundwater							
	PFOS	**0.90**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	**0.19**	0.07	µg/L	3/3	**Yes**		
	PFOS+PFOA	**1.09**	0.07	µg/L	3/3	**Yes**		
	PFBS	0.59	40	µg/L	3/0	No		
AFFF Area 7 Hangar Building 1870	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**2,200**	126	µg/kg	3/3	**Yes**	No	Advance Area to RI
	PFOA	11	126	µg/kg	3/0	No		
	PFBS	4.1 J	130,000	µg/kg	3/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	32	126	µg/kg	4/0	No	No	Further Evaluation Deferred
	PFOA	1.3	126	µg/kg	4/0	No		
	PFBS	1.1	130,000	µg/kg	4/0	No		
	Sediment							
	PFOS	6.5	126	µg/kg	1/0	No	No	Further Evaluation Deferred
	PFOA	0.67 J	126	µg/kg	1/0	No		
	PFBS	0.51 J	130,000	µg/kg	1/0	No		
	Groundwater							
	PFOS	**10**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	**14**	0.07	µg/L	3/3	**Yes**		
	PFOS+PFOA	**24**	0.07	µg/L	3/3	**Yes**		
	PFBS	**56**	40	µg/L	3/2	**Yes**		
AFFF Area 8 Hangar Building 1874	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**2,900**	126	µg/kg	3/3	**Yes**	No	Advance Area to RI
	PFOA	41	126	µg/kg	3/0	No		
	PFBS	110	130,000	µg/kg	3/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 8 Hangar Building 1874 (cont.)	Subsurface Soil (5 to 25 feet bgs)							
	PFOS	**2,400**	126	µg/kg	7/4	**Yes**	No	Advance Area to RI
	PFOA	32	126	µg/kg	7/0	No		
	PFBS	49	130,000	µg/kg	7/0	No		
	Groundwater							
	PFOS	**55**	0.07	µg/L	4/3	**Yes**	No	Advance Area to RI
	PFOA	**2.7**	0.07	µg/L	4/4	**Yes**		
	PFOS+PFOA	**56**	0.07	µg/L	4/4	**Yes**		
	PFBS	7.5	40	µg/L	4/0	No		
AFFF Area 9 Hangar Building 1881	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	110	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	1.0	126	µg/kg	2/0	No		
	PFBS	0.92	130,000	µg/kg	2/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	110 J	126	µg/kg	5/0	No	No	Further Evaluation Deferred
	PFOA	0.96 J	126	µg/kg	5/0	No		
	PFBS	1.2 J	130,000	µg/kg	5/0	No		
	Groundwater							
	PFOS	**5.4**	0.07	µg/L	4/3	**Yes**	No	Advance Area to RI
	PFOA	**1.0 J**	0.07	µg/L	4/4	**Yes**		
	PFOS+PFOA	**6.4**	0.07	µg/L	4/4	**Yes**		
	PFBS	3.9	40	µg/L	4/0	No		
AFFF Area 10 Hangar Building 4801	Sediment							
	PFOS	**240**	126	µg/kg	3/1	**Yes**	No	Advance Area to RI
	PFOA	2.5	126	µg/kg	3/0	No		
	PFBS	4.2	130,000	µg/kg	3/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 10 Hangar Building 4801 (cont.)	Groundwater							
	PFOS	**25**	0.07	µg/L	1/1	**Yes**	No	Advance Area to RI
	PFOA	**1.2**	0.07	µg/L	1/1	**Yes**		
	PFOS+PFOA	**26.2**	0.07	µg/L	1/1	**Yes**		
	PFBS	4.2	40	µg/L	1/0	No		
AFFF Area 11 Hangar Building 4802	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**2,800**	126	µg/kg	2/2	**Yes**	No	Advance Area to RI
	PFOA	21 J	126	µg/kg	2/0	No		
	PFBS	ND	130,000	µg/kg	2/0	No		
	Subsurface Soil (6 to 20 feet bgs)							
	PFOS	4.4	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	2/0	No		
	PFBS	ND	130,000	µg/kg	2/0	No		
	Groundwater							
	PFOS	**260**	0.07	µg/L	2/2	**Yes**	No	Advance Area to RI
	PFOA	**17**	0.07	µg/L	2/2	**Yes**		
	PFOS+PFOA	**277**	0.07	µg/L	2/2	**Yes**		
	PFBS	23	23	µg/L	2/0	No		
AFFF Area 12 Hangar Building 4826	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	85	126	µg/kg	4/0	No	No	Further Evaluation Deferred
	PFOA	64	126	µg/kg	4/0	No		
	PFBS	1.9 J	130,000	µg/kg	4/0	No		
	Subsurface Soil (6 to 20 feet bgs)							
	PFOS	13	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	21	126	µg/kg	6/0	No		
	PFBS	ND	130,000	µg/kg	6/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 12 Hangar Building 4826 (cont.)	Groundwater							
	PFOS	**37**	0.07	µg/L	3/1	**Yes**	No	Advance Area to RI
	PFOA	**4.1**	0.07	µg/L	3/3	**Yes**		
	PFOS+PFOA	**38.6**	0.07	µg/L	3/3	**Yes**		
	PFBS	1.7 J	40	µg/L	3/0	No		
AFFF Area 13 Hangar Building 4840	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**710**	126	µg/kg	3/1	**Yes**	No	Advance Area to RI
	PFOA	1.6	126	µg/kg	3/0	No		
	PFBS	0.28 J	130,000	µg/kg	3/0	No		
	Subsurface Soil (5 to 20 feet bgs)							
	PFOS	110	126	µg/kg	4/0	No	No	Further Evaluation Deferred
	PFOA	4.2	126	µg/kg	4/0	No		
	PFBS	0.21 J	130,000	µg/kg	4/0	No		
	Sediment							
	PFOS	78	126	µg/kg	1/0	No	No	Further Evaluation Deferred
	PFOA	0.82 J	126	µg/kg	1/0	No		
	PFBS	0.21 J	130,000	µg/kg	1/0	No		
	Groundwater							
	PFOS	**140**	0.07	µg/L	4/4	**Yes**	No	Advance Area to RI
	PFOA	**7.7**	0.07	µg/L	4/4	**Yes**		
	PFOS+PFOA	**147.7**	0.07	µg/L	4/4	**Yes**		
	PFBS	9.6	40	µg/L	4/0	No		
AFFF Area 14 Fire Station #3 (Building 250)	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**32,000**	126	µg/kg	4/4	**Yes**	No	Advance Area to RI
	PFOA	**330 J**	126	µg/kg	4/2	No		
	PFBS	430 J	130,000	µg/kg	4/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 14 Fire Station #3 (Building 250) (cont.)	Subsurface Soil (7.5 to 25 feet bgs)							
	PFOS	**770**	126	µg/kg	6/2	**Yes**	No	Advance Area to RI
	PFOA	80	126	µg/kg	6/0	No		
	PFBS	440	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	**3.6**	0.07	µg/L	4/4	**Yes**	No	Advance Area to RI
	PFOA	**0.079**	0.07	µg/L	4/1	**Yes**		
	PFOS+PFOA	**3.679**	0.07	µg/L	4/4	**Yes**		
	PFBS	0.31	40	µg/L	4/0	No		
AFFF Area 15 Fire Station 5 (Building 4456)	Groundwater							
	PFOS	0.0083 J	0.07	µg/L	3/0	No	Yes	Initiate Expanded SI Advance Area to RI
	PFOA	**25 J**	0.07	µg/L	3/3	**Yes**		
	PFOS+PFOA	**25 J**	0.07	µg/L	3/3	**Yes**		
	PFBS	10 J	40	µg/L	3/0	No		
AFFF Area 16 Former Fire Station (Building 1850)	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**3,300**	126	µg/kg	4/3	**Yes**	No	Advance Area to RI
	PFOA	25	126	µg/kg	4/0	No		
	PFBS	7.3 J	130,000	µg/kg	4/0	No		
	Subsurface Soil (3 to 25 feet bgs)							
	PFOS	**170**	126	µg/kg	4/2	**Yes**	No	Advance Area to RI
	PFOA	45	126	µg/kg	4/0	No		
	PFBS	5.8	130,000	µg/kg	4/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 16 Former Fire Station (Building 1850) (cont.)	Groundwater							
	PFOS	**3.4**	0.07	µg/L	1/1	**Yes**	No	Advance Area to RI
	PFOA	**7.0**	0.07	µg/L	1/1	**Yes**		
	PFOS+PFOA	**10.4**	0.07	µg/L	1/1	**Yes**		
	PFBS	2.5	40	µg/L	1/0	No		
AFFF Area 17 1970 Aero Spacelines 377MGT	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**3.0**	126	µg/kg	4/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	4/0	No		
	PFBS	ND	130,000	µg/kg	4/0	No		
	Subsurface Soil (6 to 25 feet bgs)							
	PFOS	ND	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	6/0	No		
	PFBS	ND	130,000	µg/kg	6/0	No		
	Sediment							
	PFOS	4.1	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	2/0	No		
	PFBS	ND	130,000	µg/kg	2/0	No		
	Groundwater							
	PFOS	**0.34**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	0.034	0.07	µg/L	3/0	No		
	PFOS+PFOA	**0.374**	0.07	µg/L	3/3	**Yes**		
	PFBS	0.015 J	40	µg/L	3/0	No		
AFFF Area 18 1984 Boeing 720 Controlled Impact Demonstration	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	9.2	126	µg/kg	3/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	3/0	No		
	PFBS	1.7	130,000	µg/kg	3/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 18 1984 Boeing 720 Controlled Impact Demonstration (cont.)	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	0.40 J	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	0.44 J	126	µg/kg	6/0	No		
	PFBS	ND	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	0.011 J	0.07	µg/L	3/0	No	No	Further Evaluation Deferred
	PFOA	0.0086 J	0.07	µg/L	3/0	No		
	PFOS+PFOA	0.0183 J	0.07	µg/L	3/0	No		
	PFBS	ND	40	µg/L	3/0	No		
AFFF Area 19 Former Main Base Treatment Plant	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**300**	126	µg/kg	3/1	**Yes**	No	Advance Area to RI
	PFOA	11	126	µg/kg	3/0	No		
	PFBS	0.25 J	130,000	µg/kg	3/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	0.32 J	126	µg/kg	6/0	No	No	Further Evaluation Deferred
	PFOA	0.33 J	126	µg/kg	6/0	No		
	PFBS	ND	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	ND	0.07	µg/L	3/0	No	No	Further Evaluation Deferred
	PFOA	ND	0.07	µg/L	3/0	No		
	PFOS+PFOA	NA	0.07	µg/L	3/0	No		
	PFBS	0.019 J	40	µg/L	3/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 20 Current Main Base Treatment Plant	Sediment							
	PFOS	36	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	13	126	µg/kg	2/0	No		
	PFBS	1.3	130,000	µg/kg	2/0	No		
	Groundwater							
	PFOS	ND	0.07	µg/L	4/0	No	No	Further Evaluation Deferred
	PFOA	ND	0.07	µg/L	4/0	No		
	PFOS+PFOA	3/0	0.07	µg/L	4/0	No		
	PFBS	0.016 J	40	µg/L	4/0	No		
AFFF Area 21 Former Nozzle Spray Test Area	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**2,200**	126	µg/kg	3/3	**Yes**	No	Advance Area to RI
	PFOA	36	126	µg/kg	3/0	No		
	PFBS	ND	130,000	µg/kg	3/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	**600**	126	µg/kg	6/1	**Yes**	No	Advance Area to RI
	PFOA	13	126	µg/kg	6/0	No		
	PFBS	7.7	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	**11**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	**0.58**	0.07	µg/L	3/3	**Yes**		
	PFOS+PFOA	**11.58**	0.07	µg/L	3/3	**Yes**		
	PFBS	0.59	40	µg/L	3/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 22 Refractometer Spray Test Area	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**5,900**	126	µg/kg	3/3	**Yes**	No	Advance Area to RI
	PFOA	53	126	µg/kg	3/0	No		
	PFBS	6.3 J	130,000	µg/kg	3/0	No		
	Subsurface Soil (5.5 to 25 feet bgs)							
	PFOS	**200**	126	µg/kg	6/1	**Yes**	No	Advance Area to RI
	PFOA	14	126	µg/kg	6/0	No		
	PFBS	27	130,000	µg/kg	6/0	No		
	Groundwater							
	PFOS	**1.6 J**	0.07	µg/L	3/3	**Yes**	No	Advance Area to RI
	PFOA	0.047 J	0.07	µg/L	3/0	No		
	PFOS+PFOA	**1.647**	0.07	µg/L	3/3	**Yes**		
	PFBS	0.030	40	µg/L	3/0	No		
AFFF Area 23 Muroc Golf Course	Sediment							
	PFOS	0.28 J	126	µg/kg	3/0	No	No	Further Evaluation Deferred
	PFOA	ND	126	µg/kg	3/0	No		
	PFBS	ND	130,000	µg/kg	3/0	No		
	Groundwater							
	PFOS	0.018 J	0.07	µg/L	1/0	No	No	Advance Area to RI
	PFOA	0.063 J	0.07	µg/L	1/0	No		
	PFOS+PFOA	**0.081**	0.07	µg/L	1/1	**Yes**		
	PFBS	0.21 J	40	µg/L	1/0	No		

