FINAL

SITE INSPECTION REPORT

FAIRCHILD AIR FORCE BASE, WASHINGTON

Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide

Contract FA8903-16-D-0027
Task Order 0004

Prepared for:

Air Force Civil Engineer Center
JBSA Lackland, Texas

January 2019

Submitted by:

amec foster wheeler

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SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS

FAIRCHILD AIR FORCE BASE, WASHINGTON

Project No. RPMO20167118

Prepared for:
Air Force Civil Engineer Center
Joint Base San Antonio – Lackland, Texas

Prepared by:

Amec Foster Wheeler Programs, Inc.

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ACRONYMS

AEI	Amec Foster Wheeler Environment & Infrastructure, Inc.
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
Amec Foster Wheeler	Amec Foster Wheeler Programs, Inc. (API) and its affiliate Amec Foster Wheeler Environment & Infrastructure, Inc. (AEI) collectively
amsl	above mean sea level
API	Amec Foster Wheeler Programs, Inc.
ASTM	ASTM International
bgs	below ground surface
bmp	below measuring point
BRAC	Base Realignment and Closure
CoC	chain-of-custody
DL	detection limit
DoD	United States Department of Defense
DOT	United States Department of Transportation
DPT	direct-push technology
DQO	data quality objective
EC	emerging contaminant
Ecology	Washington Department of Ecology
ERPIMS	Environmental Resource Program Information Management System
FTA	fire training area
FTS	fluorotelomer sulfonate
GPS	Global Positioning System
HA	Health Advisory
HDPE	high-density polyethylene
HGL	HydroGeoLogic, Inc.
IDW	investigation-derived waste
ISWP	Installation-Specific Work Plan
JP	jet propellant
LC-MS/MS	Liquid Chromatography and Tandem Mass Spectrometry
Maxxam	Maxxam Analytics
mL	milliter
MS	matrix spike
MSD	matrix spike duplicate

µg/L	micrograms per liter
mg/kg	milligrams per kilogram
Navy	United States Department of the Navy
ND	not detected
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NL	not listed
OWS	oil/water separator
PA	Preliminary Assessment
%	percent
PFAS	per- and polyfluorinated alkyl substances
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
PID	photoionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride
QC	quality control
QPP	Quality Program Plan
QSM	DoD Quality Systems Manual
RPM	Remedial Project Manager
RSL	Regional Screening Level
SI	Site Investigation
SIR	Site Investigation Report
SOP	standard operating procedure
S.U.	standard units
THQ	target hazard quotient
TOC	total organic carbon
USAF	United States Air Force
USACE	United State Army Corps of Engineers
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Site Inspection (SI) Report (SIR) was prepared by Amec Foster Wheeler Programs, Inc. (API), together with affiliate Wood Environment & Infrastructure Solutions, Inc. (formerly known as Amec Foster Wheeler Environment & Infrastructure, Inc.), [1] collectively referred to as Amec Foster Wheeler, under Contract No. FA8903-16-D-0027, Task Order 0004, to document the results of SI activities conducted at five aqueous film forming foam (AFFF) release areas located at Fairchild Air Force Base (AFB). The purpose of the SI was to determine, through environmental media sampling, if a release of per- and polyfluorinated alkyl substances (PFAS) has occurred at potential AFFF release areas identified by others during a Preliminary Assessment (PA) (CH2M Hill, 2015) or during an installation scoping visit conducted by Amec Foster Wheeler on 27 September 2016. The data presented in this SIR were collected and evaluated in accordance with the Final Installation-Specific Work Plan (ISWP) (Amec Foster Wheeler, 2017a) and the General Quality Program Plan (QPP) (Amec Foster Wheeler, 2017b). This SIR addresses investigation activities and results for on-base SI activities only, which were completed in February and May 2017. Off-base follow-on groundwater sampling began in April 2017 and is ongoing; when sampling is complete, the off-base follow-on activities will be reported under separate cover.

PFAS are a class of synthetic organofluorine compounds that possess a chemical structure that gives them unique properties, including thermal stability and the ability to repel both water and oil. These chemical properties make them useful components in a wide variety of consumer and industrial products, including nonstick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards for fire extinguishing agents (United States Department of Defense [DoD] Military Specification MIL-F-24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and using AFFF containing PFAS (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA]) for extinguishing petroleum fires and during firefighting training activities in 1970. AFFF was primarily used on USAF installations at fire training areas (FTAs), but may have also been used, stored, or released from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and during emergency response actions for fuel spills and/or aircraft mishaps.

The United States Environmental Protection Agency (USEPA) Office of Water issued lifetime drinking water Health Advisory (HA) values for PFOS and PFOA in May 2016 that replaced the 2009 Preliminary HA values. The HA values for PFOS and PFOA are 0.07 micrograms per liter (µg/L) for each constituent; however, when these two chemicals co-occur in a drinking water source, a conservative and health-protective approach is recommended that compares the sum of the concentrations (PFOS+PFOA) to the HA value (0.07 µg/L). HA values are not to be construed as legally enforceable federal standards and are

[1] Amec Foster Wheeler Environment & Infrastructure, Inc. changed its name on 6 April 2018 to Wood Environment & Infrastructure Solutions, Inc., to reflect Wood Group's acquisition of Amec Foster Wheeler. All resource documents created and activities conducted under Amec Foster Wheeler Environment & Infrastructure, Inc. remain in place, will be referred to Amec Foster Wheeler, and are executed under Wood Environment & Infrastructure Solutions, Inc.

subject to change as new information becomes available (USEPA, 2016a and 2016b). Although the USEPA has not established HA values for PFAS in soil, the USAF initially calculated a residential screening level of 1.26 milligrams per kilogram (mg/kg) for PFOS and PFOA in soil using the USEPA Regional Screening Level (RSL) calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). This screening value was presented in the Final ISWP (Amec Foster Wheeler, 2017a). In March 2018, the USAF issued revised guidance, *PFAS Site Inspection Objectives and Follow-On Activities,* whereby a new residential screening level for soil and sediment of 0.126 mg/kg was calculated based on a target hazard quotient (THQ) of 0.1 (USAF, 2018).

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, the USEPA has also derived RSL values for perfluorobutanesulfonic acid (PFBS), for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value) (USEPA, 2017a). Concentrations of PFBS detected in groundwater and soil were initially compared to the RSLs of 400 µg/L (tap water) and 1,300 mg/kg (residential soil), respectively, in accordance with the ISWP. However, as per the USAF revised guidance issued subsequent to the ISWP, revised screening levels for PFBS in groundwater (40 µg/L) and in soil and sediment (130 mg/kg) were calculated based on a THQ of 0.1, and will be used for comparison in this SIR (USAF, 2018).

The Washington Department of Ecology (Ecology) has not issued standards for PFOS or PFOA or other PFAS constituents to date. The USEPA has not issued HA values, RSLs, or other standards for PFAS constituents other than PFOS, PFOA, and PFBS.

Fairchild AFB is located in northeastern Washington in Spokane County, approximately 12 miles west of Spokane, and encompasses approximately 4,300 acres (**Figure 2.1-1**). The installation comprises one major runway supported by numerous taxiways and support facilities, a medical clinic, housing units, and an elementary school.

The installation was established in 1942 and has served numerous missions, ranging from a repair depot to its current primary mission as the largest air-refueling wing in the USAF (USAF, 2016a). The installation was originally constructed as a World War II repair and supply depot within the Cascade Mountains, 300 miles from the ocean, where it would be safe from Japanese attack. The installation was transferred to the Strategic Air Command in 1947 and became home of the 92nd Bombardment Wing. The 92nd Bombardment Wing was redesignated as the 92nd Air Refueling Wing in 1994, and the installation was transferred to the Air Mobility Command. Since then, the installation has provided air refueling and wing supporting contingency operations around the world and today represents the backbone of the USAF west coast tanker fleet.

The PA provided findings from research conducted to determine whether and where AFFF, containing PFAS, was stored, handled, used, or released at Fairchild AFB. Based on the results of the PA, as well as information collected during the installation scoping visit conducted by Amec Foster Wheeler on 27 September 2016, the following five AFFF release areas were recommended for SI:

- AFFF Release Area 1: FT004 (FT01)
- AFFF Release Area 2: Calibration Area
- AFFF Release Area 3: Aircraft Crash Location SS008 (PS-4/9)
- AFFF Release Area 4: B-52 Crash Location 1994
- AFFF Release Area 5: Fire Station 1 (Building 3)

The specific objectives of the initial SI were as follows:

1) Determine if PFOS, PFOA, or PFBS are present in soil and groundwater at AFFF release areas selected for SI;
2) Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL, based on a residential exposure scenario, of 0.126 mg/kg, and if PFBS concentrations in soil exceed the USEPA residential RSL of 130 mg/kg;
3) Determine if PFOS, PFOA, or the sum of PFOS and PFOA concentrations in groundwater exceed the USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the USEPA Tap Water RSL of 40 µg/L; and
4) Identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA concentrations above the USEPA HA value, or PFBS concentrations above the USEPA Tap Water RSL).

Follow-on objectives, based on the results of the initial SI, were as follows:

- Perform follow-up sampling of off-base private drinking water wells to identify and verify where PFOS and PFOA are present in drinking water at concentrations above USEPA HA values and/or state-specific standards and evaluate potential exposure pathways with immediate threats to human health.

PFAS Analytical Results

Analytical results indicated the presence of PFAS in soil and groundwater at Fairchild AFB in excess of the applicable USEPA HA value and/or calculated RSL, based on a residential exposure scenario. PFOS concentrations in soil exceeded the calculated RSL at AFFF Release Areas 1, 2, 4, and 5. PFOS, PFOA, and/or PFOS+PFOA concentrations in groundwater exceeded the USEPA HA values at AFFF Release Areas 1, 2, 3, 4, and 5.

Potential human health pathways were identified during this SI. The potential receptors and targets vary by AFFF release area and are summarized below.

Surface and Subsurface Soil Receptors

The highest potential for exposure to PFAS from soil is to onsite workers, specifically those involved with excavation or drilling activities. PFOS, PFOA, and/or PFBS were detected in soil at AFFF Release Areas 1,

2, 3, 4, and 5; however, the only calculated RSL exceedances were for PFOS at AFFF Release Areas 1, 2, 4, and 5.

Groundwater Receptors

PFOS and PFOA concentrations in groundwater exceeded the USEPA HA value of 0.07 µg/L for PFOS, PFOA, and/or PFOS+PFOA at AFFF Release Areas 1, 2, 3, 4, and 5. Groundwater receptors are considered to be present on Fairchild AFB because the installation infrequently obtains drinking water from an on-base supply well. Drinking water is predominantly provided to the base from the Fort Wright well field (Water Supply Annex No. 1) and periodically from On-base Supply Well No. 2 (Water Supply Annex No. 2), which is used as a backup supply. The Fort Wright well field is located 12 miles east of the base and On-base Supply Well No. 2 is located at the southern end of the base (USACE, 2011). The Fairchild AFB drinking water supply has been tested for PFOS and PFOA and results indicate concentrations less than the HA value.

Off-base potential receptors for groundwater were identified via a desktop well inventory and site reconnaissance downgradient of AFFF Release Area 1. Potential receptors were identified east of the installation, and analytical results from monitoring wells installed along the eastern installation boundary were above the USEPA HA value for PFOS and PFOA and below the Tap Water RSL for PFBS. Off-base sampling of residential wells commenced in April 2017 and is ongoing. Results of the SI follow-on work will be reported under separate cover.

Sediment and Surface Water Receptors

Sediment and surface water were not sampled as part of this SI, based on the distance from identified AFFF release areas to sediment and surface water bodies and the likelihood that SI objectives would be met closer to the point of release. On-base sediment and surface water bodies are No Name Creek and the stormwater retention pond on the eastern side of the base south of the runway. There is potential for human contact with sediment and/or surface water at these features by maintenance workers and groundskeepers. No Name Creek flows off the base to the east and through a rural residential area where there is potential for human contact with surface water and/or sediment.

1.0 INTRODUCTION

This Site Inspection (SI) Report (SIR) was prepared by Amec Foster Wheeler Programs, Inc. (API), together with affiliate Wood Environment & Infrastructure Solutions, Inc. (formerly known as Amec Foster Wheeler Environment & Infrastructure, Inc.)[1], collectively referred to as Amec Foster Wheeler, under Contract No. FA8903-16-D-0027, Task Order 0004, to document the results of SI activities conducted at five aqueous film forming foam (AFFF) release areas located at Fairchild Air Force Base (AFB). The purpose of the SI was to determine, through environmental media sampling, if a release of per- and polyfluorinated alkyl substances (PFAS) has occurred at potential AFFF release areas identified by others during a Preliminary Assessment (PA) (CH2M Hill, 2015) or during an installation scoping visit conducted by Amec Foster Wheeler on 27 September 2016.

The data presented in this SIR were collected and evaluated in accordance with the Final Installation-Specific Work Plan (ISWP) (Amec Foster Wheeler, 2017a) and the General Quality Program Plan (QPP) (Amec Foster Wheeler, 2017b).

1.1 PER- AND POLYFLUORINATED ALKYL SUBSTANCES OVERVIEW

PFAS are a class of synthetic organofluorine compounds that possess a chemical structure that gives them unique properties, including thermal stability and the ability to repel both water and oil. These chemical properties make them useful components in a wide variety of consumer and industrial products, including non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards for fire extinguishing agents (United States Department of Defense [DoD] Military Specification MIL-F-24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and using AFFF containing PFAS (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA]) for extinguishing petroleum fires and during firefighting training activities in 1970, as confirmed by the following federal government documents:

- Military Specification for AFFF (MIL-F-24385), formally issued in 1969 (DoD, 1969);
- General Accounting Office determination on sole source award protest to provide AFFF to the United States Department of the Navy (Navy) in December 1969; and
- A History of USAF Fire Protection Training at Chanute Air Force Base, 1964-1976 (Coats, 1977).

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AFFF was primarily used on USAF installations at fire training areas (FTAs), but may have also been used, stored, or released from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and during emergency response actions for fuel spills and/or aircraft fires.

The United States Environmental Protection Agency (USEPA) Office of Water issued lifetime drinking water Health Advisory (HA) values for PFOS and PFOA in May 2016 that replaced the 2009 Preliminary HA values. The HA values for PFOS and PFOA are 0.07 micrograms per liter (µg/L) for each constituent; however, when these two chemicals co-occur in a drinking water source, a conservative and health-protective approach is recommended that compares the sum of the concentrations (PFOS+PFOA) to the HA value (0.07 µg/L). HA values are nonregulatory concentrations of drinking water contaminants at or below which adverse health effects are not anticipated to occur over specific exposure durations (e.g., 1 day, 10 days, and a lifetime). They serve as informal technical guidance to assist federal, state, and local officials, and managers of public or community water systems in protecting public health when emergency spills or other contamination situations occur. A HA document provides information on the environmental properties, health effects, analytical methodology, and treatment technologies for removing drinking water contaminants. HA values are not to be construed as legally enforceable federal standards and are subject to change as new information becomes available (USEPA, 2016a and 2016b).

The USEPA has not established HA values or published Regional Screening Levels (RSLs) for PFOS or PFOA for soil; however, for this project, a residential screening level of 1.26 milligrams per kilogram (mg/kg) for soil was initially calculated using the USEPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search), as presented in the ISWP. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg per day derived by the USEPA in their Drinking Water HA values for both PFOS and PFOA (USEPA, 2016a and 2016b). In March 2018, the USAF issued revised guidance, *PFAS Site Inspection Objectives and Follow-On Activities,* whereby a new residential screening level for soil and sediment of 0.126 mg/kg was calculated based on a target hazard quotient (THQ) of 0.1 (USAF, 2018).

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, the USEPA has also derived RSL values for perfluorobutanesulfonic acid (PFBS), for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value) (USEPA, 2017a). PFBS concentrations detected in groundwater and soil were initially compared to the RSLs of 400 µg/L (tap water) and 1,300 mg/kg (residential soil), respectively, in accordance with the ISWP. However, as per the USAF revised guidance issued subsequent to the ISWP, revised screening levels for PFBS in groundwater (40 µg/L) and in soil and sediment (130 mg/kg) were calculated based on a THQ of 0.1, and will be used for comparison in this SIR (USAF, 2018).

Table 1.1-1 presents the screening values for comparing analytical results for PFOS, PFOA, and PFBS. The USEPA and Washington Department of Ecology (Ecology) have not issued HA values or promulgated standards for any other PFAS to date.

Table 1.1-1. Regulatory Screening Values.

Parameter	Chemical Abstract Number	USEPA Regional Screening Level (November 2017)[a]		Calculated RSL for Soils and Sediments[b] (mg/kg)	USEPA Health Advisory for Drinking Water (Surface Water or Groundwater) (µg/L)[c]
		Residential Soil (mg/kg)	Tap Water (µg/L)		
PFBS	375-73-5	130	40	NL	NL
PFOA	335-67-1	NL	NL	0.126	0.07[d]
PFOS	1763-23-1	NL	NL	0.126	

Notes:

a USEPA Regional Screening Levels (2017a) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017].

b Screening levels calculated using the USEPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). Based on target hazard quotient of 0.1.

c USEPA, May 2016a. "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" and USEPA, May 2016b. "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)."

d When both PFOA and PFOS are both present, the combined concentrations of PFOA and PFOS should be compared with the health advisory level of 0.07 µg/L.

µg/L - micrograms per liter
mg/kg – milligrams per kilogram
NL - not listed
PFBS - perfluorobutanesulfonic acid
PFOA - perfluorooctanoic acid
PFOS - perfluorooctanesulfonic acid
RSL - Regional Screening Level
USEPA - United States Environmental Protection Agency

1.2 PROJECT OBJECTIVES

In accordance with DoD Instruction 4715.18, "Emerging Contaminants (ECs)" (DoD, 2009), the *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations* (USAF, 2012), and the *SAF/IE Policy on Perfluorinated Compounds of Concern* (USAF, 2016b), the USAF will:

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

The primary objectives of this initial SI were to:

1) Determine if PFOS, PFOA, or PFBS are present in soil and/or groundwater at AFFF release areas selected for SI;
2) Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL, based on a residential exposure scenario, of 0.126 mg/kg, and if PFBS concentrations in soil exceed the USEPA residential RSL of 130 mg/kg;
3) Determine if PFOS, PFOA, or the sum of PFOS and PFOA concentrations in groundwater exceed the USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the USEPA Tap Water RSL of 40 µg/L; and

4) Identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA concentrations above the USEPA HA value, or PFBS concentrations above the USEPA Tap Water RSL).

Follow-on objectives, based on the results of the initial SI, were as follows:

- Perform follow-up sampling of off-base private drinking water wells to identify and verify where PFAS are present in drinking water at concentrations above USEPA HA values and/or state-specific standards and evaluate potential exposure pathways with immediate threats to human health.

1.3 PROJECT SCOPE

Selection of the AFFF release areas for the SI at Fairchild AFB was based on research conducted by others during a PA, and from the installation scoping visit conducted by Amec Foster Wheeler on 27 September 2016. The five AFFF release areas investigated in the SI are as follows:

- AFFF Release Area 1: FT004 (FT01)
- AFFF Release Area 2: Calibration Area
- AFFF Release Area 3: Aircraft Crash Location SS008 (PS-4/9)
- AFFF Release Area 4: B-52 Crash Location 1994
- AFFF Release Area 5: Fire Station 1 (Building 3)

Media evaluated at each area included surface and subsurface (vadose zone) soil, and groundwater collected from borings and existing monitoring wells.

This SIR discusses and provides a comparison of the analytical results to screening values for PFOS, PFOA, and PFBS in soil and groundwater. The remaining PFAS do not have screening values; therefore, only the results for PFOS, PFOA, and PFBS are discussed in detail and presented in figures. However, all data are presented in the soil and groundwater analytical tables provided in this SIR.

2.0 AFFF RELEASE AREA BACKGROUND

2.1 SITE LOCATION AND SETTING

Fairchild AFB is located in northeastern Washington in Spokane County, approximately 12 miles west of Spokane, and encompasses approximately 4,300 acres (**Figure 2.1-1**). The installation comprises one major runway supported by numerous taxiways and support facilities, a medical clinic, housing units, and an elementary school.

2.2 SITE HISTORY

The installation was established in 1942 and has served numerous missions, ranging from a repair depot to its current primary mission as the largest air-refueling wing in the USAF (USAF, 2016a). The installation was originally constructed as a World War II repair and supply depot within the Cascade Mountains, 300 miles from the ocean, where it would be safe from Japanese attack. The installation was transferred to the Strategic Air Command in 1947 and became home of the 92nd Bombardment Wing. The 92nd Bombardment Wing was redesignated as the 92nd Air Refueling Wing in 1994, and the installation was transferred to the Air Mobility Command. Since then, the installation has provided air refueling and wing supporting contingency operations around the world and today represents the backbone of the USAF west coast tanker fleet.

2.3 PREVIOUS INVESTIGATIONS

HydroGeoLogic, Inc. (HGL) and subcontractor CH2M Hill (the HGL team) were contracted by the Air Force Civil Engineer Center (AFCEC) to prepare a PA of FTA and non-FTA sites at Fairchild AFB to determine locations of potential environmental release of PFAS from AFFF storage or usage areas (CH2M Hill, 2015). Sixteen potential AFFF release areas were identified during the PA research, with the following three potential AFFF release areas recommended for SI:

- FT004 (FT01): The former FTA was used after 1970 through approximately 1991. During this period, an estimated 125 gallons or more of AFFF were used during each training exercise. After each exercise, the remaining water, fuel, and foam were drained into an oil/water separator (OWS) that discharged effluent water into a low area east of the training location.
- Aircraft Crash Location SS008 (PS-4/9): An unknown quantity of AFFF was used to extinguish a jet fuel (JP-4) fire in March 1987 that resulted from the crash of a KC-135 aircraft in a grassy field near Buildings 2005 and 2007.
- B-52 Crash Location 1994: An unknown quantity of AFFF was released onto a grassy field approximately 900 feet southeast of the control tower while extinguishing a JP-4 fuel fire following the crash of a B-52 in 1994.

The following two additional areas were also recommended for investigation based on data obtained during the installation scoping visit conducted on 27 September 2016:

- Fire Station 1 (Building 3): Calibration tests using AFFF were conducted on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb onto a grassy area between the pavement and a wall that divides the fire station from the airfield.
- Calibration Area: AFFF was sprayed onto an old taxiway during equipment and AFFF calibration testing where it flowed south to an unpaved area.

3.0 FIELD ACTIVITIES AND ANALYTICAL PROTOCOL

SI activities were conducted at Fairchild AFB in February and May 2017 at five AFFF release areas identified by others during the PA (CH2M Hill, 2015) and during the installation scoping visit conducted by Amec Foster Wheeler on 27 September 2016 (**Figure 3.0-1**). Sampling locations were determined on the basis of discussions among Amec Foster Wheeler, Fairchild AFB, USEPA Region 10, and AFCEC personnel, and were documented in the Final ISWP (Amec Foster Wheeler, 2017a). Media sampled during the initial SI included surface soil, subsurface soil, and groundwater collected from soil borings and existing groundwater monitoring wells.

Follow-on SI activities were conducted off-base to the east, northeast, north, southeast, and south of the installation, beginning in April 2017, based on the results of groundwater sampling at AFFF Release Area 1 in February 2017 (**Figure 3.0-1**). Sampling locations were determined on the basis of discussions among representatives of Amec Foster Wheeler, Fairchild AFB, USEPA Region 10, and AFCEC. Media sampled during the follow-on SI consisted of groundwater collected from private and public water supply wells, in addition to existing on- and off-base monitoring wells. The follow-on activities are ongoing, and will be reported under separate cover once complete.

Photographic documentation of the initial and follow-on SI areas is provided in **Appendix A** and field documentation is provided in **Appendix B**. Inspection activities were recorded by field personnel on field activity daily logs (**Appendix B-1**), and daily PFAS protocol checklists were completed to ensure that PFAS were not introduced by Amec Foster Wheeler employees or subcontractors (**Appendix B-2**). A tailgate safety meeting was conducted each morning prior to beginning work, as documented on tailgate safety meeting reports provided in **Appendix B-3**.

Soil Boring Advancement and Soil Sample Collection

Twelve soil borings were advanced for collection of soil samples and/or grab groundwater samples by Environmental West Explorations, Inc., a Washington-licensed driller. Soil borings were initially cleared, where possible, to a depth of 5 feet below ground surface (bgs) with a hand auger and were completed using direct-push technology (DPT) drilling methods. Surface soil samples were collected at each boring location from 0 to 0.5 foot bgs using a decontaminated stainless-steel trowel. Subsurface soil samples were continuously collected from ground surface to first-encountered groundwater using a hand auger or decontaminated 4-foot DPT macro samplers with acetate liners, field-screened with a photoionization detector (PID) equipped with a 10.6-electron-volt lamp for volatile organic vapors, and logged by a Washington Licensed Geologist in accordance with the Unified Soil Classification System. Soil boring information, PID readings, lithologic data, and discrete soil sampling locations are included on drilling logs provided in **Appendix B-4**. Samples for laboratory analysis were extracted from the hand auger bucket or acetate liners and then transferred directly into laboratory-provided high-density polyethylene (HDPE) containers. Sample containers were sealed, labeled, packed into ice-filled coolers, and delivered under chain-of-custody (CoC) protocol to Maxxam Analytics (Maxxam) in Mississauga, Ontario, Canada. Soil samples were collected in accordance with Standard Operating Procedure (SOP) AFW 02 – *Soil Sampling*

(Amec Foster Wheeler, 2017b). Soil sampling activities were documented on soil sample collection logs provided in **Appendix B-5**.

Groundwater Elevations

Depth-to-water measurements were recorded from each existing monitoring well prior to groundwater purging and sampling, and groundwater elevations were calculated relative to top-of-casing elevations provided in the Fairchild AFB database. A summary of well construction information for existing monitoring wells is provided in Table 3.0-1. Measured depth to groundwater ranged from 3.42 to 5.40 feet below the measuring point (bmp) in February 2017 at FT004 (FT01), and 6.11 to 12.10 feet bmp for all other locations measured in May 2017. Groundwater elevations ranged from 2,424.66 feet to 2,431.91 feet above mean sea level in May 2017 (**Table 3.0-2**).

Groundwater Sampling

The groundwater sampling program included collection of groundwater samples for laboratory chemical analysis of PFAS from 11 existing permanent monitoring wells and four soil borings.

Samples from existing monitoring wells were collected using low-flow groundwater sampling methods with a peristaltic pump. The HDPE tubing was connected to a flow-through cell whereby recovered groundwater was monitored for pH, temperature, specific conductivity, dissolved oxygen, and oxidation/reduction potential. Turbidity was measured with a separate turbidity meter. Groundwater sampling equipment was calibrated on a daily basis prior to use, with the resulting data recorded on water quality sampling instrument calibration forms presented in **Appendix B-6**. Depth-to-water measurements and field parameters were monitored until groundwater indicator parameters reached stabilization criteria in accordance with SOP AFW 03 – *Groundwater Sampling* (Amec Foster Wheeler, 2017b). The flow-through cell was then removed and groundwater samples were collected directly into laboratory-provided HDPE containers from the discharge tubing.

Grab groundwater samples were collected from borings using a 0.75-inch diameter 0.01-inch machine slotted polyvinyl chloride (PVC) well screen and casing placed in the open borehole or retracted core barrel to the boring total depth. Low-flow groundwater purging and sampling were conducted using a peristaltic pump fitted with HDPE tubing, as described above and in accordance with SOP AFW-03 – *Groundwater Sampling* (Amec Foster Wheeler, 2017b). A groundwater sample was collected after parameters stabilized, or after a minimum of 5 borehole volumes of water had been removed, or after 30 minutes of purging.

The sample containers were sealed, labeled, packed on ice in an insulated cooler, and shipped to Maxxam under CoC protocol. Groundwater sampling activities were documented on groundwater sample collection logs provided in **Appendix B-7**.

Soil Boring Abandonment

The casings and screens used to collect the four grab groundwater samples were removed and disposed of in a dumpster at the installation. The 12 soil borings were abandoned with bentonite chips in minimum 2-foot lifts in accordance with SOP AFW 06 – *Borehole Abandonment* (Amec Foster Wheeler, 2017b) at the completion of groundwater and/or soil sampling activities.

Total Sample Counts

The total sample counts for each medium (including field duplicate samples) are listed below:

- 27 soil samples (including three field duplicate samples) were collected at 12 soil boring locations; and
- 17 groundwater samples (including two field duplicate samples) were collected from four soil borings and 11 existing permanent monitoring wells.

Samples were analyzed for the following 16 PFAS compounds:

- PFOS;
- PFOA;
- PFBS;
- Perfluoroheptanoic acid (PFHpA);
- Perfluorohexanesulfonic acid (PFHxS);
- Perfluorononanoic acid (PFNA);
- N-ethyl perfluorooctanesulfonamidoacetic acid (NETFOSAA);
- N-methyl perfluorooctanesulfonamidoacetic acid (NMEFOSAA);
- Perfluorodecanoic acid (PFDA);
- Perfluorotetradecanoic acid (PFTeDA);
- Perfluorododecanoic acid (PFDoA);
- Perfluorohexanoic acid (PFHxA);
- Perfluorotridecanoic acid (PFTrDA);
- Perfluoroundecanoic acid (PFUnA);
- 6:2 fluorotelomer sulfonate (FTS); and
- 8:2 FTS.

Soil and groundwater samples were analyzed by Maxxam, in Mississauga, Ontario, Canada, a laboratory accredited and certified by the DoD Environmental Laboratory Accreditation Program. Samples were analyzed by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

(LC-MS/MS). The LC-MS/MS method provides acceptable detection limits to confirm the presence of the PFAS compounds listed above. The laboratory analytical reports for the samples analyzed as part of the SI are included in **Appendix C**.

Groundwater analysis was performed by Maxxam using a modification of USEPA Method 537. Under this modified method samples are not preserved with Trizma because the samples were not collected from chlorinated or potentially chlorinated sources and extracted sample volumes are 125 milliliters (mL) instead of the USEPA 537-specified 250 mL sample volumes. Maxxam adds isotopically labeled internal standards to all field and quality control (QC) samples and adjusts the sample pH to 4-5 using 2 percent (%) formic acid and/or 2% ammonium hydroxide before extraction. Extraction procedures are the same as USEPA method 537 except containers and extraction cartridges are rinsed using a methanol/ammonium hydroxide mixture instead of a methanol/water mixture and the final extract volume is either 3 or 0.3 mL, depending on the desired analytical sensitivity, instead of 1 mL. Target analytes are quantified using the isotopically labeled internal standards added before extraction instead of injection internal standards added after extraction.

Soil analysis was performed by Maxxam using a modification of USEPA Method 537. Under this modified method, soil samples are homogenized, subsampled into centrifuge tubes, and spiked with mass-labeled internal standards; a 70/30 methanol/water solution is added to the centrifuge tubes; and the tubes are vortexed, placed in an ultrasonic bath, and then centrifuged. A measured volume of the supernatant is transferred to a new tube, water is added, the pH is adjusted using a formic acid solution, the extract undergoes soil phase extraction cleanup, and an injection internal standard is added before analysis. Reference the QPP (Amec Foster Wheeler, 2017b) for additional information.

Analytical results for PFOS, PFOA, and PFBS are discussed in the following sections, while the analytical results for the remaining PFAS constituents are provided in **Tables 3.0-3** and **3.0-4**.

Co-occurrence of PFOS and PFOA (PFOS+PFOA) in aqueous samples was reported using the following guidelines:

1) If PFOS and PFOA are both detected in concentrations at or above the laboratory detection limit (DL) in groundwater, then the reported concentration for PFOA was added to the reported concentration for PFOS.
2) If only PFOS or only PFOA was detected in concentrations at or above the DL in groundwater, then co-occurrence was reported as the PFOS or PFOA result.
3) If neither PFOA nor PFOS was detected at concentrations at or above the DL, then co-occurrence was reported as *Not Detected*.

One composite surface soil sample and one composite subsurface soil sample were also collected at the five AFFF release areas. Samples were composited from the depth ranges of surface and subsurface sample collection for PFAS analysis; for example, for an AFFF release area where subsurface soil samples for PFAS analysis were collected from three borings at sampling depths of 4.0 to 4.5 feet bgs, 4.5 to 5.0 feet bgs, and 3.5 to 4.0 feet bgs, the subsurface composite sample from this AFFF release area

represents a depth range of 3.5 to 5.0 feet bgs. The composite soil samples were submitted to CT Laboratories in Baraboo, Wisconsin, for laboratory analysis of physiochemical properties, including soil potential of hydrogen (pH; USEPA Method 9045B), particle size analysis (ASTM International [ASTM] D422), and total organic carbon (TOC) content (USEPA Method 9060 or Lloyd Kahn Method). The particle size analysis was subcontracted to Mi-Tech Services, Inc. in Weston, Wisconsin. Results for pH and TOC analyses are provided in **Table 3.0-5**. The laboratory analytical reports for the physiochemical properties, including particle size analysis, are included in **Appendix C**.

Data Validation and Usability Assessment

The quality and usability of data obtained during the project were determined by reviewing and inspecting field logbooks, sampling forms, CoC forms, laboratory data packages, and data validation reports, and by verifying that the sampling procedures and analytical results were obtained following the applicable protocols such that they will satisfy project requirements and can be relied upon for evaluating the data with respect to project data quality objectives (DQOs). The data usability assessment identifies possible effects on data usage resulting from project requirement failures (i.e., data quality), and the adequacy of the data in meeting project-specific quality assurance/quality control requirements (i.e., data usability).

The main project DQO is the determination of the presence (at concentrations greater than the laboratories' DLs, defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence) or absence of PFAS in sampled media from identified AFFF areas.

Amec Foster Wheeler validated data from soil, sediment, and groundwater samples that were collected between 14 February and 12 May 2017 and analyzed for PFAS by modified USEPA Method 537. A description of the data validation scope, data validation procedures, and data validation observations and actions is presented in the data validation reports in **Appendix D.**

Amec Foster Wheeler performed USEPA Stage 4 data validation on 10% of the samples for each medium, and USEPA Stage 2B data validation on the remaining samples. Field and equipment blanks were not validated because these samples were used to assess data usability for the field samples. The validation was performed following the logic identified in The Contract Laboratory Program Data Validation Functional Guidelines for Evaluating Organic Analyses (USEPA, 2014a).

Qualifiers used in association with the final validated results include the following:

- B: The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than ten times the concentration detected in the blank;
- J: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample;
- Q: The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue; and

- UJ: The analyte was not detected at a concentration above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

During validation, data were reviewed against precision, accuracy, representativeness, comparability, and completeness criteria specified in the QPP.

Precision

Amec Foster Wheeler assessed sampling and analytical precision by collecting and analyzing field duplicates and assessed analytical precision by evaluating relative percent differences between laboratory duplicate and/or matrix spike (MS) and MS duplicate (MSD) results. Precision values between field duplicates, laboratory duplicates, and MS/MSD collected from this installation generally met QPP-specified criteria, except for seven results that were J-qualified as estimated values due to imprecision between laboratory or field duplicate results.

Accuracy/Bias

Amec Foster Wheeler evaluated target analyte detections in the laboratory, field, and equipment blanks to determine potential analytical bias from laboratory contamination, ambient contamination, and insufficient decontamination procedures. Four results were B-qualified due to detections in associated laboratory or equipment blanks.

Amec Foster Wheeler evaluated initial calibration verification, continuing calibration verification, laboratory control sample, MS, surrogate, and internal standard recoveries against QPP-specified limits to determine analytical accuracy. Recoveries were generally acceptable, with 29 data points J- or UJ-qualified as estimated concentrations due to recoveries outside QPP-specified limits.

Representativeness

Samples were collected from locations representative of site conditions using appropriate sampling procedures, and were properly preserved, adequately homogenized before taking aliquots for analysis, and analyzed using appropriate analytical methods for the required parameters.

Comparability

Comparability was ensured by using standard sample collection procedures, standard field measurement procedures, and standard reporting methods and consistent units. Samples were analyzed by a DoD-certified laboratory using modified USEPA Method 537, within QPP-specified maximum hold times, with the exception of a single water sample that was initially extracted and analyzed within holding, but was re-extracted six days past the maximum recommended hold time to achieve lower detection limits. The laboratory used standards traceable to standard reference materials for instrument calibration and for their spiking solutions. Analytical instruments were calibrated and calibrations were confirmed in accordance with the laboratory's SOP, DoD Quality Systems Manual (QSM) 5.0 (DoD, 2013), and USEPA Method 537.

Surveying

All proposed soil boring locations were located, surveyed, and marked using a handheld Global Positioning System (GPS) unit prior to utility clearance, as specified in the ISWP. The coordinates from the GPS unit were used to accurately locate borings on SIR figures, and coordinates were entered into the project database and will be uploaded to Environmental Resource Program Information Management System (ERPIMS).

Investigation-Derived Waste

Investigation-derived waste (IDW) consisted of soil cuttings from soil boring advancement, groundwater sampling purge water, decontamination water, disposable personal protective equipment (PPE), and other miscellaneous refuse. Used PPE and other miscellaneous refuse were placed in plastic bags and discarded in an on-base sanitary trash container for disposal at a sanitary landfill. Soil IDW generated from soil borings was placed into United States Department of Transportation (DOT)-approved 55-gallon, open-top steel drums. Liquid IDW generated from equipment decontamination and monitoring well purging activities was placed into DOT-approved 55-gallon steel drums. IDW containers were appropriately labeled with site/contact information and contents, and were initially staged in Building 2411; however, because of space constraints, IDW was transferred to a paved outdoor location specified by the Restoration Program Manager (RPM), and a fence was rented to secure the storage area. Based upon waste characterization results, IDW will be profiled and transported offsite by a licensed waste hauler to a permitted disposal facility. A designated USAF representative will oversee IDW loading for transport and disposal and will sign all manifests/bills of lading. Copies of the bills of lading/manifests will be included in the final SI Report or under separate cover.

Because of the low volume of purge and decontamination water generated during the SI, the liquid IDW was not segregated into separate containers for monitoring well purge water and equipment decontamination water; these two wastes were combined and sampled for characterization. As of January 2018, the initial and follow-on SI work has generated two drums of water and one drum of soil IDW.

Using a dedicated bailer, an aliquot of water was collected from each drum of liquid IDW at the conclusion of drilling and sampling activities. The samples were decanted directly into laboratory-provided containers. Soil IDW was sampled using a representative aliquot from each soil boring that was field-composited and packed into laboratory-provided containers. Water and soil IDW samples were labeled, packed on ice in insulated coolers, and delivered under CoC protocol to the selected laboratory. The samples were submitted to CT Laboratories for laboratory analysis for volatile organic compounds, semivolatile organic compounds, pesticides, herbicides, metals, polychlorinated biphenyls, total petroleum hydrocarbons (gasoline range organics and diesel range organics), flashpoint, pH, sulfide, and cyanide to determine the applicable disposal options (**Appendix E**).

Sections 3.1 through 3.5 provide detailed descriptions of sampling locations and results at each AFFF release area.

3.1 AFFF RELEASE AREA 1: FT004 (FT01)

The former FTA was used after 1970 through approximately 1991. During this period, an estimated 125 gallons or more of AFFF were used during each training exercise. After each exercise, the remaining water, fuel, and foam were drained into an OWS, which discharged effluent water into a low area east of the training location (CH2M Hill, 2015). Petroleum contaminated soil was previously excavated in this area (Amec Foster Wheeler, 2017a).

3.1.1 Sampling Location and Methodologies

3.1.1.1 Soil Samples

Soil borings FRCHD01-SB-1 and FRCHD01-SB-2 were advanced on 10 May 2017 within and adjacent to the former burn pit and OWS excavations (**Figure 3.1-1**). A surface soil sample was collected at 0 to 0.5 foot bgs at FRCHD01-SB-2, and subsurface soil samples were collected from both borings at depths ranging from 4.5 to 8.0 feet bgs, for PFAS analysis. A surface soil sample was not collected from FRCHD01-SB-1 because of its location within a previously backfilled excavation. Composite soil samples were also collected from each soil boring from 0 to 0.5 foot bgs (FRCHD01-C-1) and 0.5 to 8.0 feet bgs (FRCHD01-C-2) for TOC, pH, and particle size analysis. Groundwater was encountered at 6 to 7 feet bgs during boring advancement.

3.1.1.2 Groundwater Samples

Groundwater samples were collected from existing shallow monitoring well MW-3 located near the source area; downgradient shallow monitoring wells MW-225, MW-226, and MW-50; and the downgradient basalt bedrock monitoring well MW-100. The samples from the installation boundary were collected to evaluate whether PFAS at concentrations above HA levels are likely migrating off-base toward downgradient private supply wells (**Figure 3.1-1**). These existing monitoring wells were sampled on 14 and 15 February 2017 to assess PFAS concentrations downgradient of FT004.

3.1.2 Analytical Results

3.1.2.1 Soil Results

One surface soil sample and three subsurface soil samples were collected from borings FRCHD01-SB-1 and FRCHD01-SB-2. PFAS results are provided in **Table 3.0-3**, illustrated on **Figure 3.1-2**, and summarized below. **Table 3.0-3** includes definitions of data qualifiers that may be used in the discussion below.

FRCHD01-SB-1:

- PFOS was detected at concentrations above the RSL at 4.5 to 5.5 feet bgs (1.8 mg/kg), below the excavation fill, and at 7.0 to 8.0 feet bgs (0.51 mg/kg).
- PFOA was detected at concentrations below the RSL at the two sampling intervals at a maximum concentration of 0.11 mg/kg (4.5 to 5.5 feet bgs).

- PFBS was detected at concentrations below the RSL at the two sampling intervals at a maximum concentration of 0.036 mg/kg (4.5 to 5.5 feet bgs).

FRCHD01-SB-2:

- PFOS was detected at a concentration above the RSL at 6.0 to 7.0 feet bgs (0.98 mg/kg) and below the RSL at 0.0 to 0.5 feet bgs (0.0088 mg/kg).
- PFOA was detected at concentrations below the RSL at the two sampling intervals at a maximum concentration of 0.026 mg/kg (6.0 to 7.0 feet bgs).
- PFBS was detected at a concentration below the RSL at 0.0022 mg/kg (6.0 to 7.0 feet bgs) and was not detected in the surface sample.