AFFF Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 24 Pad 7 Outfall and Stormwater Detention Pond	Surface Soil (0 to 0.5 feet bgs)							
	PFOS	**140**	126	µg/kg	1/1	**Yes**	No	Advance Area to RI
	PFOA	10	126	µg/kg	1/0	No		
	PFBS	2.8	130,000	µg/kg	1/0	No		
	Subsurface Soil (12.5 to 25 feet bgs)							
	PFOS	2.9	126	µg/kg	2/0	No	No	Further Evaluation Deferred
	PFOA	9.7	126	µg/kg	2/0	No		
	PFBS	0.30 J	130,000	µg/kg	2/0	No		
	Sediment							
	PFOS	**13,000**	126	µg/kg	4/3	**Yes**	No	Advance Area to RI
	PFOA	**240**	126	µg/kg	4/1	**Yes**		
	PFBS	14	130,000	µg/kg	4/0	No		
	Groundwater							
	PFOS	**5.5**	0.07	µg/L	5/5	**Yes**	No	Advance Area to RI
	PFOA	**3.2**	0.07	µg/L	5/5	**Yes**		
	PFOS+PFOA	**8.7**	0.07	µg/L	5/5	**Yes**		
	PFBS	4.1	40	µg/L	5/0	No		

NOTES:

* includes normal and field duplicate samples (count does not include QC samples)

DEFINITIONS:

ft bgs = feet below ground surface
DW = Drinking Water
J = Estimated detect at concentration shown
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
NA = not applicable
ND = not detected
RI = Remedial Investigation

This page intentionally left blank.

7.0 REFERENCES

AECOM Technical Services, Inc. (AECOM). 2009. *Final 2008 Biennial Groundwater Monitoring Report, Site 29, South Base, Operable Unit No. 2.* September.

_____. 2015. *Final Operable Unit 1 Groundwater Monitoring and Sampling Report for 201*2, Edwards Air Force Base, California. Figure 2.2-2. February.

_____. 2017a. *Draft Sites 5/14 Groundwater Contaminant Plume Annual Remedial Action Status Report, October 2015 through September 2016, South Base, Operable Unit 2*, Edwards Air Force Base, California. May.

_____. 2017a. *Draft Sites 5/14 Groundwater Contaminant Plume Annual Remedial Action Status Report, October 2015 through September 2016, South Base, Operable Unit 2*, Edwards Air Force Base, California. May.

_____. 2017b. *Remedial Performance and Groundwater Monitoring Report, Site 25 Operable Unit 6, Edwards Air Force Base, California (Figure 1).*

California Department of Water Resources. 1981. Bulletin 74-81, California Well Standards. December.

California Department of Water Resources. 1991. Bulletin 74-90, California Well Standards, Supplement to Bulletin 74-81. June.

California Regional Water Quality Control Board Lahontan Region (LRWQCB). 1986. Board Order 6-86-12, Updated Waste Discharge Requirements for Edwards Air Force Base, Main Base Wastewater Treatment Plant, Kern County.

_____. 1994. Board Order 6-94-52, WDID No. 6B150700001. Revised Waste Discharge Requirements for U.S. Department pf the Air Force, Edwards Air Force Base, Main Base Wastewater Treatment Plant, Kern County.

CH2M HILL. 2015*. Final Preliminary Assessment Report for Perfluorinated Compounds at Edwards Air Force Base, Kern County, California*. July.

Department of Defense (DoD). 2009. *Department of Defense Instruction 4715.18, Emerging Contaminants*, Certified current through 11 June 2016.

Duell, Lowell F.W. Jr. 1987. *Geohydrology of the Antelope Valley Area, California, and Design for a Groundwater Quality Monitoring Network*. U.S. Geological Survey Water Resources Investigations Report 84-4081.

Earth Tech. 2001a. Informal Technical information Report, Site 14 Biovent System, South Base, Operable Unit No. 2. Final. August

Earth Tech. 2001b. Interim Removal Action Report Site 26 Former Fire Training Area, Air Force Research Laboratory, Operable Unit No. 4. Final. November.

Edwards Air Force Base. 2014a. 2013 Consumer Confidence Report, Edwards Air Force Base, California.

_____. 2014b. 2013 Consumer Confidence Report Air Force Research Lab (AFRL), California.

Edwards, Mark. 2018. Personal communication by email from Mark Edwards in Edwards Air Force Base Civil Engineering Department regarding AFRL wells and Mary's Well locations, status, and sampling.

Environmental Protection Agency (EPA). 1991 Guidance for Performing Preliminary Assessments under CERCLA. EPA/540/G-91/013. September.

_____. 1992. Guidance for Performing Site Inspections under CERCLA. Interim Final. EPA/540-R-92-021. September.

_____. 2012. Third Unregulated Contaminant Monitoring Rule (UCMR 3), Fact Sheet for Assessment Mnitoring of List 1 Contaminants. EPA 815-F-12-003. http://water.epa.gove/drink/. May.

_____. 2016a. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), EPA Document Number 822-R-16-005. May.

_____. 2016b. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), EPA Document Number 822-R-16-004. May.

_____. 2016c. Health Effects Support Document for Perfluorooctanoic Acid (PFOA), EPA Document Number 822-R-16-003. May.

_____. 2016d. Health Effects Support Document for Perfluorooctane Sulfonate (PFOS), EPA Document Number 822-R-16-002. May.