The composite TOC concentrations were 26,400 mg/kg (0.0 to 0.5 foot bgs) and 5,380 mg/kg (0.5 to 8.0 feet bgs), while the composite pH concentrations were 8.14 standard units (S.U.) (0.0 to 0.5 foot bgs) and 7.9 S.U. (0.5 to 8.0 feet bgs) (**Table 3.0-5**). The particle size analytical results for the composite sample from 0.0 to 0.5 foot bgs were 12.2% fines (silt and clay), 51.5% sand (fine to coarse), and 36.3% gravel (fine), while the particle size analytical results for the composite sample from 0.5 to 8.0 feet bgs were 18.0% fines (silt and clay), 77.1% sand (fine to coarse), and 4.9% gravel (fine). The material description for the sample from 0.0 to 0.5 foot bgs was poorly graded sand with silt and gravel, while the material description for the sample from 0.5 to 8.0 feet bgs was silty sand. These results are included in the laboratory report in **Appendix C**.

3.1.2.2 Groundwater Results

Six groundwater samples (including one field duplicate) were collected from existing monitoring wells MW-3, MW-50, MW-100, MW-225, and MW-226. PFAS results are provided in **Table 3.0-4**, illustrated on **Figure 3.1-3,** and summarized below.

MW-3:

- PFOS was detected above the USEPA HA value at a concentration of 55 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 22 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 77 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 2.7 µg/L.

MW-50:

- PFOS was detected above the USEPA HA value at a concentration of 11 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 1.1 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 12.1 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 1.8 µg/L.

MW-100:

- PFOS was detected above the USEPA HA value at a concentration of 25 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 9.8 µg/L.
- PFOS+PFOA was detected above USEPA HA value at a concentration of 34.8 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 2.9 µg/L.

MW-225:

- PFOS was detected above the USEPA HA value at a concentration of 21 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 3.5 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 24.5 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 1.7 µg/L.

MW-226:

- PFOS was detected above the USEPA HA value at an approximate concentration of 41 J µg/L.
- PFOA was detected above the USEPA HA value at an approximate concentration of 7.9 J µg/L.
- PFOS+PFOA was detected above the USEPA HA value at an approximate concentration of 48.9 J µg/L.
- PFBS was detected below the USEPA Tap Water RSL at an approximate concentration of 2.4 J µg/L.

3.1.3 Conclusions

PFOS was detected in subsurface soil at concentrations exceeding the USEPA RSL in Release Area 1; however, PFOS was not detected above the USEPA RSL in the single surface soil sample. PFOA and PFBS in soil were detected at concentrations below the RSLs. PFOS, PFOA, and PFOS+PFOA concentrations exceeded the USEPA HA values in all existing monitoring wells sampled, while PFBS was detected at concentrations below the USEPA Tap Water RSL.

3.2 AFFF RELEASE AREA 2: CALIBRATION AREA

AFFF was sprayed onto an old taxiway where it flowed south to an unpaved area at AFFF Release Area 2.

3.2.1 Sampling Location and Methodologies

3.2.1.1 Soil Samples

Two soil borings (FRCHD02-SB-1 and FRCHD02-SB-2) were advanced south of the paved area (**Figure 3.2-1**). Surface soil samples were collected from 0.0 to 0.5 foot bgs on 9 May 2017, and subsurface soil samples were collected from 7.0 to 8.0 feet bgs on 10 May 2017, for PFAS analysis. Composite soil samples were also collected from each soil boring from 0.0 to 0.5 foot bgs (FRCHD02-C-1) and 0.5 to

8.0 feet bgs (FRCHD02-C-2) for TOC, pH, and particle size analysis. Groundwater was encountered at approximately 7.0 feet bgs during boring advancement.

3.2.1.2 Groundwater Samples

One groundwater sample was collected from soil boring FRCHD02-SB-2 to assess PFAS concentrations in groundwater within the calibration area (**Figure 3.2-1**). The boring groundwater was sampled on 10 May 2017.

3.2.2 Analytical Results

3.2.2.1 Soil Results

Two surface soil samples and two subsurface soil samples were collected from soil borings FRCHD02-SB-1 and FRCHD02-SB-2. PFAS results are provided in **Table 3.0-3**, illustrated in **Figure 3.2-2**, and summarized below.

FRCHD02-SB-1:

- PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of 0.028 mg/kg (0.0 to 0.5 foot bgs).
- PFOA was detected below the RSL at the two sampling intervals at an approximate maximum concentration of 0.00048 J mg/kg (7.0 to 8.0 feet bgs).
- PFBS was detected at an approximate concentration below the RSL at 7.0 to 8.0 feet bgs (0.0006 J mg/kg) and was not detected at 0.0 to 0.5 foot bgs.

FRCHD02-SB-2:

- PFOS was detected above the RSL at 0 to 0.5 foot bgs (0.79 mg/kg) and below the RSL at 7.0 to 8.0 feet bgs (0.051 mg/kg).
- PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0016 mg/kg (0 to 0.5 foot bgs).
- PFBS was not detected at either interval.

The composite TOC concentrations were 8,900 mg/kg (0.0 to 0.5 foot bgs) and 1,890 mg/kg (0.5 to 8.0 feet bgs), while the composite pH concentrations were 7.99 S.U. (0.0 to 0.5 foot bgs) and 8.19 S.U. (0.5 to 8.0 feet bgs) (**Table 3.0-5**). The particle size analytical results for the composite sample at 0.0 to 0.5 foot bgs were 28.4% fines (silt and clay), 57.1% sand (fine to coarse), and 14.5% gravel (fine), while the particle size analytical results for the composite sample at 0.5 to 8.0 feet bgs were 15.4% fines (silt and clay), 67.3% sand (fine to coarse), and 17.3% gravel (fine to coarse). The material description for the sample from 0.0 to 0.5 foot bgs was silty sand, while the material description for the sample from 0.5 to 8.0 feet bgs was silty sand with gravel.

3.2.2.2 Groundwater Results

One groundwater sample was collected from FRCHD02-SB-2. PFAS results are provided in **Table 3.0-4**, illustrated in **Figure 3.2-3,** and summarized below.

FRCHD02-SB-2:

- PFOS was detected above the USEPA HA value at a concentration of 21 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 0.69 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 21.69 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 1.2 µg/L.

3.2.3 Conclusions

PFOS was detected at a concentration that exceeded the RSL in surface soil at one boring location but at concentrations below the RSL in subsurface soil. PFOA and PFBS were detected in soil at AFFF Release Area 2 at concentrations below the RSLs. The highest concentrations of PFAS were observed in surface soil (0 to 0.5 foot bgs) at sampling location FRCHD02-SB-02. PFOS, PFOA, and PFOS+PFOA concentrations exceeded the USEPA HA values in groundwater from boring FRCHD-2-SB-2. PFBS was detected at a concentration below the USEPA Tap Water RSL in groundwater from boring FRCHD02-SB-2.

3.3 AFFF RELEASE AREA 3: AIRCRAFT CRASH LOCATION SS008 (PS-4/9)

AFFF Release Area 3 is the location of a KC-135 aircraft crash in a former grassy field near present-day Buildings 2005 and 2007. An unknown quantity of AFFF was used to extinguish the fire resulting from the crash in March 1987 (CH2M Hill, 2015).

3.3.1 Sampling Location and Methodologies

3.3.1.1 Soil Samples

Three soil borings (FRCHD03-SB-1, FRCHD03-SB-2, and FRCHD03-SB-3) were advanced in paved parking areas and a grassy field near Buildings 2005 and 2007 (**Figure 3.3-1**). Surface soil samples were collected from 0.0 to 0.5 foot bgs on 8 May 2017 (FRCHD03-SB-2 and FRCHD03-SB-3) and 2.5 to 3.0 feet bgs on 11 May 2017 (FRCHD03-SB-1; this boring had asphalt and gravel to a depth of 2.5 feet bgs), and subsurface soil samples were collected at depths ranging from 6.0 to 7.5 feet bgs on 11 May 2017, for PFAS analysis. Composite soil samples were also collected from each soil boring from 0.0 to 3.0 feet bgs (FRCHD03-C-1) and 0.5 to 7.5 feet bgs (FRCHD03-C-2) for TOC, pH, and particle size analysis. Groundwater was encountered at approximately 5.0 to 6.5 feet bgs during boring advancement.

3.3.1.2 Groundwater Samples

Four existing monitoring wells were sampled (MMW-1023-1, MW-185, MW-265, and MW-438) on 8 and 9 May 2017 to assess PFAS concentrations at and downgradient from the KC-135 crash site (**Figure 3.3-1**).

3.3.2 Analytical Results

3.3.2.1 Soil Results

Six surface and subsurface soil samples were collected for PFAS analysis, with the results provided in **Table 3.0-3**, illustrated on **Figure 3.3-2**, and summarized below.

FRCHD03-SB-1:

- PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of 0.013 mg/kg (2.5 to 3.0 feet bgs).
- PFOA was detected below the RSL at 6.0 to 7.0 feet bgs at an approximate concentration of 0.00027 J mg/kg, and was not detected at 2.5 to 3.0 feet bgs.
- PFBS was not detected at either interval.

FRCHD03-SB-2:

- PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of 0.025 mg/kg (6.0 to 7.0 feet bgs).
- PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0019 mg/kg (6.0 to 7.0 feet bgs).
- PFBS was not detected at either interval.

FRCHD03-SB-3:

- PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of 0.089 mg/kg (6.5 to 7.5 feet bgs).
- PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0023 mg/kg (6.5 to 7.5 feet bgs).
- PFBS was not detected at either interval.

The composite TOC concentrations were 8,360 mg/kg (0.0 to 3.0 feet bgs) and 1,480 mg/kg (0.5 to 7.5 feet bgs), while the composite pH concentrations were 7.89 S.U. (0.0 to 3.0 feet bgs) and 8.18 S.U. (0.5 to 7.5 feet bgs). The particle size analytical results for the composite sample from 0.0 to 0.5 foot bgs were 26.1% fines (silt and clay), 70.5% sand (fine to coarse), and 3.4% gravel (fine to coarse), while the particle size analytical results for the composite sample from 0.5 to 7.5 feet bgs were 24.2% fines (silt and clay), 60.7% sand (fine to coarse), and 15.1% gravel (fine to coarse). The material description for the sample from 0 to 0.5 foot bgs was silty sand, while the material description for the sample from 0.5 to 7.5 feet bgs was silty sand with gravel.

3.3.2.2 Groundwater Results

Five groundwater samples (including one field duplicate) were collected for PFAS analysis, with the results provided in **Table 3.0-4**, illustrated on **Figure 3.3-3**, and summarized below.

MMW-1023-1

- PFOS was detected below the USEPA HA value at a concentration of 0.026 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 1.5 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 1.526 µg/L.
- PFBS was not detected.

MW-185:

- PFOS was detected above the USEPA HA value at an approximate concentration of 0.24 J µg/L.
- PFOA was detected below the USEPA HA value at a concentration of 0.022 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at an approximate concentration of 0.262 J µg/L.
- PFBS was detected below the USEPA Tap Water RSL at an approximate concentration of 0.012 J µg/L.

MW-265:

- PFOS was detected above the USEPA HA value at a concentration of 8.4 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 0.83 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 9.23 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.77µg/L.

MW-438:

- PFOS was detected above the USEPA HA value at a concentration of 17 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 0.62 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 17.62 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.28 µg/L.

3.3.3 Conclusions

PFOS, PFOA, and PFBS in soil were detected at concentrations below the USEPA RSLs. PFOS, PFOA, and PFOS+PFOA concentrations in groundwater exceeded the USEPA HA values in each of the four existing monitoring wells, except for PFOS in monitoring well MMW-1023-1 and PFOA in monitoring well MW-185. PFBS was detected at concentrations below the USEPA Tap Water RSL at three of the existing monitoring wells.

3.4 AFFF RELEASE AREA 4: B-52 CRASH LOCATION 1994

AFFF Release Area 4 is the location of a 1994 B-52 crash in a grass-covered open field where an unknown quantity of AFFF was released while extinguishing a JP-4 fire resulting from the crash (CH2M Hill, 2015).

3.4.1 Sampling Location and Methodologies

3.4.1.1 Soil Samples

Three soil borings (FRCHD04-SB-1, FRCHD04-SB-2, and FRCHD04-SB-3) were advanced in the grassy field at the crash site (**Figure 3.4-1**). Surface soil samples were collected from 0.0 to 0.5 foot bgs on 8 May 2017, and subsurface soil samples were collected at depths ranging from 3.5 to 5.0 feet bgs on 11 and 12 May 2017, for PFAS analysis. Composite soil samples were also collected from each soil boring from 0.0 to 0.5 feet bgs (FRCHD04-C-1) and 0.5 to 5.0 feet bgs (FRCHD04-C-2) for TOC, pH, and particle size analysis. Groundwater was encountered at approximately 3.5 to 4.0 feet bgs during boring advancement.

3.4.1.2 Groundwater Samples

Groundwater from one existing monitoring well (MW-451) and two soil borings (FRCHD04-SB-1 and FRCHD04-SB-3) were sampled on 10 through 12 May 2017 to assess PFAS concentrations at and approximately downgradient from the crash site (**Figure 3.4-1**).

3.4.2 Analytical Results

Six surface and subsurface soil samples were collected for PFAS analysis, with the results provided in **Table 3.0-3,** illustrated on **Figure 3.4-2**, and summarized below.

FRCHD04-SB-1:

- PFOS was detected above the RSL at 0.0 to 0.5 feet bgs (0.26 mg/kg) and below the RSL at 4.0 to 4.5 feet bgs (0.011 mg/kg).
- PFOA was detected below the RSL at the two sampling intervals at a maximum approximate concentration of 0.00065 J mg/kg (4.0 to 4.5 feet bgs).
- PFBS was detected below the RSL at 4.0 to 4.5 feet bgs at an approximate concentration of 0.00037 J mg/kg, and was not detected at 0.0 to 0.5 foot bgs.

FRCHD04-SB-2:

- PFOS was detected below the RSL at the two sampling intervals at a maximum approximate concentration of 0.019 J mg/kg (0.0 to 0.5 foot bgs).
- PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0018 mg/kg (4.5 to 5.0 feet bgs).
- PFBS was detected below the RSL at 4.5 to 5.0 feet bgs at an approximate concentration of 0.0024 J mg/kg, and was not detected at 0.0 to 0.5 foot bgs.

FRCHD04-SB-3:

- PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0056 mg/kg (0.0 to 0.5 foot bgs).

- PFOA was detected below the RSL at 3.5 to 4.0 feet bgs at an approximate concentration of 0.0008 J mg/kg, and was not detected at 0.0 to 0.5 foot bgs.
- PFBS was detected below the RSL at 0.0 to 0.5 foot bgs at an approximate concentration of 0.00035 J mg/kg, and was not detected at 3.5 to 4.0 feet bgs.

The composite TOC concentrations were 20,500 mg/kg (0.0 to 0.5 foot bgs) and 209 mg/kg (0.5 to 5.0 feet bgs), while the composite pH concentrations were 7.85 S.U. (0 to 0.5 foot bgs) and 6.91 S.U. (0.5 to 5.0 feet bgs). The particle size analytical results for the composite sample from 0.0 to 0.5 foot bgs were 54.5% fines (silt and clay) and 39.8% sand (fine to coarse), while the particle size analytical results for the composite sample from 0.5 to 5.0 feet bgs were 8.1% fines (silt and clay), 72.6% sand (fine to coarse), and 19.3% gravel (fine to coarse). The material description for the sample from 0.0 to 0.5 foot bgs was sandy silt, while the material description for the sample from 0.5 to 5.0 feet bgs was well graded sand with silt and gravel.

3.4.2.1 Groundwater Results

Three groundwater samples were collected for PFAS analysis, with the results provided in **Table 3.0-4**, illustrated on **Figure 3.4-3**, and summarized below.

FRCHD04-SB-1:

- PFOS was detected above the USEPA HA value at a concentration of 22 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 2.5 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 24.5 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.58 µg/L.

FRCHD04-SB-3:

- PFOS was detected above the USEPA HA value at a concentration of 6.3 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 1.6 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 7.9 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.62 µg/L.

MW-451:

- PFOS was detected below the USEPA HA value at a concentration of 0.026 µg/L.
- PFOA was detected below the USEPA HA value at an approximate concentration of 0.0092 J µg/L.
- PFOS+PFOA was detected below the USEPA HA value at an approximate concentration of 0.0352 J µg/L.
- PFBS was not detected.

3.4.3 Conclusions

PFOS was detected at a concentration that exceeded the RSL in the surface soil at one boring location, but was detected in subsurface soil at concentrations below the RSL. PFOA and PFBS in soil were detected at concentrations below the RSLs. PFOS, PFOA, and PFOS+PFOA concentrations in groundwater exceeded the USEPA HA values in each of the two groundwater samples from borings. PFBS was detected at concentrations below the USEPA Tap Water RSL. Concentrations of PFOS, PFOA, and PFOS+PFOA were less than USEPA HA values in monitoring well MW-451. PFBS was not detected at this well.

3.5 AFFF RELEASE AREA 5: FIRE STATION 1 (BUILDING 3)

AFFF Release Area 5 consists of a grassy area south of the Fire Station 1 fire engine garage between the paved area and a wall that divides the fire station from the airfield. Calibration tests using AFFF occurred on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb and into the grassy area.

3.5.1 Sampling Location and Methodologies

3.5.1.1 Soil Samples

Two soil borings (FRCHD05-SB-1 and FRCHD05-SB-2) were advanced near a curb cut where surface water drains into a grassy drainage swale (**Figure 3.5-1**). Surface soil samples were collected from 0.0 to 0.5 foot bgs on 8 May 2017, and subsurface soil samples were collected from depths ranging from 3.0 to 13.0 feet bgs on 11 May 2017, for PFAS analysis. Composite soil samples were also collected from each soil boring from 0.0 to 0.5 foot bgs (FRCHD05-C-1) and 0.5 to 13.0 feet bgs (FRCHD05-C-2) for TOC, pH, and particle size analysis. Groundwater was encountered at approximately 3 feet bgs at boring FRCHD05-SB-2 and at approximately 13 feet bgs at boring FRCHD05-SB-1 during boring advancement.

3.5.1.2 Groundwater Samples

Groundwater from one existing well (MW-399) and one soil boring (FRCHD05-SB-1) was sampled on 8 and 11 May 2017, respectively, to assess PFAS concentrations in the grassy drainage swale near Fire Station 1 (**Figure 3.5-1**).

3.5.2 Analytical Results

3.5.2.1 Soil Results

Three surface soil samples and three subsurface soil samples (including two field duplicates) were collected for PFAS analysis, with the results provided in **Table 3.0-3**, illustrated on **Figure 3.5-2**, and summarized below.

FRCHD05-SB-1:

- PFOS was detected above the RSL at 0.0 to 0.5 foot bgs at a concentration of 8.2 mg/kg and at 12.0 to 13.0 feet bgs at a concentration of 0.15 J mg/kg (duplicate).

- PFOA was detected below the RSL at both sampling intervals at an approximate maximum concentration of 0.011 J mg/kg (0.0 to 0.5 foot bgs).
- PFBS was detected below the RSL at both sampling intervals at an approximate maximum concentration of 0.0042 J mg/kg (0.0 to 0.5 foot bgs).

FRCHD05-SB-2:

- PFOS was detected above the RSL at 0.0 to 0.5 foot at a concentration of 3.2 mg/kg and at 3.0 to 4.0 feet bgs at a concentration of 0.61 mg/kg.
- PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of 0.0065 mg/kg (3.0 to 4.0 feet bgs).
- PFBS was detected below the RSL at 3.0 to 4.0 feet bgs at a concentration of 0.0043 mg/kg, and was not detected at 0.0 to 0.5 foot bgs.

The composite TOC concentrations were 30,100 mg/kg (0.0 to 0.5 foot bgs) and 5,430 mg/kg (0.5 to 13.0 feet bgs), while the composite pH concentrations were 7.94 S.U. for both samples (0.0 to 0.5 foot bgs and 0.5 to 13.0 feet bgs). The particle size analytical results for the composite sample collected at 0.0 to 0.5 foot bgs was 36.8% fines (silt and clay), 55.7% sand (fine to coarse), and 7.5% gravel (fine to coarse), while the particle size analytical results for the composite sample collected at 0.5 to 13.0 feet bgs was 27.9% fines (silt and clay), 58.8% sand (fine to coarse), and 13.6% gravel (fine to coarse). The material description for both samples was silty sand.

3.5.2.2 Groundwater Results

Two groundwater samples were collected for PFAS analysis, with the results provided in **Table 3.0-4**, illustrated in **Figure 3.5-3**, and summarized below.

FRCHD05-SB-1:

- PFOS was detected above the USEPA HA value at a concentration of 150 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 17 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 167 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 9.2 µg/L.

MW-399:

- PFOS was detected above the USEPA HA value at a concentration of 98 µg/L.
- PFOA was detected above the USEPA HA value at a concentration of 6 µg/L.
- PFOS+PFOA was detected above the USEPA HA value at a concentration of 104 µg/L.
- PFBS was detected below the USEPA Tap Water RSL at a concentration of 3.8 µg/L.

3.5.3 Conclusions

PFOS was detected at a concentration that exceeded the RSL in the surface and subsurface soil at both boring locations. PFOA and PFBS in soil were detected at concentrations below the RSLs. PFOS, PFOA, and PFOS+PFOA concentrations in groundwater exceeded the USEPA HA values at the soil boring and existing monitoring well MW-399. PFBS was detected in groundwater at a concentration below the USEPA Tap Water RSL at both locations.

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4.0 MIGRATION/EXPOSURE PATHWAYS AND TARGETS

An updated base-wide conceptual site model table is provided as **Table 4.0-1**. The table provides an overview of the facility, physical, release, land use, exposure, and ecological profiles at Fairchild AFB. The table has been updated to include information collected during this SI. A more detailed description of source area conditions and exposure pathways is provided in the following sections. A cross section through AFFF Release Area 1 is provided in **Appendix F.**

4.1 SOIL (SURFACE AND SUBSURFACE) EXPOSURE PATHWAY

4.1.1 Local Geologic Setting

Fairchild AFB is within the Columbia Plateau. The ground surface is relatively flat and generally slopes toward the northeast. Ground surface elevation ranges from 2,400 to 2,460 feet above mean sea level (amsl). Surficial soil consists of up to 50 feet of alluvial sediments composed mostly of sand and gravel with some silt and clay deposits. Alluvial deposits at Fairchild AFB consist of layers of sands and gravels with some silt and clay. These materials were Quaternary flood deposits from former glacial Lake Missoula of Pleistocene age. Underlying the alluvial deposit is a thick sequence of layered basalt associated with the regional Columbia River Basalt Group (CH2M Hill, 2015).

The uppermost sequence of basalts is referred to as Basalt A and Basalt B. Basalt A varies in thickness from approximately 160 to 190 feet. Basalts A and B are separated by a low-permeability clay referred to as Interbed A. The basalt flows are underlain by massive granitic rock.

4.1.2 Soil Exposure Pathways and Targets

PFOS, PFOA, and/or PFBS were detected in soil at AFFF Release Areas 1, 2, 3, 4, and 5; however, only PFOS concentrations exceeded the RSL of 0.126 mg/kg, at AFFF Release Areas 1, 2, 4, and 5. AFFF Release Areas 1 through 4 have a clean soil cover, gravel, vegetation, or permanent impenetrable cover above the impacted soil. AFFF Release Area 5 does not have a clean soil cover, gravel, vegetation, or permanent impenetrable cover above the impacted soil.

Surface soil at Fairchild AFB is potentially accessible by onsite workers, site visitors, and/or trespassers. Subsurface soil is primarily accessible by onsite construction workers involved with excavating, drilling, or any activity that exposes them to subsurface soil. Access to source area soil is not expected to change in the future.

Potential exposure routes for soil include inhalation of impacted surface soil dust particles and dermal contact of contaminants in soil.

4.1.3 Soil Exposure Conclusions

Potential exposure receptors include Fairchild AFB personnel, onsite workers, visitors, and trespassers that may come into contact with surface and/or subsurface soil at AFFF release areas via inhalation or dermal contact. The highest potential of exposure to PFAS from soil is to onsite workers that may be involved with excavation or drilling activities in AFFF Areas 1, 2, 4, and 5 or occupational workers who

could potentially be exposed to surface soil in AFFF Release Areas 2, 4, and 5. Based on the SI activities completed by Amec Foster Wheeler, a potential complete exposure pathway for soil with contamination at levels exceeding screening values exists at AFFF Release Areas 1, 2, 4, and 5; however, it is unlikely that occupational workers will come in contact with surface soil at Areas 2 and 4 because surface soil is covered with pavement, clean soil, or vegetation in these areas.

4.2 GROUNDWATER MIGRATION PATHWAY

4.2.1 Local Hydrogeologic Setting

Groundwater at Fairchild AFB is typically encountered at 3 to 12 feet bgs in alluvium or within the fractured and weathered upper portion of Basalt A under unconfined conditions. Based on work completed by others, groundwater within both the alluvium and Basalt A generally flows west to east across Fairchild AFB, except:

- At the very western margin of the base, where a groundwater flow divide directs groundwater toward the west; and
- At the eastern side of the base, where groundwater flow splits around a basalt outcrop, resulting in flow toward the northeast and northwest in the central and northern portion of the base, and southeast and east in the southern portion of the base (CH2M Hill, 2015).

4.2.2 Groundwater Exposure Pathways and Targets

Once in groundwater, PFAS are highly mobile and will migrate at a velocity near that of groundwater because of their high solubility and low partition coefficient value. PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. As a result, these chemicals are extremely persistent in the environment, with a half-life greater than 41 years for PFOS and greater than 92 years for PFOA (USEPA, 2014b). PFBS is generally less toxic and less bio accumulative in wildlife and humans (USEPA, 2017b).

PFOS, PFOA, and/or PFBS were detected in groundwater at AFFF Release Areas 1, 2, 3, 4, and 5; PFOS and PFOA concentrations exceeded the USEPA HA value of 0.07 µg/L at AFFF Release Areas 1, 2, 3, 4, and 5 and these are considered release areas for pathway analysis.

Groundwater receptors are considered to be present on Fairchild AFB because the installation infrequently obtains drinking water from an on-base supply well. Drinking water is primarily provided to the base from the Fort Wright well field (Water Supply Annex No. 1) and periodically from n-base Supply Well No. 2 (Water Supply Annex No. 2), which is used as a backup supply. The Fort Wright well field is located 12 miles east of the base and On-base Supply Well No. 2 is located at the southern end of the base (United State Army Corps of Engineers [USACE], 2011). The Fairchild AFB drinking water supply has been tested for PFOS and PFOA and results indicate concentrations less than the HA value.

The primary groundwater targets located downgradient from PFAS-impacted AFFF release areas include private and public water supply wells within close proximity to the installation boundary. Groundwater

flow direction has been identified to the northeast and northwest in the central and northern portions of the installation, and to the southeast and east in the southern portion of the installation (CH2M Hill, 2015). Based on the results of ongoing off-base sampling of private and public water supply wells and existing monitoring wells, PFAS in groundwater have migrated off-base into the adjacent community.

4.2.3 Well Inventory

The USAF had previous knowledge of off-base private wells that were used as a starting point in identifying potential off-base receptors. Additional potential receptors have been identified during off-base follow-on work. In addition, the USAF has engaged in public outreach through public meetings and notifications to obtain information about nearby residential or commercial water wells. Sampling of private and public drinking water wells in areas downgradient of the AFFF areas is ongoing, and the effort includes identification of additional drinking water wells, as needed, as results are reviewed. The current off-base area extends up to approximately 4 miles from the base (to the northeast) and includes 332 private wells and four municipal wells. A map showing the extent of the current off base sampling area is provided in **Appendix G**. The results of sampling efforts and the follow-on mitigations will be reported under separate cover.

4.2.4 Groundwater Migration Pathway Conclusions

PFOS and PFOA concentrations in groundwater exceeded the USEPA HA value of 0.07 µg/L for PFOS, PFOA, and/or PFOS+PFOA at all five identified AFFF release areas. Groundwater receptors are considered to be present on Fairchild AFB because the installation infrequently obtains drinking water from an on-base supply well. Off-base potential exposure receptors for groundwater were initially identified by the USAF and continue to be identified in an ongoing process overseen by AFCEC during the off-base follow-on investigation.

4.3 SURFACE WATER AND SEDIMENT MIGRATION PATHWAY

4.3.1 Hydrologic Setting

The primary pathway for surface runoff at Fairchild AFB is along paved areas and stormwater conveyances to a retention pond, located south of the runway on the eastern side of the base, that discharges to No Name Creek. Stormwater collected within stormwater drains throughout the base empties into the retention pond. Other surface water runoff not collected by the drains flows to swales that run along the inside of the perimeter fence, where the water either infiltrates into the ground or evaporates. No Name Creek is the sole surface water discharge point from the base. It flows approximately 1 mile downstream from the stormwater retention pond, and does not enter another surface water body before flow infiltrates or evaporates. Wetlands occur on the southern side of the base (CH2M Hill, 2015). Sediment could potentially accumulate along these same drainage features.

4.3.1 Surface Water and Sediment Exposure Pathways and Targets

Potential on-base exposure receptors include workers, visitors, and trespassers at No Name Creek, the retention pond, and the numerous drainage ditches that convey surface water potentially impacted by PFAS from the various AFFF release areas at Fairchild AFB. Potential exposure routes for surface water and sediment include ingestion, inhalation, and dermal contact.

Surface water and sediment samples were not collected as part of the SI. The USEPA and Ecology have not promulgated screening levels for PFAS in surface water.

4.3.2 Surface Water Exposure Conclusions

Surface water and sediment samples were not collected as part of the SI. Potential exposure receptors include onsite workers, visitors, and trespassers at the retention pond and/or No Name Creek.

5.0 SUMMARY AND CONCLUSIONS

As stated in Section 1.0, the objectives of this study were to:

1) Determine if PFOS, PFOA, or PFBS are present in soil and/or groundwater at AFFF release areas selected for SI;
2) Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL, based on a residential exposure scenario, of 0.126 mg/kg, and if PFBS concentrations in soil exceed the USEPA residential RSL of 130 mg/kg;
3) Determine if PFOS, PFOA, or the sum of PFOS and PFOA concentrations in groundwater exceed the USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the USEPA Tap Water RSL of 40 µg/L; and
4) Identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA concentrations above the USEPA HA value, or PFBS concentrations above the USEPA Tap Water RSL).

Section 3.0 of this SI detailed the analytical results for PFAS at each AFFF release area. **Table 5.0-1** lists specific exceedances by release area and medium, fulfilling the objectives of the SI.

Table 5.0-1. Summary of Analytical Results and Screening Level Exceedances.

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples*/ Number of Exceedances	Exceeds Screening Level?	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Release Area 1 FT004 (FT01)	Surface Soil (0.0 to 0.5 foot)						YES	Advance Area to RI
	PFOS	**0.0088**	0.126	mg/kg	1/0	No		
	PFOA	**0.00046 J**	0.126	mg/kg	1/0	No		
	PFBS	0.00047 U	1,300	mg/kg	1/0	No		
	Subsurface Soil (4.5 to 8.0 feet)							
	PFOS	**1.8**	0.126	mg/kg	3/3	**Yes**		
	PFOA	**0.11**	0.126	mg/kg	3/0	No		
	PFBS	**0.036**	1,300	mg/kg	3/0	No		
	Groundwater							
	PFOS	**55**	0.07	µg/L	5/5	**Yes**		
	PFOA	**22**	0.07	µg/L	5/5	**Yes**		
	PFOS+PFOA	**77**	0.07	µg/L	5/5	**Yes**		
	PFBS	**2.9**	40	µg/L	5/0	No		

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level?	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Release Area 2 Calibration Area	Surface Soil (0.0 to 0.5 foot)						YES	Advance Area to RI
	PFOS	**0.79**	0.126	mg/kg	2/1	**Yes**		
	PFOA	**0.0016**	0.126	mg/kg	2/0	No		
	PFBS	0.0006 U	130	mg/kg	2/0	No		
	Subsurface Soil (7.0 to 8.0 feet)							
	PFOS	**0.051**	0.126	mg/kg	2/0	No		
	PFOA	**0.00048 J**	0.126	mg/kg	2/0	No		
	PFBS	**0.0006 J**	130	mg/kg	2/0	No		
	Groundwater							
	PFOS	**21**	0.07	µg/L	1/1	**Yes**		
	PFOA	**0.69**	0.07	µg/L	1/1	**Yes**		
	PFOS+PFOA	**21.69**	0.07	µg/L	1/1	**Yes**		
	PFBS	**1.2**	40	µg/L	1/0	No		
AFFF Release Area 3 Aircraft Crash Location SS008 (PS-4/9)	Surface Soil (0.0 to 3.0 feet)						YES	Advance Area to RI
	PFOS	**0.02**	0.126	mg/kg	3/0	No		
	PFOA	**0.00041 J**	0.126	mg/kg	3/0	No		
	PFBS	0.00055 U	130	mg/kg	3/0	No		
	Subsurface Soil (6.0 to 7.5 feet)							
	PFOS	**0.089**	0.126	mg/kg	3/0	No		
	PFOA	**0.0023**	0.126	mg/kg	3/0	No		
	PFBS	0.00066 U	130	mg/kg	3/0	No		
	Groundwater							
	PFOS	**17**	0.07	µg/L	4/3	**Yes**		
	PFOA	**1.5**	0.07	µg/L	4/3	**Yes**		
	PFOS+PFOA	**17.62**	0.07	µg/L	4/4	**Yes**		
	PFBS	**0.77**	40	µg/L	4/0	No		
AFFF Release Area 4 B-52 Crash Location 1994	Surface Soil (0.0 to 0.5 foot)						YES	Advance Area to RI
	PFOS	**0.26**	0.126	mg/kg	3/1	**Yes**		
	PFOA	**0.00067 J**	0.126	mg/kg	3/0	No		
	PFBS	**0.00035 J**	130	mg/kg	3/0	No		
	Subsurface Soil (3.5 to 5.0 feet)							
	PFOS	**0.011**	0.126	mg/kg	3/0	No		
	PFOA	**0.0018**	0.126	mg/kg	3/0	No		
	PFBS	**0.0024 J**	130	mg/kg	3/0	No		

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level?	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Release Area 4 (cont.)	Groundwater							
	PFOS	**22**	0.07	µg/L	3/2	**Yes**		
	PFOA	**2.5**	0.07	µg/L	3/2	**Yes**		
	PFOS+PFOA	**24.5**	0.07	µg/L	3/2	**Yes**		
	PFBS	**0.62**	40	µg/L	3/0	No		
AFFF Release Area 5 Fire Station 1 (Building 3)	Surface Soil (1.0 to 1.5 feet)						YES	Advance Area to RI
	PFOS	**8.2**	0.126	mg/kg	2/2	**Yes**		
	PFOA	**0.011 J**	0.126	mg/kg	2/0	No		
	PFBS	**0.0042 J**	130	mg/kg	2/0	No		
	Subsurface Soil (3.0 to 13.0 feet)							
	PFOS	**0.61**	0.126	mg/kg	2/2	**Yes**		
	PFOA	**0.0065**	0.126	mg/kg	2/0	No		
	PFBS	**0.0043**	130	mg/kg	2/0	No		
	Groundwater							
	PFOS	**150**	0.07	µg/L	2/2	**Yes**		
	PFOA	**17**	0.07	µg/L	2/2	**Yes**		
	PFOS+PFOA	**167**	0.07	µg/L	2/2	**Yes**		
	PFBS	**9.2**	40	µg/L	2/0	No		

Notes:
* normal samples (count does not include QC samples)
Bold – detected analyte
AFFF – aqueous film forming foam
DW – drinking water
U – The analyte was not detected above the method detection limit shown.
J – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample
µg/L - micrograms per liter
mg/kg - milligrams per kilogram
ND – not detected
QC - quality control

Potential pathways for PFAS to reach human receptors were identified and presented in Section 4.0 of this SIR. The potential receptors and targets vary by AFFF release area. Media-specific pathways and receptors are discussed below.

Surface and Subsurface Soil Receptors

The highest potential for exposure to PFAS from soil is to onsite workers, specifically those involved with excavation or drilling activities. PFOS, PFOA, and/or PFBS were detected in soil at each of the AFFF release areas sampled; however, the only RSL exceedances were for PFOS at AFFF Release Areas 1, 2, 4, and 5.

Groundwater Receptors

PFOS and PFOA concentrations in groundwater exceeded the USEPA HA value of 0.07 µg/L for PFOS, PFOA, and/or PFOS+PFOA at AFFF Release Areas 1, 2, 3, 4, and 5. Groundwater receptors are considered to be present on Fairchild AFB because the installation infrequently obtains drinking water from an on-base supply well. Potential off-base exposure receptors for groundwater were initially identified by the USAF and continue to be identified in an ongoing process overseen by AFCEC during the off-base follow-on investigation.

Surface Water and Sediment Receptors

Surface water and sediment were not sampled as a part of this SI. The USEPA and Ecology have not promulgated screening levels for PFAS in surface water to date. Potential exposure receptors include onsite workers, visitors, and trespassers at the retention pond and/or No Name Creek.

6.0 REFERENCES

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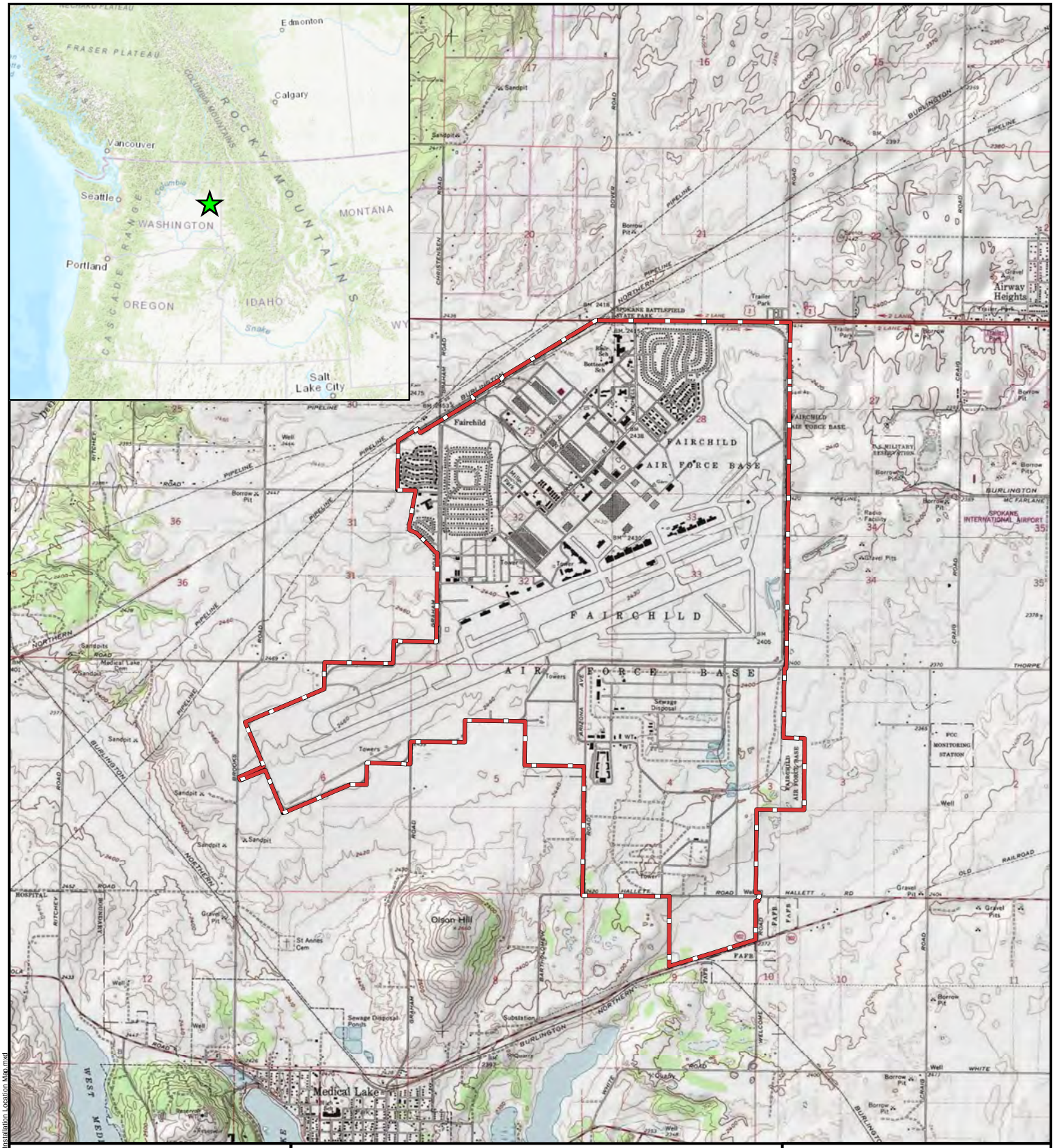
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FIGURES

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Symbol Key

Fairchild AFB Installation Boundary

FIGURE 2.1-1
Installation Location Map
Fairchild Air Force Base
Spokane, Washington

Project: 775303101

By: SD

Date: 12/10/2018

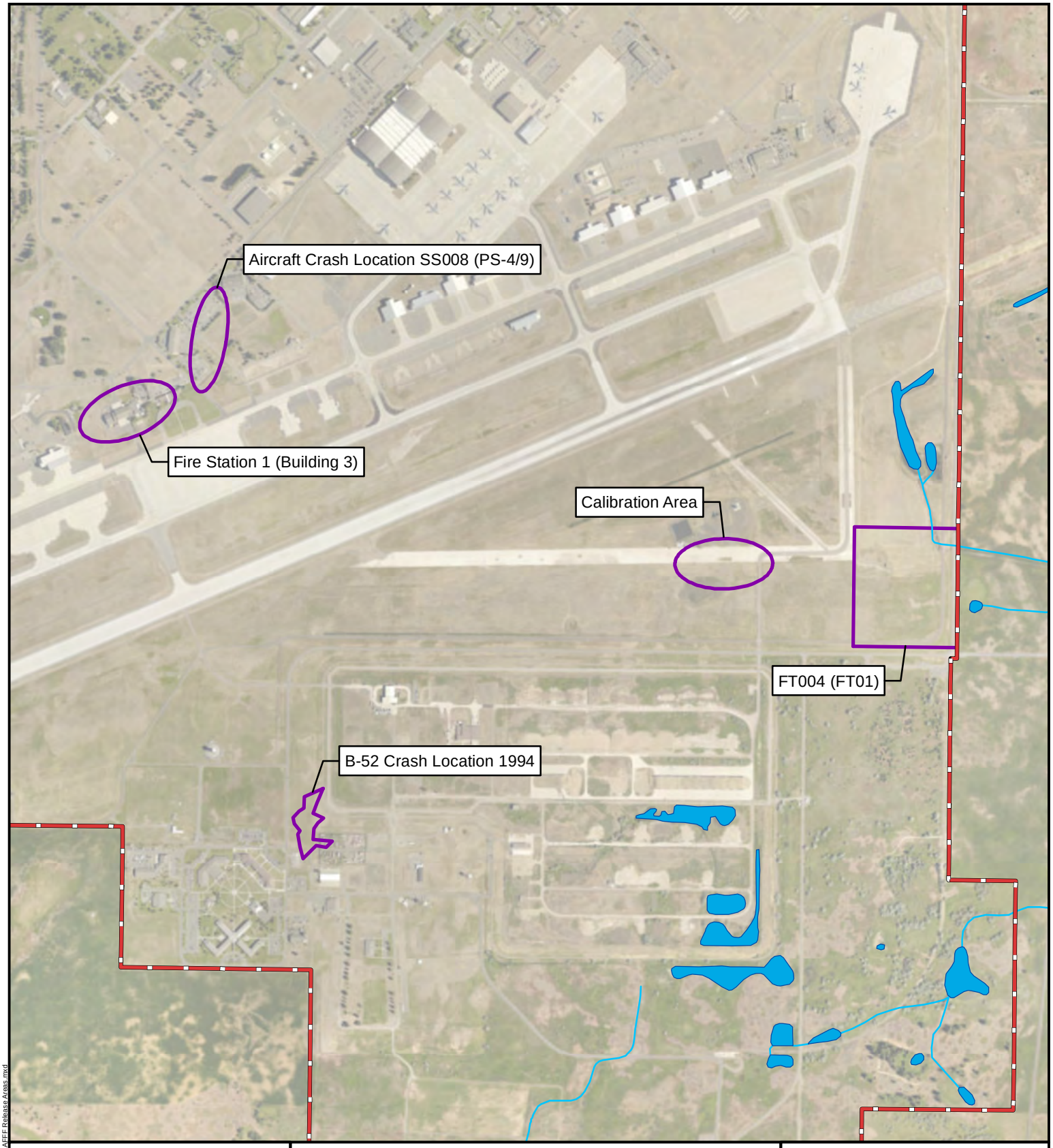
0 2,000 4,000 Feet

Disclaimer: For general reference purposes only.