_____. 2016e. Fact Sheet, PFOA & PFOS Drinking Water, Health Advisories. EPA 800 F 16 003. November.

_____. 2018. EPA Regional Screening Level (RSL) Summary Table (TR = 1E-06. HQ = 0.1). May.

Federal Emergency Management Agency (FEMA). 2008. Flood Insurance Rate Map, Kern County Unincorporated Areas. Map Number 06029C3725E. September 26.

Oneida Total Integrated Enterprises, LLC. (OTIE). 2015. *Final Work Plan, Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in EPA Regions 6 & 9*. December.

_____. 2016. *Revised Final Uniform Federal Policy for Quality Assurance Project Plan (QAPP), Site Inspections of Aqueous Film Forming Foam Usage at Multiple United States Air Force Installations in EPA Regions 6 & 9*. August.

_____. 2017a. *Final Uniform Federal Policy for Quality Assurance Project Plan (QAPP) Addendum, Site Inspections of Aqueous Film Forming Foam Usage at Edwards AFB*. March.

_____. 2017b. *Site Safety and Health Plan for Site Inspections of Aqueous Film Forming Foam Usage at Edwards Air Force Base (AFB) Kern County, California*. March.

Tetra Tech, Inc. (Tetra Tech). 2015. *Draft Feasibility Study Addendum, North Base, Operable Unit 5/10 Edwards Air Force Base, California*. May.

_____. 2018. Final 2016 Groundwater Monitoring Report, South Air Force Research Laboratory Groundwater Area, Operable Unit 4/9. February.

Tseng, Julia (Environmental Restoration – Edwards ISS; AFCEC/CZOW). 2017. Email communication. September 7 and 12.

United States Air Force. 2012. *Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Closure and Realignment (BRAC) Installations*. 27 August.

_____. 2016. SAF/IE Policy on Perfluorinated Compounds of Concern.

This page intentionally left blank.

FIGURES

This page intentionally left blank.

FIGURE 1-1
Installation Location Map
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

Edwards AFB Installation Boundary

Abbreviations

AFB = Air Force Base
AFFF = Aqueous Film Forming Foam
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **3/16/2018**

N W E S

OTIE
An Oneida Nation Company

0 75 150 300
Miles

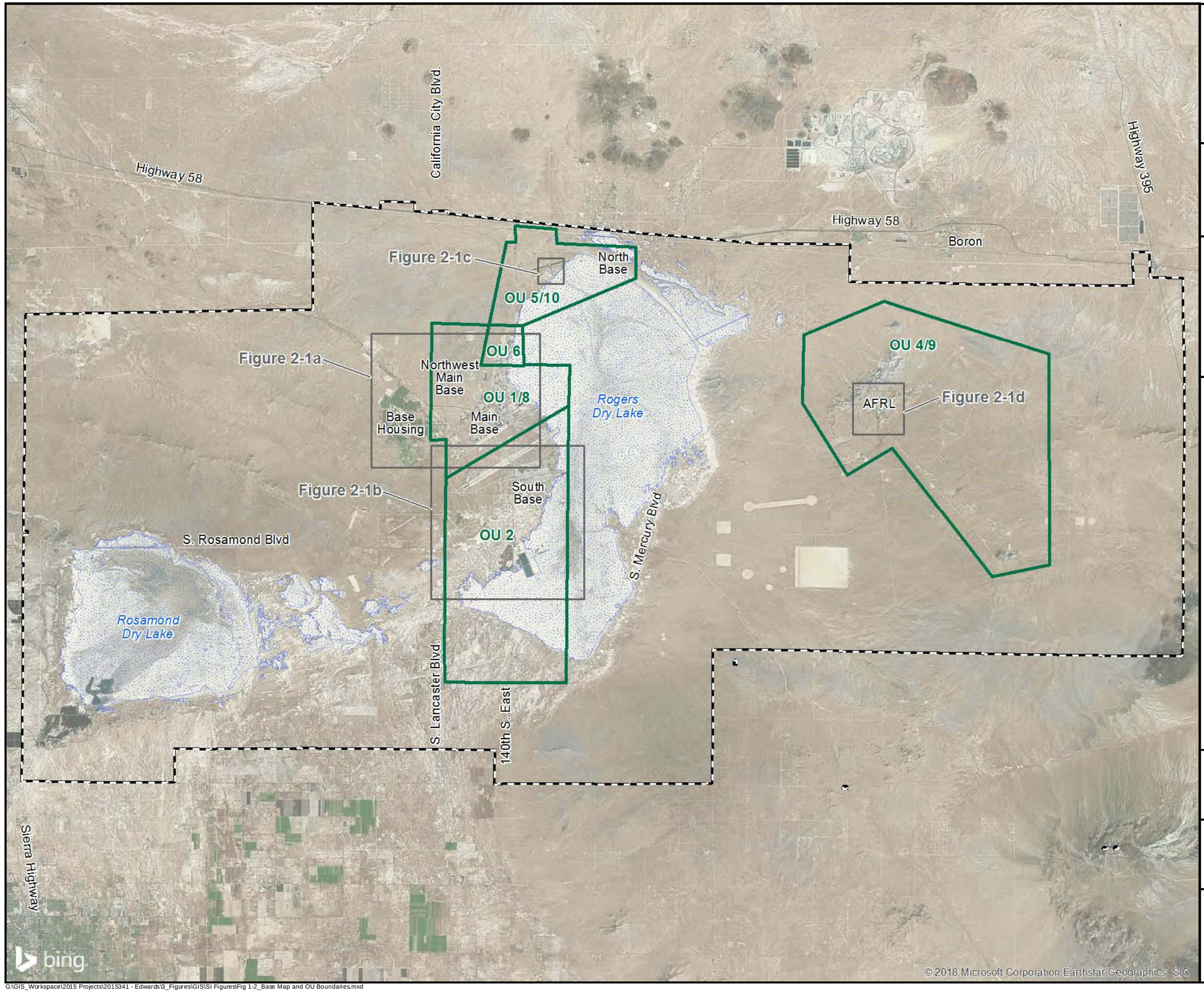
G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 1-1_Installation Location Map.mxd

5623160

FIGURE 1-2
Base Map and OU Boundaries
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236



Legend

- Installation Boundary
- Operable Unit
- Dry Lake
- Extent of Regional Figure showing AFFF Areas

Abbreviations

AFB = Air Force Base
AFF = Aqueous Film Forming Foam
OU = Operable Unit
U.S. = United States

Service Layer Credits: Source: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

OTIE
An Oneida Nation Company

N W E S

Contract # W912BV-15-C-0082	
By: M. Witkauskis	3/16/2018

0 1 2 4
Miles

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 1-2_Base Map and OU Boundaries.mxd

5623161

FIGURE 2-1a
AFFF Areas
Main Base
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Base Production Wells
- AFFF Area
- Zoomed Map View Extent
- Rogers Dry Lake
- Operable Unit
- Historical Regional Groundwater Flow Direction (CH2M Hill, 2015)

Abbreviations

AFB = Air Force Base
AFFF = Aqueous Film Forming Foam
OU = Operable Unit
U.S. = United States

Service Layer Credits: Source: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

OTIE
An Oneida Nation Company

Contract # W912BV-15-C-0082

By: E. Cutler | 3/16/2018

0 500 1,000 2,000
Approximate Scale in Feet

N W E S

Figure 2-1c
Air Force Research Laboratory
Figure 2-1a
Main Base
Figure 2-1d
South Base
Figure 2-1b
Inset 1
1984 Boeing 720 Controlled Impact Demonstration
0 5,500 11,000 22,000
Approximate Scale in Feet

AFFF Area 18
1984 Boeing 720 Controlled Impact Demonstation (B720)
Inset 1
AFRL Well D
AFRL Well A
AFRL Well C
AFRL Well B
0 1,250 2,500 5,000
Approximate Scale in Feet

AFFF Area 12
Hangar 4826 (4826)
AFFF Area 13
Hangar 4840 (4840)
AFFF Area 10
Hangars 4801 (4801)
AFFF Area 11
Hangars 4802 (4802)
AFFF Area 16
Former Fire Station
(Building 1850) (1850)
AFFF Area 7
Hangar 1870 (1870)
AFFF Area 9
Hangar 1881 (1881)
AFFF Area 8
Hangar 1874 (1874)
AFFF Area 24
Pad 7 Outfall and
Stormwater Detention
Pond (PAD7)
AFFF Area 5
Hangar 1608 (1608)
AFFF Area 4
Hangar 1600 (1600)
AFFF Area 6
Hangar 1624 (1624)
AFFF Area 21
Former Nozzle
Spray Test Area (FNSTA)
AFFF Area 23
Muroc Golf Course (MGC)
OU 6
OU 1/8
OU 2
Lancaster Boulevard
Forbes Avenue
Rosamond Boulevard
Yeager Boulevard
Fitzgerald Boulevard
North Muroc Drive
Gregorious Avenue
Wolfe Avenue
Poison Avenue
TAXIWAY E
TAXIWAY D
TAXIWAY C
TAXIWAY A
TAXIWAY B
TAXIWAY G
RAMP 4
MAIN BASE AIRFIELD
RUNWAY 04L/22R
RUNWAY 04R/22L

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 2-1a_AFFF Areas-Main Base.mxd

5623162

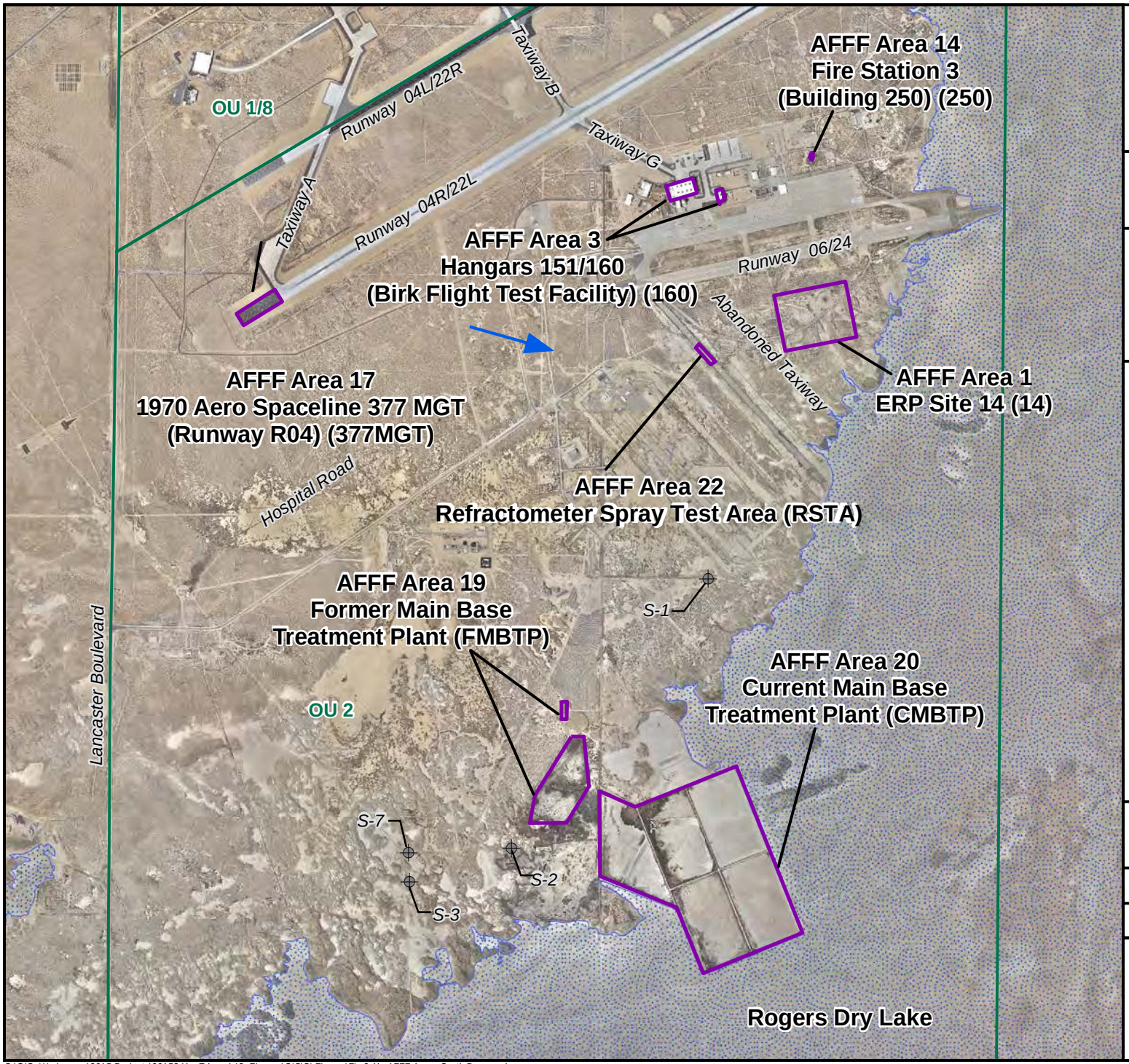


FIGURE 2-1b
AFFF Areas
South Base
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Base Production Well
- AFFF Area
- Rogers Dry Lake
- Operable Unit
- Historical Regional Groundwater Flow Direction (CH2M Hill, 2015)

Abbreviations

AFB = Air Force Base
AFFF = Aqueous Film Forming Foam
ERP = Environmental Restoration Program
OU = Operable Unit
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **2/16/2018**

N W E S

OTIE An Oneida Nation Company

0 750 1,500 3,000
Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 2-1b_AFFF Areas-South Base.mxd

5623163

FIGURE 2-1c
AFFF Areas
North Base
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- AFFF Area
- Rogers Dry Lake
- Historical Regional Groundwater Flow Direction (CH2M Hill, 2015)

Note:
The area shown on this figure falls completely within OU 5/10.

Abbreviations

AFB = Air Force Base
AFFF = Aqueous Film Forming Foam
OU = Operable Unit
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **3/16/2018**

N W E S

OTIE
An Oneida Nation Company

0 125 250 500
Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 2-1c_AFFF Areas-North Base.mxd

5623164

FIGURE 2-1d
AFFF Areas
AFRL
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

AFFF Area

Historical Regional Groundwater Flow Direction (CH2M Hill, 2015)

Note:
The area shown on this figure falls completely within OU 4/9.

Abbreviations

AFB = Air Force Base
AFFF = Aqueous Film Forming Foam
AFRL = Air Force Research Laboratory
ERP = Environmental Restoration Program
OU = Operable Unit
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **3/16/2018**

N W E S

OTIE
An Oneida Nation Company

0 250 500 1,000
Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 2-1d_AFFF Areas-AFRL.mxd

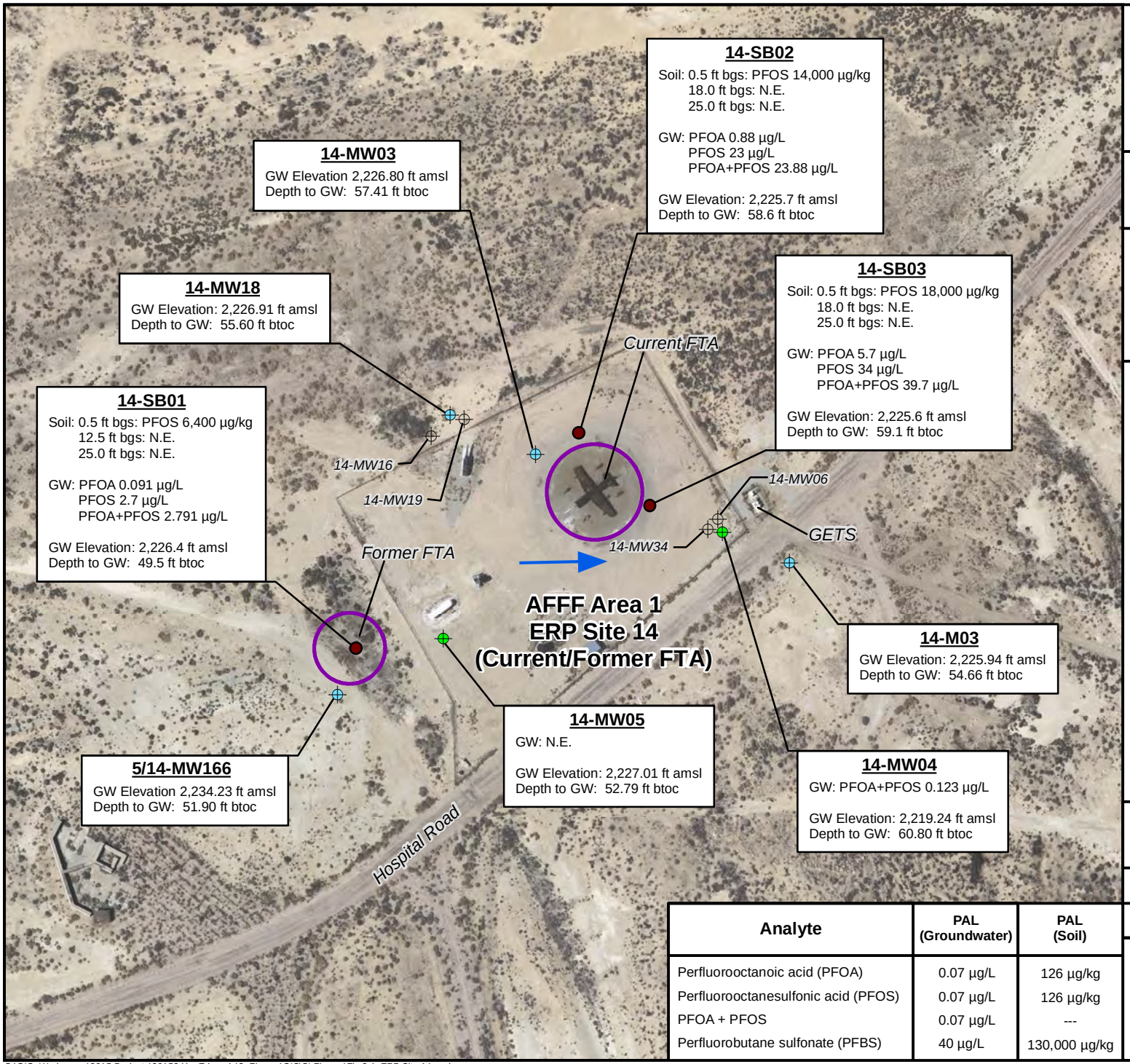


FIGURE 3-1
Sample Locations and PAL Exceedances AFFF Area 1 ERP Site 14 (Current/Former FTA) Edwards Air Force Base California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Soil Boring
- GW Monitoring Well-Gauging Only
- GW Monitoring Well-Deeper Zone
- Fire Training Areas
- Local Groundwater Flow Direction (April 2017)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ERP = Environmental Restoration Area
FTA = Fire Training Area
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
GETS - Groundwater Extraction Treatment System
GW = groundwater
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
U.S. = United States