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg\1_SI_Report\Figure 2-1-1 - Installation Location Map.mxd



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Project: 775303101

By: SD | Date: 12/10/2018

0 750 1,500 Feet

Symbol Key

- Surface Water
- Lake/Pond
- AFFF Release Area
- Fairchild AFB Installation Boundary

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 3.0-1
AFFF Release Areas
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-0-1 - AFFF Release Areas.mxd

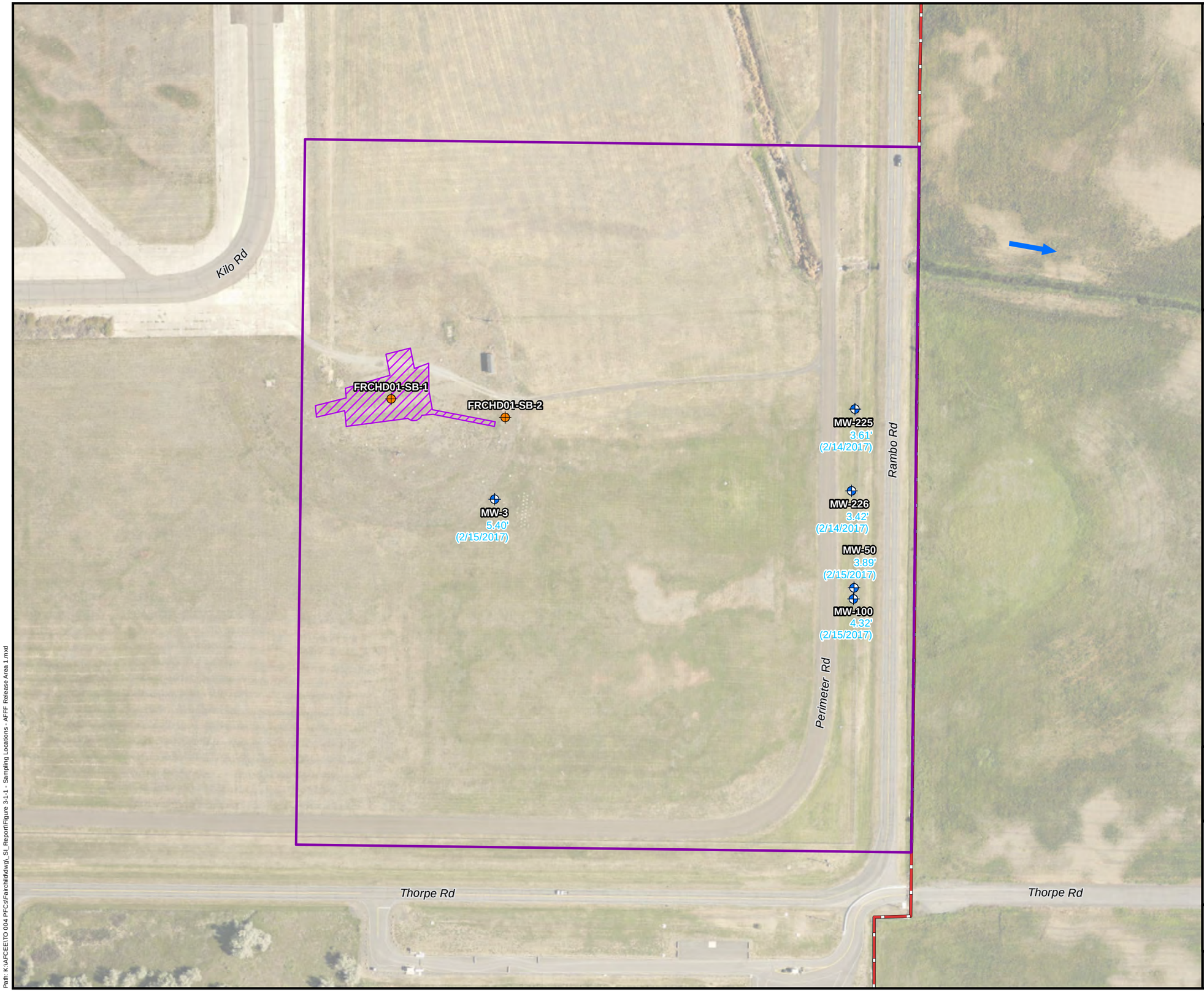


FIGURE 3.1-1
Sampling Locations & Groundwater Elevations
FT004 (FT01)
AFFF Release Area 1
Fairchild Air Force Base
Spokane, Washington

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Aqueous Film Forming Foam (AFFF)
Release Areas
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Symbol Key

- Monitoring Well
- SI Soil Boring
- Limits of Historical Excavation
- AFFF Release Area
- Fairchild AFB Installation Boundary
- Approximate Uppermost, Shallow Groundwater Flow Direction*
- 3.61' (5/3/2017) — Depth to Groundwater (feet below measuring point) Measurement Date

Note: Measurement from well top of casing. Well water level measuring points are not available to calculate groundwater elevation.

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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Project: 775303101

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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-1-1 - Sampling Locations - AFFF Release Area 1.mxd

FIGURE 3.1-2
PFAS in Soil
FT004 (FT01)
AFFF Release Area 1
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
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FRCHD01-SB-1				
Sample Date	***Sample Depth (ft bgs)***	**PFOS (mg/kg)**	**PFOA (mg/kg)**	**PFBS (mg/kg)**
10-May-17	4.5-5.5	1.8	0.11	0.036
	7.0-8.0	0.51	0.069	0.025

FRCHD01-SB-2				
Sample Date	***Sample Depth (ft bgs)***	**PFOS (mg/kg)**	**PFOA (mg/kg)**	**PFBS (mg/kg)**
10-May-17	0.0-0.5	0.0088	0.00046 J	0.00047 U
	6.0-7.0	0.98	0.026	0.0022

Notes:
Soil results in mg/kg (milligrams/kilogram)
ft bgs = feet below ground surface
Screening level = 0.126 mg/kg (130 mg/kg PFBS)
= Exceeds Screening Level
U = Non-detect at reporting limit shown
J = Estimated detect at concentration shown
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

Symbol Key

- Monitoring Well
- SI Soil Boring
- Limits of Historical Excavation
- AFFF Release Area
- Fairchild AFB Installation Boundary

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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-1-2 - PFAS in Soil - AFFF Release Area 1.mxd

FIGURE 3.1-3
PFAS in Groundwater
FT004 (FT01)
AFFF Release Area 1
Fairchild Air Force Base
Spokane, Washington

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Symbol Key

- Monitoring Well
- SI Soil Boring
- Limits of Historical Excavation
- AFFF Release Area
- Fairchild AFB Installation Boundary
- Approximate Uppermost, Shallow Groundwater Flow Direction*

Kilo Rd

FRCHD01-SB-1

FRCHD01-SB-2

MW-225

MW-225					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
14-Feb-17	6.0-16.0	21	3.5	24.5	1.7

Ram

MW-226

MW-226					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
14-Feb-17	15.0-16.0	41 J	7.9 J	48.9 J	2.4 J

MW-3

MW-3					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
15-Feb-17	3.5-9.0	55	22	77	2.7

MW-50

MW-50					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
15-Feb-17	6.0-16.0	11	1.1	12.1	1.8

MW-100

MW-100					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
15-Feb-17	43.0-53.0	25	9.8	34.8	2.9

MW-3

MW-50

MW-100

Perimeter Rd

Thorpe Rd

Thorpe Rd

Notes:
Groundwater results in µg/L (micrograms/liter)
ft bgs = feet below ground surface
Health Advisory = 0.07 µg/L
PFBS Tap Water RSL = 40 µg/L
= Exceeds Health Advisory
U = Non-detect at reporting limit shown
ND = Not Detected
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-1-3 - PFAS in Groundwater - AFFF Release Area 1.mxd



FIGURE 3.2-1
Sampling Locations & Groundwater Elevations
Calibration Area
AFFF Release Area 2
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center
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Symbol Key

- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-2-1 - Sampling Locations - AFFF Release Area 2.mxd

FIGURE 3.2-2
PFAS in Soil
Calibration Area
AFFF Release Area 2
Fairchild Air Force Base
Spokane, Washington

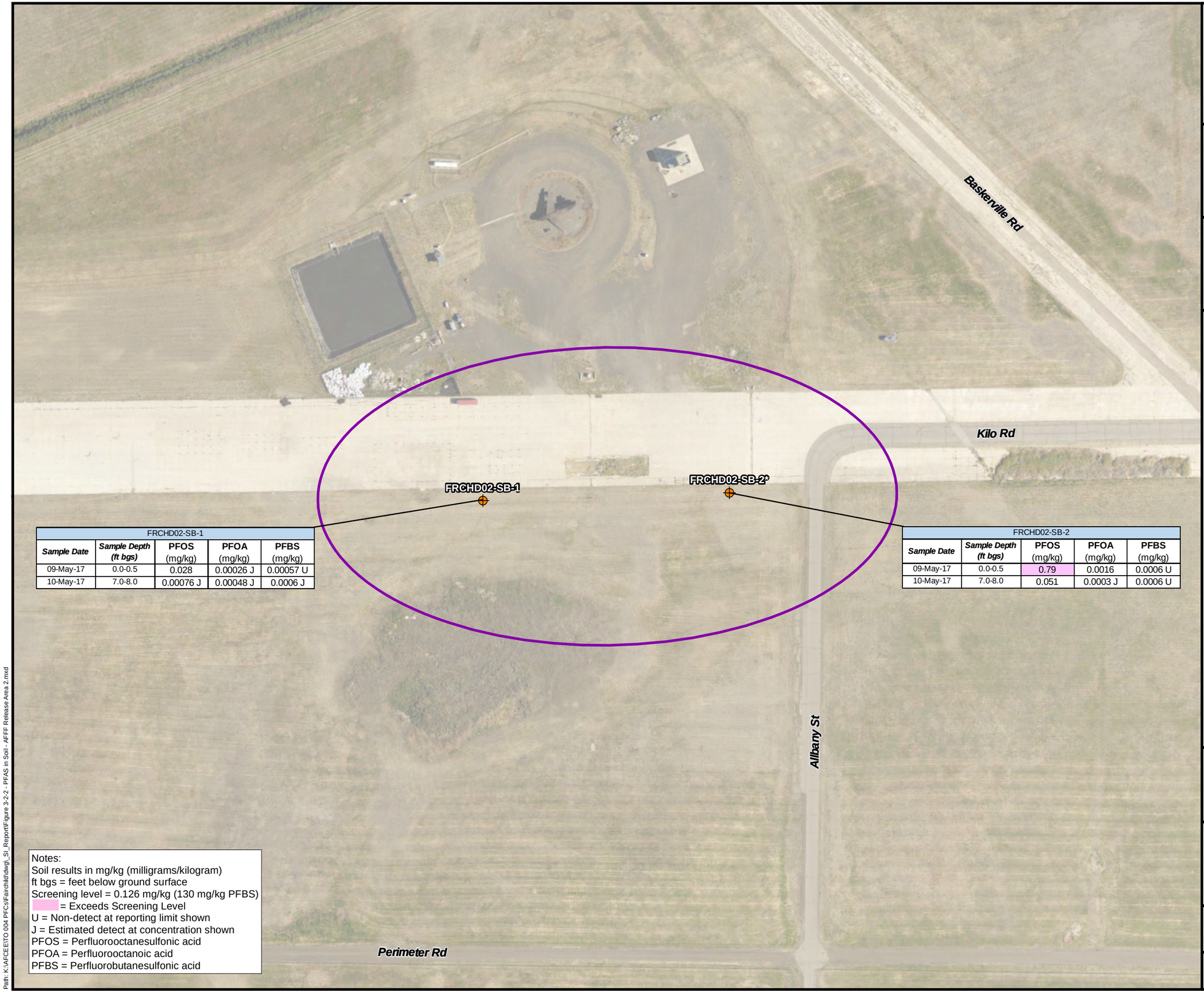
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Release Areas
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Symbol Key

- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area



FRCHD02-SB-1

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
09-May-17	0.0-0.5	0.028	0.00026 J	0.00057 U
10-May-17	7.0-8.0	0.00076 J	0.00048 J	0.0006 J

FRCHD02-SB-2

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
09-May-17	0.0-0.5	0.79	0.0016	0.0006 U
10-May-17	7.0-8.0	0.051	0.0003 J	0.0006 U

Notes:
Soil results in mg/kg (milligrams/kilogram)
ft bgs = feet below ground surface
Screening level = 0.126 mg/kg (130 mg/kg PFBS)
= Exceeds Screening Level
U = Non-detect at reporting limit shown
J = Estimated detect at concentration shown
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

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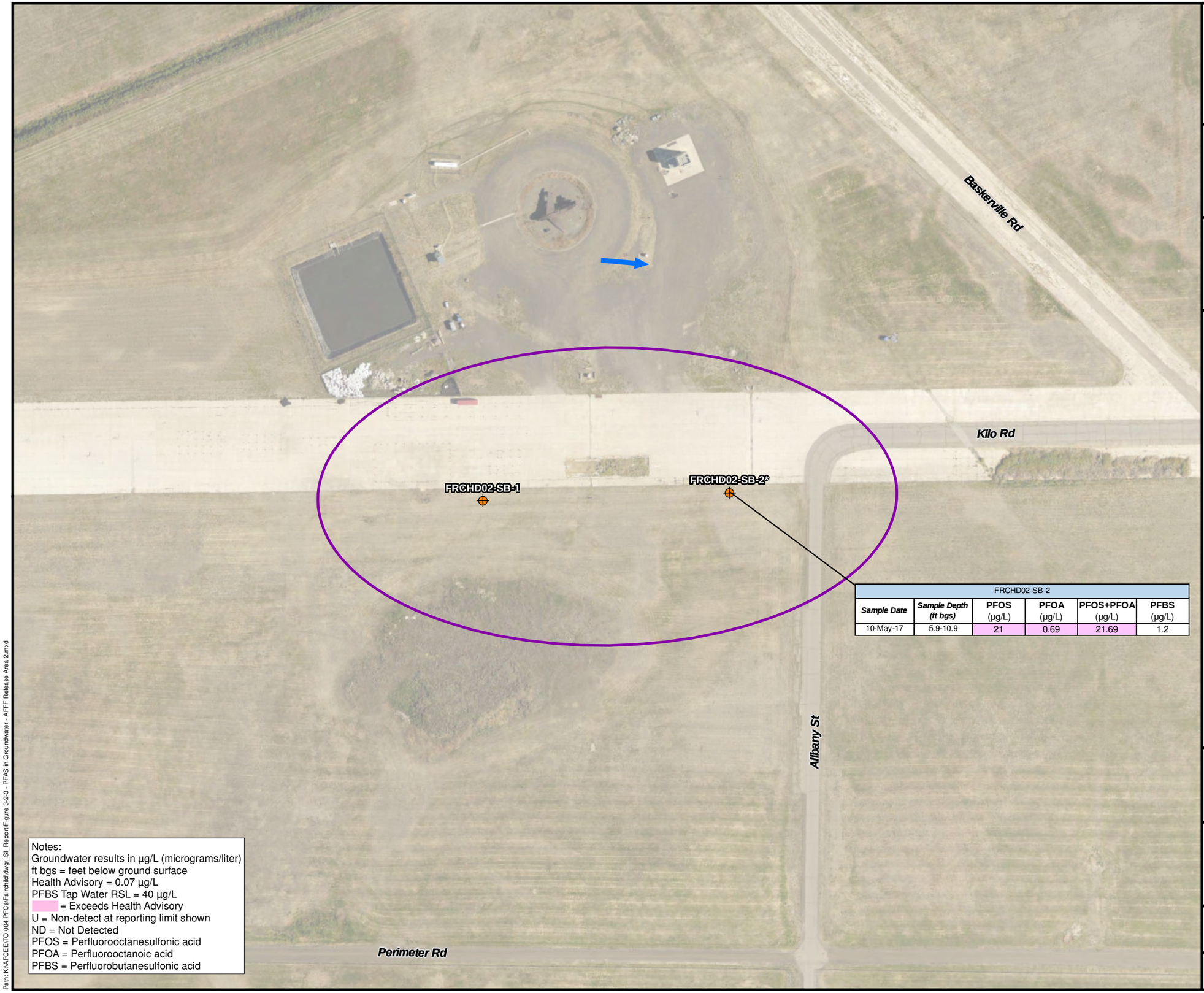
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FRCHD02-SB-2					
Sample Date	*Sample Depth (ft bgs)*	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
10-May-17	5.9-10.9	21	0.69	21.69	1.2

Notes:
Groundwater results in µg/L (micrograms/liter)
ft bgs = feet below ground surface
Health Advisory = 0.07 µg/L
PFBS Tap Water RSL = 40 µg/L
= Exceeds Health Advisory
U = Non-detect at reporting limit shown
ND = Not Detected
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-2-3 - PFAS in Groundwater - AFFF Release Area 2.mxd

FIGURE 3.2-3
PFAS in Groundwater
Calibration Area
AFFF Release Area 2
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
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Release Areas
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Symbol Key

- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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FIGURE 3.3-1
Sampling Locations & Groundwater Elevations
Aircraft Crash Location SS008 (PS-4/9)
AFFF Release Area 3
Fairchild Air Force Base
Spokane, Washington

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Symbol Key

- Monitoring Well
- SI Soil Boring
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*
- 2605.39' (5/3/2017) — Groundwater Elevation (feet, Above Mean Sea Level) Measurement Date

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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0 100 200 400 Ft.

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-3-1 - Sampling Locations - AFFF Release Area 3.mxd

FIGURE 3.3-2
PFAS in Soil
Aircraft Crash Location SS008 (PS-4/9)
AFFF Release Area 3
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
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Release Areas
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Symbol Key

- Monitoring Well
- SI Soil Boring
- AFFF Release Area

Olympia Ave
Arnold St
O'Malley Ave
Wainwright Blvd
Jefferson
Boston Ave
Geneseo Rd
Palenville Rd
Kenney Rd
Base Ops U-Dr
Taxiway J

MW-265
MMW-1023-1
MW-185
MW-438
MW-399
FRCHD03-SB-1
FRCHD03-SB-2
FRCHD03-SB-3

FRCHD03-SB-2

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	0.0058	0.00041 J	0.00055 U
11-May-17	6.0-7.0	0.025	0.0019	0.00066 U

FRCHD03-SB-1

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
11-May-17	2.5-3.0	0.013	0.0005 U	0.0005 U
	6.0-7.0	0.0097	0.00027 J	0.0005 U

FRCHD03-SB-3

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	0.02	0.00038 J	0.00053 U
11-May-17	6.5-7.5	0.089	0.0023	0.00051 U

Notes:
Soil results in mg/kg (milligrams/kilogram)
ft bgs = feet below ground surface
Screening level = 0.126 mg/kg (130 mg/kg PFBS)
= Exceeds Screening Level
U = Non-detect at reporting limit shown
J = Estimated detect at concentration shown
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

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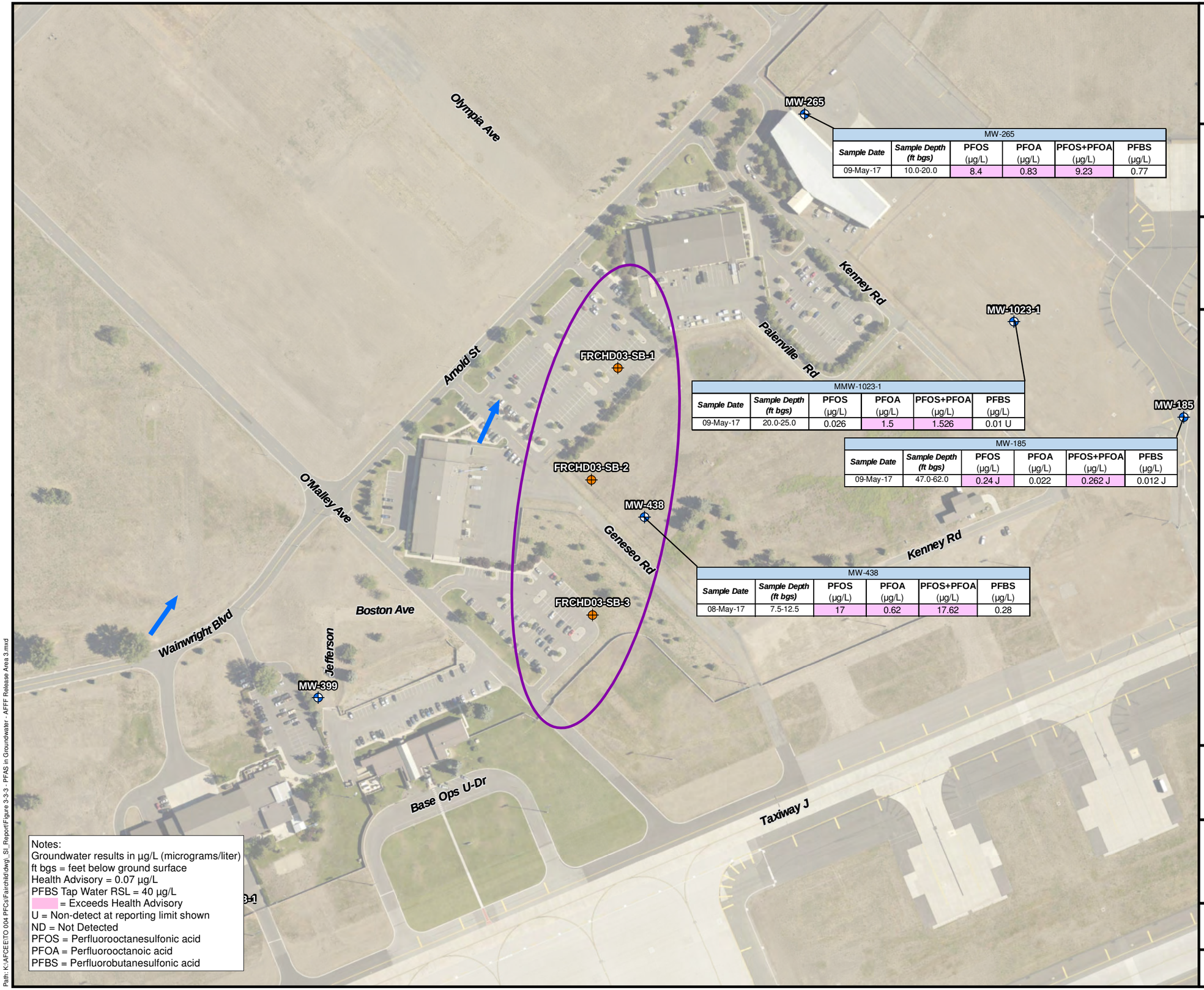
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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-3-2 - PFAS in Soil - AFFF Release Area 3.mxd



MW-265					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
09-May-17	10.0-20.0	8.4	0.83	9.23	0.77

MMW-1023-1					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
09-May-17	20.0-25.0	0.026	1.5	1.526	0.01 U

MW-185					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
09-May-17	47.0-62.0	0.24 J	0.022	0.262 J	0.012 J

MW-438					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
08-May-17	7.5-12.5	17	0.62	17.62	0.28

Notes:
Groundwater results in µg/L (micrograms/liter)
ft bgs = feet below ground surface
Health Advisory = 0.07 µg/L
PFBS Tap Water RSL = 40 µg/L
= Exceeds Health Advisory
U = Non-detect at reporting limit shown
ND = Not Detected
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3.3-3 - PFAS in Groundwater - AFFF Release Area 3.mxd

FIGURE 3.3-3
PFAS in Groundwater
Aircraft Crash Location SS008 (PS-4/9)
AFFF Release Area 3
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center
2261 Hughes Avenue
Building 171, Suite 155
JBSA Lackland, Texas 78236

Symbol Key

- Monitoring Well
- SI Soil Boring
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.
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FIGURE 3.4-1
Sampling Locations & Groundwater Elevations
B-52 Crash Location 1994
AFFF Release Area 4
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center

2261 Hughes Avenue
Building 171, Suite 155
JBSA Lackland, Texas 78236

Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*
- 3.61' (5/3/2017) — Depth to Groundwater (feet below measuring point) Measurement Date

Note: Measurement from well top of casing. Well water level measuring points are not available to calculate groundwater elevation.

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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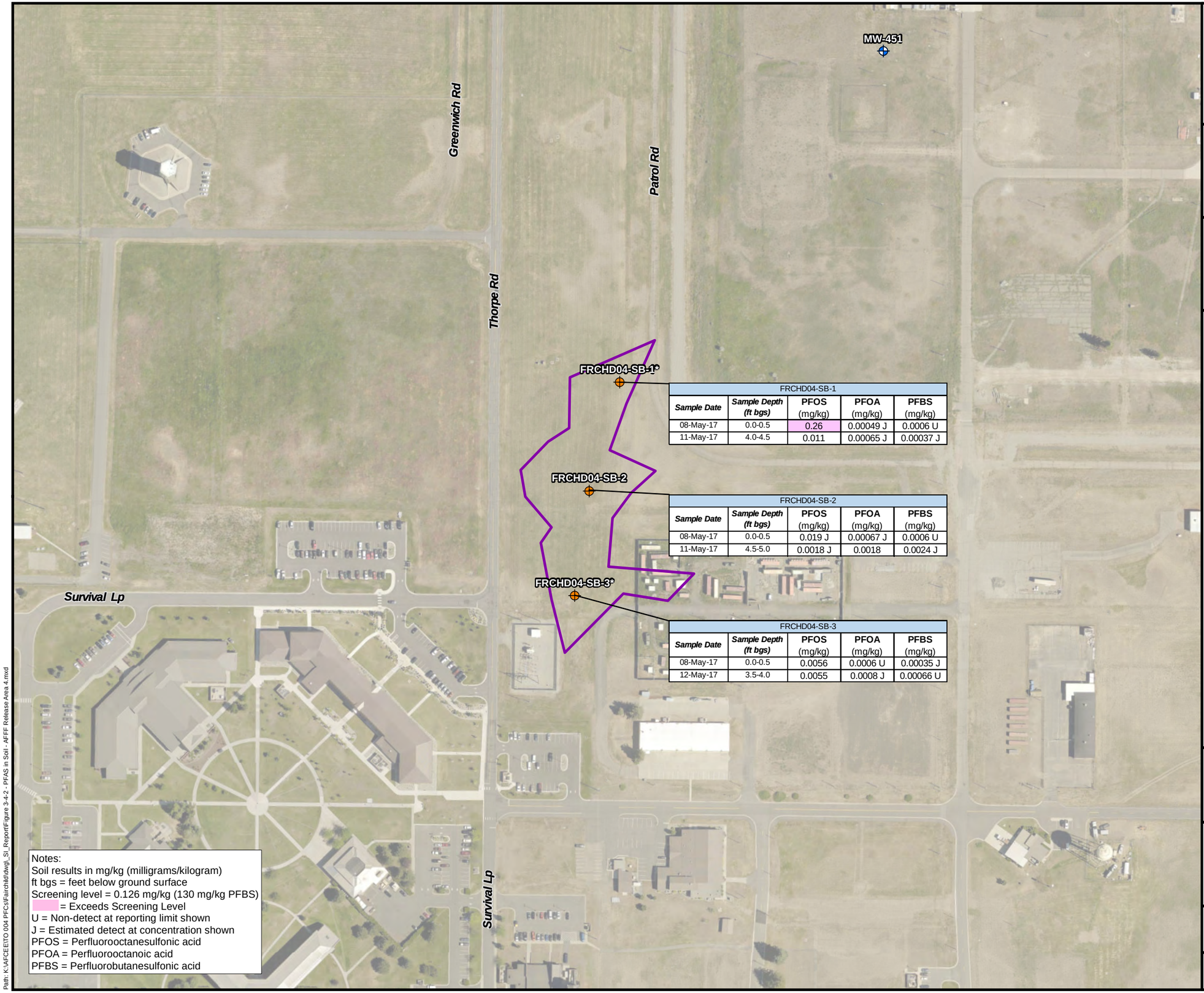
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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-4-1 - Sampling Locations - AFFF Release Area 4.mxd



FRCHD04-SB-1				
Sample Date	*Sample Depth (ft bgs)*	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	0.26	0.00049 J	0.0006 U
11-May-17	4.0-4.5	0.011	0.00065 J	0.00037 J

FRCHD04-SB-2				
Sample Date	*Sample Depth (ft bgs)*	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	0.019 J	0.00067 J	0.0006 U
11-May-17	4.5-5.0	0.0018 J	0.0018	0.0024 J

FRCHD04-SB-3				
Sample Date	*Sample Depth (ft bgs)*	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	0.0056	0.0006 U	0.00035 J
12-May-17	3.5-4.0	0.0055	0.0008 J	0.00066 U

Notes:
Soil results in mg/kg (milligrams/kilogram)
ft bgs = feet below ground surface
Screening level = 0.126 mg/kg (130 mg/kg PFBS)
= Exceeds Screening Level
U = Non-detect at reporting limit shown
J = Estimated detect at concentration shown
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-4-2 - PFAS in Soil - AFFF Release Area 4.mxd

FIGURE 3.4-2
PFAS in Soil
B-52 Crash Location 1994
AFFF Release Area 4
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center
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JBSA Lackland, Texas 78236

Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area

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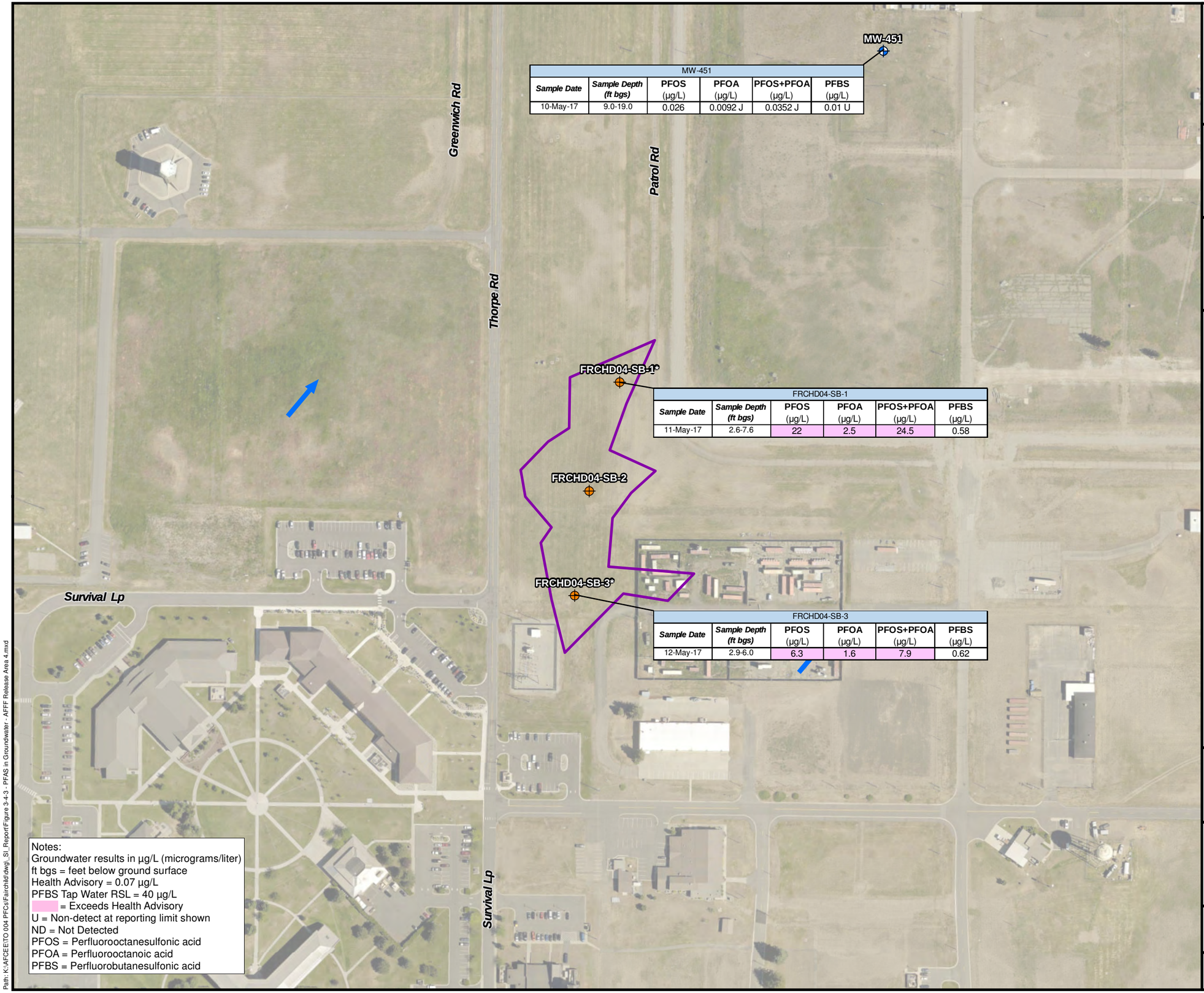
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MW-451					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
10-May-17	9.0-19.0	0.026	0.0092 J	0.0352 J	0.01 U

FRCHD04-SB-1					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
11-May-17	2.6-7.6	22	2.5	24.5	0.58

FRCHD04-SB-3					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
12-May-17	2.9-6.0	6.3	1.6	7.9	0.62

Notes:
Groundwater results in µg/L (micrograms/liter)
ft bgs = feet below ground surface
Health Advisory = 0.07 µg/L
PFBS Tap Water RSL = 40 µg/L
= Exceeds Health Advisory
U = Non-detect at reporting limit shown
ND = Not Detected
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-4-3 - PFAS in Groundwater - AFFF Release Area 4.mxd

FIGURE 3.4-3
PFAS in Groundwater
B-52 Crash Location 1994
AFFF Release Area 4
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center
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Building 171, Suite 155
JBSA Lackland, Texas 78236

Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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FIGURE 3.5-1
Sampling Locations & Groundwater Elevations
Fire Station 1 (Building 3)
AFFF Release Area 5
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center

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Building 171, Suite 155
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Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*
- 2605.39' (5/3/2017) Groundwater Elevation (feet, Above Mean Sea Level) Measurement Date

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-5-1 - Sampling Locations - AFFF Release Area 5.mxd

FIGURE 3.5-2
PFAS in Soil
Fire Station 1 (Building 3)
AFFF Release Area 5
Fairchild Air Force Base
Spokane, Washington

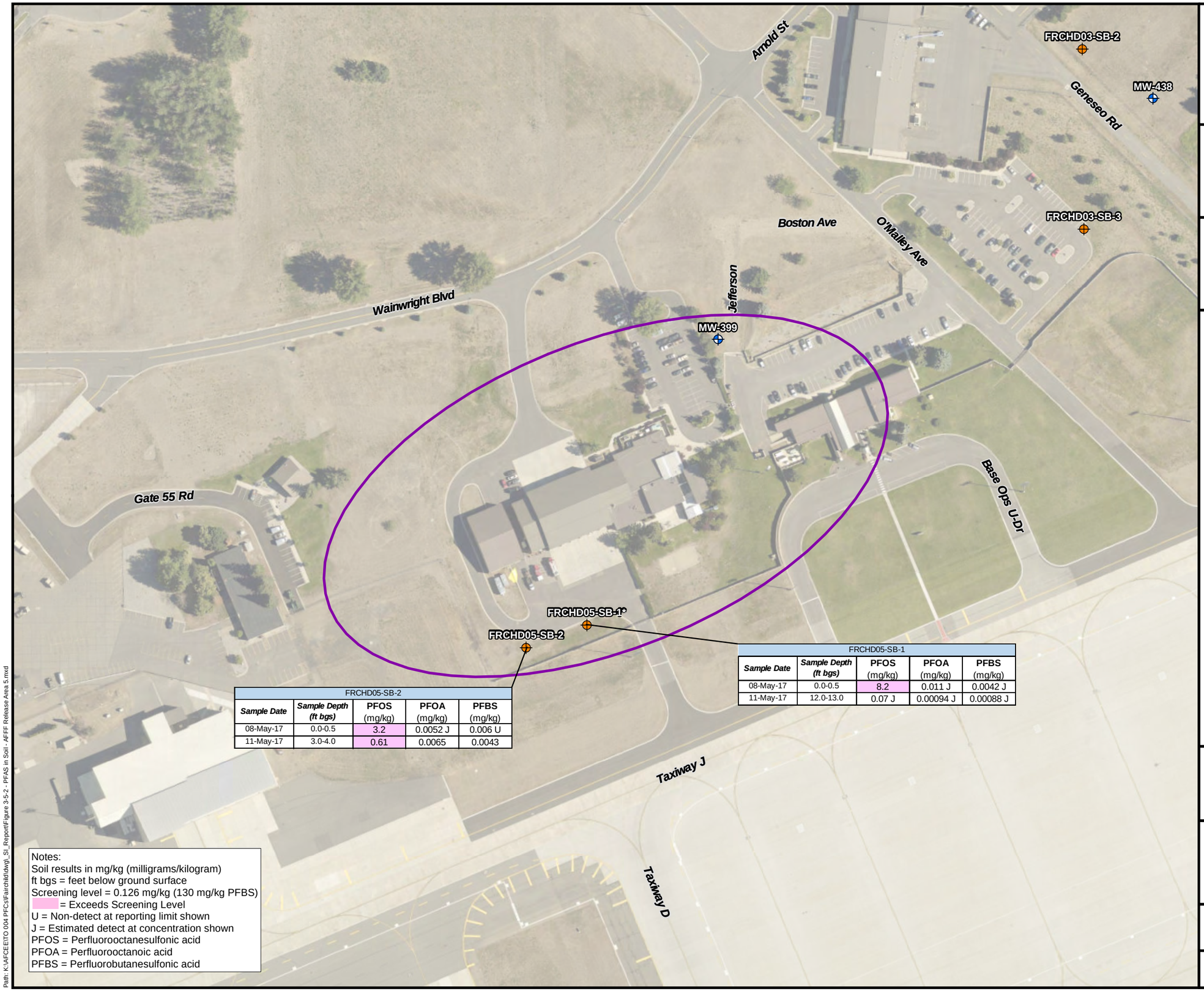
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Release Areas
Environmental Programs Worldwide
Site Inspection Report

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Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area



FRCHD05-SB-2

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	3.2	0.0052 J	0.006 U
11-May-17	3.0-4.0	0.61	0.0065	0.0043

FRCHD05-SB-1

Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
08-May-17	0.0-0.5	8.2	0.011 J	0.0042 J
11-May-17	12.0-13.0	0.07 J	0.00094 J	0.00088 J

Notes:
Soil results in mg/kg (milligrams/kilogram)
ft bgs = feet below ground surface
Screening level = 0.126 mg/kg (130 mg/kg PFBS)
= Exceeds Screening Level
U = Non-detect at reporting limit shown
J = Estimated detect at concentration shown
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

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Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-5-2 - PFAS in Soil - AFFF Release Area 5.mxd

FIGURE 3.5-3
PFAS in Groundwater
Fire Station 1 (Building 3)
AFFF Release Area 5
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center

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Symbol Key

- Monitoring Well
- SI Soil Boring (*groundwater sample collected)
- AFFF Release Area
- Approximate Uppermost, Shallow Groundwater Flow Direction*

Arnold St
Geneseo Rd
Boston Ave
O'Malley Ave
Jefferson
Wainwright Blvd
Gate 55 Rd
Base Ops U-Dr
Taxiway J
Taxiway D

FRCHD03-SB-2
MW-438
FRCHD03-SB-3
MW-399
FRCHD05-SB-1*
FRCHD05-SB-2

MW-399					
Sample Date	*Sample Depth (ft bgs)*	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
08-May-17	7.0-17.0	98	6	104	3.8

FRCHD05-SB-1					
Sample Date	*Sample Depth (ft bgs)*	PFOS (µg/L)	PFOA (µg/L)	PFOS+PFOA (µg/L)	PFBS (µg/L)
11-May-17	7.0-12.0	150	17	167	9.2

Notes:
Groundwater results in µg/L (micrograms/liter)
ft bgs = feet below ground surface
Health Advisory = 0.07 µg/L
PFBS Tap Water RSL = 40 µg/L
= Exceeds Health Advisory
U = Non-detect at reporting limit shown
ND = Not Detected
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid

*Source: Figures 3,5,6 - Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington, by CH2MHill, June 2015;
Figure 4 - AECOM Geologic Features Map (undated) provided by Air Force Civil Engineer Center.

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0 75 150 300 Ft.