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **5/4/2018**

N W E S

OTIE An Oneida Nation Company

0 50 100 200
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-1_ERP Site 14.mxd

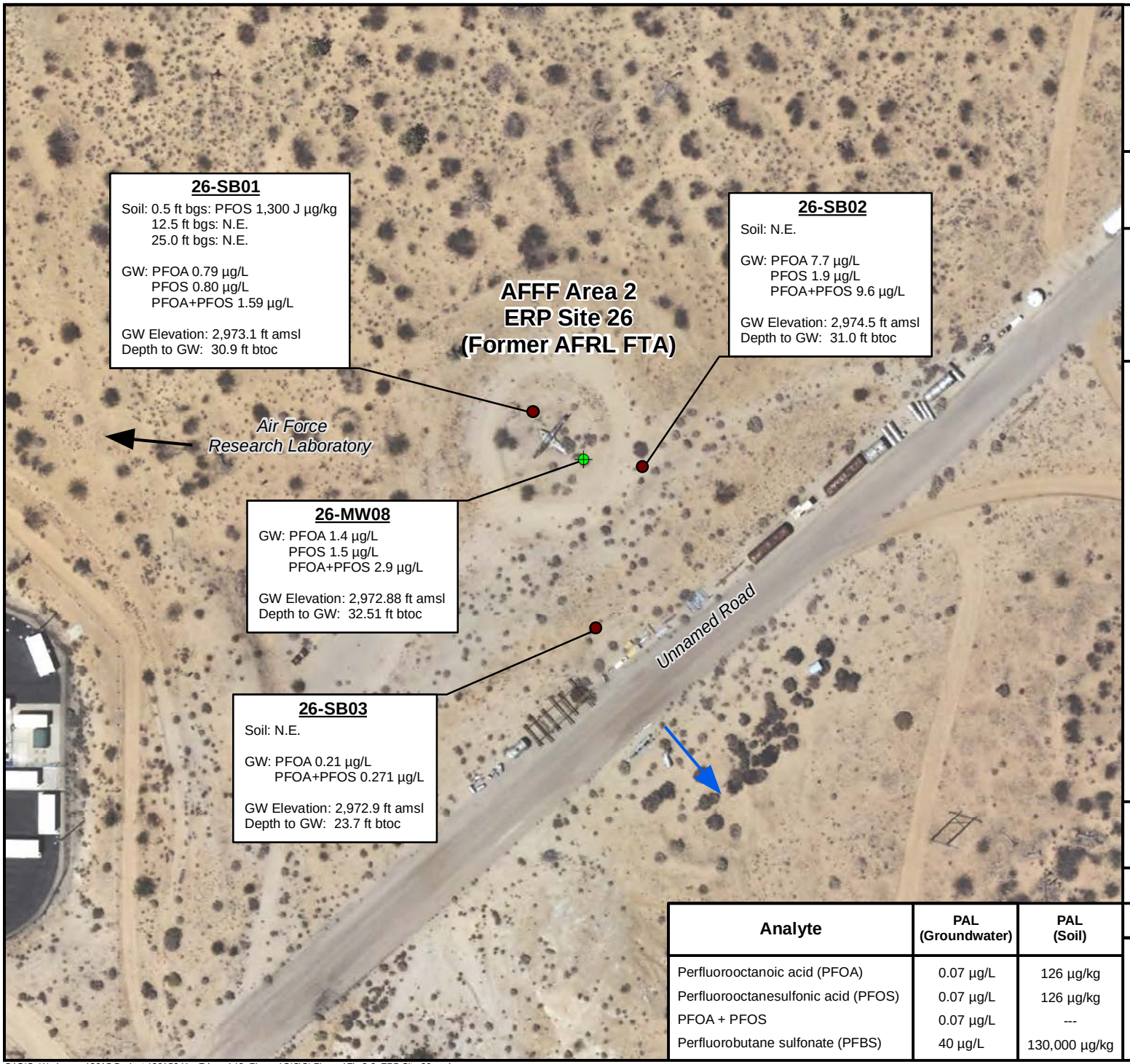


FIGURE 3-2
Sample Locations and PAL Exceedances AFFF Area 2 ERP Site 26 (Former ARFL FTA) Edwards Air Force Base California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Soil Boring
- GW Monitoring Well-Sampling Location
- Local Groundwater Flow Direction, Second Quarter 2016 (Tetra Tech, Inc. 2018)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ERP = Environmental Restoration Area
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
GW = groundwater
J = estimate concentration
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler	**5/4/2018**

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

N W E S

OTIE An Oneida Nation Company

0 25 50 100
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-2_ERP Site 26.mxd

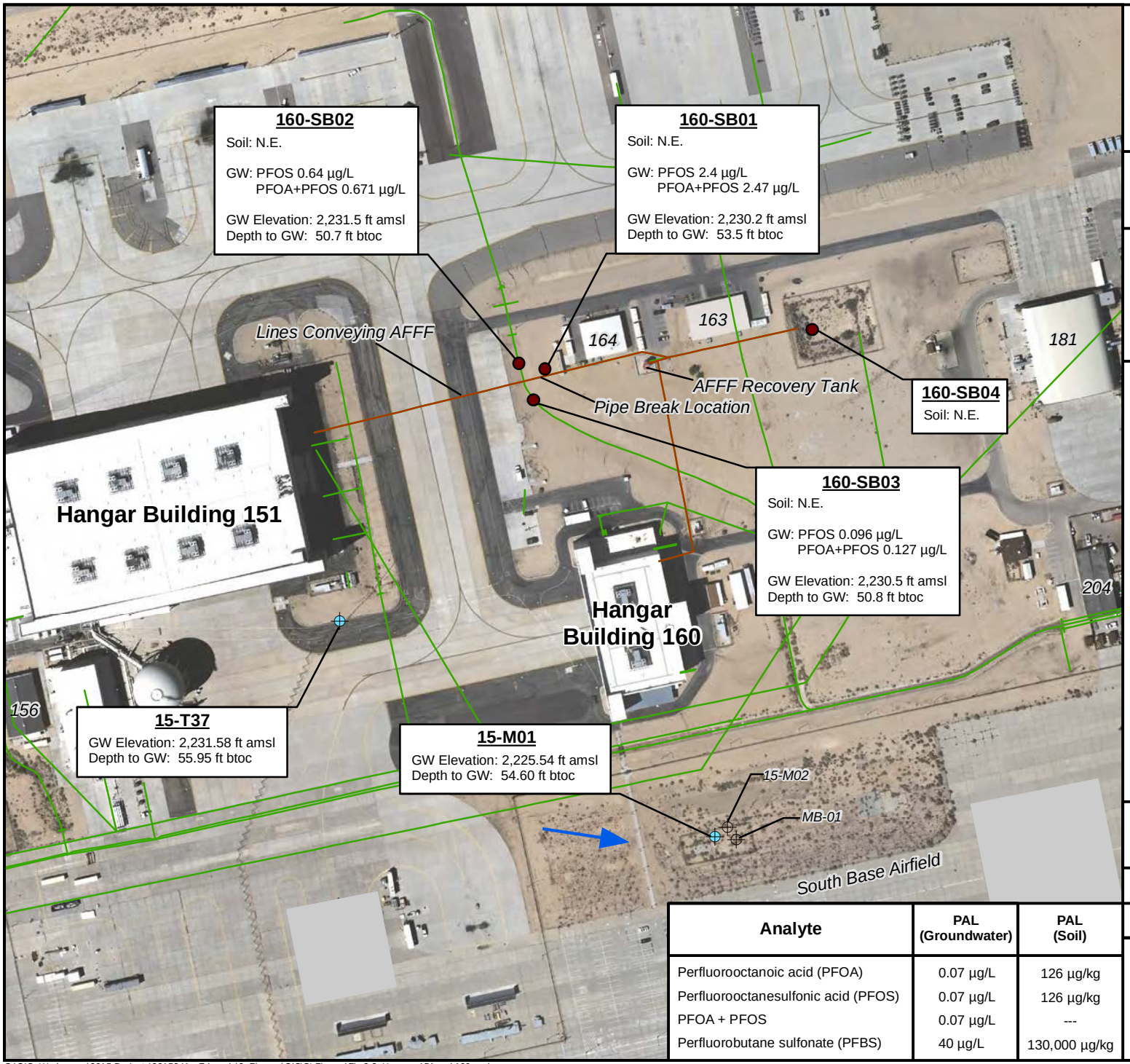


FIGURE 3-3
Sample Locations and PAL Exceedances
AFFF Area 3
Hangar Buildings 151/160
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Soil Boring
- GW Monitoring Well-Deeper Zone
- GW Monitoring Well-Gauging Only
- Line Conveying AFFF
- Stormwater Line
- 181 Building Number
- Regional Groundwater Flow Direction (AECOM, 2017a)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft btoc = feet below top of casing
GW = groundwater
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
U.S. = United States

Contract # W912BV-15-C-0082

By: E. Cutler	5/4/2018

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

N W E S

OTIE An Oneida Nation Company

0 60 120 240
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-3_Hangars 151 and 160.mxd

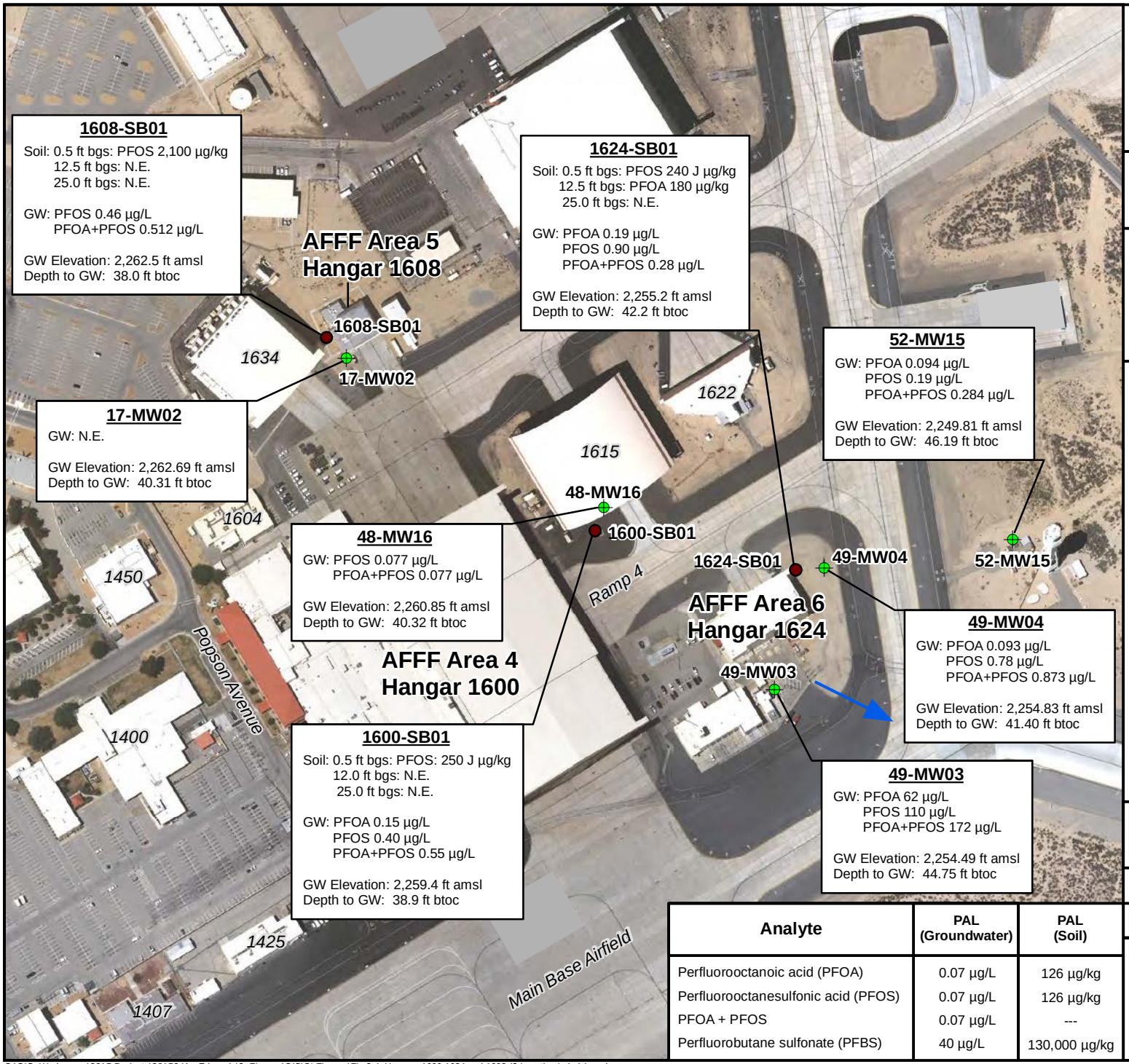


FIGURE 3-4
Sample Locations and PAL Exceedances AFFF Areas 4, 5, and 6 Hangars 1600, 1608, and 1624 Edwards Air Force Base California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- GW Monitoring Well
- Soil Boring
- 1634 Building Number
- Local Groundwater Flow Direction (April 2017)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
GW = groundwater
J = estimate concentration
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
U.S. = United States

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **5/4/2018**

N W E S

OTIE An Oneida Nation Company

0 80 160 320
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-4_Hangars 1600 1624 and 1608 (2 Location Labels).mxd

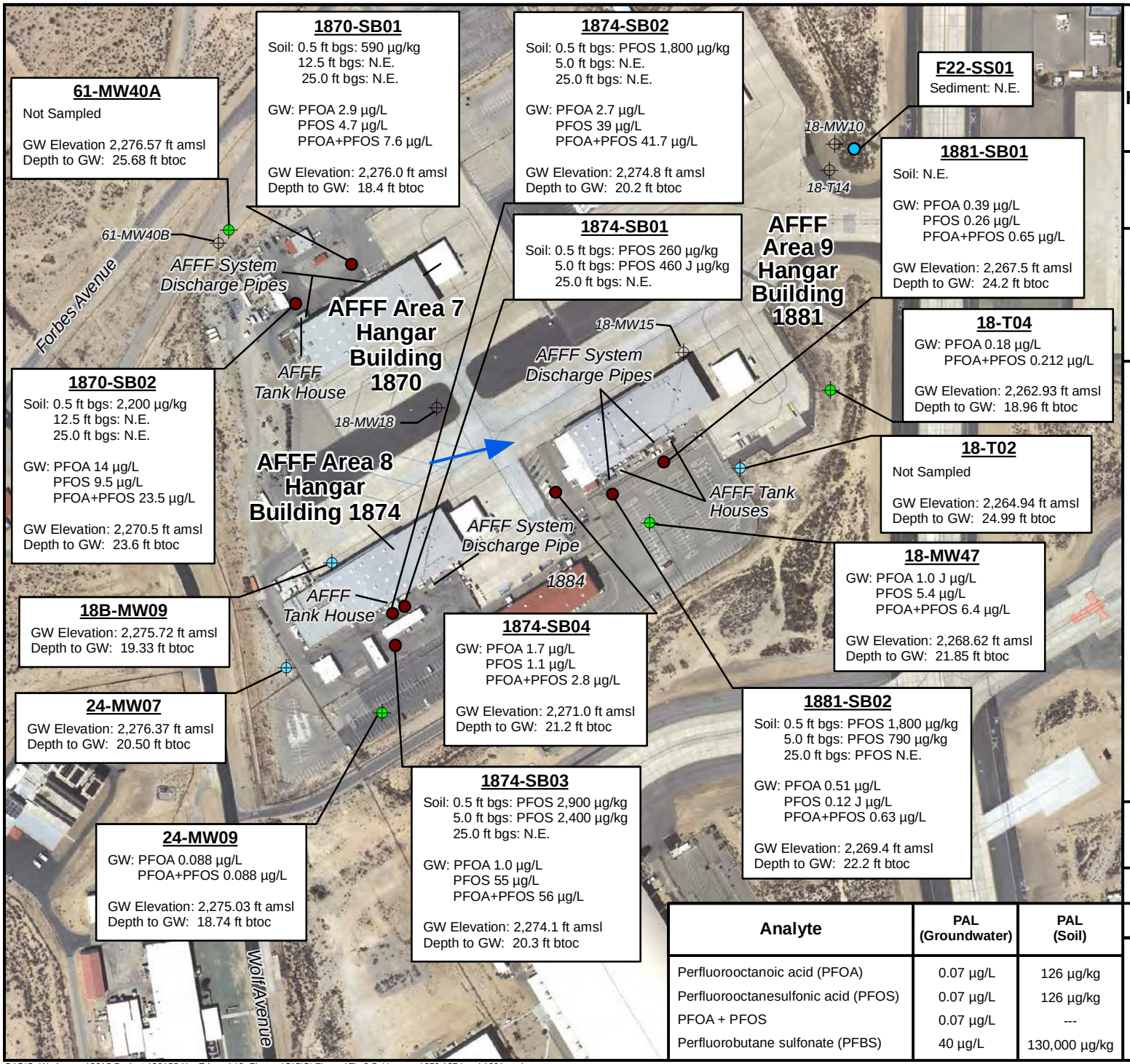


FIGURE 3-5
Sample Locations and PAL Exceedances
AFFF Areas 7, 8, and 9
Hangar Buildings 1870, 1874, and 1881
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- GW Monitoring Well-Gauging Only
- GW Monitoring Well-Deeper Zone
- GW Monitoring Well-Sampling Location
- Sediment Sample
- Soil Boring
- 1864 Building Number
- Local Groundwater Flow Direction May 2017

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
GW = groundwater
J = estimate concentration
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
SS = sediment sample
U.S. = United States