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure 3-5-3 - PFAS in Groundwater - AFFF Release Area 5.mxd

TABLES

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Table 3.0-1
Monitoring Well Construction Details1
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Fairchild AFB, Washington

AFFF Area	Location ID	Installation Date	Well Material	Northing[2]	Easting[2]	Ground Elevation[3] (ft amsl)	TOC Elevation[3] (ft amsl)	Installed Well Depth (ft bmp)	Well Diameter (in)	Screen Length (ft)	Screen Size (in)	Screen Interval (ft bgs)
1	MW-3	NA	PVC	5273771.60	452794.14	NA	NA	9.0	2	5.5	NA	3.5-9
	MW-225	NA	PVC	5273815.95	452971.37	NA	NA	16.0	2	10	NA	6-16
	MW-226	NA	PVC	5273775.62	452969.70	NA	NA	16.0	2	1	NA	15-16
	MW-50	NA	PVC	5273728.06	452970.90	NA	NA	16.0	2	10	NA	6-16
	MW-100	NA	PVC	5273722.52	452970.53	NA	NA	53.3	4	10	NA	43-53
3	MMW-1023-1	11/29/2011	PVC	5274609.80	451095.38	2,435.00	2,434.16	25.0	2	5	NA	20-25
	MW-185	11/29/2011	PVC	5274547.11	451207.14	2,430.00	2,432.56	63.0	4	15	NA	47-62
	MW-265	11/29/2011	PVC	5274746.30	450957.82	2,436.00	2,435.40	20.0	2	10	NA	10-20
	MW-438	6/7/2012	PVC	5274481.48	450852.33	2,435.20	2,434.83	13.0	2	5	NA	7.5-12.5
4	MW-451	NA	PVC	5273376.64	451302.95	NA	NA	19.0	2	10	NA	9-19
5	MW-399	11/29/2011	PVC	5274362.80	450637.66	2,439.20	2,438.79	18.0	2	10	NA	7-17

Notes:
AFFF - aqueous film forming foam
amsl - above mean sea level
bgs - below ground surface
bmp - below measuring point
ft - feet
ID - identification
in - inches
NA - not available
PVC - polyvinyl chloride
TOC - top of casing

[1]Information provided by Air Force (Table 1 Site SS-39 Groundwater Monitoring Wells, Fairchild AFB, Dated 10 April 2013)

[2]Horizontal coordinates based on Universal Transverse Mercator (UTM) Coordinate System, Meters, World Geodetic System Datum of 1984 (WGS84).

[3]Ground surface and top-of-casing elevations based on North American Vertical Datum of 1988.

Table 3.0-2
Groundwater Elevations
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Fairchild AFB, Washington

AFFF Area	Location ID	Installed Well Depth (ft bmp)	Ground Surface Elevation[1] (ft amsl)	TOC Elevation[1] (ft amsl)	Date Measured	Depth to Groundwater (ft bmp)	Groundwater Elevation[2] (ft amsl)
1	MW-3	9.0	NA	NA	2/15/2017	5.40	NA
	MW-225	16.0	NA	NA	2/14/2017	3.61	NA
	MW-226	16.0	NA	NA	2/14/2017	3.42	NA
	MW-50	16.0	NA	NA	2/15/2017	3.89	NA
	MW-100	53.3	NA	NA	2/15/2017	4.32	NA
3	MMW-1023-1	25.0	2,435.00	2,434.16	5/9/2017	8.14	2,426.02
	MW-185	65.0	2,430.00	2,432.56	5/9/2017	7.90	2,424.66
	MW-265	20.0	2,436.00	2,435.40	5/9/2017	9.15	2,426.25
	MW-438	12.5	2,435.20	2,434.83	5/9/2017	6.11	2,428.72
4	MW-451	19.0	NA	NA	5/10/2017	12.10	NA
5	MW-399	17.0	2,439.20	2,438.79	5/8/2017	6.88	2,431.91

Notes:
AFFF = aqueous film forming foam
amsl - above mean sea level
bgs - below ground surface
bmp - below measuring point
ft - feet
NA - not available
[1]Ground surface and top-of-casing elevations provided by Air Force (Table 1 Site SS-39 Groundwater Monitoring Wells, Fairchild AFB, Dated 10 April 2013), and based on North American Vertical Datum of 1988.
[2] Depth to groundwater measurements were collected at various times and should not be relied on for generating groundwater contours.

Table 3.0-3
Summary of Soil Analytical Testing Results
Site Inspection of AFFF Areas
Site Investigation Report, Fairchild Air Force Base, Washington

						Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	6:2 Fluorotelomer sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	N-Ethyl perfluorooctanesulfonamidoacetic acid (NETFOSAA)	N-Methyl perfluorooctanesulfonamidoacetic acid (NMEFOSAA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnA)
						Screening Level:	0.126[1]	0.126[1]	130[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AFFF Area	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	FRCHD01-SB-1	FRCHD01-SO-001	10-May-17	4.5-5.5	N		1.8	0.11	0.036	1.9	0.0045 J	0.0057 U	0.0057 U	0.0038 U	0.0057 U	0.04	0.56	0.19	0.0058 J	0.0038 U	0.0015 J	0.0057 U
		FRCHD01-SO-002	10-May-17	7.0-8.0	N		0.51	0.069	0.025	1.1	0.0053 J	0.0066 U	0.0066 U	0.0044 U	0.0066 U	0.033	0.28	0.22	0.0025 J	0.0044 U	0.0044 U	0.0066 U
	FRCHD01-SB-2	FRCHD01-SO-003	10-May-17	0.0-0.5	N		0.0088	0.00046 J	0.00047 U	0.00079	0.0072	0.00018 J	0.00047 U	0.00044 J	0.0028	0.00033 J	0.0008	0.0004 J	0.00013 J	0.00026 J	0.0013	0.0065
		FRCHD01-SO-004	10-May-17	6.0-7.0	N		0.98	0.026	0.0022	0.036	1	0.00033 J	0.00049 J	0.00088 J	0.00066 U	0.0059	0.13	0.017	0.0037	0.00044 U	0.00044 U	0.00066 U
2	FRCHD02-SB-1	FRCHD02-SO-001	09-May-17	0.0-0.5	N		0.028	0.00026 J	0.00057 U	0.00035 J	0.00057 U	0.00057 U	0.00057 U	0.00028 J	0.00057 U	0.00057 U	0.00089 J	0.00025 J	0.00055 J	0.00038 U	0.00038 U	0.00057 U
		FRCHD-FD-SO-02	09-May-17	0.0-0.5	FD		0.021	0.00026 J	0.00049 U	0.00049 UJ	0.00048 J	0.00049 U	0.00049 U	0.00033 J	0.00049 UJ	0.00057 U	0.00077 J	0.00019 J	0.00046 J	0.00032 U	0.00032 U	0.0003 J
		FRCHD02-SO-002	10-May-17	7.0-8.0	N		0.00076 J	0.00048 J	0.0006 J	0.0039	0.00058 U	0.00058 U	0.00058 U	0.00038 U	0.00058 U	0.00073 J	0.017	0.0014	0.00058 U	0.00038 U	0.00038 U	0.00058 U
	FRCHD02-SB-2	FRCHD02-SO-003	09-May-17	0.0-0.5	N		0.79	0.0016	0.0006 U	0.0082	0.047	0.0006 U	0.0006 U	0.0071	0.0039 J	0.00033 J	0.0062	0.0015	0.0012	0.00096 J	0.00098 J	0.0026
		FRCHD02-SO-004	10-May-17	7.0-8.0	N		0.051	0.0003 J	0.0006 U	0.0054	0.002	0.0006 U	0.0006 U	0.00021 J	0.0006 U	0.0006 U	0.0015	0.0003 J	0.0006 U	0.0004 U	0.0004 U	0.0006 U
3	FRCHD03-SB-1	FRCHD03-SO-001	11-May-17	2.5-3.0	N		0.013	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.00019 J	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.00075 J	0.00033 U	0.00018 J	0.0003 J
		FRCHD03-SO-002	11-May-17	6.0-7.0	N		0.0097	0.00027 J	0.0005 U	0.0013	0.00045 J	0.0005 U	0.0005 U	0.00034 U	0.0005 U	0.0005 U	0.00038 J	0.0005 U	0.0005 U	0.00034 U	0.00034 U	0.0005 U
	FRCHD03-SB-2	FRCHD03-SO-003	08-May-17	0.0-0.5	N		0.0058	0.00041 J	0.00055 U	0.00055 U	0.00055 U	0.00055 U	0.00055 U	0.00043 J	0.00055 U	0.00055 U	0.00055 U	0.00055 U	0.00099	0.00036 U	0.00036 U	0.00055 U
		FRCHD03-SO-004	11-May-17	6.0-7.0	N		0.025	0.0019	0.00066 U	0.00066 U	0.00066 U	0.00066 U	0.00066 U	0.00044 U	0.00066 U	0.00086 J	0.00087 J	0.00043 J	0.00066 U	0.00044 U	0.00044 U	0.00066 U
	FRCHD03-SB-3	FRCHD03-SO-005	08-May-17	0.0-0.5	N		0.02	0.00038 J	0.00053 U	0.00053 U	0.00053 U	0.00053 U	0.00053 U	0.00036 J	0.00053 U	0.00053 U	0.0004 B	0.00053 U	0.0017	0.00036 U	0.00018 J	0.00033 J
		FRCHD03-SO-006	11-May-17	6.5-7.5	N		0.089	0.0023	0.00051 U	0.0015	0.0016	0.00051 U	0.00051 U	0.00034 U	0.00051 U	0.00041 J	0.0027	0.00051 U	0.00033 J	0.0034 U	0.0034 U	0.00051 U
4	FRCHD04-SB-1	FRCHD04-SO-001	08-May-17	0.0-0.5	N		0.26	0.00049 J	0.0006 U	0.0006 U	0.0006 U	0.0006 U	0.0006 U	0.0004 U	0.0006 U	0.0006 U	0.0031	0.0006 U	0.00038 J	0.0004 U	0.0004 U	0.0006 U
		FRCHD04-SO-002	11-May-17	4.0-4.5	N		0.011	0.00065 J	0.00037 J	0.00047 J	0.00058 U	0.00058 U	0.00058 U	0.00039 U	0.00058 U	0.00056 J	0.0064	0.00069 J	0.0002 J	0.00039 U	0.00039 U	0.00058 U
	FRCHD04-SB-2	FRCHD04-SO-003	08-May-17	0.0-0.5	N		0.019 J	0.00067 J	0.0006 U	0.0006 U	0.0006 U	0.0006 U	0.0006 U	0.0004 U	0.0006 U	0.0006 U	0.0008 Q	0.0006 U	0.00045 J	0.0004 U	0.0004 U	0.0006 U
		FRCHD04-SO-004	11-May-17	4.5-5.0	N		0.0018 J	0.0018	0.0024 J	0.00081 J	0.00059 U	0.00059 U	0.00059 U	0.0004 UJ	0.00059 U	0.0012 J	0.029 J	0.0038 J	0.00059 UJ	0.0004 U	0.0004 U	0.00059 U
	FRCHD04-SB-3	FRCHD04-SO-005	08-May-17	0.0-0.5	N		0.0056	0.0006 U	0.00035 J	0.0006 U	0.0006 U	0.0006 U	0.0006 U	0.0004 U	0.0006 U	0.0006 U	0.0008 B	0.0006 U	0.00022 J	0.0004 U	0.0004 U	0.0006 U
		FRCHD04-SO-006	12-May-17	3.5-4.0	N		0.0055	0.0008 J	0.00066 U	0.00028 J	0.00066 U	0.00066 U	0.00066 U	0.00044 U	0.00066 U	0.00065 J	0.0051	0.00097 J	0.00066 U	0.00044 U	0.00044 U	0.00066 U
5	FRCHD05-SB-1	FRCHD05-SO-001	08-May-17	0.0-0.5	N		8.2	0.011 J	0.0042 J	0.47	0.94 J	0.002 J	0.0026 J	0.047	0.11	0.0054 J	0.062	0.024	0.006 J	0.038	0.037	0.044
		FRCHD-FD-SO-01	08-May-17	0.0-0.5	FD		6.9	0.011 J	0.0072 U	0.52	1.2 J	0.0029 J	0.0031 J	0.05	0.12	0.0052 J	0.058	0.026	0.0058 J	0.034	0.037	0.045
		FRCHD05-SO-002	11-May-17	12.0-13.0	N		0.07 J	0.00094 J	0.00088 J	0.011 J	0.0052 J	0.00066 U	0.00066 U	0.00021 J	0.00053 J	0.0005 J	0.0072	0.0025	0.00066 U	0.00031 J	0.00032 J	0.00033 J
		FRCHD-FD-SO-03	11-May-17	12.0-13.0	FD		0.15 J	0.00099 J	0.00076 J	0.018 J	0.011 J	0.0006 U	0.0006 U	0.00044 J	0.0003 J	0.00045 J	0.0068	0.0023	0.0002 J	0.00018 J	0.00023 J	0.00043 J
	FRCHD05-SB-2	FRCHD05-SO-003	08-May-17	0.0-0.5	N		3.2	0.0052 J	0.006 U	0.17	0.35	0.006 U	0.006 U	0.013	0.0049 J	0.0036 J	0.025	0.026	0.0044 J	0.0021 J	0.0017 J	0.0062 J
		FRCHD05-SO-004	11-May-17	3.0-4.0	N		0.61	0.0065	0.0043	0.039	0.082	0.0006 U	0.0006 U	0.0004 U	0.0006 U	0.0021	0.11	0.0079	0.00054 J	0.0004 U	0.0004 U	0.0006 U

Notes
Purple Shaded = Exceeds Screening Level
B = The analyte was found in an associated blank, as well as in the sample.
FD = Field Duplicate Sample
ft = Feet
ID = Identification
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
N = Normal Field Sample
NA = Not applicable
Q = The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.
U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
UJ = The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
mg/kg = milligrams per kilogram
[1] Screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]
[2] USEPA Regional Screening Levels (November, 2017a) [https://semspub.epa.gov/work/HQ/197027.pdf]

Table 3.0-4
Summary of Groundwater Analytical Testing Results
Site Inspection of AFFF Areas
Site Investigation Report, Fairchild Air Force Base, Washington

						Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	PFOS+PFOA	Perfluorobutanesulfonic acid (PFBS)	6:2 Fluorotelomer sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	N-Ethyl perfluorooctanesulfonamidoacetic acid (NETFOSAA)	N-Methyl perfluorooctanesulfonamidoacetic acid (NMEFOSAA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnA)
						Health Advisory:	0.07	0.07	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
						EPA RSL Tapwater[1]:	NA	NA	NA	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AFFF Area	**Location**	**Sample ID**	**Sample Date**	**Sample Depth (ft.)**	**Sample Type**		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1	MW-100	FRCHD01-GW-005	15-Feb-17	43.0-53.0	N		25	9.8	34.8	2.9	39	1.4	0.1 U	0.1 U	0.14 U	0.14 U	2.2	30	12	0.21	0.14 U	0.1 U	0.1 U
	MW-225	FRCHD01-GW-002	14-Feb-17	6.0-16.0	N		21	3.5	24.5	1.7	35	1.8	0.1 U	0.1 U	0.14 U	0.14 U	1.2	15	7.1	0.13 J	0.14 U	0.1 U	0.1 U
		FRCHD01-DUP01	14-Feb-17	6.0-16.0	FD		22	3	25	1.7	37	2	0.082 J	0.049 J	0.14 U	0.14 U	1.3	16	7.1	0.15 J	0.14 U	0.1 U	0.059 J
	MW-226	FRCHD01-GW-003	14-Feb-17	15.0-16.0	N		41 J	7.9 J	48.9 J	2.4 J	46 J	8.9 J	0.1 UJ	0.1 UJ	0.072 J	0.14 UJ	2.7 J	26 J	11 J	0.32 J	0.14 UJ	0.1 UJ	0.1 UJ
	MW-3	FRCHD01-GW-001	15-Feb-17	3.5-9.0	N		55	22	77	2.7	79	3	0.1 U	0.1 U	0.14 U	0.14 U	3.3	56	16	0.74	0.14 U	0.1 U	0.1 U
	MW-50	FRCHD01-GW-004	15-Feb-17	6.0-16.0	N		11	1.1	12.1	1.8	34	0.14 U	0.1 U	0.1 U	0.14 U	0.14 U	0.69	11	5.7	0.1 U	0.14 U	0.1 U	0.1 U
2	FRCHD02-SB-2	FRCHD02-GW-001	10-May-17	5.9-10.9	N		21	0.69	21.69	1.2	15	0.7	0.1 U	0.1 U	0.14 J	0.1 U	0.59	8.4	3.2	0.1 J	0.1 U	0.1 U	0.1 U
3	MMW-1023-1	FRCHD03-GW-003	09-May-17	20.0-25.0	N		0.026	1.5	1.526	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.12	0.01 U	0.88	0.011 J	0.41	0.35	0.01 U	0.01 U	0.01 U
	MW-185	FRCHD03-GW-004	09-May-17	47.0-62.0	N		0.24 J	0.022	0.262 J	0.012 J	0.097	0.01 U	0.01 U	0.01 U	0.0061 J	0.0037 J	0.016 J	0.077	0.044	0.0042 J	0.01 U	0.01 U	0.01 U
	MW-265	FRCHD03-GW-002	09-May-17	10.0-20.0	N		8.4	0.83	9.23	0.77	9.2	0.19 J	0.1 U	0.1 U	0.1 U	0.1 U	0.52	7.3	2.2	0.042 J	0.1 U	0.1 U	0.1 U
	MW-438	FRCHD03-GW-001	08-May-17	7.5-12.5	N		17	0.62	17.62	0.28	1.9	0.31	0.059 J	0.1 U	0.1 U	0.1 U	1.4	2.4	1.4	0.077 J	0.1 U	0.1 U	0.1 U
		FRCHD-FD-GW-01	08-May-17	7.5-12.5	FD		17 J	0.58	17.58 J	0.26	1.8	0.33	0.1 U	0.1 U	0.1 U	0.1 U	1.4	2.3	1.3	0.084 J	0.1 U	0.1 U	0.1 U
4	FRCHD04-SB-1	FRCHD04-GW-001	11-May-17	2.6-7.6	N		22	2.5	24.5	0.58	1.5	0.089 J	0.1 U	0.1 U	0.1 U	0.1 U	1.7	14	2.5	0.34	0.1 U	0.1 U	0.1 U
	FRCHD04-SB-3	FRCHD04-GW-002	12-May-17	2.9-6.0	N		6.3	1.6	7.9	0.62	0.63	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1	16	2.1	0.13 J	0.1 U	0.037 J	0.1 U
	MW-451	FRCHD04-GW-003	10-May-17	9.0-19.0	N		0.026	0.0092 J	0.0352 J	0.01 U	0.0079 B	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0048 J	0.02	0.015 J	0.01 U	0.01 U	0.01 U	0.01 U
5	FRCHD05-SB-1	FRCHD05-GW-001	11-May-17	7.0-12.0	N		150	17	167	9.2	91	2.5	1 UJ	1 UJ	1 U	1 U	4.3	91	26	0.41 J	1 U	1 U	1 U
	MW-399	FRCHD05-GW-002	08-May-17	7.0-17.0	N		98	6	104	3.8	14 J	3.6	1 U	1 U	1 U	1 U	2.1	29	7.8	0.46 J	1 U	1 U	1 U

Notes:
Purple Shaded = Exceeds Screening Level
Gray Values = not detected
AFFF = aqueous film forming foam
FD = field duplicate sample
ft = feet
ID = identification
N= normal field sample
NA = not applicable
ND = not detected
µg/L = micrograms per liter

Qualifier Definitions:
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
UJ = The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
B = The analyte was found in an associated blank, as well as in the sample.

PFOS+PFOA = Co-occurrence of PFOA and PFOS (PFOA+PHOS) in aqueous samples is reported using the following guidelines:
1. If both PFOA and PFOS are detected at or above the detection limit (DL), then the sum of PFOA+PHOS is reported.
2. If either PFOA or PFOS is detected at or above the DL and the other is not dectected, then PFOA+PFOS is reported as the detected concentration.
3. If neither PFOA nor PFOS is detected at or above the DL then PFOA+PFOS is reported as "ND" representing Not Detected (ND).

[1] PFAS analysis by Modified USEPA Method 537.1 using Liquid Chromatography and Tandem Mass Spectrometry
[2] Health Advisory from USEPA Office of Water, 2016a and 2016b, Health Advisories (HAs) for drinking water.
[3] USEPA Regional Screening Levels (June 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017]

Table 3.0-5
Summary of Soil General Chemistry Analytical Testing Results
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Fairchild Air Force Base, Washington

AFFF Area	Location	Sample ID	Sample Date	Sample Depth (ft)	Sample Type	Analyte	
						PH	TOC
						pH Units	mg/kg
1	FRCHD01-C	FRCHD01-C-1	10-May-17	0.0-0.5	N	8.14	26,400
		FRCHD01-C-2	10-May-17	0.5-8.0	N	7.9	5,380
2	FRCHD02-C	FRCHD02-C-1	09-May-17	0.0-0.5	N	7.99	8,900
		FRCHD02-C-2	10-May-17	0.5-8.0	N	8.19	1,890
3	FRCHD03-C	FRCHD03-C-1	11-May-17	0.0-3.0	N	7.89	8,360
		FRCHD03-C-2	11-May-17	0.5-7.5	N	8.18	1,480
4	FRCHD04-C	FRCHD04-C-1	08-May-17	0.0-0.5	N	7.85	20,500
		FRCHD04-C-2	12-May-17	0.5-5	N	6.91	209
5	FRCHD05-C	FRCHD05-C-1	08-May-17	0-0.5	N	7.94	30,100
		FRCHD05-C-2	11-May-17	0.5-13.0	N	7.94	5,430

Notes:
AFFF = aqueous film forming foam
ft = feet
ID = identification
mg/kg = milligrams per kilogram
TOC = total organic carbon

Table 4.0-1
Conceptual Site Model: Installation-Wide Summary
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Investigation Report, Fairchild Air Force Base, Washington

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Installation Description/History: • Years of operation: 1942 to present • Size: Approximately 4,300 acres • Location: Approximately 12 miles southwest of Spokane, Washington • Layout: One major runway supported by numerous taxiways and support facilities, a hospital, housing units, and an elementary school • History: Constructed as a WWII repair and supply depot within the Cascade Mountains, 300 miles from the Pacific Ocean. In 1947, the installation was transferred to the Strategic Air Command and became the home of the 92nd Bombardment Wing. In 1994, the 92nd Bombardment Wing was redesignated as the 92nd Air Refueling Wing and the base was transferred to the Air Mobility Command. Since then, it has provided air refueling and wing supporting contingency operations around the world and today represents the backbone of the United States Air Force's west coast tanker fleet. • Mission: "Provide responsive, precise air refueling and operational support for the full range of military operations." **AFFF Use:** AFFF containing PFAS was used for firefighting training activities, testing of firefighting equipment, and extinguishing of petroleum fires. Sixteen potential AFFF release areas were identified during the PA research by CH2M Hill. Through research and interviews with knowledgeable base personnel, 13 of these potential release areas were determined to be unlikely to have caused a release of AFFF to the environment. The following three potential AFFF release areas were recommended for SI (Figure 3.0-1): • FT004 (FT01) • Aircraft Crash Location SS008 (PS-4/9) • B-52 Crash Location 1994 The following two potential AFFF release areas were added to the SI based on information from the Installation Scoping Visit: • Fire Station 1 (Building 3) • Calibration Area	**Topography:** • Fairchild AFB is within the Columbia Plateau. The ground surface is relatively flat and slopes toward the northeast. Elevations range from 2,400 to 2,460 feet above mean sea level (amsl). **Surface Water:** • "No Name" Creek is the primary pathway for surface runoff at Fairchild AFB. It flows approximately 1 mile from a stormwater retention pond located south of the runway on the eastern side of the base, and does not enter another surface water body before flow infiltrates or evaporates. No Name Creek is the sole surface • water discharge point from the base. • Stormwater collected within stormwater drains throughout the • base empties into the retention pond. • Other surface water runoff not collected by the drains flows to swales that run along the inside of the perimeter fence where the water either infiltrates into the ground or evaporates. **Soils:** • Alluvial deposits at Fairchild AFB consist of layers of sands and gravels with some silt and clay. These materials were Quaternary flood deposits from former glacial Lake Missoula of Pleistocene age. **Geology:** • Surficial sediments consist of up to 50 feet of alluvial sediments composed mostly of sand and gravel with some silt deposits. • Underlying the alluvial deposit is a thick sequence of layered basalt associated with the regional Columbia River Basalt Group. • The uppermost sequence of basalts is referred to as Basalt A and Basalt B. Basalt A varies in thickness from approximately 160 to 190 feet. • Basalts A and B are separated by a low-permeability clay referred to as Interbed A. • The basalt flows are underlain by massive granitic rock.	**Contaminants of Potential Concern:** • Contaminants of potential concern are PFAS, which are compounds that are used in formulation of AFFF. • Fuel-related compounds and chlorinated solvents are historical site contaminants. • According to the USEPA (2014), PFOS and PFOA are fully fluorinated organic compounds and are the most common of the PFAS compounds. They are stable chemicals with long carbon chains. PFOS and PFOA have been used in a variety of industrial and commercial products, including AFFF. They can also be formed by environmental microbial degradation or by metabolism in larger organisms from a large group of related substances or precursor compounds. • PFOS and PFOA are chemically and biologically stable and resist typical degradation processes; they are extremely persistent in the environment. They have a very low volatility and are highly soluble, migrating readily from soil to groundwater. Pathways for human exposure include ingestion of food and water, use of commercial products, or inhalation from long-range air transport of PFAS-containing particulate matter. PFOS and PFOA have been found in blood in the general human population, indicating widespread exposure. Toxicity studies are ongoing, but early studies indicate that continued exposure to low levels of PFOA in drinking water may cause adverse health effects. • PFOS has a water solubility of 370 mg/L in fresh water, a vapor pressure of 2.48X10-06 mm Hg, a Henry's Law constant of 3.05X10-09 atm-m^3/mol, and half-lives in the atmosphere of 114 days and in the water of >41 years. • PFOA has a water solubility of 9,500 mg/L (in purified water), a vapor pressure of 0.017 mm Hg, an unmeasurable Henry's Law constant, and half-lives in the atmosphere of 90 days and in the water of >92 years. • Soil and groundwater **Media of Potential Concern:** • Soil and groundwater. **Confirmed or Potential AFFF Release Areas** • **FT004 (FT01)** – AFFF used from 1970-1991. Approximately 125 gallons of AFFF were used during each training exercise . Water was drained into an oil-water separator that discharged into a low area east of the training location. • **Calibration Area** – AFFF was sprayed onto old taxiway pavement where it could runoff onto unpaved area.	**Current Land Use:** • Occupied by Fairchild AFB. • Future Land Use: • Land use is not expected to change in the future. **Potential Receptors:** • No Name Creek • Stormwater retention pond on the eastern side of the base south of the runway • Humans/non-residential, maintenance workers, groundskeepers • Biota – • Endangered • species at or in the vicinity of the • sites • Offsite residences on private wells	**Potential Ecological Receptors:** • Inland and aquatic plant species, reptiles, birds, soil invertebrates, and mammals that inhabit or migrate through the installation or are in the vicinity of No Name Creek **Threatened and Endangered Species:** Threatened species that are known to inhabit Spokane County and may possibly be found within the boundary of Fairchild AFB include the following: • Bald Eagle (*Haliaeetus leucocephalus*). • Bull Trout (*Salvelinus confluentus*). • Spaldings Catchfly (*Silene spaldingii*). • Water Howellia (*Howelia aquatilis*).

Table 4.0-1
Conceptual Site Model: Installation-Wide Summary
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Investigation Report, Fairchild Air Force Base, Washington

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
	Hydrogeology: • Groundwater at Fairchild AFB is typically encountered at 3 to 12 feet bgs in alluvium or within the fractured and weathered upper portion of Basalt A under unconfined conditions. • Groundwater within both the alluvium and Basalt A generally flows west to east across Fairchild AFB, except for the very western margin of the base, where a groundwater flow divide directs groundwater flow toward the west. • At the eastern side of the base groundwater flow splits around a basalt outcrop, resulting in flow toward the northeast and southeast. **Meteorology:** • The average annual rainfall is 16.6 inches/year. • The average temperature is 49.4 degrees Fahrenheit (°F). • The average annual snowfall is 44.9 inches, occurring primarily in the winter months.	**Confirmed or Potential AFFF Release Areas (cont.)** • **Aircraft Crash Location SS008 (PS-4/9)** – KC-135 crashed in grassy area in March 1987. An unknown amount of AFFF was used to extinguish the fire. AFFF likely infiltrated into the ground. • **B-52 Crash Location 1994** – B-52 crashed in grassy field approximately 900 ft. southeast of the tower. Unknown amount of AFFF was used to extinguish the fire. • **Fire Station 1 (Building 3)** - According to Assistant Fire Chief, calibration tests have occurred on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb into a grassy area between the pavement and a wall that divides the fire station from the airstrip. **Primary Release Pathways:** • Release or application of AFFF to the ground at potential source areas • Infiltration of PFAS deeper into the soil column over time potentially reaching groundwater • AFFF washed into drainage, stormwater, or sewer system **Potential Migration Pathways:** • Infiltration into groundwater (unconsolidated material, fracture flow, etc.) • Direct discharge into stormwater collection system • Adsorption to soil matrix near source • Topographic controlled migration • Migration with groundwater flow		

Sources:
CH2M HILL, 2015, Final Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington. June.
Fairchild Air Force Base: A Brief History, March 15, 2016, http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history
USEPA, 2014, Fact Sheet: Emerging Contaminants – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA). March.
Weather DB, Fairchild AFB, site visited December 16, 2016, https://www.weatherdb.com/

List of Abbreviations:
°F=degrees Fahrenheit
AFB=Air Force Base
AFFF=aqueous film forming foam
amsl=feet above mean sea level
atm m3/mole=atmospheres cubic meter per mole
bgs=below ground surface
mg/L=milligrams per liter
mmHg=millimeters of mercury
PA=Preliminary Assessment
PFAS=per- and polyfluorinated alkyl substances
PFOA= perfluorooctanoic acid
PFOS= perfluorooctanesulfonic acid
SI=Site Inspection
USEPA=United States Environmental Protection Agency

APPENDIX A

PHOTOGRAPH LOGS

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	**27 September 2016** **Photo 1:** B-52 Crash Location 1994, AFFF Release Area 4.
	Direction of Photo: **North**

	**27 September 2016** **Photo 2:** Aircraft Crash Location SS008 (PS-4/9), AFFF Release Area 3.
	Direction of Photo: **Northeast**

	**27 September 2016** **Photo 3:** Aircraft Crash Location SS008 (PS-4/9), AFFF Release Area 3.
	Direction of Photo: **South**

	**27 September 2016** **Photo 4:** Former FTA FT004 (FT01), AFFF Release Area 1.
	Direction of Photo: **North**

	**27 September 2016** **Photo 5:** B-52 Crash Location 1994, AFFF Release Area 4.
	Direction of Photo: **South**

	**27 September 2016** **Photo 6:** Former FTA FT004 (FT01), AFFF Release Area 1.
	Direction of Photo: **East**

APPENDIX B

FIELD FORMS

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APPENDIX B-1

FIELD ACTIVITY DAILY LOGS

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FIELD ACTIVITY DAILY LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Investigation Area:**	FT004
Weather:	Clear 38 deg F	**Date and Time:**	02/14/17 21:22
Technician(s):	Joe Fassio, Bill McFarland		

Description of Daily Activities and Events:

7:22 Entered gate Fv-17 to FT004 area., 7:45 to 8:30 Calibrated YSI and Hach turbidity meter. Calibrated successfully., 8:45 Started sampling MW-225. PID = 0.0 ppm, 9:37 Called Teresa Wilson about high turbidity at MW-225. 40 , to 50 NTU and may have to purge for 3 well volumes plus extra hour as in SOP before we can sample. , 11:42 Sample collected from MW-225 with duplicate., 12:04 Called Pine. Battery rented for peristaltic pump is bad and requested new battery. Using rental car battery for well sampling. Will need battery for sampling MW-3., 12:00 to 12:45 Took waste water to waste storage building on Depot Ave., 13:00 Started sampling MW-226. PID = 0.0 ppm, 13:37 Collected water sampling at MW-226., 14:00 Left FT004., 14:00 to 15:30 Took waste water to waste storage building. Purchased more supplies - tubing and 5 gallon buckets, 15:30 to 16:30 Tested Pine rental Monsoon pump. Pump not functional.

List Samples Collected:

Groundwater samples from MW-225 and MW-226 (FRCHD01-GW-002 and FRCHD01-GW-003)

Deviation from Plans:

None

Visitors on Site:	**Important Telephone Calls / Photos Taken:**	**Signature:**
None	None	
		Name (print)**:** Joe Fassio

QA/QC'd by: T.Wilson **QA/QC Date:** 2/20/2017

FIELD ACTIVITY DAILY LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Investigation Area:**	FT004
Weather:	31 deg F and freezing rain	**Date and Time:**	02/15/17 09:33
Technician(s):	Joe Fassio and Bill McFarland		

Description of Daily Activities and Events:

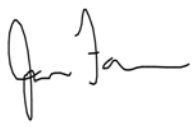
0700 Arrived at base , 0720 at FV-17 gate. Reported to ops , 0720 to 0815 Calibrated YSI and turbidity meter. Calibrated successfully. , 0815 to 0930 sampled MW – 100 , 0930 to 1026 sampled MW – 50, 1026 to 1126 Off base to get FedEx shipment with more tubing. , 1126 to 1330 sampled MW – 3, Turbidity and OPR did not stabilize after purging 3 well casing volumes and an additional hour. Collected field blank. , 1330 to 1420 at waste storage building to transfer groundwater to drum., 1420 Called Marc Connally, provide update and let him know we are leaving site. Left base. , 1440 to 1530 Prepared sample for shipment and completed COC. Shipped via FedEx overnight to Maxxam. , 1530 to 1430 Shipped equipment back to Pine Environmental

List Samples Collected:

FRCHD-GW-001, FRCHD-GW-004,FRCHD-GW-005, FRCHD-BLK-01

Deviation from Plans:

None

Visitors on Site:	**Important Telephone Calls / Photos Taken:**	**Signature:**
None	None	
		Name (print)**:** Joe Fassio

QA/QC'd by: **Teresa Wilson** **QA/QC Date:** **2/5/2018**

Field Activity Daily Log
Rev. 0, Date: 12/11/2015

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	5	8	2017
	NO.			
	SHEET	1	OF	1

Project Name: Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide, Contract FA8903-16-D-0027 Task Order 0004 Fairchild AFB

Project No. 775303101.0012.030

Installation/Investigation Area: Von-base Areas 3, 5, and 4

Description of daily activities and events: Groundwater Samply Existing well and surface Soil sampling

700 Arrived at Front Gate of base
730 Met Marc Connelly at Engineering Building
845 Met EWE (Greg and David) at Burger King/Conducted tail-gate meeting
830 - 900 Looked at boring Locations at SWDS Crash locations
900 - 1200 Stand by for Dig Permit - After call with Teresa Wilson she was not able to get complated permit through Mark Connelly
Had EWE crew go home for day
1215 - 1530 Collected surface soil ~~soil~~ samples from Areas 3, 4, and 5
Did not collect samples from FRCHD03-SB-1 which is in asphalt covered area
1000 - 1215 Bill McFarland collected groundwater samples from MW-438 and MW-399 collected duplicate and MS/MSD
1530 - 1630 worked on completing and QC of Field forms and tablet
1630 Left base

List Samples Collected:

FRCHD03-GW-001
FRCHD05-GW-002
FRCHD-FD-GW-01
FRCHD05-~~SO~~SO-001
FRCHD-FD-SO-01 (Dup of above sample)
FRCHD05-C-1 TOC, pH, grainsize
FRCHD05-SO-003
FRCHD04-SO-001
FRCHD04-SO-003
FRCHD04-SO-005
FRCHD04-C-1
FRCHD-EB
FRCHD03-SO-003
FRCHD03-SO-~~004~~005

QM4 2/2/18

Visitors on Site: None

Deviation from plans: NONE

Weather conditions: Clear ~68°F

Important telephone calls / photos taken: Teresa Wilson - no dig permit-left driller go for day at 1200 pm

Personnel on Site: Joe Fassio, Greg and Dave EWE and Bill McFarland

Name/Signature: Joe Fassio **Date:** 5/8/17

QA/QC'd by: Teresa Wilson **Date:** 2/1/18

Field Activity Daily Log
Rev. 0, Date: 12/11/2015

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	5	9	17
	NO.			
	SHEET	1	OF	1

Project Name: Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide, Contract FA8903-16-D-0027 Task Order 0004

Project No. 775303101.0012.0300

Installation/Investigation Area: Fairchild AFB / AFFF Areas 1, 2, 3

Description of daily activities and events: surface soil sampling and groundwater sampling existing wells

630-700 Calibrated YSI and tubidimeter
800-900 Meeting to discuss plan for day
900 Arrived on-base
930-1000 Put waste water in drum at storage facility
1000-1100 Contacted Airfield opps to get access to AFFF areas 1 & 2 and down-gradient wells in Area 3
1100-1130 Travel to gate 17 w/ escort
1130-1230 Collected surface samples at Areas 1 and 2 (FT0004 and calibration Area)
1230-1300 Escorted to MW-185
1300-1600 Sampled wells MW-185, MW-1023-1 and MW-265
MW-265 needs new well cap - completely broken
1600-1730 Helped ~~Ted~~ GMA 1/10/18 reset direct fill well sampling team with sample shipment
1745 At FedEx to ship samples

List Samples Collected:
Soil: ~~FRCHD01-SO-001~~ GMA 2/2/18 FRCHD02-SO-001 | FRCHD-FB02 | ~~FRCHD01-SO-002~~ GMA 2/2/18 FRCHD02-SO-002 | ~~FRCHD01-SO-003~~ GMA 2/2/18 FRCHD02-C-1 | FRCHD02-SO-003
GW: FRCHD03-GW-004 | FRCHD-FB03 | FRCHD03-GW-003 | FRCHD03-GW-002

Visitors on Site: NONE

Deviation from plans: NONE

Weather conditions: Clear ~70°F

Important telephone calls / photos taken: NONE

Personnel on Site: Joe Fassio and Bill McFarland

Name/Signature: Joe Fassio Date: 5/9/17

QA/QC'd by: Teresa Wilson Date: 2/1/18

Field Activity Daily Log
Rev. 0, Date: 12/11/2015

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	5	10	17
	NO.			
	SHEET	1	OF	2

Project Name: Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide, Contract FA8903-16-D-0027 Task Order 0004

Project No. 775303101.0012_0300

Installation/Investigation Area: Fairchild AFB / AFFF Areas 1 and 2

Description of daily activities and events: Soil Sampling / Temp well Sampling

600 - 630 Calibrated YSI and turbidimeter

715 - 730 Meeting with Terracon Wilson, met EWE crew at Burger King

730 - 800 Travel to base

800 - Obtained Dig permits. Called Ryan with COMM to Locate at crash sites

830 - Called Brian to Escort us in to Calibration and Old FTA site)

845 - 1000 Standby for Brian to Arrive

1010 Started FRCHD02-SB-2

1145 Set temporary point for FRCND02-SB-2, started hand Augering FRCND02-SB-1

1150 - 1220 Hand Augered FRCHD02-SB-1 (4 feet to refusal)

1220 - 1250 Drilled FRCH02-SB-1

1254 - 1300 Hand Augered FRCND01-SB-1

1330 - 1345 Drilled FRCHD01-SB-1

1345 - 1415 Hand Augered FRCHD01-SB-2

1415 - 1430 Drilled FRCND01-SB-1 see back of Form (page 2 of 2)

List Samples Collected:

FRCHD02-GW-001
FRCHD02-SO-004
FRCND02-SO-002
FRCHD02-C-2
FRCND01-SO-001
FRCND01-SO-002
FRCND01-SO-003
FRCND01-C-1
FRCHD01-SO-004
FRCHD01-C-2
FRCHD04-GW-003

Visitors on Site: NONE

Deviation from plans: NONE

Weather conditions: Clear ~80°F

Important telephone calls / photos taken: NONE

Personnel on Site: Joe Fassio, Bill McFarland, Greg Watson, David Clark, Brain Panther

Name/Signature: Joe Fassio **Date:** 5/10/17

QA/QC'd by: TWR Tessa Wilson **Date:** 2/1/18

Fairchild AFB

 5/10/17

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1445-1530 standby - waiting for Marc to open gate 17
1530-1615 went with drillers to look at Area 2 (Fire Station) locations for utility locations and access.
1630 left site
1630-~~1730~~ 1800 Worked on COCs

5/30/17

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Field Activity Daily Log
Rev. 0, Date: 12/11/2015

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	5	11	17
	NO.			
	SHEET	1	OF	2

Project Name: Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide, Contract FA8903-16-D-0027 Task Order 0004

Project No. 775303101.0012.0300

Installation/Investigation Area: Fairchild AFB

Description of daily activities and events: Soil sampling / Temp well groundwater Sampling

600 - 630 calibrated YSI and rubicldmeter
730 At base visitor center
800 Meet with EWE, tailgate safety meet's
830 At FRCHD05-SB-1 Hand Augered to 5 feet
850 - 920 Drilled FRCHD05-SB-1
920 - 1000 Hand Augered to 4 feet, Drilled FRCHD05-SB-1
~~Silt drawing into well point at FRCHD05-SB-1. will have to sample from open hole. Silt is plugging screen and not going into well point. Pivot of water~~
To hole JMS 5/11/17
1000 - 1100 Drilled FRCND03-SB-1, Hand Augered to 5 feet bgs
1115 - 1755 Drilled FRCHD03-SB-2, Hand Augered to 5 Feet bgs
1200 - 1330 Drilled FRCHD03-SB-3, Hand augered to refusal (coarse gravel layer) at 2.5 feet
1345 - 1420 Drilled FRCND04-SB-2, Hand Augered to 5 feet
1430 - 1512 Drilled FRCND04-SB-1 collected water sample FRCND04-GW-001

List Samples Collected:
FRCHD-EB2
FRCND05-SO-002
FRCND-FD-SO-03
FRCND05-SO-004
FRCHD05-C-2
FRCND03-SO-001
FRCND03-C-1
FRCND-FB02
FRCND03-SO-002
FRCND03-SO-004
FRCND03-SO-006
FRCND04-SO-004
FRCND03-C-2
FRCND04-SO-002
FRCNDOS-GW-001
FRCND04-GW-001

see back of page for page 2 of 2

Visitors on Site: NONE

Deviation from plans: NONE

Weather conditions: Clear ~80°F

Important telephone calls / photos taken: NONE

Personnel on Site: Joe Fuss (o), Bill McFarland, David Clark, Greg Watson

Name/Signature: Joe Fuss / Joe Fuss (o) **Date:** 5/11/17

QA/QC'd by: Tucsa Wilson **Date:** 2/1/18

Fairchild AFB

5/11/17

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14:14 Call Communication dept at base - James told him one line near FRCNDO4-SB-3 was not marked - looks like com line on map.