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

Contract # W912BV-15-C-0082

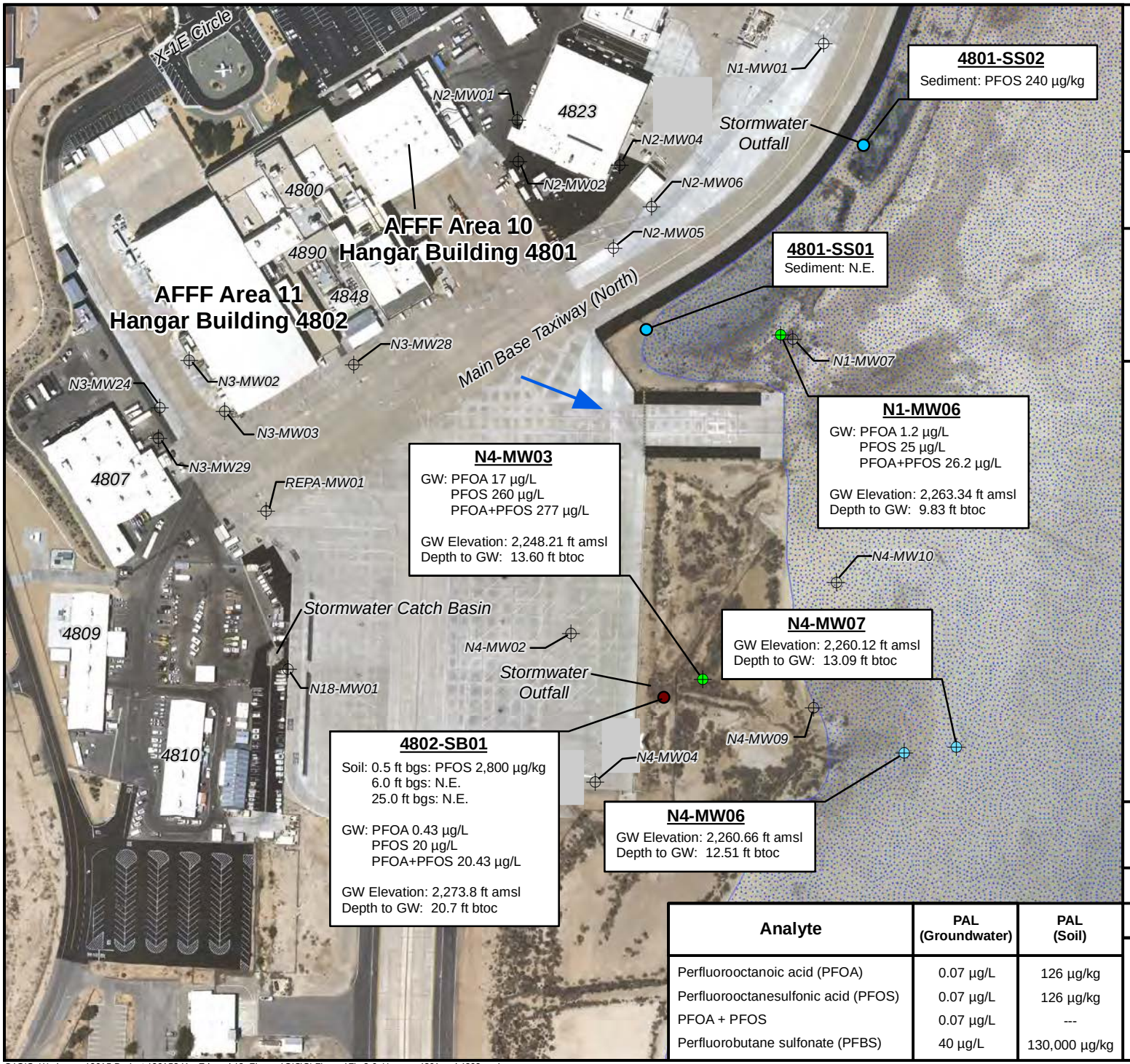
By: E. Cutler | **5/7/2018**

N W E S

OTIE An Oneida Nation Company

0 80 160 320
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-5_Hangars 1870 1874 and 1881.mxd



Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

FIGURE 3-6
Sample Locations and PAL Exceedances
AFFF Areas 10 and 11
Hangar Buildings 4801 and 4802
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Soil Boring
- Sediment Sample
- GW Monitoring Well-Gauging Only
- GW Monitoring Well-Sampling Location
- GW Monitoring Well-Deeper Zone
- Rogers Dry Lake
- 4823 Building Number
- Local Groundwater Flow Direction November 2016 (AECOM, 2017b)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = ft below top of casing
GW = groundwater
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
SS = sediment sample
U.S. = United States

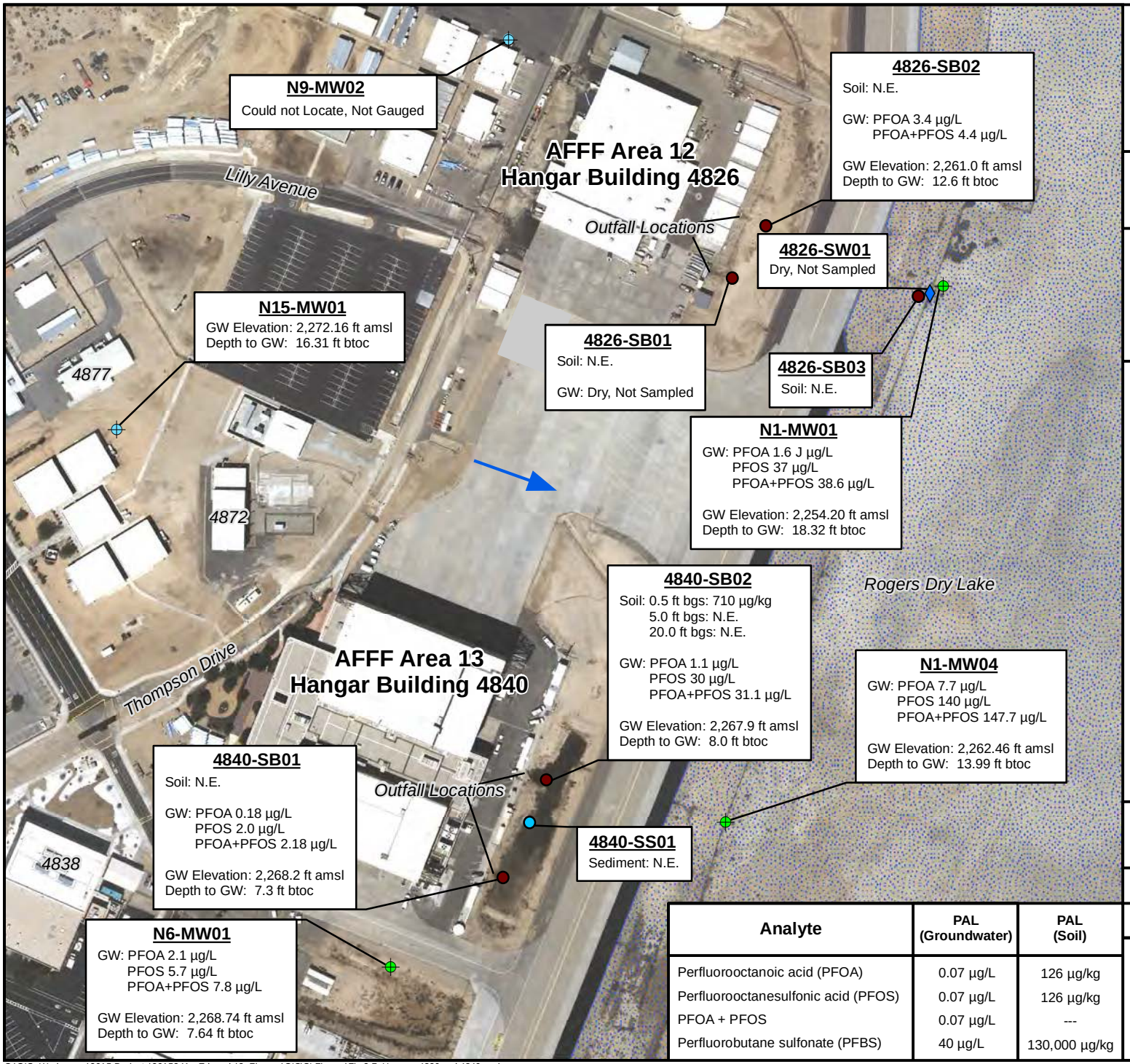
Contract # W912BV-15-C-0082

By: E. Cutler | **5/7/2018**

N W E S

OTIE An Oneida Nation Company

0 62.5 125 250
Approximate Scale in Feet



Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

FIGURE 3-7
Sample Locations and PAL Exceedances
AFFF Areas 12 and 13
Hangar Buildings 4826 and 4840
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- Soil Boring
- Sediment Sample
- GW Monitoring Well-Gauging Only
- GW Monitoring Well-Sampling Location
- Surface Water Sampling Location
- Rogers Dry Lake
- 1864 Building Number
- Local Groundwater Flow Direction November 2016 (AECOM, 2017b)

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft btoc = feet below top of casing
GW = groundwater
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
SS = sediment sample
U.S. = United States