1420 James called back - line belongs to ComCast

1457 ~~ComCast~~ - Call Teresa - got COMCAST phone # at 800-762-0592 GM 1/10/18

ticket 17146979

1500 Called ComCast - no locate done on one line - locator will call back

1549 No Reponse from Comcast, Bill finished sampling and EWE Abandoned FRCNDO4-SB-9.

1551 call from Jared at comcast. He will meet us at 8AM at ~~Big Boger~~ Burger King and will look at Location, GM 5/11/17

1622 Called Zack with EWE. David will meet us at 800AM Friday so we can finish Last hole

1600 Left Base

1630-1715 Packaged sample for Shipment

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~~1739~~ 1715-1730 At FedEx to ship samples GM 1/10/18

Field Activity Daily Log
Rev. 0, Date: 12/11/2015

amec foster wheeler

FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	5	12	2017
	NO.			
	SHEET	1	OF	2

Project Name: Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide, Contract FA8903-16-D-0027 Task Order 0004

Project No. 775303101.0012,0300

Installation/Investigation Area: Fairchild AFB AFFF Area 4

Description of daily activities and events: Soil and Groundwater Sampling

600 - 630 Calibration YSI and turbidimeter

800 Arrive on-base at Burger King - Met Jared w/ Locator For Comcast and David w/ EWE. Greg not on site today

816 At Location for FRCHD04-SB-3

825 Could not locate line shown on the map keyed as Comcast line. May be an abandoned line.

825 - 840 Hand Augered to 4 feet bgs - hole caved at 4 feet due to saturated soils

840 - 900 Drilled to FRCH04-SB-3

900 - 1008 Collect groundwater sample ~~from~~ FRCH04-GW-002

910 Collect IDW from composite soil sample derived from soil from each boring

1008 - 1100 Collect IDW sample from water drum - 5 gallon of clean water added to Purge groundwater.

Inventory of IDW - 1 - 55 gallon drum soil, 1 - 55 gallon drum of water (over)

Page 2 of 2

List Samples Collected:

FRCHD04-SO-006
FRCHD04-C-2
FRCHD04-GW-002
IDW
FRCHD-IDW-SO-01
FRCHD-GW-IDW-1

Visitors on Site: None	**Deviation from plans:** None
Weather conditions: Cloudy ~50°F	**Important telephone calls / photos taken:** None

Personnel on Site: Joe Fassio, Bill McFarland, David Clark (EWE)

Name/Signature: Joe Fassio / Joe Fassio **Date:** 5/12/2017

QA/QC'd by: TWR Tucsa Wilson **Date:** 2/1/18

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1100 - 1300 Prepared samples and shipment and went to FedEx to ship samples

1330 Left Spokane

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APPENDIX B-2

DAILY PFAS PROTOCOL CHECKLISTS

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ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Clear, 21deg F.
Site/Area Name:	FT004		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	02/14/17 07:29

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

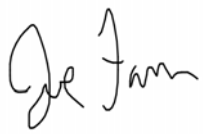
- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Freezing rain, 31deg F.
Site/Area Name:	FT004		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	02/15/17 06:58

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

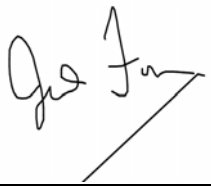
- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Clear, 55 deg F
Site/Area Name:	On base		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	05/08/17 07:28

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Joe Fassio

QA/QC'd by: **Teresa Wilson** **QA/QC Date:** **2/5/2018**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Sunny 65
Site/Area Name:	AFFF area 3		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	05/09/17 09:44

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Bill McFarland

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **9/26/2017**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Clear 80 deg F
Site/Area Name:	Areas1 and 2		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	05/10/17 13:04

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **9/26/2017**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Overcast, slight wind, & 60
Site/Area Name:	Fire Station/ Area 5		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	05/11/17 08:39

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Bill McFarland

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **8/4/2017**

ATTACHMENT 1 TO SOP AFW-01
DAILY PFC PROTOCOL CHECKLIST

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Weather (temp./precipitation):**	Cloudy and 50
Site/Area Name:	Area 4		
Field Manager:	Joe Fassio - Geologist	**Date and Time:**	05/12/17 08:24

Field Clothing and PPE (as applicable):

- ☑ Field crew in compliance with Tables 1 and 2, SOP AFW-01
- ☑ Field crew has not used fabric softener on clothing
- ☑ Field crew has not used cosmetics, moisturizers, hand cream, or other related products or exposed body parts this morning
- ☑ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

- ☑ No Teflon® containing materials on-site
- ☑ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☑ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☑ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☑ No adhesives (Post-it® Notes) on-site
- ☑ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☑ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☑ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☑ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☑ "PFC-free" water on-site for decontamination of sample equipment
- ☑ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☑ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:



Name (print)**:**

Bill McFarland

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

APPENDIX B-3

TAILGATE SAFETY MEETING REPORTS

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TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101.0012.0300
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	02/14/17 07:37
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Initial Kickoff Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- [x] Site History/Site Layout
- [x] Scope of Work
- [x] Personnel Responsibilities
- [x] Medical Surveillance Requirements
- [x] Training Requirements
- [x] Safe Work Practices
- [x] Logs, Reports, Recordkeeping
- [x] Sanitation and Illumination
- [x] Air Surveillance Type and Frequency
- [x] Monitoring Instruments and Personal Monitoring
- [x] Action Levels
- [x] Accident Reporting Procedures
- [x] Site Control (visitor access, buddy system, work zones, security, communications)
- [ ] Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- [x] Engineering Controls
- [x] PPE Required/PPE Used
- [x] Define PPE Levels, Donning, Doffing Procedures
- [x] Physical Hazards and Controls (e.g., overhead utility lines)
- [x] Decontamination Procedures for Personnel and Equipment
- [x] General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- [x] Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- [x] Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- [x] Hazardous Materials Spill Procedures
- [x] Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- [x] Injury/Illness Reporting Procedures
- [x] Route to Hospital and Medical Care Provider Visit Guidelines
- [x] Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- [x] Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	None
Action taken on previous suggestions:	NA
Injuries/accidents/personnel changes since previous meeting:	NA
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Out of gate FV17
Other Safety Topics Discussed:	NA
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	AFW				
Bill McFarland	AFW				

Meeting Conducted By (print):	Company and Title	Signature
Joe Fassio	AFW - Geologist	

QA/QC'd by: Beth Flynn **QA/QC Date: 11/20/2017**

TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101.0012.0300
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	02/15/17 07:02
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- ☐ Site History/Site Layout
- ☑ Scope of Work
- ☐ Personnel Responsibilities
- ☐ Medical Surveillance Requirements
- ☐ Training Requirements
- ☑ Safe Work Practices
- ☐ Logs, Reports, Recordkeeping
- ☐ Sanitation and Illumination
- ☐ Air Surveillance Type and Frequency
- ☐ Monitoring Instruments and Personal Monitoring
- ☐ Action Levels
- ☐ Accident Reporting Procedures
- ☑ Site Control (visitor access, buddy system, work zones, security, communications)
- ☐ Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- ☐ Engineering Controls
- ☑ PPE Required/PPE Used
- ☑ Define PPE Levels, Donning, Doffing Procedures
- ☑ Physical Hazards and Controls (e.g., overhead utility lines)
- ☐ Decontamination Procedures for Personnel and Equipment
- ☐ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- ☐ Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- ☐ Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- ☐ Hazardous Materials Spill Procedures
- ☐ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- ☐ Injury/Illness Reporting Procedures
- ☑ Route to Hospital and Medical Care Provider Visit Guidelines
- ☐ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- ☐ Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	None
Action taken on previous suggestions:	None
Injuries/accidents/personnel changes since previous meeting:	With wet weather will need to take more frequent warming breaks in vehicle
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Out of gate FV17
Other Safety Topics Discussed:	NA
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	AFW				
Bill McFarland	AFW				

Meeting Conducted By (print):	**Company and Title**	**Signature**
Joe Fassio	AFW - Geologist	

QA/QC'd by: Beth Flynn **QA/QC Date: 11/20/2017**

TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	05/08/17 08:54
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Initial Kickoff Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- ☑ Site History/Site Layout
- ☑ Scope of Work
- ☑ Personnel Responsibilities
- ☑ Medical Surveillance Requirements
- ☑ Training Requirements
- ☑ Safe Work Practices
- ☑ Logs, Reports, Recordkeeping
- ☑ Sanitation and Illumination
- ☑ Air Surveillance Type and Frequency
- ☑ Monitoring Instruments and Personal Monitoring
- ☑ Action Levels
- ☑ Accident Reporting Procedures
- ☑ Site Control (visitor access, buddy system, work zones, security, communications)
- ☑ Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- ☑ Engineering Controls
- ☑ PPE Required/PPE Used
- ☑ Define PPE Levels, Donning, Doffing Procedures
- ☑ Physical Hazards and Controls (e.g., overhead utility lines)
- ☑ Decontamination Procedures for Personnel and Equipment
- ☑ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- ☑ Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- ☑ Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- ☑ Hazardous Materials Spill Procedures
- ☑ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- ☑ Injury/Illness Reporting Procedures
- ☑ Route to Hospital and Medical Care Provider Visit Guidelines
- ☑ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- ☑ Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	None
Action taken on previous suggestions:	None
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Out front gate
Other Safety Topics Discussed:	Discussed restricted areas
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	AFW				
Bill McFarland	AFW				
Greg Walston	EWE				
David clark	Ewe				

Meeting Conducted By (print):	Company and Title	Signature
Joe Fassio	AFW - Geologist	

QA/QC'd by: Beth Flynn **QA/QC Date: 8/23/2017**

TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	05/10/17 09:11
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- [x] Site History/Site Layout
- [ ] Scope of Work
- [ ] Personnel Responsibilities
- [ ] Medical Surveillance Requirements
- [ ] Training Requirements
- [x] Safe Work Practices
- [ ] Logs, Reports, Recordkeeping
- [ ] Sanitation and Illumination
- [ ] Air Surveillance Type and Frequency
- [ ] Monitoring Instruments and Personal Monitoring
- [ ] Action Levels
- [ ] Accident Reporting Procedures
- [ ] Site Control (visitor access, buddy system, work zones, security, communications)
- [ ] Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- [ ] Engineering Controls
- [x] PPE Required/PPE Used
- [ ] Define PPE Levels, Donning, Doffing Procedures
- [x] Physical Hazards and Controls (e.g., overhead utility lines)
- [ ] Decontamination Procedures for Personnel and Equipment
- [x] General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- [ ] Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- [ ] Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- [ ] Hazardous Materials Spill Procedures
- [ ] Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- [ ] Injury/Illness Reporting Procedures
- [ ] Route to Hospital and Medical Care Provider Visit Guidelines
- [ ] Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- [ ] Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	None
Action taken on previous suggestions:	None
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Out gate 17
Other Safety Topics Discussed:	NA
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	AFW				
Bill McFarland	AFW				
GregWatson	EWE				
David Clark	EWE				
Brian Panther	Ageiss				

Meeting Conducted By (print):	**Company and Title**	**Signature**
Joe Fassio	AFW - Geologist	

QA/QC'd by: Beth Flynn **QA/QC Date: 11/20/2017**

TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	05/11/17 08:03
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- [x] Site History/Site Layout
- [x] Scope of Work
- [x] Personnel Responsibilities
- [ ] Medical Surveillance Requirements
- [ ] Training Requirements
- [x] Safe Work Practices
- [ ] Logs, Reports, Recordkeeping
- [x] Sanitation and Illumination
- [ ] Air Surveillance Type and Frequency
- [ ] Monitoring Instruments and Personal Monitoring
- [ ] Action Levels
- [ ] Accident Reporting Procedures
- [ ] Site Control (visitor access, buddy system, work zones, security, communications)
- [ ] Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- [ ] Engineering Controls
- [x] PPE Required/PPE Used
- [ ] Define PPE Levels, Donning, Doffing Procedures
- [x] Physical Hazards and Controls (e.g., overhead utility lines)
- [ ] Decontamination Procedures for Personnel and Equipment
- [x] General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- [ ] Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- [ ] Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- [ ] Hazardous Materials Spill Procedures
- [ ] Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- [ ] Injury/Illness Reporting Procedures
- [ ] Route to Hospital and Medical Care Provider Visit Guidelines
- [ ] Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- [x] Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	None
Action taken on previous suggestions:	None
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Front gate
Other Safety Topics Discussed:	NA
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	Amec Foster Wheeler				
Bill McFarland	Amec Foster Wheeler				
Greg walston	EWE				
David clark	EWE				

Meeting Conducted By (print):	**Company and Title**	**Signature**
Joe Fassio	Amec Foster Wheeler - Geologist	

QA/QC'd by: Teresa Wilson **QA/QC Date: 2/5/2018**

TAILGATE SAFETY MEETING REPORT

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Date and Time:**	05/12/17 08:17
Field Manager Name:	Joe Fassio	**Site Health and Safety Officer (HSO):**	Joe Fassio
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- ☐ Site History/Site Layout
- ☑ Scope of Work
- ☑ Personnel Responsibilities
- ☐ Medical Surveillance Requirements
- ☐ Training Requirements
- ☑ Safe Work Practices
- ☐ Logs, Reports, Recordkeeping
- ☐ Sanitation and Illumination
- ☐ Air Surveillance Type and Frequency
- ☐ Monitoring Instruments and Personal Monitoring
- ☐ Action Levels
- ☑ Accident Reporting Procedures
- ☐ Site Control (visitor access, buddy system, work zones, security, communications)
- ☐ Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- ☐ Engineering Controls
- ☑ PPE Required/PPE Used
- ☐ Define PPE Levels, Donning, Doffing Procedures
- ☑ Physical Hazards and Controls (e.g., overhead utility lines)
- ☑ Decontamination Procedures for Personnel and Equipment
- ☐ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- ☐ Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- ☐ Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- ☐ Hazardous Materials Spill Procedures
- ☐ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- ☑ Injury/Illness Reporting Procedures
- ☑ Route to Hospital and Medical Care Provider Visit Guidelines
- ☐ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- ☐ Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	Hearing and eye protection
Action taken on previous suggestions:	All persons have both safety glasses and ear plugs
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	No changes
Other Safety Topics Discussed:	NA
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Joe Fassio	AFW				
Bill McFarland	AFW				
David clark	Ewe				

Meeting Conducted By (print):	**Company and Title**	**Signature**
Bill McFarland	AFW - Env Tech	

QA/QC'd by: Beth Flynn **QA/QC Date: 11/20/2017**

APPENDIX B-4

DRILLING LOGS

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DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Poorly-graded Sand (SP), brown (Y7.5 5/3), dry, fine gravelly sand, loose, trace organics					0.9		0
	Silty Sand (SM), brown (Y7.5 5/3), dry, silty fine sand with gravel, medium dense, (Fill)							
5	Sandy Silt (ML), black (7.5YR 2.5/1), moist, fine sand, nonplastic, medium stiff, slight hydrocarbon-like odor			FRCHD01-SO-001 4.5-5.5'		1.9		5
				FRCHD01-SO-002 7-8'		1.5		
10	Poorly-graded Sand (SP), brown (7.5YR 5/2), wet, medium to coarse sand, dense Gray, strong hydrocarbon-like odor at 11' bgs					366.5		10
	End of Boring at 12' bgs. No refusal.							
15								15
20								20
25								25

START DATE: 5/10/2017
END DATE: 5/10/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFB Area 1
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17302527.38 ft.
EASTING: 1485374.992 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD01-SB-1**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Well-graded Sand (SW), brown (7.5YR 3/3), dry, fine to medium sand with gravel (up to 3 inches in diameter), dense			FRCHD01-SO-003 0-0.5'		0.4		0
	Silty Sand (SM), brown (7.5YR 3/3), moist, fine to medium silty sand, medium dense							
5	Black, hydrocarbon-like odor at 4' bgs ▽			FRCHD01-SO-004 6-7'				5
	Poorly-graded Sand (SP), bluish black (2.5/5PB), wet, medium to coarse sand, no fines, medium dense, moderate hydrocarbon-like odor					10.2		
10	End of Boring at 8' bgs. No refusal.							10
15								15
20								20
25								25

START DATE:	5/10/2017	GROUND ELEVATION:	NA ft.
END DATE:	5/10/2017		(Source: USDA, Service Center Agencies
DRILLER:	EWE		10m Digital Elevation Model)
EQUIPMENT:	5400 Geoprobe DPT	VERTICAL DATUM:	NAVD88
METHOD:	Geoprobe Direct Push	NORTHING:	17302497.66 ft.
HOLE DIA.:	2-inch	EASTING:	1485559.109 ft.
SITE:	AFB Area 1	HORIZONTAL DATUM:	
LOGGED BY:	J. Fassio		WGS84 UTM Zone 11 N

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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB

Project No: 775303101.0012.0300

Checked By: C. Duitman **Boring No. FRCHD01-SB-2**

amec foster wheeler

2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Poorly-graded Sand (SP), brown (Y7.5 4/2), dry, gravelly fine sand, trace medium to coarse sand, gravels (up to 3 inches in diameter), some cobbles (up to 6 inches in diameter), dense			FRCHD02-SO-001 0-0.5'		0.3		0
5	Silty Sand (SM), brown (7.5YR 4/2), moist, fine sand, trace coarse to medium sand, dense			FRCHD02-SO-002 7-8'		1.0		5
10	End of Boring at 12' bgs. No refusal.							10
15								15
20								20
25								25

START DATE: 5/10/2017
END DATE: 5/10/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFFF Area 2
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17302589.02 ft.
EASTING: 1483785.843 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

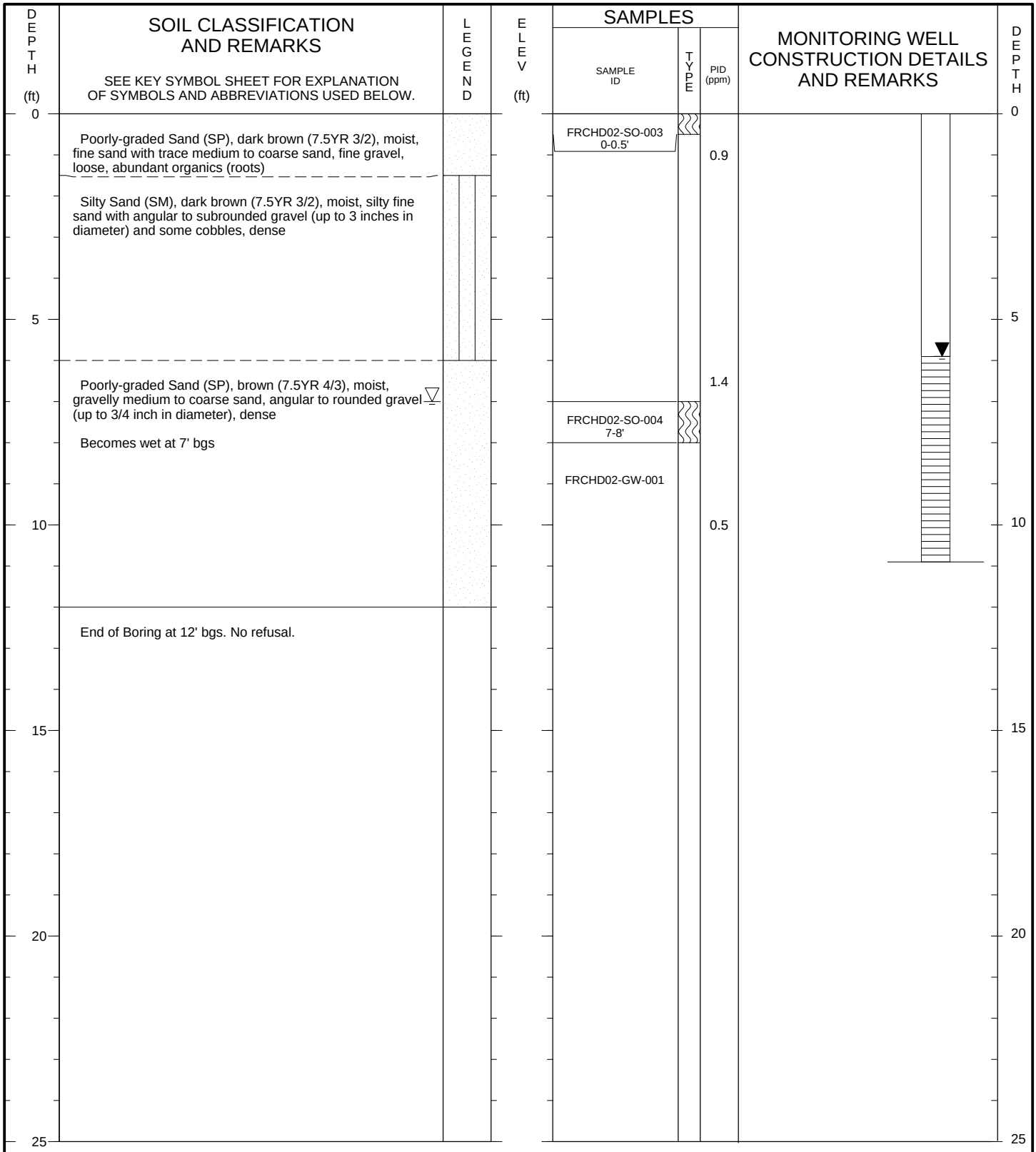
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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD02-SB-1**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENV1 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17



START DATE:	5/10/2017	GROUND ELEVATION:	NA ft.
END DATE:	5/10/2017		(Source: USDA, Service Center Agencies
DRILLER:	EWE		10m Digital Elevation Model)
EQUIPMENT:	5400 Geoprobe DPT	VERTICAL DATUM:	NAVD88
METHOD:	Geoprobe Direct Push	NORTHING:	17302602.04 ft.
HOLE DIA.:	2-inch	EASTING:	1484183.846 ft.
SITE:	AFFF Area 2	HORIZONTAL DATUM:	
LOGGED BY:	J. Fassio		WGS84 UTM Zone 11 N

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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD02-SB-2**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENV1 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Asphalt (2.5 inches)							0
	Poorly-graded Gravel with Sand (GP), dark brown (7.5YR 3/2), dry, coarse gravel with fine to coarse sand, loose							
	Poorly-graded Sand (SP), brown (7.5YR 4/2), moist, medium to coarse sand with some fine angular to subangular gravel, medium dense			FRCHD03-SO-001 2.5-3'		0.1		
	Less gravel at 3' bgs							
5	Some silt at 5-6' bgs							5
	Becomes wet, gravelly (~45%), no fines at 6' bgs			FRCHD03-SO-002 6-7'		1.7		
	End of Boring at 8' bgs. No refusal.							
10								10
15								15
20								20
25								25

START DATE: 5/11/2017
END DATE: 5/11/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFFF Area 3
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17305015.23 ft.
EASTING: 1479113.751 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD03-SB-1**

amec foster wheeler

2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Poorly-graded Sand with Silt (SP-SM), brown (7.5YR 4/3), moist, fine to medium sand with trace silt, trace fine gravel, loose Gravelly at 1-2.5' bgs			FRCHD03-SO-003 0-0.5'		0.8		0
5	Silt (ML), light brown (7.5YR 6/4), moist, silt with trace clay, low plasticity, medium stiff ▽ Silty Sand (SM), brown (7.5YR 4/3), wet, fine sand, medium dense			FRCHD03-SO-004 6-7'		0.1		5
10	End of Boring at 8' bgs. No refusal.							10
15								15
20								20
25								25

START DATE: 5/11/2017
END DATE: 5/11/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFB Area 3
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17304774.35 ft.
EASTING: 1479056.893 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

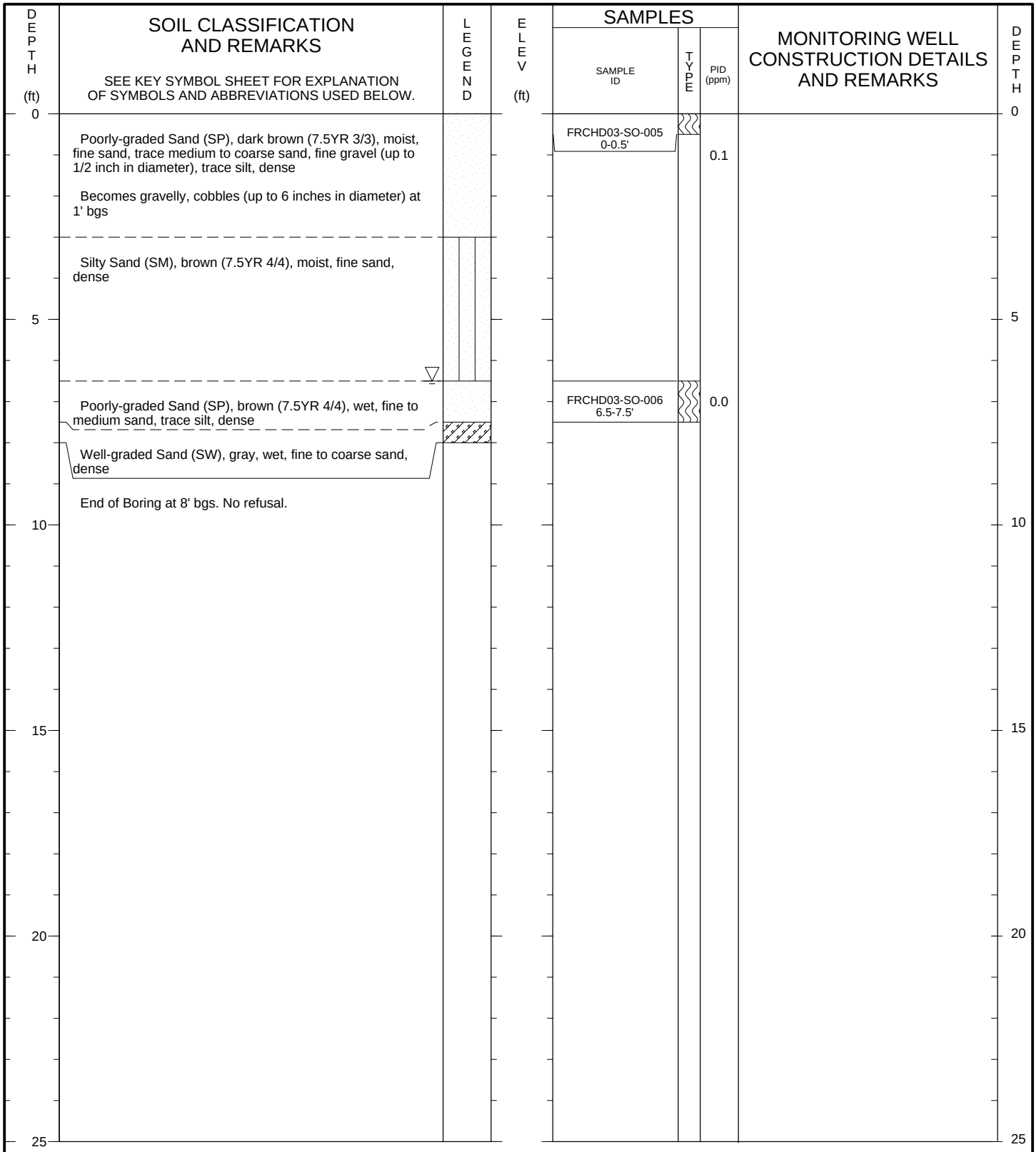
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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD03-SB-2**

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START DATE:	5/11/2017	GROUND ELEVATION:	NA ft.
END DATE:	5/11/2017		(Source: USDA, Service Center Agencies
DRILLER:	EWE		10m Digital Elevation Model)
EQUIPMENT:	5400 Geoprobe DPT	VERTICAL DATUM:	NAVD88
METHOD:	Geoprobe Direct Push	NORTHING:	17304483.55 ft.
HOLE DIA.:	2-inch	EASTING:	1479059.497 ft.
SITE:	AFB Area 3	HORIZONTAL DATUM:	
LOGGED BY:	J. Fassio		WGS84 UTM Zone 11 N

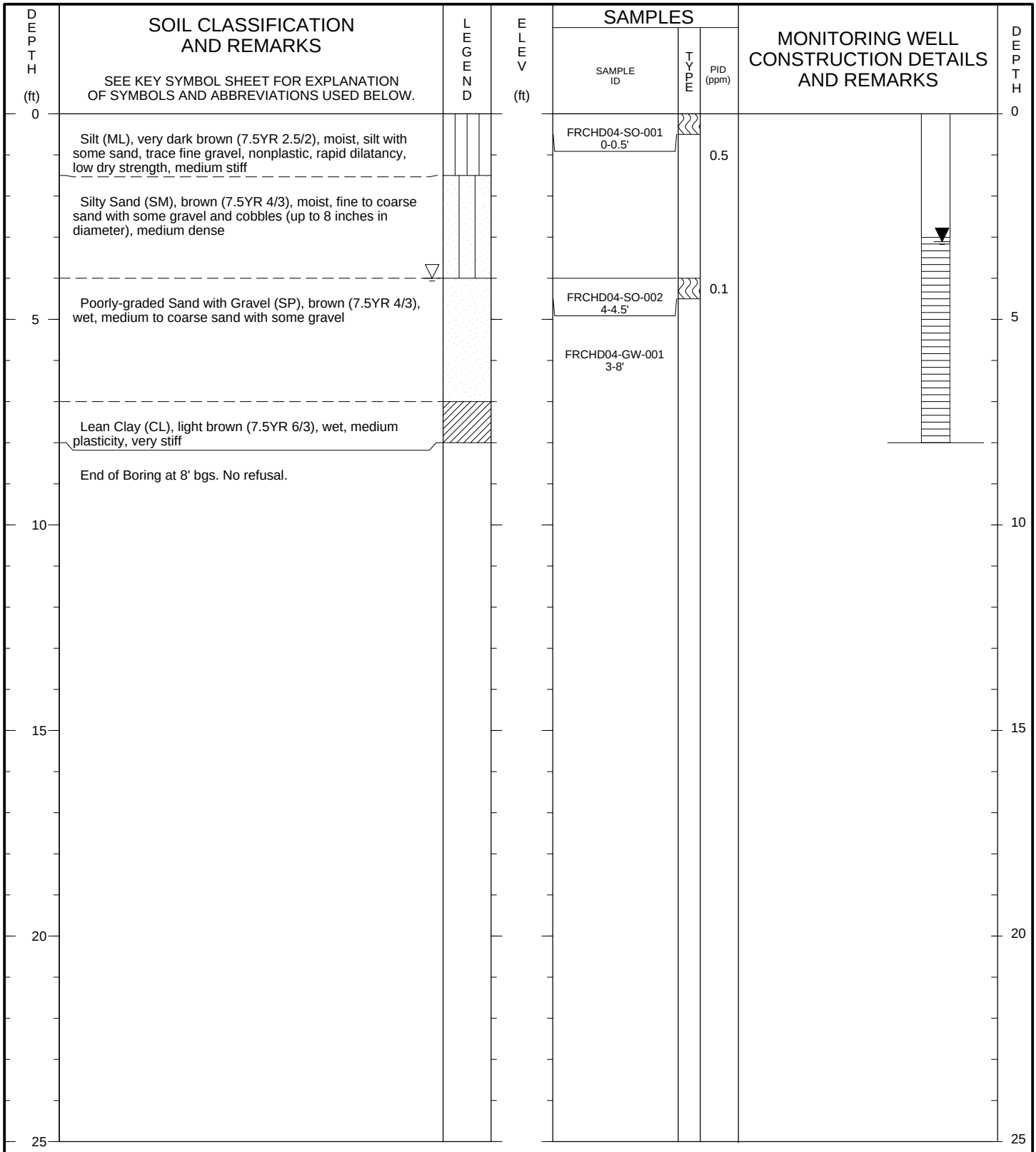
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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD03-SB-3**

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Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17



START DATE:	5/11/2017	GROUND ELEVATION:	NA ft.
END DATE:	5/11/2017		(Source: USDA, Service Center Agencies
DRILLER:	EWE		10m Digital Elevation Model)
EQUIPMENT:	5400 Geoprobe DPT	VERTICAL DATUM:	NAVD88
METHOD:	Geoprobe Direct Push	NORTHING:	17300357.96 ft.
HOLE DIA.:	2-inch	EASTING:	1480081.933 ft.
SITE:	AFFF Area 4	HORIZONTAL DATUM:	
LOGGED BY:	J. Fassio		WGS84 UTM Zone 11 N

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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB

Project No: 775303101.0012.0300

Checked By: C. Duitman **Boring No. FRCHD04-SB-1**

amec foster wheeler

2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Silt (ML), very dark brown (7.5YR 2.5/2), moist, fine sandy silt, nonplastic, low dry strength, stiff, trace organics (rootlets)			FRCHD04-SO-003 0-0.5'		0.1		0
5	Well-graded Sand (SW), brown (7.5YR 5/4), moist, fine to coarse sand with fine gravel (~15%), dense ▽			FRCHD04-SO-004 4.5-5'		0.2		5
10	Lean Clay (CL), light brown (7.5YR 6/3), wet, medium plasticity, no dilatancy, very stiff							10
15	End of Boring at 12' bgs. No refusal.							15
20								20
25								25

START DATE: 5/11/2017
END DATE: 5/11/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFB Area 4
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17300124.77 ft.
EASTING: 1480016.815 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

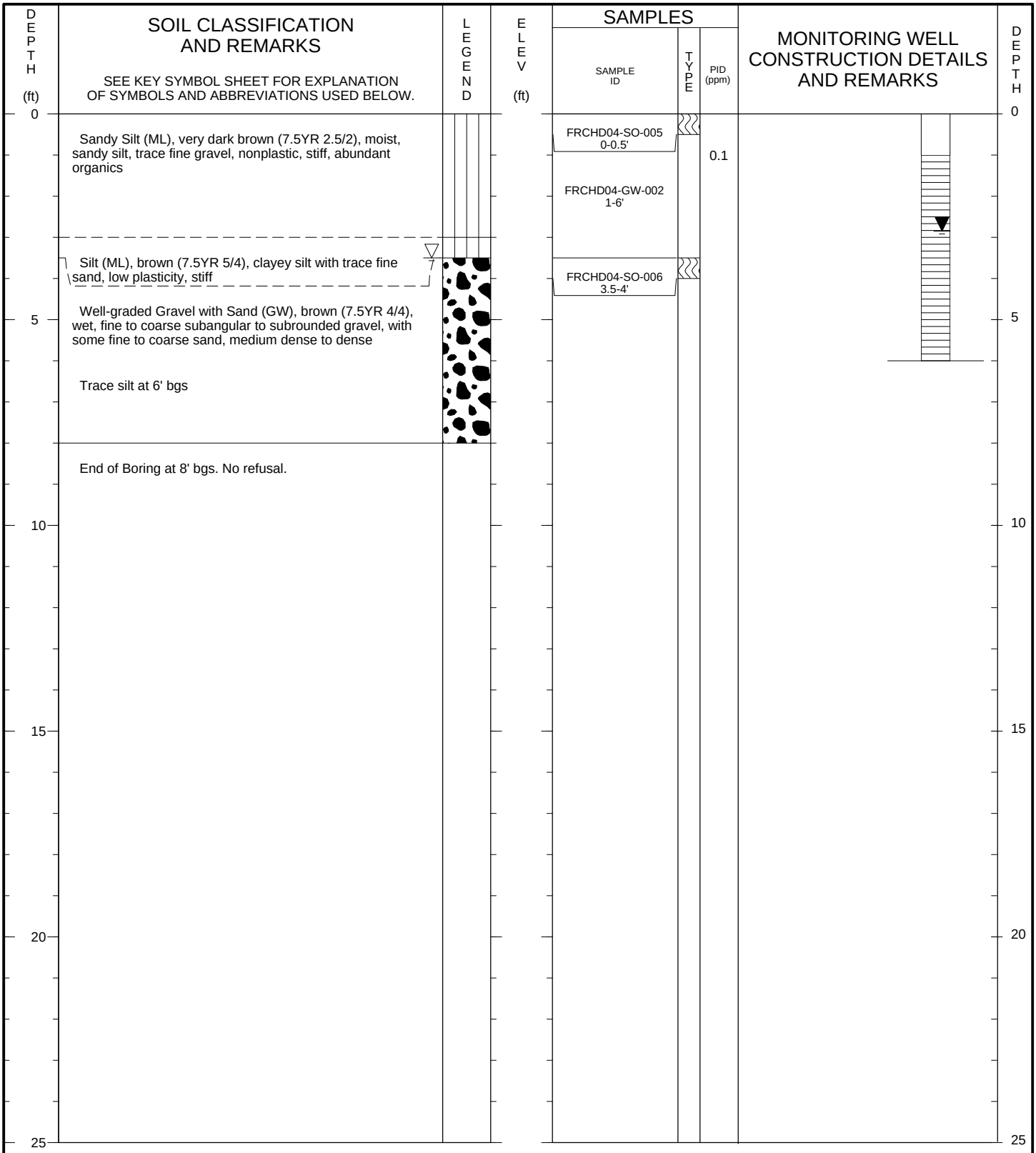
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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD04-SB-2**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17



START DATE: 5/12/2017
END DATE: 5/12/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFB Area 4
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17299899.35 ft.
EASTING: 1479985.278 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

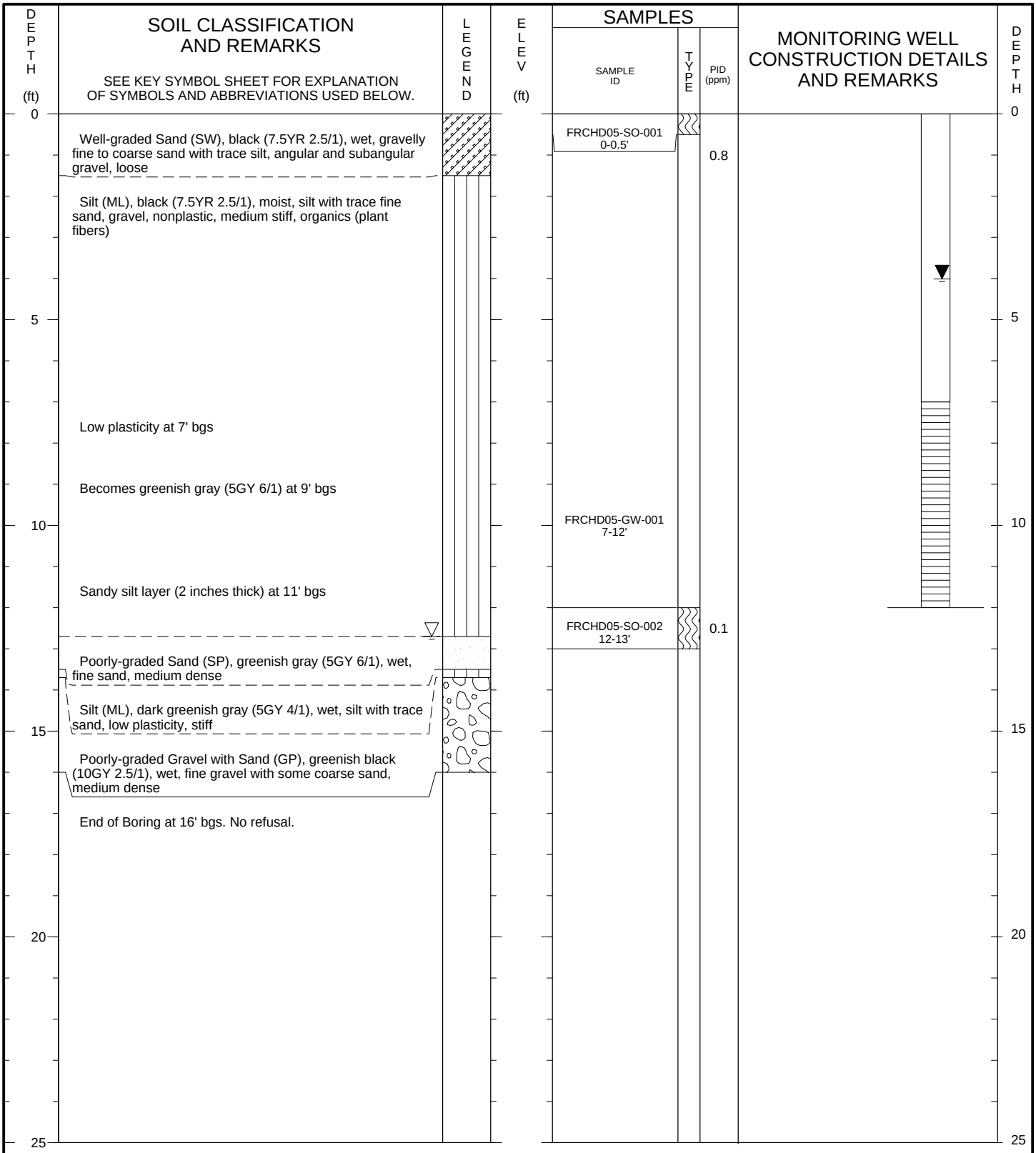
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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD04-SB-3**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17



START DATE:	5/11/2017	GROUND ELEVATION:	NA ft.
END DATE:	5/11/2017		(Source: USDA, Service Center Agencies
DRILLER:	EWE		10m Digital Elevation Model)
EQUIPMENT:	5400 Geoprobe DPT	VERTICAL DATUM:	NAVD88
METHOD:	Geoprobe Direct Push	NORTHING:	17303843.79 ft.
HOLE DIA.:	2-inch	EASTING:	1478254.81 ft.
SITE:	AFB Area 5	HORIZONTAL DATUM:	
LOGGED BY:	J. Fassio		WGS84 UTM Zone 11 N

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD05-SB-1**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	Silty Sand (SM), dark brown (7.5YR 3/3), moist, silty fine sand, loose, trace organics (rootlets)			FRCHD05-SO-003 0-0.5'		0.8		0
	Becomes gravelly, cobbles (up to 6 inches in diameter) at 1-3' bgs							
	Poorly-graded Sand (SP), dark gray (N 4/), wet, medium to coarse sand, medium dense			FRCHD05-SO-004 3-4'		0.2		
5								5
	Poorly-graded Sand with Silt (SP-SM), brown (7.5YR 4/2), wet, medium to coarse sand with some silt, dense, stiff silty clay layers (2-3 inches thick)							
	End of Boring at 8' bgs. No refusal.							
10								10
15								15
20								20
25								25

START DATE: 5/11/2017
END DATE: 5/11/2017
DRILLER: EWE
EQUIPMENT: 5400 Geoprobe DPT
METHOD: Geoprobe Direct Push
HOLE DIA.: 2-inch
SITE: AFFF Area 5
LOGGED BY: J. Fassio

GROUND ELEVATION: NA ft.
(Source: USDA, Service Center Agencies 10m Digital Elevation Model)
VERTICAL DATUM: NAVD88
NORTHING: 17303807.33 ft.
EASTING: 1478156.719 ft.
HORIZONTAL DATUM: WGS84 UTM Zone 11 N

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SOIL BORING / MONITORING WELL RECORD

Project: Fairchild AFB
Project No: 775303101.0012.0300
Checked By: C. Duitman **Boring No. FRCHD05-SB-2**

amec foster wheeler
2030 Falling Waters Road
Suite 300
Knoxville, TN 37922

AMEC SOIL-ROCK-MWELL ENVI 02 775303101.0012.0300.GPJ AMECFW TEMPLATE.GDT 11/22/17

APPENDIX B-5

SOIL SAMPLE COLLECTION FORMS

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SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/09/17
Location ID:	FRCHD01-SB-1	**End Date:**	05/09/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD01-SO-001	05/10/17 13:30	4.5 - 5.5	SM	
FRCHD01-SO-002	5/10/2017 13:37	7 - 8	ML	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA Mod 537)
Sample Container Type(s):	250 mlpoly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **9/26/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/10/17
Location ID:	FRCHD01-SB-2	**End Date:**	05/10/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD01-SO-003	05/10/17 14:00	0 - 0.5	SW	
FRCHD01-SO-004	05/10/17 14:20	6 - 7	SM	
FRCHD01-C-1	05/10/17 14:00	0 - 0.5	SW	
FRCHD01-C-2	05/10/17 14:30	0.5 - 8	SM	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA Mod 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **9/26/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/10/17
Location ID:	FRCHD02-SB-1	**End Date:**	05/10/17
Technician(s):	Joe Fassio and Bill McFarland		

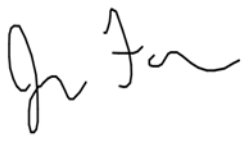
Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD02-SO-001	05/09/17 12:15	0 - 0.5	SP	
FRCHD02-SO-002	05/10/17 12:30	7 - 8	SM	
FRCHD-FD-SO-02	5/9/2017 12:16	0 - 0.5	SP	
FRCHD02-C-1	5/9/17 12:17	0 - 0.5	SM	
FRCHD02-C-2	5/10/17 12:45	0.5 - 8.0	SM	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA Mod 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

FRCHD-FD-SO-02 duplicate

Signature:



Notes:

Boring moved to south further away from power line.

Name (print)**:**

Joe Fassio

QA/QC'd by:	**Beth Flynn**	**QA/QC Date:**	**9/26/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/09/17
Location ID:	FRCHD02-SB-2	**End Date:**	05/10/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD02-SO-003	05/09/17 12:00	0 - 0.5	SP	
FRCHD02-SO-004	05/10/17 10:48	7 - 8	SP	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFCs (EPA 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	TRIZMA, Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **9/26/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/11/17
Location ID:	FRCHD03-SB-1	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

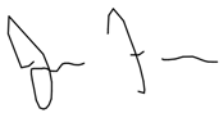
Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD03-SO-001	05/11/17 10:20	2.5 - 3	SP	
FRCHD03-SO-002	05/11/17 10:50	6 - 7	SP	
FRCHD03-C-1	5/11/2017 10:20	0 - 0.5	SP	
FRCHD03-C-2	5/11/2017 14:50	0.5 - 7.5	SM	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA Mod 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

FRCHD-FB02 at 10:49

Signature:



Notes:

Asphalt surface

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **8/4/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD03-SB-2	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD03-SO-003	05/08/17 10:00	0 - 0.5	SP-SM	
FRCHD03-SO-004	05/11/17 11:45	6 - 7	SM	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS(EPA Mod 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **8/4/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD03-SB-3	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

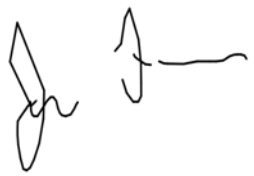
Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD03-SO-005	05/08/17 13:08	0 - 0.5	SP	
FRCHD03-SO-006	05/11/17 12:55	6.5 - 7.5	SP	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA 537 Mod)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **8/4/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD04-SB-1	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

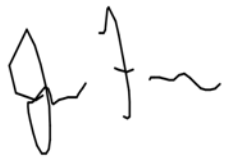
Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD04-SO-001	05/08/17 14:18	0 - 0.5	ML	
FRCHD04-SO-002	05/11/17 14:40	4 - 4.5	SP	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA 537 Mod)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

MS/MSD collected for surface and subsurface samples.

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **8/4/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD04-SB-2	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD04-SO-003	05/08/17 14:30	0 - 0.5	ML	
FRCHD04-SO-004	05/11/17 13:50	4.5 - 5	SW	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS (EPA 537 Mod)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD05-SB-1	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD05-SO-001	05/08/17 12:40	0 - 0.5	SW	
FRCHD-FD-SO-01	05/08/17 12:41	0 - 0.5	SW	
FRCHD05-SO-002	05/11/17 09:15	12 - 13	SP	
FRCHD-FD-SO-03	05/11/17 09:16	12 - 13	SP	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFAS(EPA 537 Mod)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

FRCHD-EB2 at 9:16

Signature:



Notes:

Boring at drainage curb cut.

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD05-SB-2	**End Date:**	05/11/17
Technician(s):	Joe Fassio and Bill McFarland		

Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD05-SO-003	05/08/17 12:55	0 - 0.5	SM	
FRCHD05-C-1	05/08/17 13:15	0 - 0.5	SM	
FRCHD05-SO-004	05/11/17 09:40	3 - 4	SP	
FRCHD05-C-2	05/11/17 12:16	0.5 - 13	SM	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFCs (EPA 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

None

Signature:



Notes:

Boring move 3 to 4 feet from sewer line

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

SOIL SAMPLE COLLECTION LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Start Date:**	05/08/17
Location ID:	FRCHD04-SB-3	**End Date:**	05/12/17
Technician(s):	Joe Fassio and Bill McFarland		

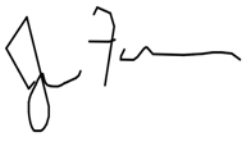
Sample ID	Sample Date/Time	Sample Depth (ft)	USCS Symbol	Comments/Observations
FRCHD04-SO-005	05/08/17 14:40	0 - 0.5	ML	
FRCHD04-C-1	05/08/17 14:50	0 - 0.5	ML	
FRCHD04-SO-006	05/12/17 08:45	3.5-4.0	GW	
FRCHD04-C-2	05/12/17 08:50	0.5 - 5	SW	

Sample Collection Method:	DPT	**Analysis/Method(s):**	PFCs (EPA 537)
Sample Container Type(s):	250 ml poly	**Preservative(s):**	Ice (4 °C)

Associated Blank Samples:

FRCHD-EB01 at 15:30 on 5/8/17

Signature:



Notes:

None

Name (print)**:**

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

APPENDIX B-6

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORMS

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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	02/14/17
Installation:	FRCHD			**Calibration Start Time:**	07:49
Sample Technician(s):	Joe Fassio. Bill McFarland			**Calibration End Time:**	08:24

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
02/13/17	15:00	Na	3.89	9.50	1.334	10.76	Na	242.9	757	None
			7.18	20.8						
			9.40	100.8						
				820						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
02/14/17	07:51	Na	3.99	9.94	1.412	10.02	Na	241.5	757	None
			7.00	20.2						
			10.01	101.0						
				812						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6gg264	08/14/18
pH (7)	6gl570	12/31/18
pH (10)	6gb188	02/28/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	6gl243	03/31/17
Salinity	Na	02/14/17
D.O.	Na	02/14/17
ORP	0207	05/31/21

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
10	A5358	03/14/17
20	A6009	04/14/17
100	A6013	04/14/17
800	A5359	03/14/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	13j102654
Turbidity Meter:	Hach 2100Q	140806034707

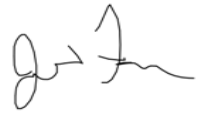
Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:



Name (print): Joe Fassio

QA/QC'd by: Beth Flynn **QA/QC Date:** 11/20/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	2/15/2017
Installation:	FRCHD			**Calibration Start Time:**	07:49
Sample Technician(s):	Joe Fassio. Bill McFarland			**Calibration End Time:**	08:24

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
02/13/17	15:00	Na	3.89	9.50	1.334	10.76	Na	242.9	757	None
			7.18	20.8						
			9.40	100.8						
				820						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
02/14/17	07:51	Na	3.99	9.94	1.412	10.02	Na	241.5	757	None
			7.00	20.2						
			10.01	101.0						
				812						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6gg264	08/14/18
pH (7)	6gl570	12/31/18
pH (10)	6gb188	02/28/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	6gl243	03/31/17
Salinity	Na	02/14/17
D.O.	Na	02/14/17
ORP	A0207	05/31/21

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
10	A5358	03/14/17
20	A6009	04/14/17
100	A6013	04/14/17
800	A5359	03/14/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	13j102654
Turbidity Meter:	Hach 2100Q	140806034707

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes: None

Signature: 

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn **QA/QC Date:** 11/20/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	05/08/17
Installation:	FRCHD			**Calibration Start Time:**	04:49
Sample Technician(s):	Joe Fassio and Bill McFarland			**Calibration End Time:**	05:47

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/08/17	04:59	18.08	3.97	0.37	Na	9.44	Na	244.1	703.5	Na
			7.02	14.9						
			9.87	103						
				755						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/08/17	05:47	18.64	4.00	0.43	1406	8.77	Na	240.1	703.5	Na
			7.00	14.6						
			9.98	102						
				745						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	F158-8	06/14/18
pH (7)	G037-23	02/13/18
pH (10)	6020-23	01/19/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	06062-1	01/17/19
Salinity	Na	05/08/17
D.O.	Na	05/08/17
ORP	G062-18	03/08/18

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
<0.1	C690745	08/01/17
15	C688406	08/01/17
100	C687762	08/01/17
750	C690772	08/01/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	08e100694
Turbidity Meter:	Hanna HI 98703	8266503

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:



Name (print): Joe Fassio

QA/QC'd by: Teresa Wilson **QA/QC Date:** 2/6/2018

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	05/09/17
Installation:	FRCHD			**Calibration Start Time:**	06:02
Sample Technician(s):	Joe Fassio and Bill McFarland			**Calibration End Time:**	06:25

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/09/17	06:02	18.97	4.02	0.13	1.221	9.03	Na	242.6	700.4	None
			7.27	14.9						
			9.49	98.6						
				749						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/09/17	06:25	18.71	4.00	0.21	1.409	8.75	Na	248.8	700.4	None
			7.00	15.0						
			9.89	99.8						
				750						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	F158-8	06/14/18
pH (7)	G037-23	02/13/18
pH (10)	6020-23	01/19/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	06062-1	12/19/19
Salinity	Na	05/09/17
D.O.	Na	05/09/17
ORP	G062-18	03/08/18

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
<0.1	C690745	08/01/17
15	C688406	08/01/17
100	C687762	08/01/17
750	C690772	08/01/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	08e100694
Turbidity Meter:	Hanna HI 98703	8266503

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:



Name (print): Joe Fassio

QA/QC'd by: Beth Flynn **QA/QC Date:** 9/26/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	05/10/17
Installation:	FRCHD			**Calibration Start Time:**	06:07
Sample Technician(s):	Joe Fassio and Bill McFarland			**Calibration End Time:**	06:32

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/10/17	06:07	19.67	3.64	0.15	1.394	8.49	Na	235.1	697.8	None
			7.21	14.9						
			9.40	99.3						
				750						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/10/17	06:32	19.40	4.00	0.16	1.406	8.63	Na	237.4	697.8	None
			7.00	15.0						
			9.89	101						
				750						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	F158-8	06/14/18
pH (7)	G037-23	02/13/18
pH (10)	6020-23	01/19/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	06062-1	12/19/19
Salinity	Na	05/10/17
D.O.	Na	05/10/17
ORP	G062-18	03/08/18

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
<0.1	C690745	08/01/17
15	C688406	08/01/17
100	C687762	08/01/17
750	C690772	08/01/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	08e100694
Turbidity Meter:	Hanna HI 98703	8266503

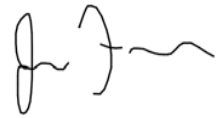
Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:



Name (print): Joe Fassio

QA/QC'd by: Beth Flynn **QA/QC Date:** 9/26/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	05/11/17
Installation:	FRCHD			**Calibration Start Time:**	06:16
Sample Technician(s):	Joe Fassio and Bill McFarland			**Calibration End Time:**	06:36

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/11/17	06:16	20.51	3.61	0.18	1.306	8.98	Na	227.0	269.5	None
			7.47	15.0						
			9.39	99.0						
				751						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/11/17	06:36	20.73	4.00	0.15	1.409	8.41	Na	236.2	269.5	None
			7.00	15.0						
			9.88	100						
				750						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	F158-8	06/14/18
pH (7)	G037-23	02/13/18
pH (10)	6020-23	01/19/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	06062-1	12/19/19
Salinity	Na	05/11/17
D.O.	Na	05/11/17
ORP	G062-18	03/08/18

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
<0.1	C690745	08/01/17
15	C688406	08/01/17
100	C687762	08/11/17
750	C690772	08/11/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	08e100694
Turbidity Meter:	Hanna HI 98703	8266503

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

No cal solution for salinity

Signature:



Name (print): Joe Fassio

QA/QC'd by: Beth Flynn **QA/QC Date:** 9/26/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide			**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004	**Date:**	05/12/17
Installation:	FRCHD			**Calibration Start Time:**	06:27
Sample Technician(s):	Joe Fassio and Bill McFarland			**Calibration End Time:**	06:28

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/12/17	06:00	19.71	3.76	0.25	1.350	11.21	Na	239.3	698.1	None
			7.21	15.2						
			9.53	102						
				752						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
05/12/17	06:27	19.72	4.00	0.20	1.406	8.46	Na	237.5	698.1	None
			7.00	14.9						
			9.91	99.0						
				752						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	F158-8	06/14/18
pH (7)	G037-23	02/13/18
pH (10)	6020-23	01/19/18

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	06062-1	12/19/19
Salinity	Na	05/12/17
D.O.	Na	05/12/17
ORP	G062-18	03/08/18

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
<0.1	C690745	08/01/17
15	C688406	08/01/17
100	C687762	08/01/17
750	C690772	08/01/17

Instruments (Manufacturer, Model, and Serial No.):

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	08e100694
Turbidity Meter:	Hanna HI 98703	8266503

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:



Name (print): Bill McFarland

QA/QC'd by: Teresa Wilson **QA/QC Date:** 2/6/2018

APPENDIX B-7

GROUNDWATER SAMPLE COLLECTION LOGS

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GROUNDWATER SAMPLING RECORD

amec foster wheeler

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-226	**Date:**	02/14/17
Initial Depth to Water (ft):	3.42	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	16.0	**1 Casing Volume (gal):**	2.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	6.2
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	15.5

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
12:53		200								Pumping/Purging Started
12:54	3.49	200	1	7.30	7.31	1.307	3.75	62.0	73.2	Clear water
12:59	3.49	200	2	6.90	7.31	1.348	2.70	63.0	45.2	
13:04	3.49	200	3	6.65	7.20	1.354	1.50	35.4	21.5	
13:09	3.49	200	4	6.91	7.22	1.379	1.09	3.0	12.3	
13:13	3.49	200	5	6.66	7.11	1.390	1.08	-9.0	10.3	
13:18	3.49	200	6	6.65	7.13	1.378	1.09	-14.9	9.62	
13:23	3.49	200	7	6.69	7.09	1.394	0.99	-20.9	5.56	
13:28	3.49	200	8	6.52	7.04	1.400	0.96	-26.4	5.47	
13:33	3.49	200	9	6.60	7.04	1.397	0.96	-27.0	5.25	
13:37	3.49	200	10	6 64	6.95	1.391	0.98	-25.3	4.94	
Stability Reached (Y/N):			Yes		If No, Provide Explanation				NA	
			Final Values:	**6 64**	**6.95**	**1.391**	**0.98**	**-25.3**	**4.94**	

Sample ID:	FRCH01-003	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes MS/MSD	**Sample Date:**	02/14/17
Duplicate ID:	NA	**Sample Collection Time:**	13:37
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	2.6
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	15.5 - 15.5
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	3.49

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 12.58 * 7.48 gal/ft^3
= 2.1 gal.

Signature:

Notes:

None

Name (print):

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

GROUNDWATER SAMPLING RECORD

amec foster wheeler

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-226	**Date:**	02/14/17
Initial Depth to Water (ft):	3.42	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	16.0	**1 Casing Volume (gal):**	2.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	6.2
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	15.5

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
			Stabilization Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
12:53		200								Pumping/Purging Started
12:54	3.49	200	1	7.30	7.31	1.307	3.75	62.0	73.2	Clear water
12:59	3.49	200	2	6.90	7.31	1.348	2.70	63.0	45.2	
13:04	3.49	200	3	6.65	7.20	1.354	1.50	35.4	21.5	
13:09	3.49	200	4	6.91	7.22	1.379	1.09	3.0	12.3	
13:13	3.49	200	5	6.66	7.11	1.390	1.08	-9.0	10.3	
13:18	3.49	200	6	6.65	7.13	1.378	1.09	-14.9	9.62	
13:23	3.49	200	7	6.69	7.09	1.394	0.99	-20.9	5.56	
13:28	3.49	200	8	6.52	7.04	1.400	0.96	-26.4	5.47	
13:33	3.49	200	9	6.60	7.04	1.397	0.96	-27.0	5.25	
13:37	3.49	200	10	6 64	6.95	1.391	0.98	-25.3	4.94	

Stability Reached (Y/N): Yes   If No, Provide Explanation NA

Final Values:	Temp.	pH	Cond.	DO	ORP	Turbidity
	6 64	**6.95**	**1.391**	**0.98**	**-25.3**	**4.94**

Sample ID:	FRCHD01-GW-003	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes MS/MSD	**Sample Date:**	02/14/17
Duplicate ID:	NA	**Sample Collection Time:**	13:37
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	2.6
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	15.5 - 15.5
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	3.49

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes   Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 12.58 * 7.48 gal/ft^3
= 2.1 gal.

Signature:

Notes: None

Name (print): Joe Fassio

QA/QC'd by: **Beth Flynn**   **QA/QC Date:** **11/20/2017**

GROUNDWATER SAMPLING RECORD

amec foster wheeler

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-226	**Date:**	02/14/17
Initial Depth to Water (ft):	3.42	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	16.0	**1 Casing Volume (gal):**	2.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	6.2
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	15.5

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
12:53		200								Pumping/Purging Started
12:54	3.49	200	1	7.30	7.31	1.307	3.75	62.0	73.2	Clear water
12:59	3.49	200	2	6.90	7.31	1.348	2.70	63.0	45.2	
13:04	3.49	200	3	6.65	7.20	1.354	1.50	35.4	21.5	
13:09	3.49	200	4	6.91	7.22	1.379	1.09	3.0	12.3	
13:13	3.49	200	5	6.66	7.11	1.390	1.08	-9.0	10.3	
13:18	3.49	200	6	6.65	7.13	1.378	1.09	-14.9	9.62	
13:23	3.49	200	7	6.69	7.09	1.394	0.99	-20.9	5.56	
13:28	3.49	200	8	6.52	7.04	1.400	0.96	-26.4	5.47	
13:33	3.49	200	9	6.60	7.04	1.397	0.96	-27.0	5.25	
13:37	3.49	200	10	6 64	6.95	1.391	0.98	-25.3	4.94	
Stability Reached (Y/N):				Yes		If No, Provide Explanation			NA	
			Final Values:	**6 64**	**6.95**	**1.391**	**0.98**	**-25.3**	**4.94**	

Sample ID:	FRCH01-GW-003	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes MS/MSD	**Sample Date:**	02/14/17
Duplicate ID:	NA	**Sample Collection Time:**	13:37
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	2.6
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	15.0 - 16
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	3.49

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes   Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 12.58 * 7.48 gal/ft^3
= 2.1 gal.

Signature: [signature]

Notes:

None

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn   **QA/QC Date:** 11/20/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-225	**Date:**	02/14/17
Initial Depth to Water (ft):	3.61	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	16.0	**1 Casing Volume (gal):**	2.0
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	6.1
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	11

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
08:45		200								Pumping/Purging Started
08:48	3.65	200	1.00	3.56	6.81	1.431	7.45	120.4	354	Brown
08:53	3.65	200	2	4.36	6.63	1.303	2.02	29.7	200	Brown
09:00	3.65	200	3	4.02	6.68	1.294	0.78	-10.6	155	Brown
09:06	3.65	200	4	4.04	6.65	1.296	0.66	-26.0	142	Brown
09:11	3.65	200	5	3.61	6.74	1.298	0.52	-37.4	110	Brown
09:16	3.65	200	6	3.55	6.76	1.304	0.51	-38.0	75.2	Iron fouling
09:22	3.65	200	7	4.08	6.81	1.304	0.60	-52.0	70.5	Iron fouling
09:28	3.65	200	8	3.98	6.63	1.298	0.55	-53.6	74.3	Iron fouling
09:34	3.65	200	9	4.25	6.68	1.299	0.77	-63.7	81.3	Iron fouling
09:39	3.65	200	10	4.14	6.86	1.316	0.77	-66.7	67.1	
09:47	3.65	200	11.8	4.21	6.86	1.310	0.67	-68.7	59	
09:52	3.65	200	13	4.48	6.95	1.318	0.53	-71.3	57.8	
09:59	3.65	200	14.4	4.59	6.98	1.315	0.51	-73.4	52.2	
10:06	3.65	200	16	4.81	6.98	1.311	0.41	-77.8	64.3	
10:11	3.65	200	17	5.28	6.93	1.313	0.43	-76.3	52.7	
10:16	3.65	200	18	5.80	6.99	1.304	0.45	-76.6	41.9	
10:21	3.65	200	19	5.96	7.03	1.309	0.45	-80.4	54.1	
10:27	3.65	200	20.2	5.56	7.01	1.306	0.42	-81.5	40.8	
10:32	3.65	200	21.2	5.80	6.94	1.315	0.44	-83.8	41.8	
10:37	3.65	200	22.2	5.51	7.04	1.315	0.49	-86.2	42.8	
10:42	3.65	200	23.2	5.71	7.09	1.315	0.44	-85.0	33.6	Clear, no color
10:47	3.65	200	24.2	5.82	7.09	1.316	0.35	-79.3	34.9	
10:53	3.65	200	25.4	6.14	7.11	1.316	0.30	-76.0	18.8	
11:01	3.65	200	27	6.21	7.11	1.322	0.30	-77.1	17.6	
11:08	3.65	200	28.4	5.85	7.10	1.319	0.52	-85.0	14.0	
11:14	3.65	200	29.6	5.70	7.13	1.315	0.41	-82.7	14.7	
11:20	3.65	200	30.8	5.6	7.11	1.318	0.36	-79.1	13.1	
11:27	3.65	200	32.2	5.97	7.12	1.313	0.37	-79.5	13.8	
11:35	3.65	200	33.6	6.70	7.16	1.312	0.32	-81.5	10.9	
11:42	3.65	200	34.2	6.41	7.16	1.313	0.31	-86.4	9.67	

Stability Reached (Y/N): Other (some do not stabilize) If No, Provide Explanation Other (some do not stabilize) -

Final Values:	**6.41**	**7.16**	**1.313**	**0.31**	**-86.4**	**9.67**

Sample ID:	FRCHD01-GW-002	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes DUP	**Sample Date:**	02/14/17
Duplicate ID:	FRCHD01-DUP01	**Sample Collection Time:**	11:42
Sample Container Type(s):	250 ml poly	**Total Volume Purged (gal):**	10 gallons
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	6.0 - 16.0
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	3.65

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13j02654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 12.39 * 7.48 gal/ft^3
= 2.0 gal.

Signature:



Notes:

Purge volume measured in liters

34.2

Name (print):

Joe Fassio

QA/QC'd by: **Beth Flynn** **QA/QC Date:** **11/20/2017**

GROUNDWATER SAMPLING RECORD

amec foster wheeler

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-50	**Date:**	02/15/17
Initial Depth to Water (ft):	3.89	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	16.0	**1 Casing Volume (gal):**	2.0
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	6.0
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	11

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
09:49		200								Pumping/Purging Started
09:51	3.89	200	1	3.45	7.33	1.377	6.35	167.8	2.06	Clear
09:57	3.89	200	2.2	4.25	7.39	1.460	2.18	158.2	1.43	
10:03	3.89	200	3.2	4.13	7.32	1.441	1.71	156.0	1.15	
10:08	3.89	200	4.2	4.35	7.30	1.442	1.72	154.3	1.22	
10:14	3.89	200	4.4	4.32	7.30	1.447	1.67	152.6	1.27	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	4.32	7.30	1.447	1.67	152.6	1.27

Sample ID:	FRCHD01-GW-004	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	02/15/17
Duplicate ID:	NA	**Sample Collection Time:**	10:14
Sample Container Type(s):	250 ml poly	**Total Volume Purged (gal):**	1.5
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	6.0 - 16.0
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	3.89

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 12.11 * 7.48 gal/ft^3
= 2.0 gal.

Signature: [signature]

Notes: None

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn — **QA/QC Date:** 11/20/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-100	**Date:**	02/15/17
Initial Depth to Water (ft):	4.32	**Well Diameter (in):**	4.0
Total Depth of Well (ft):	53.3	**1 Casing Volume (gal):**	32.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	96.4
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	48

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
08:20		2002.5								Pumping/Purging Started
08:22	4.33	200	1	5.46	8.30	1.477	9.58	246.3	18.4	Clear
08:27	4.33	200	2	5.16	7.55	1.459	5.04	249.3	6.78	
08:32	4.33	200	3	4.54	7.42	1.461	3.91	252.8	6.01	
08:37	4.33	200	4	4.79	7.39	1.444	2.61	239.0	6.15	
08:42	4.33	200	5	5.39	7.37	1.443	2.57	216.6	5.98	
08:47	4.33	200	6	5.27	7.36	1.451	1.51	212.5	6.21	
08:53	4.33	200	7	4.96	7.33	1.456	1.21	206.8	3.11	
08:59	4.33	200	8	4.62	7.35	1.461	1.18	198.7	2.90	
09:05	4.33	200	9	4.67	7.36	1.457	1.16	198.8	2.88	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	**4.67**	**7.36**	**1.457**	**1.16**	**198.8**	**2.88**

Sample ID:	FRCHD01-GW-005	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	02/15/17
Duplicate ID:	NA	**Sample Collection Time:**	09:06
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	2.5
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	48.0 - 48.0
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	4.33

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (4.0 (in)/12 (in/ft))/2)^2 * 48.98 * 7.48 gal/ft^3
= 32.1 gal.

Signature:

Notes: None

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn — **QA/QC Date:** 11/20/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-3	**Date:**	02/15/17
Initial Depth to Water (ft):	5.4	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	9.0	**1 Casing Volume (gal):**	0.6
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	1.8
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	6.5

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:48		200								Pumping/Purging Started
11:53	5.44	200	1	2.30	7.46	1.804	4.70	65.0	34.1	
12:00	5.44	200	2.4	1.97	7.29	1.773	2.80	46.1	21.5	
12:05	5.44	200	3.4	1.39	7.16	1.629	2.03	30.9	22.2	
12:12	5.44	200	4.4	1.11	7.14	1.602	1.66	15.1	25.5	
12:17	5.44	200	5.4	1.03	7.11	1.589	1.47	7.5	24.6	
12:22	5.44	200	6.4	0.99	7.08	1.576	1.47	3.7	22.4	
12:27	5.44	200	7.4	0.99	7.03	1.561	1.40	1.1	20.1	
12:33	5.44	200	8.6	0.98	7.02	1.569	1.36	-1.8	19.8	
12:38	5.44	200	9.6	1.03	7.00	1.575	1.36	-4.0	20.2	
12:43	5.44	200	10.6	1.03	7.02	1.574	1.30	-7.6	19.4	
12:49	5.44	200	11.8	1.10	7.01	1.561	1.29	-10.5	19.4	
12:55	5.44	200	13.0	1.10	7.02	1.551	1.24	-14.1	14.1	
13:01	5.44	200	14.2	1.12	7.01	1.543	1.22	-16.6	12.2	
13:06	5.44	200	15.2	1.13	7.01	1.538	1.20	-19.0	11.0	
13:11	5.44	200	16.2	1.14	7.00	1.540	1.18	-20.1	9.81	
13:16	5.44	200	17.2	1.15	7.01	1.539	1.17	-22.1	9.10	
13:22	5.44	200	18.4	1.08	7.00	1.538	1.20	-24.5	8.59	
13:31	5.44	200	20.0	1.04	6.99	1.520	1.14	-27.4	5.81	

Stability Reached (Y/N): Other (some do not stabilize) — If No, Provide Explanation: Other (some do not stabilize) - Orp and turbidity not stabile

Final Values:	**1.04**	**6.99**	**1.520**	**1.14**	**-27.4**	**5.81**	

Sample ID:	FRCHD01-GW-001	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	02/15/17
Duplicate ID:	NA	**Sample Collection Time:**	13:31
Sample Container Type(s):	250 ml poly	**Total Volume Purged (gal):**	5.0
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	3.5 - 9
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	5.44

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 3.60 * 7.48 gal/ft^3
= 0.6 gal.

Signature:



Notes:

Parameters did not reached stability after 3 well volume and an hour of purging. Purge volume measured in liters. Collected field blank with sample FRCHD01-BLK-001at 13:45 using PFC free water Maxxam batch B708146.

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn — **QA/QC Date:** 9/26/2017

amec foster wheeler

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio. Bill McFarland
Well ID:	MW-100	**Date:**	02/15/17
Initial Depth to Water (ft):	4.32	**Well Diameter (in):**	4.0
Total Depth of Well (ft):	53.3	**1 Casing Volume (gal):**	32.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	96.4
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	48

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
08:20		200								Pumping/Purging Started
08:22	4.33	200	1	5.46	8.30	1.477	9.58	246.3	18.4	Clear
08:27	4.33	200	2	5.16	7.55	1.459	5.04	249.3	6.78	
08:32	4.33	200	3	4.54	7.42	1.461	3.91	252.8	6.01	
08:37	4.33	200	4	4.79	7.39	1.444	2.61	239.0	6.15	
08:42	4.33	200	5	5.39	7.37	1.443	2.57	216.6	5.98	
08:47	4.33	200	6	5.27	7.36	1.451	1.51	212.5	6.21	
08:53	4.33	200	7	4.96	7.33	1.456	1.21	206.8	3.11	
08:59	4.33	200	8	4.62	7.35	1.461	1.18	198.7	2.90	
09:05	4.33	200	9	4.67	7.36	1.457	1.16	198.8	2.88	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	**4.67**	**7.36**	**1.457**	**1.16**	**198.8**	**2.88**

Sample ID:	FRCH01-GW-005	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	02/15/17
Duplicate ID:	NA	**Sample Collection Time:**	09:06
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	9
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	43.0 - 53.0
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	4.33

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID, Peristaltic Pump
Hach 2100Q 1408006034707, YSI 556 MPS 13J102654

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (4.0 (in)/12 (in/ft))/2)^2 * 48.98 * 7.48 gal/ft^3
= 32.1 gal.

Signature: Joe Fassio

Notes: None

Name (print): Joe Fassio

QA/QC'd by: Beth Flynn — **QA/QC Date:** 11/20/2017

GROUNDWATER SAMPLING RECORD

amec foster wheeler

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	MW 399	**Date:**	05/08/17
Initial Depth to Water (ft):	6.88	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	17.0	**1 Casing Volume (gal):**	1.7
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	5.0
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	15.0

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
			Stabilization Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:25		200								Pumping/Purging Started
11:28	6.88	200	Cell	12.32	7.20	1195	5.11	82.7	265	Cloudy
11:33	6.89	200	0.25	11.64	6.71	1145	1.14	101.0	142	
11:38	6.90	200	0.50	11.67	6.61	1141	0.75	98.8	62.1	
11:43	6.90	200	0.75	11.57	6.65	1129	0.77	94.9	30.7	
11:48	6.90	200	1.00	11.75	6.75	1121	0.83	87.9	16.5	
11:53	6.91	200	1.25	11.75	6.79	1121	0.84	82.8	11.8	
11:58	6.91	200	1.50	11.90	6.83	1126	0.81	78.2	6.30	
12:03	6.91	200	1.75	11.83	6.82	1126	0.77	75.3	4.07	
12:08	6.91	200	2.00	11.86	6.84	1132	0.78	75.0	4.14	
12:13	6.91	200	2.25	11.82	6.83	1130	0.75	75.6	3.83	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	**11.82**	**6.83**	**1130**	**0.75**	**75.6**	**3.83**

Sample ID:	FRCHD05-GW-002	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes MS/MSD	**Sample Date:**	05/08/17
Duplicate ID:	NA	**Sample Collection Time:**	12:15
Sample Container Type(s):	250 ml	**Total Volume Purged (gal):**	2.25
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	7.0 - 17.0
Analysis/Method(s):	PFCs (EPA 537)	**Depth to Water After Sampling (ft):**	6.91

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, PID
Hanna Hi 98703 08213804, YSI 556 MPS 08e100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 10.12 * 7.48 gal/ft^3
= 1.7 gal.

Signature: [signature]

Notes: None

Name (print): Bill McFarland

QA/QC'd by: Beth Flynn **QA/QC Date:** 8/23/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	MW_265	**Date:**	05/09/17
Initial Depth to Water (ft):	9.15	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	20.0	**1 Casing Volume (gal):**	1.8
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	5.3
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	15

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
15:11		200								Pumping/Purging Started
15:13	9.19	200	Cell	12.55	7.46	867	8.82	67.0	3.49	
15:18	9.19	200	.25	12.36	7.26	865	7.33	71.0	4.05	
15:23	9.19	200	.50	12.24	6.91	858	6.61	83.4	5.48	
15:28	9.19	200	.75	12.23	6.83	858	6.51	88.4	3.23	
15:33	9.19	200	1.0	12.18	6.75	859	6.48	88.9	3.33	
15:38	9.19	200	1.25	12.22	6.75	859	6.56	90.13	3.17	
15:43	9.19	200	1.50	12.21	6.78	863	6.51	90.17	3.20	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**12.21**	**6.78**	**863**	**6.51**	**90.17**	**3.20**

Sample ID:	FRCHD03-GW-002	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/09/17
Duplicate ID:	NA	**Sample Collection Time:**	15:45
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.50
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	10.0 - 20.0
Analysis/Method(s):	PFAS (EPA Mod 537)	**Depth to Water After Sampling (ft):**	9.19

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 10.85 * 7.48 gal/ft^3
= 1.8 gal.

Signature:



Notes:

Well cap was found broken and in pieces when monument was opened. All we had at that time was a nitrlie glove to cover the well.

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn — **QA/QC Date:** 9/26/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	MMW_1023-1	**Date:**	05/09/17
Initial Depth to Water (ft):	8.14	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	25.0	**1 Casing Volume (gal):**	2.8
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	8.3
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	22

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
14:13		200								Pumping/Purging Started
14:16	8.31	200	Cell	12.40	7.17	642	5.40	104.9	2.86	
14:21	8.32	200	.25	12.05	5.98	643	3.50	162.1	2.11	
14:26	8.32	200	.50	12.29	6.03	640	2.74	153.3	2.16	
14:31	8.31	200	.75	12.48	6.43	641	2.62	130.5	2.56	
14:36	8.32	200	1.0	11.83	6.55	643	3.02	123.0	1.83	
14:41	8.32	200	1.25	11.63	6.44	646	3.03	126.5	1.69	
14:46	8.37	200	1.50	11.77	6.44	647	3.13	125.7	2.55	
14:51	8.39	200	1.75	11.74	6.47	646	3.16	125.9	1.86	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	11.74	6.47	646	3.16	125.9	1.86

Sample ID:	FRCHD03-GW-003	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/09/17
Duplicate ID:	NA	**Sample Collection Time:**	14:51
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.75
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	20.0 - 25.0
Analysis/Method(s):	PFAS (EPA Mod 537)	**Depth to Water After Sampling (ft):**	8.38

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 16.86 * 7.48 gal/ft^3
= 2.8 gal.

Signature: [signature]

Notes: None

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn — **QA/QC Date:** 9/26/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	MW_185	**Date:**	05/09/17
Initial Depth to Water (ft):	7.9	**Well Diameter (in):**	4.0
Total Depth of Well (ft):	65.0	**1 Casing Volume (gal):**	37.5
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	112.4
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	55

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
13:10		200								Pumping/Purging Started
13:13	7.91	200	Cell	15.02	8.12	223	4.70	160.4	7.74	
13:18	7.91	200	.25	14.87	5.57	168	1.58	241.7	10.0	
13:23	7.91	200	.50	14.43	5.32	131	0.98	228.3	7.83	
13:28	7.91	200	.75	14.44	5.50	128	0.83	208.5	4.83	
13:33	7.91	200	1.0	14.38	5.74	123	0.88	190.5	5.40	
13:38	7.91	200	1.25	14.41	5.77	121	0.90	191.7	6.05	
13:43	7.91	200	1.50	14.43	5.86	123	0.95	191.8	5.74	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**14.43**	**5.86**	**123**	**0.95**	**191.8**	**5.74**	

Sample ID:	FRCHD03-GW-004	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes	**Sample Date:**	05/09/17
Duplicate ID:	NA	**Sample Collection Time:**	13:43
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.5
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	47.0 - 62.0
Analysis/Method(s):	PFAS (EPA Mod 537)	**Depth to Water After Sampling (ft):**	9.71

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Peristaltic Pump
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (4.0 (in)/12 (in/ft))/2)^2 * 57.10 * 7.48 gal/ft^3
= 37.5 gal.

Signature:

Notes:

Field Blank collected: FRCHD-FB03

Name (print): Bill McFarland

QA/QC'd by: Beth Flynn — **QA/QC Date:** 9/26/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	FRCHD02-SB-2	**Date:**	05/10/17
Initial Depth to Water (ft):	5.9	**Well Diameter (in):**	0.5
Total Depth of Well (ft):	10.9	**1 Casing Volume (gal):**	0.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	0.2
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	8.0

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:49		100								Pumping/Purging Started
11:52	Na	100	Cell	14.30	7.80	386	3.65	45.5	OS	
11:57	Na	200	0.25	13.55	6.35	371	2.40	57.4	OS	
12:02	Na	200	0.50	13.05	6.73	377	2.85	27.5	OS	
12:07	Na	200	0.75	12.27	6.33	368	2.77	27.2	735	
12:12	Na	200	1.00	12.39	6.21	361	2.69	24.8	358	
12:17	Na	200	1.25	12.33	6.27	366	2.72	24.2	359	
12:22	Na	200	1.5	12.37	6.22	361	2.77	23.9	82.0	
12:27	Na	200	1.75	12.32	6.25	364	2.79	23.5	58.9	
12:32	Na	200	2.0	12.36	6.31	359	2.82	24.1	43.2	
12:37	Na	200	2.25	12.29	6.29	354	2.88	24.3	32.4	
12:42	Na	200	2.50	12.30	6.33	350	3.00	20.0	20.0	
12:47	Na	200	2.75	12.26	6.32	349	3.08	19.7	16.6	
12:52	Na	200	3.0	12.26	6.30	349	3.10	19.9	15.3	
12:58	Na	200	3.25	12.30	6.26	352	3.14	20.2	14.2	
13:03	Na	200	3.50	12.32	6.31	351	3.11	20.1	10.5	
13:08	Na	200	3.75	12.31	6.31	347	3.15	19.7	10.2	
13:13	Na	200	4.0	12.29	6.32	350	3.09	20.2	9.89	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**12.29**	**6.32**	**350**	**3.09**	**20.2**	**9.89**	

Sample ID:	FRCHD02-GW-001	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/10/17
Duplicate ID:	NA	**Sample Collection Time:**	13:13
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	4.0
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	5.9 - 10.9
Analysis/Method(s):	PFAS (EPA 537 Mod)	**Depth to Water After Sampling (ft):**	5.41

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (0.5 (in)/12 (in/ft))/2)^2 * 5.00 * 7.48 gal/ft^3
= 0.1 gal.

Signature:

Notes:

Turbidity: OS = Turbidity exceeded the scale/range of the meter.

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn — **QA/QC Date:** 8/4/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	MW-451	**Date:**	05/10/17
Initial Depth to Water (ft):	12.1	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	19.0	**1 Casing Volume (gal):**	1.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	3.4
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	10

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
			Stabilization Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
16:26		200								Pumping/Purging Started
16:31	12.10	200	Cell	13.85	7.73	208	5.96	-3.5	10.1	
16:36	14.13	200	1.0 liters	13.48	6.34	205	5.52	51.4	7.53	Slowed purge rate
16:41	14.62	100	1.5 liters	13.71	6.72	207	5.65	28.4	5.97	
16:46	14.81	100	2.0 liters	13.79	6.79	207	6.56	26.5	5.77	
16:51	14.85	100	2.5 liters	13.84	6.77	207	6.66	25.5	5.65	
16:56	14.87	100	3.0 liters	13.79	6.69	207	6.63	24.9	5.67	
17:01	14.90	100	3.5 liters	13.79	6.73	210	6.57	24.9	5.43	
17:06	14.92	100	4.0 liters	13.76	6.75	209	6.59	25.3	5.41	
Stability Reached (Y/N):				Yes		If No, Provide Explanation				NA
			Final Values:	**13.76**	**6.75**	**209**	**6.59**	**25.3**	**5.41**	

Sample ID:	FRCHD04-GW-003	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/10/17
Duplicate ID:	NA	**Sample Collection Time:**	17:06
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.0
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	9.0 - 19.0
Analysis/Method(s):	PFAS (EPA 537 Mod)	**Depth to Water After Sampling (ft):**	14.92

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes   Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (2.0 (in)/12 (in/ft))/2)^2 * 6.90 * 7.48 gal/ft^3
= 1.1 gal.

Signature: [signature]

Notes:

Well draw down stabilized with lower flow rate

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn   **QA/QC Date:** 8/4/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	FRCHD05-SB-1	**Date:**	05/11/17
Initial Depth to Water (ft):	4.01	**Well Diameter (in):**	0.5
Total Depth of Well (ft):	12.0	**1 Casing Volume (gal):**	0.1
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	0.2
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	8

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
09:31		200								Pumping/Purging Started
09:36	Na	200	Cell	13.27	7.35	761	10.47	-26.6	OS	
09:41	Na	200	0.25	13.94	6.19	1076	2.06	-81.4	OS	
09:46	Na	200	.50	13.80	6.45	1012	2.56	-67.4	OS	
09:51	Na	200	.75	13.38	6.38	1487	2.38	-79.5	OS	
09:56	Na	200	1.0	13.37	6.35	1535	1.20	-85.5	OS	
10:01	Na	200	1.25	13.29	6.33	1516	1.11	-87.4	OS	
10:06	Na	200	1.50	13.04	6.14	1520	0.44	-81.7	OS	
10:11	Na	200	1.75	13.13	6.18	1525	0.45	-87.7	OS	
10:16	Na	200	2.00	13.11	8.13	1519	0.50	-86.9	OS	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**13.11**	**8.13**	**1519**	**0.50**	**-86.9**	**OS**

Sample ID:	FRCHD05-GW-001	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/11/17
Duplicate ID:	NA	**Sample Collection Time:**	10:16
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	2.0
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	7.0 - 12.0
Analysis/Method(s):	PFAS (EPA 537 MOD)	**Depth to Water After Sampling (ft):**	4.11

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes — Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (0.5 (in)/12 (in/ft))/2)^2 * 7.99 * 7.48 gal/ft^3
= 0.1 gal.