Contract # W912BV-15-C-0082

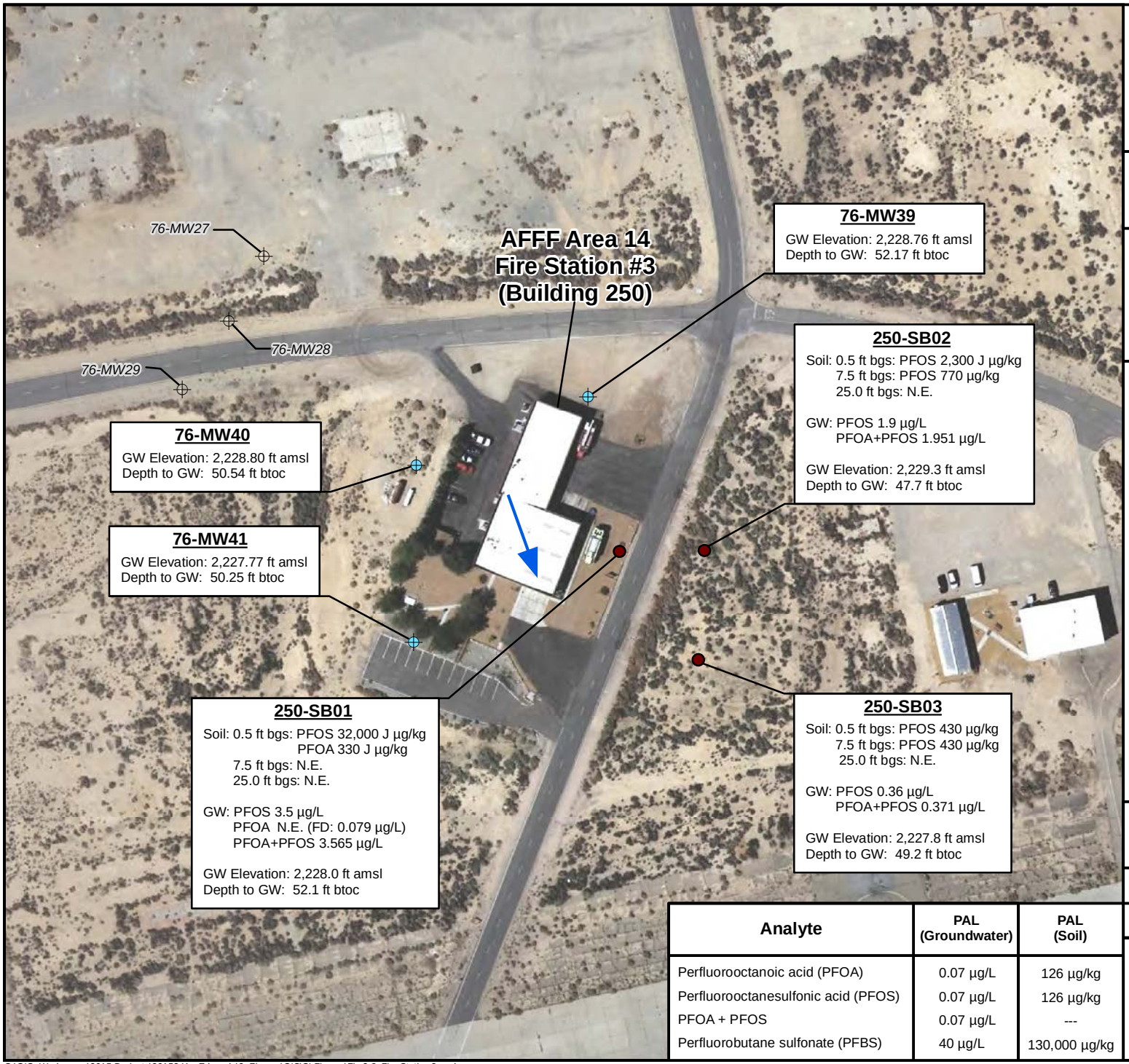
By: E. Cutler | **5/4/2018**

N W E S

OTIE An Oneida Nation Company

0 50 100 200
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-7_Hangars 4826 and 4840.mxd



Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

FIGURE 3-8
Sample Locations and PAL Exceedances
AFFF Area 14
Fire Station #3 (Building 250)
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- GW Monitoring Well-Deeper Zone
- GW Monitoring Well-Gauging Only
- Soil Boring
- Local Groundwater Flow Direction April 2017

Notes

- Concentrations shown exceed PALs
- GW elevations in soil borings are approximate
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
FD = Field Duplicate
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
GW = groundwater
J = estimate concentration
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
SB = soil boring
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **5/7/2018**

N W E S

OTIE An Oneida Nation Company

0 30 60 120
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-8_Fire Station 3.mxd

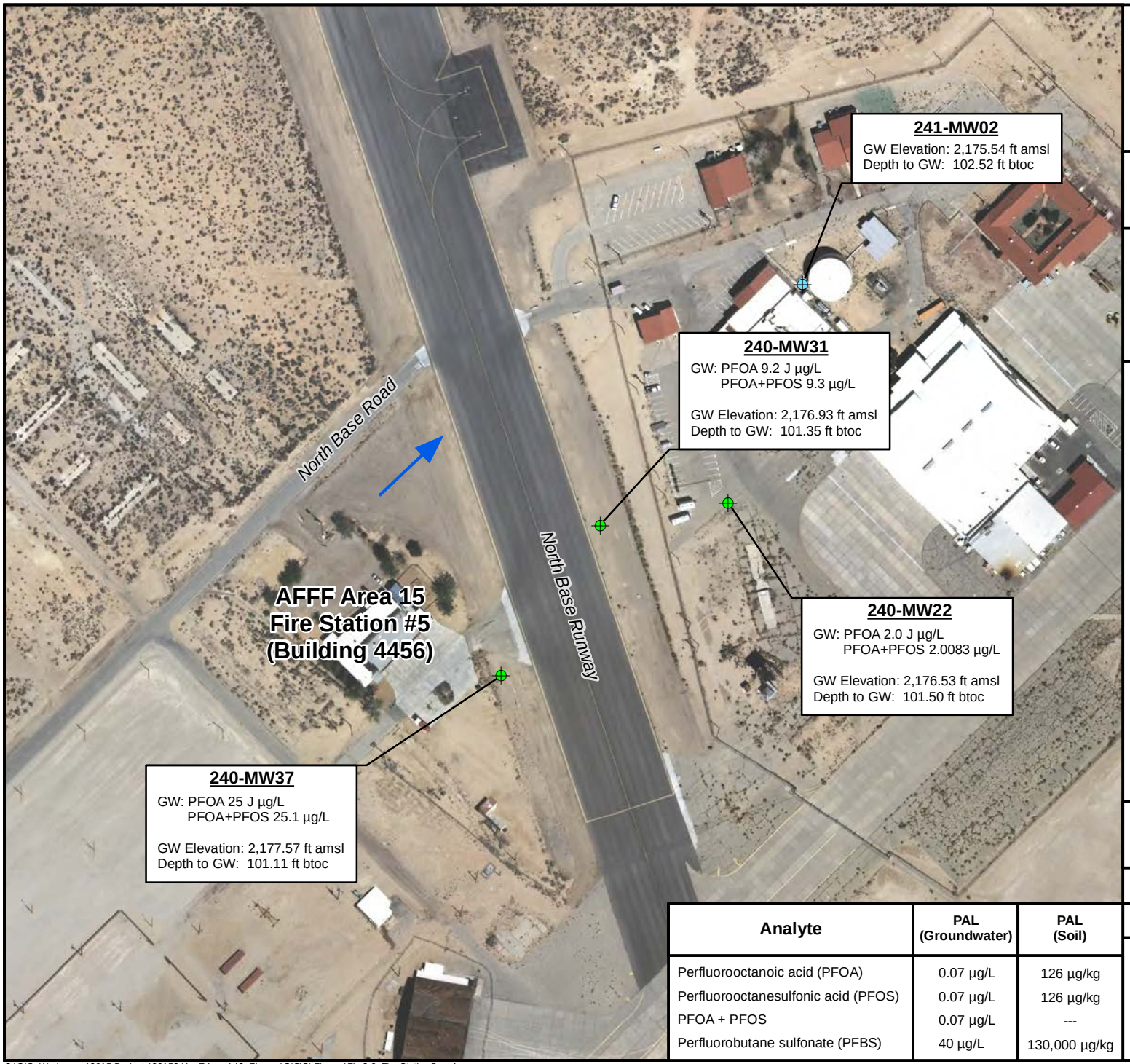


FIGURE 3-9
Sample Locations and PAL Exceedances
AFFF Area 15
Fire Station #5 (Building 4456)
Edwards Air Force Base
California

Site Inspection For Aqueous Film Forming Foam (AFFF) Areas at Edwards Air Force Base California

U.S. Army Corps of Engineers
Tulsa District
for
Air Force Civil Engineer Center
2261 Hughes Avenue
Building 1, Suite 155
JBSA Lackland, Texas 78236

Legend

- GW Monitoring Well-Gauging Only
- GW Monitoring Well-Sampling Location
- Local Groundwater Flow Direction May 2014 (Tetra Tech, 2015)

Notes

- Concentrations shown exceed PALs
- GW elevations in existing monitoring wells were measured from the surveyed top of casing

Abbreviations

AFFF = Aqueous Film Forming Foam
ft amsl = feet above mean sea level
ft btoc = feet below top of casing
GW = groundwater
J = Estimate concentration
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
N.E. = no exceedances
PAL = Project Action Limit
U.S. = United States

Layer Credits: Edwards AFB Geodatabase (2013)
Disclaimer: For general reference purposes only. DO NOT USE to determine, certify, or verify map features, scale and/or other information.

Contract # W912BV-15-C-0082

By: E. Cutler | **5/4/2018**

Analyte	PAL (Groundwater)	PAL (Soil)
Perfluorooctanoic acid (PFOA)	0.07 µg/L	126 µg/kg
Perfluorooctanesulfonic acid (PFOS)	0.07 µg/L	126 µg/kg
PFOA + PFOS	0.07 µg/L	---
Perfluorobutane sulfonate (PFBS)	40 µg/L	130,000 µg/kg

N W E S

OTIE An Oneida Nation Company

0 50 100 200
Approximate Scale in Feet

G:\GIS_Workspace\2015 Projects\2015341 - Edwards\3_Figures\GIS\SI Figures\Fig 3-9_Fire Station 5.mxd