Signature:



Notes:

Temp point was extremely turbid throughout purging with no sign of clearing up.
Turbidity: OS= Over scale/range of the meter

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn — **QA/QC Date:** 8/22/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	Area4-SB 3 (FRCHD04-SB-3)	**Date:**	05/12/17
Initial Depth to Water (ft):	2.85	**Well Diameter (in):**	0.5
Total Depth of Well (ft):	6.1	**1 Casing Volume (gal):**	0.0
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	0.1
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	5

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
09:30		200								Pumping/Purging Started
09:33	Na	200	Cell	9.42	7.21	560	6.47	107.3	OS	
09:38	Na	200	0.25	9.43	6.16	558	2.79	127.4	OS	
09:43	Na	200	0.50	9.07	5.89	556	3.07	127.5	OS	
09:48	Na	200	0.75	9.20	5.84	564	3.27	122.7	OS	
09:53	Na	200	1.0	9.12	5.88	556	3.37	115.2	OS	
09:58	Na	200	1.25	9.16	5.89	549	3.44	113.3	OS	
10:03	Na	200	1.50	9.15	5.92	553	3.39	114.1	OS	
10:08	Na	200	1.75	9.12	5.90	553	3.40	114.5	OS	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	9.12	5.90	553	3.40	114.5	OS

Sample ID:	FRCHD04-GW-002	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/12/17
Duplicate ID:	NA	**Sample Collection Time:**	10:08
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.75
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	2.85 - 6.1
Analysis/Method(s):	PFAS (EPA 537 Mod)	**Depth to Water After Sampling (ft):**	2.89

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (0.5 (in)/12 (in/ft))/2)^2 * 3.25 * 7.48 gal/ft^3
= 0.0 gal.

Signature:

Notes:

No sign of turbidity decreasing

Name (print): Bill McFraland

QA/QC'd by: Beth Flynn **QA/QC Date:** 8/4/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	**Project Number:**	775303101
Contract:	FA8903-16-D-0027	**Task Order:**	0004
Installation:	FRCHD	**Technician(s):**	Joe Fassio and Bill McFarland
Well ID:	FRCHD04-SB-1	**Date:**	05/11/17
Initial Depth to Water (ft):	3.11	**Well Diameter (in):**	0.5
Total Depth of Well (ft):	7.6	**1 Casing Volume (gal):**	0.0
Method of Purging:	Pumping	**3 Casing Volumes (gal):**	0.1
Measuring Point (toc, tor, etc.):	Top of Riser	**Pump Intake Depth (feet):**	6

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization Criteria		±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
15:05		200								Pumping/Purging Started
15:10	Na	200	Cell	14.90	8.01	598	7.14	-44.4	OS	
15:15	Na	200	0.25	13.76	6.92	575	6.27	29.1	OS	
15:20	Na	200	0.50	13.95	6.46	572	5.45	45.8	603	
15:25	Na	200	0.75	13.56	6.63	573	5.53	41.6	594	
15:30	Na	200	1.0	13.45	6.62	570	5.50	44.1	410	
15:35	Na	200	1.25	13.28	6.59	568	5.56	45.9	284	
15:40	Na	200	1.5	13.33	6.60	568	5.52	45.9	1.67	

Stability Reached (Y/N): Yes   If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	**13.33**	**6.60**	**568**	**5.52**	**45.9**	**1.67**

Sample ID:	FRCG04-GW-001	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	05/11/17
Duplicate ID:	NA	**Sample Collection Time:**	15:40
Sample Container Type(s):	250 Ml poly	**Total Volume Purged (gal):**	1.5
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	3.11 - 7.64
Analysis/Method(s):	PFAS (EPA 537 Mod)	**Depth to Water After Sampling (ft):**	3.20

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes   Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
Hanna 2100QHI 98703 08213804, YSI 556 MPS 08E100694

Calculations:

Saturated well casing volume: V= Π(R^2)H*7.48 gal/ft^3

V=Volume (gal/ft)
Π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2)
H = height of water column (ft)

V= Π(R^2)H*7.48 gal/ft^3
= Π * (0.5 (in)/12 (in/ft))/2)^2 * 4.49 * 7.48 gal/ft^3
= 0.0 gal.

Signature: [signature]

Notes:

None

Name (print): Bill McFarland

QA/QC'd by: Beth Flynn   **QA/QC Date:** 8/4/2017

APPENDIX D

DATA VALIDATION REPORTS

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DATA VALIDATION REPORT

SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS

ENVIRONMENTAL PROGRAMS WORLDWIDE

FAIRCHILD AIR FORCE BASE

Samples Collected on 14 and 15 February 2017

Prepared for:

Air Force Civil Engineer Center

Joint Base San Antonio – Lackland, Texas

Prepared by:

amec foster wheeler

Contract FA8903-16-D-0027

Task Order 0004

August 2017

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ACRONYMS AND ABBREVIATIONS

%	percent
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain of Custody
DL	Detection Limit
DoD	Department of Defense
EPA	United States Environmental Protection Agency
ICV	Initial Calibration Verification
ID	Identification
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantification
Maxxam	Maxxam Analytics International
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PFCs	Perfluorinated Compounds
PFDA	Perfluorodecanoic acid
PFDoA	Perfluorododecanoic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFTeDA	Perfluorotetradecanoic acid
PFUnA	Perfluoroundecanoic acid
QC	Quality Control
QPP	Quality Program Plan
RPD	Relative Percent Difference
SDG	Sample Delivery Group

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1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) collected 7 water samples, including one field duplicate and one field blank, on 14 and 15 February 2017, from Fairchild Air Force Base, located in Spokane County, Washington. Amec Foster Wheeler submitted the samples to Maxxam Analytics International (Maxxam), located in Mississauga, Ontario, Canada on 16 February 2017. Maxxam assigned the samples to sample delivery group (SDG) B732816. Maxxam analyzed the samples for perfluorinated compounds (PFCs) by United States Environmental Protection Agency (EPA) Method 537. A list of these samples by field sample identification (ID), sample collection date, sample matrix, and laboratory sample ID is presented in Table 1.

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2.0 DATA VALIDATION METHODOLOGY

For the samples analyzed for PFCs, Amec Foster Wheeler performed EPA Stage IV validation on 10 percent (%) of the samples and EPA Stage IIB validation on the remaining samples associated with this sampling event as indicated on Table 1. Amec Foster Wheeler performed EPA Stage IIA validation on the non-PFC analyses performed on these samples.

The Stage IV validation includes review of the quality control (QC) results in the laboratory's analytical report and reported on QC summary forms as well as recalculation checks and review of the instrument raw data outputs. The Stage IIB validation includes review of the QC results in the laboratory's analytical report and reported on QC summary forms with no review of the associated raw data. The Stage IIA validation includes review of sample-related QC only, with no review of instrument calibration QC. Data from equipment and field blanks and investigation derived samples did not undergo validation. This data validation has been performed in general accordance with:

- Amec Foster Wheeler, 2016. Draft, Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2016.
- Department of Defense (DOD), 2017. DoD Quality Systems Manual for Environmental Laboratories, Version 5.1. January 2017.
- EPA, 2009. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.
- EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

The CLP guideline was written specifically for the CLP, and has been modified for the purposes of this data review where it differs from method-specific, QPP-specified, and laboratory-specified QC requirements.

The laboratory's certified analytical report and supporting documentation were reviewed to assess the following:

- Data package and electronic data deliverable completeness;
- Laboratory case narrative review;
- Chain of custody (COC) compliance;
- Holding time compliance;
- QC sample frequency;

- Initial calibration, initial calibration verification (ICV), and continuing calibration verification (CCV) compliance with method-specified criteria;
- Presence or absence of laboratory contamination as demonstrated by laboratory blanks;
- Accuracy and bias as demonstrated by recovery of surrogate spikes, laboratory control sample (LCS), and matrix spike (MS) samples;
- Internal standard recoveries;
- Analytical precision as relative percent difference (RPD) of analyte concentration between laboratory duplicates or MS/MS duplicate (MSD);
- Sampling and analytical precision as RPD of analyte concentration between field duplicates;
- Assessment of field contamination as demonstrated by field and trip blanks;
- Insofar as possible, the degree of conformance to method requirements and good laboratory practices.

In general, it is important to recognize that no analytical data are guaranteed to be correct, even if all QC audits are passed. Strict QC serves to increase confidence in data, but any reported value may potentially contain error.

3.0 EXPLANATION OF DATA QUALITY INDICATORS

Summary explanations of the specific data quality indicators reviewed during this data quality review are presented below.

3.1 LABORATORY CONTROL SAMPLE RECOVERIES

LCSs and LCS duplicates (LCSDs) are aliquots of analyte-free matrices that are spiked with the analytes of interest for an analytical method, or a representative subset of those analytes. The spiked matrix is then processed through the same analytical procedures as the samples they accompany. LCS recovery is an indication of a laboratory's ability to successfully perform an analytical method in an interference-free matrix.

3.2 MATRIX SPIKE RECOVERIES

MSs and MSDs are prepared by adding known amounts of the analytes of interest for an analytical method, or a representative subset of those analytes, to an aliquot of sample. The spiked sample is then processed through the same extraction, concentration, cleanup, and analytical procedures as the unspiked samples in an analytical batch.

MS recovery and precision are an indication of a laboratory's ability to successfully recover an analyte in the matrix of a specific sample or closely related sample matrices. It is important not to apply MS results for any specific sample to other samples without understanding how the sample matrices are related.

3.3 SURROGATE SPIKE RECOVERIES

Surrogate spikes are used to evaluate accuracy, method performance, and extraction efficiency in each individual sample. Surrogate compounds are compounds not normally found in environmental samples, but which are similar to target analytes in chemical composition and behavior in the analytical process.

3.4 BLANK CONCENTRATIONS

Blank samples are aliquots of analyte free matrix that are used as negative controls to verify that the sample collection, storage, preparation, and analysis system does not produce false positive results.

Equipment blanks are prepared by passing analyte-free water through or over sample collection equipment and collecting the water in sample containers. Equipment blanks are analyzed for the analytical suite required for the project. Equipment blanks are used to monitor for possible sample contamination during the sample collection process and serve as a check on the effectiveness of field decontamination procedures.

Field blanks are prepared by pouring an aliquot of analyte-free water into a sample container in the field. Field blanks are analyzed for the analytical suite required for the project. Field blanks are used to monitor for possible sample contamination originating from the water used for equipment decontamination.

Laboratory, equipment, and field blanks are processed by the laboratory using exactly the same procedures as the field samples. Target analytes should not be found in laboratory blanks.

When target analytes are detected in blanks, analyte concentrations in the associated samples less than ten times the concentration detected in the blank will be B qualified.

3.5 LABORATORY AND FIELD DUPLICATES

Laboratory and field duplicate analysis verifies acceptable method precision by the laboratory at the time of preparation and analysis and/or sampling precision at the time of collection.

4.0 DEFINITIONS OF QUALIFIERS THAT MAY BE USED DURING DATA VALIDATION

B The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than ten times the concentration detected in the blank.

U The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Q The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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5.0 QUALIFICATION REASON CODES

Amec Foster Wheeler applied the following reason code to the data during validation:

HHL Exceeded extraction hold time

TR Detected concentration is less than the Limit of Quantification (LOQ).

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6.0 CHAIN OF CUSTODY AND SAMPLE RECEIPT CONDITION DOCUMENTATION

The samples were received at the laboratory under proper COC, intact, properly preserved, and at temperatures less than the QPP-specified maximum of 10 degrees Celsius.

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7.0 SPECIFIC DATA VALIDATION FINDINGS

Results from these samples may be considered usable with the limitations and exceptions described Sections 7.1 through 0.

7.1 PERFLUORINATED COMPOUNDS BY EPA METHOD 537

PFCs results generated by Maxxam are usable with the limitations described in Sections 7.1.1 through 7.1.12.

7.1.1 Holding Times

The aqueous samples were extracted for PFCs within the QPP-specified maximum holding time of 14 days from sample collection and the extracts were analyzed within the QPP-specified maximum hold time of 28 days from extraction. Exceptions to these hold times are noted below.

- Sample FRCHD01-GW-003 was initially extracted within the method-specified hold time and analyzed using a high concentration method. The sample was re-extracted six days past the QPP-specified holding time of 14 days and analyzed using a low concentration method in order to achieve lower detection limits for all analytes. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFC results from this sample because of the exceeded extraction hold time. (Qualifier and reason code: J/UJ-HHL)

7.1.2 Initial Calibrations

The ICALs associated with the analysis of these samples met the QPP-specified criteria of correlation coefficients greater than 0.99 and the calibration standards calculating to 75 to 125% of its true concentrations.

7.1.3 Initial Calibration Verification

ICV recoveries were within the QPP-specified 75% to 125% limits.

7.1.4 Continuing Calibration Verification

CCV recoveries were within the QPP specified 75% to 125% limits.

7.1.5 Laboratory Blanks

PFCs were not detected in the laboratory blanks associated with these samples.

7.1.6 Field Blanks

PFCs were not detected in the field blank associated with these samples.

7.1.7 Laboratory Control Sample Accuracy

LCS recoveries were within QPP-specified 70 to 130% limits.

7.1.8 Laboratory Duplicate Precision

Maxxam performed duplicate analysis of sample FRCHD01-GW-003. RPDs between duplicate results were within the QPP-specified limit of 30%.

7.1.9 Matrix Spikes/ Matrix Spike Duplicates

Maxxam did not perform an MS and MSD analysis on any of the samples covered in this report and it is not possible to evaluate data usability based on spike recoveries for unrelated samples.

7.1.10 Surrogate Recoveries

Surrogate recoveries were within the QPP-specified 70 to 130% limits with the following exceptions:

- Recoveries of the surrogate compound $^{13}C_2$-perfluorododecanoic acid (PFDoA) were low in the 10-fold dilutions performed on samples FRCHD01-DUP01 and FRCHD01-GW-004 at 53% and 69%, respectively. These samples were diluted past the instrument's ability to accurately resolve the surrogate compounds and it is not possible to evaluate data usability based on surrogate recoveries for this analyte.
- Recoveries of the surrogate compounds $^{13}C_2$-perfluorodecanoic acid (PFDA) (67%), $^{13}C_2$-perfluorotetradecanoic acid (PFTeDA) (66%), and $^{13}C_5$-perfluorononanoic acid (PFNA) (68%) were low in the 10-fold dilution performed on sample FRCHD01-GW-001. This sample was diluted past the instrument's ability to accurately resolve the surrogate compounds and it is not possible to evaluate data usability based on surrogate recoveries for these analytes.
- Recoveries of the surrogate compounds $^{13}C_2$-PFTeDA and $^{13}C_4$-perfluorooctanoic acid (PFOA) were low at 67% and 69%, respectively, in the 10-fold dilution performed on sample FRCHD01-GW-002. This sample was diluted past the instrument's ability to accurately resolve the surrogate compounds and it is not possible to evaluate data usability based on surrogate recoveries for these analytes.
- Recoveries of the surrogate compounds $^{13}C_2$-PFTeDA and $^{13}C_2$-perfluoroundecanoic acid (PFUnA) were low at 65% and 69%, respectively, in the 10-fold dilution performed on sample FRCHD01-GW-003. This sample was diluted past the instrument's ability to accurately resolve the surrogate compounds and it is not possible to evaluate data usability based on surrogate recoveries for these analytes.

7.1.11 Internal Standard Recoveries

Internal standard areas were within the QPP-specified limits of 50 to 150% of the average area counts measured during the initial calibration.

7.1.12 Data Reporting and Analytical Procedures

Maxxam J qualified analytes with concentrations between the detection limit (DL) and the LOQ. Amec Foster Wheeler agrees that these results are quantitatively uncertain and has J qualified these results. (Qualifier and reason code: J-TR)

8.0 FIELD DUPLICATE RESULTS

Amec Foster Wheeler collected a field duplicate, FRCHD01-DUP01, with sample FRCHD01-GW-002. Detected results and RPDs for the field duplicate are summarized in Table 2. Precision values were within the QPP-specified limits of less than 30% RPD or the difference between analytical results less than the LOQ.

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9.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler evaluated a total of 96 data records from field samples during the validation. Amec Foster Wheeler J or UJ qualified 21 records (21.9%) as estimated values because of exceeded extraction hold times and/or analyte concentrations between the DL and the LOQ. Qualified data are summarized in Table 3.

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REFERENCES

Amec Foster Wheeler, 2016. Draft, Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2016.

Department of Defense (DOD), 2017. DoD Quality Systems Manual for Environmental Laboratories, Version 5.1. January 2017.

EPA, 2009. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.

EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

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TABLES

Table 1
Field Samples Submitted to Maxxam Analytics International
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Collection Date	Sample Matrix	Laboratory SDG	Laboratory Sample Identification	Notes
FRCHD01-BLK-01	15-Feb-17	QC Water	B732816	DXR288	Field Blank
FRCHD01-DUP01	14-Feb-17	Groundwater	B732816	DXR289	Field Duplicate of Sample FRCHD01-GW-002
FRCHD01-GW-	15-Feb-17	Groundwater	B732816	DXR290	Stage IV
FRCHD01-GW-	14-Feb-17	Groundwater	B732816	DXR291	
FRCHD01-GW-	14-Feb-17	Groundwater	B732816	DXR292	
FRCHD01-GW-	15-Feb-17	Groundwater	B732816	DXR293	
FRCHD01-GW-	15-Feb-17	Groundwater	B732816	DXR294	

Notes:
IDW = Investigation Derived Waste
MS/MSD = Matrix Spike / Matrix Spike Duplicate
SDG = Sample Delivery Group

Table 2
Field Duplicate Detections
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Analyte	LOQ	Primary Sample	Field Duplicate	Units	RPD	Notes
Samples FRCHD01-GW-002 and FRCHD01-DUP01						
6:2 FTS	1.0	35	37	µg/L	5.6%	
8:2 FTS	0.20	1.8	2.0	µg/L	10.5%	
EtFOSAA	0.20	0.10 U	0.082 J	µg/L	NC	
MeFOSAA	0.20	0.10 U	0.049 J	µg/L	NC	± LOQ
PFBS	0.20	1.7	1.7	µg/L	0.0%	
PFHpA	0.20	1.2	1.3	µg/L	8.0%	
PFHxS	1.0	15	16	µg/L	6.5%	
PFHxA	0.20	7.1	7.1	µg/L	0.0%	
PFOA	0.20	3.5	3.0	µg/L	15.4%	
PFNA	0.20	0.13 J	0.15 J	µg/L	14.3%	
PFOS	1.0	21	22	µg/L	4.7%	
PFUnA	0.20	0.10 U	0.059 J	µg/L	NC	± LOQ

Notes:
µg/L = micrograms per liter
6:2 FTS = 6:2 fluorotelomer sulfonate
8:2 FTS = 8:2 fluorotelomer sulfonate
EtFOSAA = Ethylperfluorooctanesulfonamidoacetic acid
MeFOSAA = Methylperfluorooctanesulfonamidoacetic acid
LOQ = limit of quantification
NC = not calculable
PFBS = perfluorobutanesulfonic acid
PFHpA = perfluoroheptanoic acid
PFHxA = perfluorohexanoic acid
PFHxS = perfluorohexanesulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid
PFUnA = perfluoroundecanoic acid
RPD = relative percent difference

Qualifier Definitions:
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but was not detected above the reported limit of detection.

Reason Codes:
± LOQ = The difference between analyte concentrations is less than the LOW, indicating acceptable analytical precision.
FDD = field duplicate imprecision

Table 3
Qualifiers Added During Validation
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
FRCHD01-DUP01	EtFOSAA	0.082 µg/L	J TR
	MeFOSAA	0.049 µg/L	J TR
	PFNA	0.15 µg/L	J TR
	PFUnA	0.059 µg/L	J TR
FRCHD01-GW-002	PFNA	0.13 µg/L	J TR
FRCHD01-GW-003	6:2 FTS	46 µg/L	J HHL
	8:2 FTS	8.9 µg/L	J HHL
	EtFOSAA	0.10 µg/L	UJ HHL
	MeFOSAA	0.10 µg/L	UJ HHL
	PFBS	2.4 µg/L	J HHL
	PFDA	0.072 µg/L	J HHL, TR
	PFDoA	0.14 µg/L	UJ HHL
	PFHpA	2.7 µg/L	J HHL
	PFHxA	11 µg/L	J HHL
	PFHxS	26 µg/L	J HHL
	PFNA	0.32 µg/L	J HHL
	PFOA	7.9 µg/L	J HHL
	PFOS	41 µg/L	J HHL
	PFTeDA	0.14 µg/L	UJ HHL
	PFTrDA	0.10 µg/L	UJ HHL
	PFUnA	0.10 µg/L	UJ HHL

Notes:
µg/L = micrograms per liter
6:2 FTS = 6:2 fluorotelomer sulfonate
8:2 FTS = 8:2 fluorotelomer sulfonate
EtFOSAA = ethylperfluorooctanesulfonamidoacetic acid
MeFOSAA = methylperfluorooctanesulfonamidoacetic acid
PFBS = perfluorobutanesulfonic acid
PFDA = perfluorodecanoic acid
PFDoA = perfluorododecanoic acid
PFHpA = perfluoroheptanoic acid
PFHxA = perfluorohexanoic acid
PFHxS = perfluorohexanesulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid
PFTeDA = perfluorotetradecanoic acid
PFTrDA = perfluorotridecanoic acid
PFUnA = perfluoroundecanoic acid

Validation Qualifiers
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Reason Codes
HHL = Exceeded extraction hold time.
TR = Detected concentration is less than the limit of quantification.

DATA VALIDATION REPORT

SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS

ENVIRONMENTAL PROGRAMS WORLDWIDE

FAIRCHILD AIR FORCE BASE

Samples Collected Between 8 and 12 May 2017

Prepared for:

Air Force Civil Engineer Center

Joint Base San Antonio – Lackland, Texas

Prepared by:

Contract FA8903-16-D-0027

Task Order 0004

August 2017

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ACRONYMS AND ABBREVIATIONS

%	percent
µg/L	Micrograms per Liter
6:2 FTS	6:2 Fluorotelomer Sulfonate
8:2 FTS	8:2 Fluorotelomer Sulfonate
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain of Custody
DL	Detection limit
DoD	Department of Defense
EPA	United States Environmental Protection Agency
EtFOSAA	Ethylperfluorooctane Sulfonamidoacetic Acid
ICV	Initial Calibration Verification
ID	Identification
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantification
Maxxam	Maxxam Analytics International
MeFOSAA	Methylperfluorooctane Sulfonamidoacetic Acid
mg/kg	Milligrams per Kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PFASs	Per- And Polyfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFDA	Perfluorodecanoic Acid
PFDoA	Perfluorododecanoic Acid

PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFTeDA	Perfluorotetradecanoic Acid
PFTrDA	Perfluorotridecanoic Acid
PFUnA	Perfluoroundecanoic Acid
QC	Quality Control
QPP	Quality Program Plan
QSM	Quality Systems Manual
RPD	Relative Percent Difference
SOP	Standard Operating Procedure

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) collected 15 water samples, including one field duplicate, two equipment blanks, and two field blanks, and 27 soil samples, including three field duplicates, between 8 and 12 May 2017, from Fairchild Air Force Base, located in Spokane County, Washington. Amec Foster Wheeler submitted the samples to Maxxam Analytics International (Maxxam), located in Mississauga, Ontario, Canada on 12 and 13 May 2017. Maxxam assigned the samples to sample delivery groups B797259 and B797896. Maxxam analyzed the samples for per- and polyfluoroalkyl substances (PFASs) by Modified United States Environmental Protection Agency (EPA) Method 537.1. The modifications to EPA Method 537.1 are consistent with Quality Systems Manual (QSM) V5.1 and are specified in the laboratory's analytical standard operating procedure (SOP) CAM SOP-00894. A list of these samples by field sample identification (ID), sample collection date, sample matrix, and laboratory sample ID is presented in Table 1.

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2.0 DATA VALIDATION METHODOLOGY

Amec Foster Wheeler performed EPA Stage 4 validation on 10 percent (%) of the samples and EPA Stage 2B validation on the remaining samples associated with this sampling event as indicated on Table 1. The Stage 4 validation includes review of the quality control (QC) results in the laboratory's analytical report and reported on QC summary forms as well as recalculation checks and review of the instrument raw data outputs. The Stage 2B validation includes review of the QC results in the laboratory's analytical report and reported on QC summary forms with no review of the associated raw data. Data from equipment and field blanks did not undergo validation because results from these samples are only used to assess data usability for field samples. This data validation has been performed in general accordance with:

- Amec Foster Wheeler, 2016. Draft, Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2016.
- Department of Defense (DoD), 2017. DoD Quality Systems Manual for Environmental Laboratories, Version 5.1. January 2017.
- EPA, 2009. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry, Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.
- EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

The CLP guideline was written specifically for the CLP, and has been modified for the purposes of this data review where it differs from method-specific, QPP-specified, and laboratory-specified QC requirements.

The laboratory's certified analytical report and supporting documentation were reviewed to assess the following:

- Data package and electronic data deliverable completeness;
- Laboratory case narrative review;
- Chain of custody (COC) compliance;
- Holding time compliance;
- QC sample frequency;
- Initial calibration, initial calibration verification (ICV), and continuing calibration verification (CCV) compliance with method-specified criteria;
- Presence or absence of laboratory contamination as demonstrated by laboratory blanks;

- Accuracy and bias as demonstrated by recovery of surrogate spikes, laboratory control sample (LCS), and matrix spike (MS) samples;
- Internal standard recoveries;
- Analytical precision as relative percent difference (RPD) of analyte concentration between laboratory duplicates or MS/MS duplicate (MSD);
- Sampling and analytical precision as RPD of analyte concentration between field duplicates;
- Assessment of field contamination as demonstrated by field and equipment blanks;
- Insofar as possible, the degree of conformance to method requirements and good laboratory practices.

In general, it is important to recognize that no analytical data are guaranteed to be correct, even if all QC audits are passed. Strict QC serves to increase confidence in data, but any reported value may potentially contain error.

3.0 EXPLANATION OF DATA QUALITY INDICATORS

Summary explanations of the specific data quality indicators reviewed during this data quality review are presented below.

3.1 LABORATORY CONTROL SAMPLE RECOVERIES

LCSs and LCS duplicates (LCSDs) are aliquots of analyte-free matrices that are spiked with the analytes of interest for an analytical method, or a representative subset of those analytes. The spiked matrix is then processed through the same analytical procedures as the samples they accompany. LCS recovery is an indication of a laboratory's ability to successfully perform an analytical method in an interference-free matrix.

3.2 MATRIX SPIKE RECOVERIES

MSs and MSDs are prepared by adding known amounts of the analytes of interest for an analytical method, or a representative subset of those analytes, to an aliquot of sample. The spiked sample is then processed through the same extraction, concentration, cleanup, and analytical procedures as the unspiked samples in an analytical batch.

MS recovery and precision are an indication of a laboratory's ability to successfully recover an analyte in the matrix of a specific sample or closely related sample matrices. It is important not to apply MS results for any specific sample to other samples without understanding how the sample matrices are related.

3.3 SURROGATE SPIKE RECOVERIES

Surrogate spikes are used to evaluate accuracy, method performance, and extraction efficiency in each individual sample. Surrogate compounds are compounds not normally found in environmental samples, but which are similar to target analytes in chemical composition and behavior in the analytical process.

3.4 BLANK CONCENTRATIONS

Blank samples are aliquots of analyte free matrix that are used as negative controls to verify that the sample collection, storage, preparation, and analysis system does not produce false positive results.

Equipment blanks are prepared by passing analyte-free water through or over sample collection equipment and collecting the water in sample containers. Equipment blanks are analyzed for the analytical suite required for the project. Equipment blanks are used to monitor for possible sample contamination during the sample collection process and serve as a check on the effectiveness of field decontamination procedures.

Field blanks are prepared by pouring an aliquot of analyte-free water into a sample container in the field. Field blanks are analyzed for the analytical suite required for the project. Field blanks are used to monitor for possible sample contamination originating from the water used for equipment decontamination.

Laboratory, equipment, and field blanks are processed by the laboratory using exactly the same procedures as the field samples. Target analytes should not be found in laboratory blanks.

When target analytes are detected in blanks, analyte concentrations in the associated samples less than ten times the concentration detected in the blank will be B qualified.

3.5 LABORATORY AND FIELD DUPLICATES

Laboratory and field duplicate analysis verifies acceptable method precision by the laboratory at the time of preparation and analysis and/or sampling precision at the time of collection.

4.0 DEFINITIONS OF QUALIFIERS THAT MAY BE USED DURING DATA VALIDATION

B The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than ten times the concentration detected in the blank.

U The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Q The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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5.0 QUALIFICATION REASON CODES

Amec Foster Wheeler applied the following reason code to the data during validation:

EBL Contamination was detected in an equipment blank at a concentration less than the limit of quantitation (LOQ) and the associated sample result is less than ten times the concentration detected in the blank.

FDD Field duplicate imprecision.

ISH High internal standard recovery. Analytical result may be biased low.

ISL Low internal standard recovery. Analytical result may be biased high.

LBL Contamination was detected in a laboratory blank at a concentration less than the LOQ and the associated sample result is less than ten times the concentration detected in the blank.

LDD Laboratory duplicate imprecision.

TR Detected concentration is less than the LOQ.

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6.0 CHAIN OF CUSTODY AND SAMPLE RECEIPT CONDITION DOCUMENTATION

The samples were received at the laboratory under proper COC, intact, properly preserved, and at temperatures less than the QPP-specified maximum of 10 degrees Celsius.

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7.0 SPECIFIC DATA VALIDATION FINDINGS

Results from these samples may be considered usable with the limitations and exceptions described Sections 7.1 through 0.

7.1 PER- AND POLYFLUOROALKYL SUBSTANCES BY MODIFIED EPA METHOD 537

PFAS results generated by Maxxam are usable with the limitations described in Sections 7.1.1 through 7.1.11.

7.1.1 Holding Times

The aqueous samples were extracted for PFCs within the QPP-specified maximum holding time of 14 days from sample collection and the extracts were analyzed within the QPP-specified maximum hold time of 28 days from extraction. The solid samples were extracted for PFCs within the method-recommended maximum holding time of 60 days from sample collection and the extracts were analyzed within the method-recommended 30 days from extraction.

7.1.2 Initial Calibrations

The ICALs associated with the analysis of these samples met the QSM-specified criteria of correlation coefficients greater than 0.99 and the calibration standards calculating to 70 to 130% of their true concentrations.

7.1.3 Initial Calibration Verification

ICV recoveries were within the QPP-specified 75% to 125% limits, which is more conservative than the 70 to 130% limits specified in QSM 5.1.

7.1.4 Continuing Calibration Verification

CCV recoveries were within the QPP specified 75% to 125% limits, which is more conservative than the 70 to 130% limits specified in QSM 5.1, with the following exception.

- Perfluorotridecanoic acid (PFTrDA) recovery was high at 130% in the closing CCV associated with the analysis of samples FRCHD03-GW-003, FRCHD03-GW-004, FRCHD-FD-GW-01, FRCHD02-GW-001, and FRCHD04-GW-003, and the opening CCV associated with the analysis of samples FRCHD05-GW-001 and FRCHD04-GW-001. PFTrDA was not detected in these samples and data usability is not adversely affected by the potential high analytical bias.

7.1.5 Laboratory Blanks

PFASs were not detected in the laboratory blanks associated with these samples, with the following exception.

- 6:2 Fluorotelomer sulfonate (6:2 FTS) was detected at a concentration of 0.0075 micrograms per liter (µg/L), a concentration less than half the LOQ of 0.020 µg/L, in the laboratory blank associated with samples FRCHD03-GW-001, FRCHD05-GW-002, FRCHD03-GW-002, FRCHD03-GW-003,

FRCHD03-GW-004, FRCHD-FD-GW-01, FRCHD02-GW-001, FRCHD04-GW-003, FRCHD05-GW-001, and FRCHD04-GW-001. Data limitations are summarized below.

- Amec Foster Wheeler B qualified the detected 6:2 FTS result from sample FRCHD04-GW-003 because the detected concentration, at 0.0079 µg/L, was less than ten times the concentration detected in the blank. (Qualifier and reason code: B-LBL)
- 6:2 FTS was either not detected or was detected at concentrations exceeding ten times the concentration detected in the blank and data usability is not adversely affected.

7.1.6 Field and Equipment Blanks

PFASs were not detected in the field and equipment blanks associated with these samples at concentrations exceeding half the LOQ. No target analytes from aqueous samples were qualified as a result of detections in the associated equipment blanks. Target analytes from soil samples qualified as a result of detections in the associated equipment blanks ranged in concentration from 0.00040 milligrams per kilogram (mg/kg) to 0.0008 mg/kg.

No target analytes were detected in the field blanks associated with these samples

Target analyte detections in the equipment blanks and their impact on data usability are summarized below.

- 6:2 FTS (0.0077 µg/L, equivalent to 0.000214 mg/kg), perfluorohexanesulfonic acid (PFHxS) (0.0042 µg/L, equivalent to 0.000117 mg/kg), and perfluorooctanesulfonic acid (PFOS) (0.0065 µg/L, equivalent to 0.000181 mg/kg) were detected in equipment blank FRCHD-EB01 associated with samples FRCHD03-SO-003, FRCHD03-SO-005, FRCHD04-SO-001, FRCHD04-SO-003, FRCHD04-SO-005, FRCHD05-SO-001, FRCHD05-SO-003, and FRCHD-FD-SO-01. Data limitations are summarized below.
  - Amec Foster Wheeler B qualified the detected PFHxS results from samples FRCHD03-SO-005, FRCHD04-SO-003, and FRCHD04-SO-005 because the detected concentrations were less than ten times the concentration detected in the blank. (Qualifier and reason code: B-EBL)
  - The remaining analytes were either not detected or were detected at concentrations greater than ten times the concentrations detected in the blank and data usability is not adversely affected.
- Ethylperfluorooctane sulfonamidoacetic acid (EtFOSAA) was detected at a concentration of 0.0064 µg/L, equivalent to 0.000178 mg/kg, in equipment blank FRCHD-EB-02 associated with samples FRCHD03-SO-002, FRCHD05-SO-004, FRCHD05-SO-002, FRCHD03-SO-004, FRCHD-FD-SO-03, FRCHD05-GW-001, FRCHD-FB-02, FRCHD04-SO-004, FRCHD04-SO-002, FRCHD04-GW-001, FRCHD03-SO-006, and FRCHD03-SO-001. EtFOSAA was not detected in these samples and data usability is not adversely affected.

7.1.7 Laboratory Control Sample Accuracy

LCS recoveries were within QPP-specified 70 to 130% limits.

7.1.8 Laboratory Duplicate

Maxxam performed duplicate analysis of sample FRCHD05-GW-002. RPDs between detected results were less than the QPP-specified maximum of 30% or the difference between analytical results less than the LOQ, with the following exception.

- The RPD between 6:2 FTS results from sample FRCHD05-GW-002 and its laboratory duplicate was high at 30%. Amec Foster Wheeler J qualified the detected 6:2 FTS result from this sample because of the potential analytical imprecision. (Qualifier and reason code: J-LDD)

7.1.9 Matrix Spikes/ Matrix Spike Duplicates

Maxxam performed MS and MSD analyses on samples FRCHD04-SO-002 and MW-449-20170608. Recoveries were within the QPP-specified 70 to 130% limits and RPDs between MS and MSD results were less than the QPP-specified maximum of 30%.

7.1.10 Internal Standard Recoveries

Extracted internal standard recoveries were within the QPP-specified limits of 70 to 130% of the expected concentration, which is more conservative than the 50 to 150% limits specified in QSM 5.1, and injected internal standard areas were within the QPP-specified limits of 50 to 150% of the average area counts measured during the initial calibration, with the following exceptions.

- Recovery of the internal standards $^{13}C_2$-perfluorotetradecanoic acid (PFTeDA), D3-methylperfluorooctane sulfonamidoacetic acid (MeFOSAA), and D5-EtFOSAA were low in the analysis of samples FRCHD05-GW-002 (62%, 60%, 63%, respectively), FRCHD03-GW-002 (61%, 68%, 67%, respectively), and FRCHD02-GW-001 (64%, 68%, 65%, respectively). PFTeDA, PFTrDA, MeFOSAA, and EtFOSAA were not detected in these samples and data usability is not adversely affected by the potential high analytical bias.
- Recovery of the internal standards $^{13}C_4$-PFOS (69%), D3-MeFOSAA (68%), and D5-EtFOSAA (66%) were low in the analysis of sample FRCHD03-GW-004. Data limitations are summarized below.
  - Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)
  - MeFOSAA and EtFOSAA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recovery of the surrogate compound $^{13}C_4$-PFOS was low at 62% in the 50-fold dilution analysis of sample FRCHD-FD-GW-01. Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)

- Recoveries of the internal standards D3-MeFOSAA and D5-EtFOSAA were high at 172% and 166%, respectively, in the analysis of sample FRCHD05-GW-001. Amec Foster Wheeler UJ qualified the non-detected MeFOSAA and EtFOSAA results from this sample because of the potential low analytical bias. (Qualifier and reason code: UJ-ISH)
- Recovery of the internal standard D5-EtFOSAA was low at 69% in the analysis of sample FRCHD04-GW-001. EtFOSAA was not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recovery of the internal standards $^{13}C_2$-perfluorododecanoic acid (PFDoA) and $^{13}C_2$-PFTeDA were low at 69% and 62%, respectively, in the analysis of sample FRCHD04-SO-001. PFDoA, PFTeDA, and PFTrDA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recoveries of the internal standards $^{13}C_2$-PFDoA (66%), $^{13}C_2$-perfluorohexanoic acid (PFHxA) (68%), $^{13}C_2$-PFTeDA (58%), $^{13}C_4$-PFOS (68%), and $^{18}O_2$-PFHxS (62%) were low in the analysis of sample FRCHD04-SO-003. Data limitations are summarized below.
    - The detected PFHxS result from this sample was previously B qualified because of equipment blank contamination and it is not possible to apply combined qualifiers on this project. Amec Foster Wheeler Q qualified this result to indicate that the result should be both B qualified because of equipment blank contamination and J qualified because of the potential high analytical bias. (Qualifier and reason code: Q-ISL)
    - Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)
    - Perfluorobutanesulfonic acid (PFBS), PFDoA, PFHxA, PFTeDA, and PFTrDA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recoveries of the internal standards D3-MeFOSAA and D5-EtFOSAA were high at 141% and 145%, respectively, in the analysis of sample FRCHD-FD-SO-01. Amec Foster Wheeler J qualified the detected MeFOSAA and EtFOSAA results from this sample because of the potential low analytical bias. (Qualifier and reason code: J-ISH)
- Recoveries of the internal standards 13C2-PFDoA and 13C2-PFTeDA were low at 64% and 52%, respectively, in the analysis of sample FRCHD02-SO-003. Amec Foster Wheeler J qualified the detected PFDoA, PFTeDA, and PFTrDA results from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)
- Recoveries of the internal standards $^{13}C_2$-6:2 FTS (146%), $^{13}C_2$-8:2 fluorotelomer sulfonate (8:2 FTS) (68%), $^{13}C_2$-PFDoA (139%), $^{13}C_2$-PFHxA (148%), and $^{13}C_2$-perfluoroundecanoic acid (PFUnA) (145%)

were outside specified limits in the analysis of sample FRCHD-FD-SO-02. Data limitations are summarized below.

- Amec Foster Wheeler UJ qualified the non-detected 6:2 FTS and PFDoA results and J qualified the detected PFHxA and PFUnA results from this sample because of the potential low analytical bias. (Qualifier and reason code: J/UJ-ISH)
- Amec Foster Wheeler J qualified the detected 8:2 FTS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)

- Recoveries of the internal standards D3-MeFOSAA and D5-EtFOSAA were low at 64% and 63%, respectively, in the analysis of sample FRCHD05-SO-004. MeFOSAA and EtFOSAA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recoveries of the internal standards $^{13}C_4$-perfluoroheptanoic acid (PFHpA) and $^{13}C_4$-perfluorooctanoic acid (PFOA) were high at 131% and 132%, respectively, in the analysis of sample FRCHD01-SO-003. Amec Foster Wheeler J qualified the detected PFHpA and PFOA results from this sample because of the potential low analytical bias. (Qualifier and reason code: J-ISH)
- Recovery of the internal standard $^{13}C_2$-PFTeDA was low at 68% in the analysis of sample FRCHD01-SO-004. PFTeDA and PFTrDA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.
- Recoveries of the internal standards $^{13}C_4$-PFOS and $^{13}C_4$-PFOA were outside specified limits at 55% and 132%, respectively, in the analysis of sample FRCHD05-SO-002. Data limitations are summarized below.
  - Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)
  - Amec Foster Wheeler J qualified the detected PFOA result from this sample because of the potential low analytical bias. (Qualifier and reason code: J-ISH)
- Recovery of the internal standard $^{13}C_4$-PFOS was low at 54% in the 10-fold dilution analysis of sample FRCHD-FD-SO-03. Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential high analytical bias. (Qualifier and reason code: J-ISL)
- Recoveries of the internal standards $^{13}C_2$-6:2 FTS (149%), 13C2-perfluorodecanoic acid (PFDA) (137%), $^{13}C_2$-PFHxA (138%), $^{13}C_4$-PFHpA (147%), $^{13}C_4$-PFOS (139%), $^{13}C_5$-perfluorononanoic acid (PFNA) (132%), and $^{18}O_2$-PFHxS (136%) were high in the analysis of sample FRCHD04-SO-004. Amec Foster Wheeler J qualified the detected 6:2 FTS, PFHpA, PFHxA, PFHxS, PFBS, and PFOS results and UJ qualified the non-detected PFDA and PFNA results from this sample because of the potential low analytical bias. (Qualifier and reason code: J/UJ-ISH)

- Recovery of the internal standard $^{13}C_4$-PFOA was high at 132% in the analysis of sample FRCHD04-SO-002. Amec Foster Wheeler J qualified the detected PFOA result from this sample because of the potential low analytical bias. (Qualifier and reason code: J-ISH)
- Recoveries of the internal standards $^{13}C_2$-PFDoA (68%), $^{13}C_2$-PFTeDA (69%), $^{13}C_5$-PFNA (68%), D3-MeFOSAA (64%), and D5-EtFOSAA (62%) were low in the analysis of sample FRCHD04-SO-006. PFDoA, PFTeDA, PFTrDA, PFNA, MeFOSAA, and EtFOSAA were not detected in this sample and data usability is not adversely affected by the potential high analytical bias.

Data were qualified based on the more conservative QPP-specified limits for extracted internal standard recoveries. No data were qualified based on injection internal standard recoveries.

Internal standard recoveries were outside of QSM 5.1 specified limits in a single groundwater sample, FRCHD05-GW-001, the recoveries outside QSM-specified limits were associated with MeFOSAA and EtFOSAA, analytes without regulatory screening values.

7.1.11 Data Reporting and Analytical Procedures

Maxxam J qualified analytes with concentrations between the detection limit (DL) and the LOQ. Amec Foster Wheeler agrees that these results are quantitatively uncertain and has J qualified these results. (Qualifier and reason code: J-TR)

8.0 FIELD DUPLICATE RESULTS

Amec Foster Wheeler collected field duplicates with samples:

- FRCHD03-GW-001 (FRCHD-FD-GW-01)
- FRCHD05-SO-001 (FRCHD-FD-SO-01)
- FRCHD02-SO-001 (FRCHD-FD-SO-02)
- FRCHD05-SO-002 (FRCHD-FD-SO-03)

Detected results and RPDs for the field duplicate are summarized in Table 2. Precision values were within the QPP-specified limits of less than 30% RPD or the difference between analytical results less than the LOQ, with the following exception.

- The RPDs for 6:2 FTS (48%), 8:2 FTS (72%), and PFOS (73%) were high between sample FRCHD05-SO-002 and its field duplicate FRCHD-FD-SO-03. Amec Foster Wheeler J qualified the detected 6:2 FTS, 8:2 FTS, and PFOS results from these samples because of the potential sampling or analytical imprecision. (Qualifier and reason code: J-FDD)

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9.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler evaluated a total of 608 data records from field samples during the validation. Amec Foster Wheeler J or UJ qualified 154 records (25.3%) as estimated values because of laboratory duplicate imprecision, field duplicate imprecision, high or low internal standard recoveries, and/or analyte concentrations between the DL and the LOQ. Amec Foster Wheeler also B qualified 3 records (0.5%) because of contamination detected in an associated laboratory or equipment blank and Q qualified one record (0.2%) because of equipment blank contamination coupled with an additional QC issue. Qualified data are summarized in Table 3.

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REFERENCES

Amec Foster Wheeler, 2016. Draft, Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2016.

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EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

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TABLES

Table 1
Field Samples Submitted to Maxxam Analytics International
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Collection Date	Sample Matrix	Laboratory SDG	Laboratory Sample Identification	Notes
FRCHD03-GW-001	8-May-17	Groundwater	B797259	EJI394	
FRCHD03-SO-003	8-May-17	Soil	B797259	EJI395	
FRCHD03-SO-005	8-May-17	Soil	B797259	EJI396	
FRCHD04-SO-001	8-May-17	Soil	B797259	EJI397	
FRCHD04-SO-003	8-May-17	Soil	B797259	EJI398	
FRCHD04-SO-005	8-May-17	Soil	B797259	EJI399	
FRCHD05-GW-002	8-May-17	Groundwater	B797259	EJI400	
FRCHD05-SO-001	8-May-17	Soil	B797259	EJI401	
FRCHD05-SO-003	8-May-17	Soil	B797259	EJI402	
FRCHD-EB01	8-May-17	QC Water	B797259	EJI403	Equipment Blank
FRCHD-FD-SO-01	8-May-17	Soil	B797259	EJI404	Field Duplicate of Sample FRCHD05-SO-001
FRCHD02-SO-001	9-May-17	Soil	B797259	EJI405	
FRCHD02-SO-003	9-May-17	Soil	B797259	EJI406	
FRCHD02-SO-004	10-May-17	Soil	B797259	EJI407	
FRCHD03-GW-002	9-May-17	Groundwater	B797259	EJI408	Stage IV
FRCHD03-GW-003	9-May-17	Groundwater	B797259	EJI409	Stage IV
FRCHD03-GW-004	9-May-17	Groundwater	B797259	EJI410	
FRCHD-FB03	9-May-17	QC Water	B797259	EJI411	Field Blank
FRCHD-FD-GW-01	8-May-17	Groundwater	B797259	EJI412	Field Duplicate of Sample FRCHD03-GW-001
FRCHD-FD-SO-02	9-May-17	Soil	B797259	EJI413	Field Duplicate of Sample FRCHD02-SO-001
FRCHD03-SO-002	11-May-17	Soil	B797259	EJI414	
FRCHD05-SO-004	11-May-17	Soil	B797259	EJI415	
FRCHD01-SO-001	10-May-17	Soil	B797259	EJI416	Stage IV
FRCHD01-SO-002	10-May-17	Soil	B797259	EJI417	Stage IV
FRCHD01-SO-003	10-May-17	Soil	B797259	EJI418	Stage IV
FRCHD01-SO-004	10-May-17	Soil	B797259	EJI419	
FRCHD02-GW-001	10-May-17	Groundwater	B797259	EJI420	
FRCHD02-SO-002	10-May-17	Soil	B797259	EJI421	
FRCHD04-GW-003	10-May-17	Groundwater	B797259	EJI422	
FRCHD05-SO-002	11-May-17	Soil	B797259	EJI423	
FRCHD03-SO-004	11-May-17	Soil	B797259	EJI424	
FRCHD-FD-SO-03	11-May-17	Soil	B797259	EJI425	Field Duplicate of Sample FRCHD05-SO-002
FRCHD05-GW-001	11-May-17	Groundwater	B797259	EJI426	
FRCHD-FB-02	11-May-17	QC Water	B797259	EJI427	Field Blank
FRCHD04-SO-004	11-May-17	Soil	B797259	EJI428	
FRCHD04-SO-002	11-May-17	Soil	B797259	EJI429	MS/MSD
FRCHD04-GW-001	11-May-17	Groundwater	B797259	EJI430	
FRCHD03-SO-006	11-May-17	Soil	B797259	EJI431	
FRCHD-EB-02	11-May-17	QC Water	B797259	EJI432	Equipment Blank
FRCHD03-SO-001	11-May-17	Soil	B797259	EJI433	
FRCHD04-SO-006	12-May-17	Soil	B797896	EJL629	
FRCHD04-GW-002	12-May-17	Groundwater	B797896	EJL630	

Notes:
MS/MSD = Matrix Spike / Matrix Spike Duplicate
SDG = Sample Delivery Group

Table 2
Field Duplicate Detections
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Analyte	LOQ	Primary Sample		Field Duplicate	Units	RPD	Notes
Samples FRCHD03-GW-001 and FRCHD-FD-GW-01							
6:2 FTS	0.20	1.9		1.8	µg/L	5.4%	
8:2 FTS	0.20	0.31		0.33	µg/L	6.3%	
EtFOSAA	0.20	0.059 J		0.10 U	µg/L	NC	± LOQ
PFBS	0.20	0.28		0.26	µg/L	7.4%	
PFHpA	0.20	1.4		1.4	µg/L	0.0%	
PFHxS	0.20	2.4		2.3	µg/L	4.3%	
PFHxA	0.20	1.4		1.3	µg/L	7.4%	
PFOA	0.20	0.62		0.58	µg/L	6.7%	
PFNA	0.20	0.077 J		0.084 J	µg/L	8.7%	
PFOS	1.0	17		17	µg/L	0.0%	
Samples FRCHD05-SO-001 and FRCHD-FD-SO-01							
6:2 FTS	0.012	0.47		0.52	mg/kg	10.1%	
8:2 FTS	1.2	0.94 J		1.2 J	mg/kg	24.3%	
EtFOSAA	0.012	0.0020 J		0.0029 J	mg/kg	36.7%	± LOQ
MeFOSAA	0.012	0.0026 J		0.0031 J	mg/kg	17.5%	
PFBS	0.012	0.0042 J		0.0072 U	mg/kg	NC	± LOQ
PFDA	0.012	0.047		0.050	mg/kg	6.2%	
PFDoA	0.012	0.11		0.12	mg/kg	8.7%	
PFHpA	0.012	0.0054 J		0.0052 J	mg/kg	3.8%	
PFHxS	0.012	0.062		0.058	mg/kg	6.7%	
PFHxA	0.012	0.024		0.026	mg/kg	8.0%	
PFOA	0.012	0.011 J		0.011 J	mg/kg	0.0%	
PFNA	0.012	0.0060 J		0.0058 J	mg/kg	3.4%	
PFOS	1.2	8.2		6.9	mg/kg	17.2%	
PFTeDA	0.012	0.038		0.034	mg/kg	11.1%	
PFTrDA	0.012	0.037		0.037	mg/kg	0.0%	
PFUnA	0.012	0.044		0.045	mg/kg	2.2%	
Samples FRCHD02-SO-001 and FRCHD-FD-SO-02							
6:2 FTS	0.00081	0.00035	J	0.00049 U	mg/kg	NC	± LOQ
8:2 FTS	0.00095	0.00057	U	0.00048 J	mg/kg	NC	
PFDA	0.00095	0.00028	J	0.00033 J	mg/kg	16.4%	
PFHxS	0.00081	0.00089	J	0.00077 J	mg/kg	14.5%	
PFHxA	0.00081	0.00025	J	0.00019 J	mg/kg	27.3%	
PFOA	0.00095	0.00026	J	0.00026 J	mg/kg	0.0%	
PFNA	0.00095	0.00055	J	0.00046 J	mg/kg	17.8%	
PFOS	0.00095	0.028		0.021	mg/kg	28.6%	
PFUnA	0.00081	0.00057	U	0.00030 J	mg/kg	NC	± LOQ

Table 2
Field Duplicate Detections
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Analyte	LOQ	Primary Sample	Field Duplicate	Units	RPD	Notes
Samples FRCHD05-SO-002 and FRCHD-FD-SO-03						
6:2 FTS	0.0011	0.011	0.018	mg/kg	48.3%	J-FDD
8:2 FTS	0.0011	0.0052	0.011	mg/kg	71.6%	J-FDD
PFBS	0.0011	0.00088 J	0.00076 J	mg/kg	14.6%	
PFDA	0.0011	0.00021 J	0.00044 J	mg/kg	70.8%	± LOQ
PFDoA	0.0011	0.00053 J	0.00030 J	mg/kg	55.4%	± LOQ
PFHpA	0.0011	0.00050 J	0.00045 J	mg/kg	10.5%	
PFHxS	0.0011	0.0072	0.0068	mg/kg	5.7%	
PFHxA	0.0011	0.0025	0.0023	mg/kg	8.3%	
PFOA	0.0011	0.00094 J	0.00099 J	mg/kg	5.2%	
PFNA	0.0011	0.00066 U	0.00020 J	mg/kg	NC	± LOQ
PFOS	0.011	0.070	0.15	mg/kg	72.7%	J-FDD
PFTeDA	0.0011	0.00031 J	0.00018 J	mg/kg	53.1%	± LOQ
PFTrDA	0.0011	0.00032 J	0.00023 J	mg/kg	32.7%	± LOQ
PFUnA	0.0011	0.00033 J	0.00043 J	mg/kg	26.3%	

Notes:
µg/L = micrograms per liter
LOQ = limit of quantification
mg/kg = milligrams per kilogram
NC = not calculable
6:2 FTS = 6:2 Fluorotelomer sulfonate
8:2 FTS = 8:2 Fluorotelomer sulfonate
EtFOSAA = Ethylperfluorooctane sulfonamidoacetic acid
MeFOSAA = Methylperfluorooctane sulfonamidoacetic acid
PFBS = Perfluorobutanesulfonic acid
PFDA = Perfluorodecanoic acid
PFDoA = Perfluorododecanoic acid
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonic acid
PFHxA = Perlfuorohexanoic acid
PFOA = Perfluorooctanoic acid
PFNA = Perfluorononanoic acid
PFOS = Perfluorooctanesulfonic acid
PFTeDA = Perfluorotetradecanoic acid
PFTrDA = Perfluorotridecanoic acid
PFUnA = Perfluoroundecanoic acid
RPD = relative percent difference

Qualifier Definitions:
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but was not detected above the reported limit of detection.

Reason Codes:
± LOQ = The difference between analyte concentrations is less than the LOW, indicating acceptable analytical precision.
FDD = Field Duplicate Imprecision

Table 3
Qualifiers Added During Validation
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
FRCHD01-SO-001	8:2 FTS	0.0045 mg/kg	J TR
FRCHD01-SO-001	PFNA	0.0058 mg/kg	J TR
FRCHD01-SO-001	PFTrDA	0.0015 mg/kg	J TR
FRCHD01-SO-002	8:2 FTS	0.005 mg/kg	J TR
FRCHD01-SO-002	PFNA	0.0025 mg/kg	J TR
FRCHD01-SO-003	EtFOSAA	0.00018 mg/kg	J TR
FRCHD01-SO-003	PFDA	0.00044 mg/kg	J TR
FRCHD01-SO-003	PFHpA	0.00033 mg/kg	J ISH, TR
FRCHD01-SO-003	PFHxA	0.0004 mg/kg	J TR
FRCHD01-SO-003	PFNA	0.00013 mg/kg	J TR
FRCHD01-SO-003	PFOA	0.00046 mg/kg	J ISH, TR
FRCHD01-SO-003	PFTeDA	0.00026 mg/kg	J TR
FRCHD01-SO-004	EtFOSAA	0.00033 mg/kg	J TR
FRCHD01-SO-004	MeFOSAA	0.00049 mg/kg	J TR
FRCHD01-SO-004	PFDA	0.00088 mg/kg	J TR
FRCHD02-GW-001	PFDA	0.14 µg/L	J TR
FRCHD02-GW-001	PFNA	0.1 µg/L	J TR
FRCHD02-SO-001	6:2 FTS	0.00035 mg/kg	J TR
FRCHD02-SO-001	PFDA	0.00028 mg/kg	J TR
FRCHD02-SO-001	PFHxA	0.00025 mg/kg	J TR
FRCHD02-SO-001	PFHxS	0.00089 mg/kg	J TR
FRCHD02-SO-001	PFNA	0.00055 mg/kg	J TR
FRCHD02-SO-001	PFOA	0.00026 mg/kg	J TR
FRCHD02-SO-002	PFBS	0.0006 mg/kg	J TR
FRCHD02-SO-002	PFHpA	0.00073 mg/kg	J TR
FRCHD02-SO-002	PFOA	0.00048 mg/kg	J TR
FRCHD02-SO-002	PFOS	0.00076 mg/kg	J TR
FRCHD02-SO-003	PFDoA	0.0039 mg/kg	J ISL
FRCHD02-SO-003	PFHpA	0.00033 mg/kg	J TR
FRCHD02-SO-003	PFTeDA	0.00096 mg/kg	J ISL, TR
FRCHD02-SO-003	PFTrDA	0.00098 mg/kg	J ISL, TR
FRCHD02-SO-004	PFDA	0.00021 mg/kg	J TR
FRCHD02-SO-004	PFHxA	0.0003 mg/kg	J TR
FRCHD02-SO-004	PFOA	0.0003 mg/kg	J TR
FRCHD03-GW-001	EtFOSAA	0.059 µg/L	J TR
FRCHD03-GW-001	PFNA	0.077 µg/L	J TR
FRCHD03-GW-002	8:2 FTS	0.19 µg/L	J TR
FRCHD03-GW-002	PFNA	0.042 µg/L	J TR
FRCHD03-GW-003	PFHxS	0.011 µg/L	J TR
FRCHD03-GW-004	PFBS	0.012 µg/L	J TR
FRCHD03-GW-004	PFDA	0.0061 µg/L	J TR
FRCHD03-GW-004	PFDoA	0.0037 µg/L	J TR
FRCHD03-GW-004	PFHpA	0.016 µg/L	J TR
FRCHD03-GW-004	PFNA	0.0042 µg/L	J TR
FRCHD03-GW-004	PFOS	0.24 µg/L	J ISL
FRCHD03-SO-001	PFDA	0.00019 mg/kg	J TR
FRCHD03-SO-001	PFNA	0.00075 mg/kg	J TR
FRCHD03-SO-001	PFTrDA	0.00018 mg/kg	J TR
FRCHD03-SO-001	PFUnA	0.0003 mg/kg	J TR
FRCHD03-SO-002	8:2 FTS	0.00045 mg/kg	J TR

Table 3
Qualifiers Added During Validation
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
FRCHD03-SO-002	PFHxS	0.00038 mg/kg	J TR
FRCHD03-SO-002	PFOA	0.00027 mg/kg	J TR
FRCHD03-SO-003	PFDA	0.00043 mg/kg	J TR
FRCHD03-SO-003	PFOA	0.00041 mg/kg	J TR
FRCHD03-SO-004	PFHpA	0.00086 mg/kg	J TR
FRCHD03-SO-004	PFHxA	0.00043 mg/kg	J TR
FRCHD03-SO-004	PFHxS	0.00087 mg/kg	J TR
FRCHD03-SO-005	PFDA	0.00036 mg/kg	J TR
FRCHD03-SO-005	PFHxS	0.0004 mg/kg	B EBL
FRCHD03-SO-005	PFOA	0.00038 mg/kg	J TR
FRCHD03-SO-005	PFTrDA	0.00018 mg/kg	J TR
FRCHD03-SO-005	PFUnA	0.00033 mg/kg	J TR
FRCHD03-SO-006	PFHpA	0.00041 mg/kg	J TR
FRCHD03-SO-006	PFNA	0.00033 mg/kg	J TR
FRCHD04-GW-001	8:2 FTS	0.089 µg/L	J TR
FRCHD04-GW-002	PFNA	0.13 µg/L	J TR
FRCHD04-GW-002	PFTrDA	0.037 µg/L	J TR
FRCHD04-GW-003	6:2 FTS	0.0079 µg/L	B LBL
FRCHD04-GW-003	PFHpA	0.0048 µg/L	J TR
FRCHD04-GW-003	PFHxA	0.015 µg/L	J TR
FRCHD04-GW-003	PFOA	0.0092 µg/L	J TR
FRCHD04-SO-001	PFNA	0.00038 mg/kg	J TR
FRCHD04-SO-001	PFOA	0.00049 mg/kg	J TR
FRCHD04-SO-002	6:2 FTS	0.00047 mg/kg	J TR
FRCHD04-SO-002	PFBS	0.00037 mg/kg	J TR
FRCHD04-SO-002	PFHpA	0.00056 mg/kg	J TR
FRCHD04-SO-002	PFHxA	0.00069 mg/kg	J TR
FRCHD04-SO-002	PFNA	0.0002 mg/kg	J TR
FRCHD04-SO-002	PFOA	0.00065 mg/kg	J ISH, TR
FRCHD04-SO-003	PFHxS	0.0008 mg/kg	Q EBL, ISL
FRCHD04-SO-003	PFNA	0.00045 mg/kg	J TR
FRCHD04-SO-003	PFOA	0.00067 mg/kg	J TR
FRCHD04-SO-003	PFOS	0.019 mg/kg	J ISL
FRCHD04-SO-004	6:2 FTS	0.00081 mg/kg	J ISH, TR
FRCHD04-SO-004	PFBS	0.0024 mg/kg	J ISH
FRCHD04-SO-004	PFDA	0.0004 mg/kg	UJ ISH
FRCHD04-SO-004	PFHpA	0.0012 mg/kg	J ISH
FRCHD04-SO-004	PFHxA	0.0038 mg/kg	J ISH
FRCHD04-SO-004	PFHxS	0.029 mg/kg	J ISH
FRCHD04-SO-004	PFNA	0.00059 mg/kg	UJ ISH
FRCHD04-SO-004	PFOS	0.0018 mg/kg	J ISH
FRCHD04-SO-005	PFBS	0.00035 mg/kg	J TR
FRCHD04-SO-005	PFHxS	0.0008 mg/kg	B EBL
FRCHD04-SO-005	PFNA	0.00022 mg/kg	J TR
FRCHD04-SO-006	6:2 FTS	0.00028 mg/kg	J TR
FRCHD04-SO-006	PFHpA	0.00065 mg/kg	J TR
FRCHD04-SO-006	PFHxA	0.00097 mg/kg	J TR
FRCHD04-SO-006	PFOA	0.0008 mg/kg	J TR
FRCHD05-GW-001	EtFOSAA	1 µg/L	UJ ISH
FRCHD05-GW-001	MeFOSAA	1 µg/L	UJ ISH

Table 3
Qualifiers Added During Validation
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
FRCHD05-GW-001	PFNA	0.41 µg/L	J TR
FRCHD05-GW-002	6:2 FTS	14 µg/L	J LDD
FRCHD05-GW-002	PFNA	0.46 µg/L	J TR
FRCHD05-SO-001	8:2 FTS	0.94 mg/kg	J TR
FRCHD05-SO-001	EtFOSAA	0.002 mg/kg	J TR
FRCHD05-SO-001	MeFOSAA	0.0026 mg/kg	J TR
FRCHD05-SO-001	PFBS	0.0042 mg/kg	J TR
FRCHD05-SO-001	PFHpA	0.0054 mg/kg	J TR
FRCHD05-SO-001	PFNA	0.006 mg/kg	J TR
FRCHD05-SO-001	PFOA	0.011 mg/kg	J TR
FRCHD05-SO-002	6:2 FTS	0.011 mg/kg	J FDD
FRCHD05-SO-002	8:2 FTS	0.0052 mg/kg	J FDD
FRCHD05-SO-002	PFBS	0.00088 mg/kg	J TR
FRCHD05-SO-002	PFDA	0.00021 mg/kg	J TR
FRCHD05-SO-002	PFDoA	0.00053 mg/kg	J TR
FRCHD05-SO-002	PFHpA	0.0005 mg/kg	J TR
FRCHD05-SO-002	PFOA	0.00094 mg/kg	J ISH, TR
FRCHD05-SO-002	PFOS	0.07 mg/kg	J ISL, FDD
FRCHD05-SO-002	PFTeDA	0.00031 mg/kg	J TR
FRCHD05-SO-002	PFTrDA	0.00032 mg/kg	J TR
FRCHD05-SO-002	PFUnA	0.00033 mg/kg	J TR
FRCHD05-SO-003	PFDoA	0.0049 mg/kg	J TR
FRCHD05-SO-003	PFHpA	0.0036 mg/kg	J TR
FRCHD05-SO-003	PFNA	0.0044 mg/kg	J TR
FRCHD05-SO-003	PFOA	0.0052 mg/kg	J TR
FRCHD05-SO-003	PFTeDA	0.0021 mg/kg	J TR
FRCHD05-SO-003	PFTrDA	0.0017 mg/kg	J TR
FRCHD05-SO-003	PFUnA	0.0062 mg/kg	J TR
FRCHD05-SO-004	PFNA	0.00054 mg/kg	J TR
FRCHD-FD-GW-01	PFNA	0.084 µg/L	J TR
FRCHD-FD-GW-01	PFOS	17 µg/L	J ISL
FRCHD-FD-SO-01	8:2 FTS	1.2 mg/kg	J TR
FRCHD-FD-SO-01	EtFOSAA	0.0029 mg/kg	J ISH, TR
FRCHD-FD-SO-01	MeFOSAA	0.0031 mg/kg	J ISH, TR
FRCHD-FD-SO-01	PFHpA	0.0052 mg/kg	J TR
FRCHD-FD-SO-01	PFNA	0.0058 mg/kg	J TR
FRCHD-FD-SO-01	PFOA	0.011 mg/kg	J TR
FRCHD-FD-SO-02	6:2 FTS	0.00049 mg/kg	UJ ISH
FRCHD-FD-SO-02	8:2 FTS	0.00048 mg/kg	J ISL, TR
FRCHD-FD-SO-02	PFDA	0.00033 mg/kg	J TR
FRCHD-FD-SO-02	PFDoA	0.00049 mg/kg	UJ ISH
FRCHD-FD-SO-02	PFHxA	0.00019 mg/kg	J ISH, TR
FRCHD-FD-SO-02	PFHxS	0.00077 mg/kg	J TR
FRCHD-FD-SO-02	PFNA	0.00046 mg/kg	J TR
FRCHD-FD-SO-02	PFOA	0.00026 mg/kg	J TR
FRCHD-FD-SO-02	PFUnA	0.0003 mg/kg	J ISH, TR
FRCHD-FD-SO-03	6:2 FTS	0.018 mg/kg	J FDD
FRCHD-FD-SO-03	8:2 FTS	0.011 mg/kg	J FDD
FRCHD-FD-SO-03	PFBS	0.00076 mg/kg	J TR
FRCHD-FD-SO-03	PFDA	0.00044 mg/kg	J TR

Table 3
Qualifiers Added During Validation
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Fairchild Air Force Base, Washington

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
FRCHD-FD-SO-03	PFDoA	0.0003 mg/kg	J TR
FRCHD-FD-SO-03	PFHpA	0.00045 mg/kg	J TR
FRCHD-FD-SO-03	PFNA	0.0002 mg/kg	J TR
FRCHD-FD-SO-03	PFOA	0.00099 mg/kg	J TR
FRCHD-FD-SO-03	PFOS	0.15 mg/kg	J ISL, FDD
FRCHD-FD-SO-03	PFTeDA	0.00018 mg/kg	J TR
FRCHD-FD-SO-03	PFTrDA	0.00023 mg/kg	J TR
FRCHD-FD-SO-03	PFUnA	0.00043 mg/kg	J TR

Notes:

µg/L = micrograms per liter
mg/kg = milligrams per kilogram
6:2 FTS = 6:2 Fluorotelomer sulfonate
8:2 FTS = 8:2 Fluorotelomer sulfonate

EtFOSAA = Ethylperfluorooctane sulfonamidoacetic acid
MeFOSAA = Methylperfluorooctane sulfonamidoacetic acid
PFBS = Perfluorobutanesulfonic acid
PFDA = Perfluorodecanoic acid
PFDoA = Perfluorododecanoic acid
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonic acid
PFHxA = Perlfuorohexanoic acid
PFOA = Perfluorooctanoic acid
PFNA = Perfluorononanoic acid
PFOS = Perfluorooctanesulfonic acid
PFTeDA = Perfluorotetradecanoic acid
PFTrDA = Perfluorotridecanoic acid
PFUnA = Perfluoroundecanoic acid

Validation Qualifiers

B = The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than 10 times the concentration detected in the blank.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Q = The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.
UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Reason Codes

EBL = Contamination was detected in the equipment blank at a concentration less than the limit of quantitation (LOQ) and the associated sample result is less than ten times the concentration. detected in the blank.
FDD = Field duplicate imprecision.
ISH = High internal standard recovery. Analytical result may be biased low.
ISL = Low internal standard recovery. Analytical result may be biased high.
LBL = Contamination was detected in the laboratory blank at a concentration less than the LOQ and the associated sample result is less than ten times the concentration detected in the blank.
LDD = Laboratory duplicate imprecision.
TR = Detected concentration is less than the LOQ.

APPENDIX E

INVESTIGATION-DERIVED WASTE DOCUMENTATION

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CWMI

Please print or type. Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
WA 9 5 7 1 9 2 4 6 4 7	1	(800) 424-9300	019236551 JJK

GENERATOR

5. Generator's Name and Mailing Address
DRMO-FAIRCHILD AIR FORCE BASE
92 CES/CEIE 100 W ENT STREET #155
FAIRCHILD AFB WA 99011-9651
Generator's Phone: (509) 247-8132

Generator's Site Address (if different than mailing address)

6. Transporter 1 Company Name: CHEMICAL WASTE MANAGEMENT OF THE NW, INC.
U.S. EPA ID Number: ORD089452353

7. Transporter 2 Company Name
U.S. EPA ID Number

8. Designated Facility Name and Site Address
CHEMICAL WASTE MANAGEMENT, INC.
17629 CEDAR SPRINGS LANE
ARLINGTON OR 97812-9709
Facility's Phone: (541) 454-2643
U.S. EPA ID Number: ORD089452353

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. NON-HAZARDOUS WASTE SOLID (IDW SOIL) OR338510	1	DM	425	P	X004
	2. NON-HAZARDOUS WASTE LIQUID (IDW WATER) OR338512	2	DM	350	P	X004
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. OR338510 - LE01 - IDW SOIL
2. OR338512 - STAB01 - IDW WATER
E/R PROVIDER: CHEMTREC (1-800 424-9300) CONTRACT NUMBER 24117

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Spencer Paul — Signature — Month 07 Day 19 Year 18

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Jeffrey Knight — Signature — Month 07 Day 19 Year 18
Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name — Signature — Month Day Year

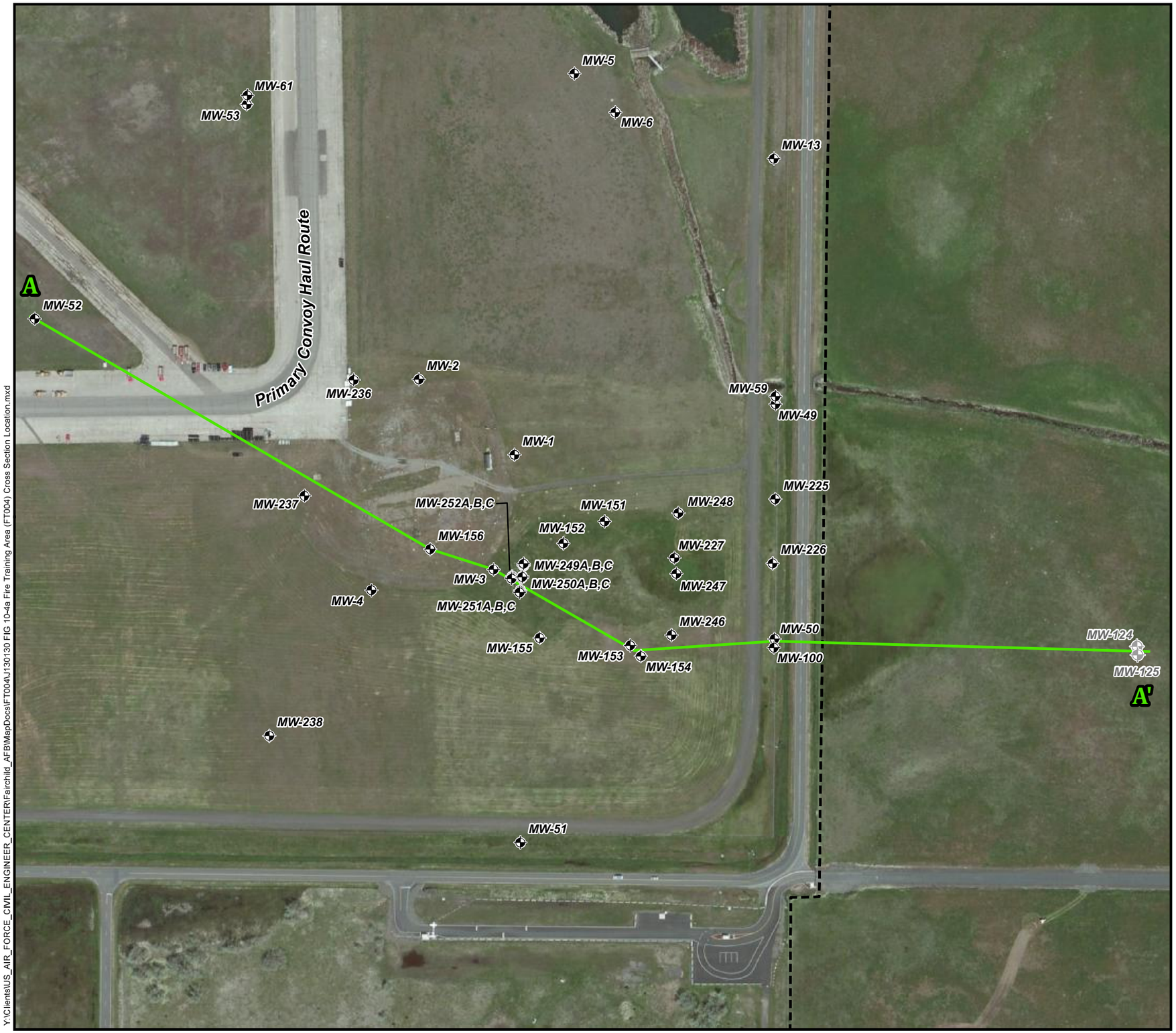
EPA Form 8700-22 (Rev. 12-17) Previous editions are obsolete. DESIGNATED FACILITY TO EPA's e-MANIFEST SYSTEM

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APPENDIX F

GEOLOGIC CROSS SECTION

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Y:\Clients\US_AIR_FORCE_CIVIL_ENGINEER_CENTER\Fairchild_AFB\MapDocs\FT004\J130130 FIG 10-4a Fire Training Area (FT004) Cross Section Location.mxd

Figure 10-4a

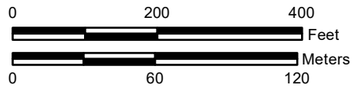
Fire Training Area (FT004) Cross Section Location

Fairchild AFB, WA





Map Projection: NAD 1983 UTM Zone 11N, Meters
Basemap: ESRI World Imagery WMS



Decommissioned Monitoring Well

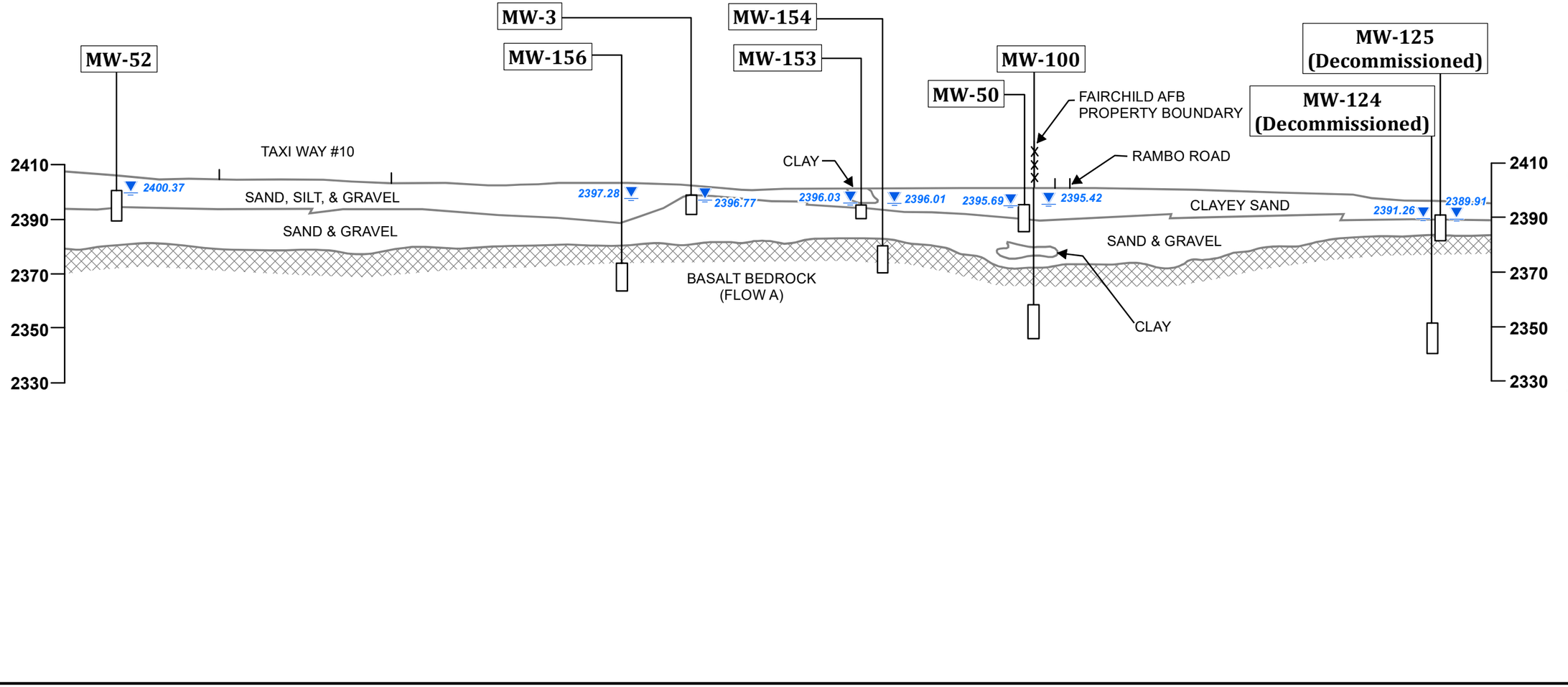
Monitoring Well

Cross Section A to A' Location

Installation Boundary

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: SG | Date Drawn/Revised: 1/21/2016 | Project No. J130130



MW-52 Well Number

Ground Surface

Top of Screen

Water Table Elevation (03/31/92)

Bottom of Screen

Bedrock (Basalt A)

NOTES: This cross-section was adapted from the February 1993 Remedial Investigation Report, On-base Priority One Operable Units, Fairchild Airforce Base, USAF, Figure 3-26

MW-124 and MW-125 have been decommissioned

VERTICAL SCALE (5:1) (FEET): 80

HORIZONTAL SCALE (FEET): 200

ENGR'G	J.O.	DATE	Bay West — Customer-Focused Environmental & Industrial Solutions
DRAWN	S.G.	1/21/2016	
REV.	00		
PROJECT NAME	FAIRCHILD AFB		
TITLE	FT004 Cross Section A to A'		
J130130 FT004		FIGURE #	10-4b

Y:\Clients\US_AIR_FORCE_CIVIL_ENGINEER_CENTER\Fairchild_AFB\MapDocs\FT004\J130130 FIG 10-4b FT004 Cross Section AtoA.mxd

APPENDIX G

CURRENT OFF-BASE WATER WELL SAMPLING AREA

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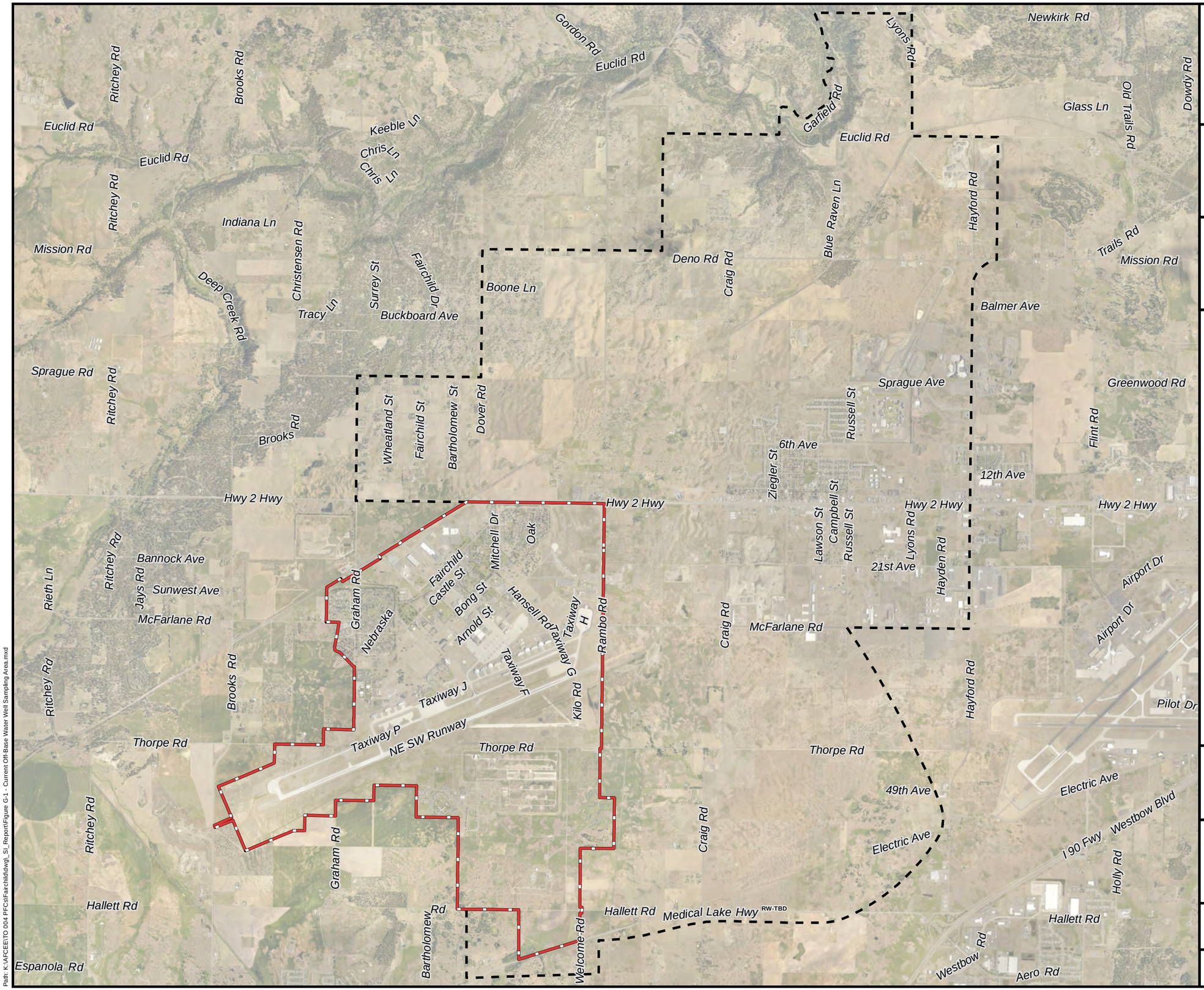


FIGURE G-1
Current Off-Base Water Well Sampling Area
Fairchild Air Force Base
Spokane, Washington

Site Inspection of
Aqueous Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

Air Force Civil Engineer Center

2261 Hughes Avenue
Building 171, Suite 155
JBSA Lackland, Texas 78236

Symbol Key

- Current Off-Base Water Well Sampling Area
- Fairchild AFB Installation Boundary

NOTE: FOR OFFICIAL USE ONLY (FOUO). This document contains information which must be protected IAW the Privacy Act of 1974 (5 U.S.C. 552a), DoD 5400.11R, AFI 33-332, and AFI 31-401.

Project: 775303101

Date: 12/10/2018 | By:SD

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Disclaimer: For general reference purposes only.

0 2,000 4,000 8,000 Ft.

Path: K:\AFCEE\TO 004 PFCs\Fairchild\dwg_SI_Report\Figure G-1 - Current Off-Base Water Well Sampling Area.mxd