



# **Final Site Inspections Report of Fire Fighting Foam Usage at Joint Base Andrews Prince George's County, Maryland**

**May 2018**

**Submitted to:**

**Air Force Civil Engineer Center  
3515 General McMullen Suite 155  
San Antonio, Texas 78226-2018**

**Submitted by:**

**U.S. Army Corps of Engineers  
Savannah District  
100 W. Oglethorpe Avenue  
Savannah, Georgia 31401-3640**



**Prepared by:**

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under  
Contract No. W912HN-15-C-0022**

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## Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AFB	Air Force Base
AFFF	aqueous film forming foam
amsl	above mean sea level
ANDRW	Environmental Resources Program Information Management System designation for Joint Base Andrews
ASA	Air Sovereignty Alert
ASL	Aerostar SES LLC
BRAC	Base Realignment and Closure
bgs	below ground surface
CAS	Chemical Abstracts Service
CL	clay
CSM	conceptual site model
DOD	Department of Defense
DOT	Department of Transportation
DPT	direct push technology
DRMO	Defense Reutilization and Marketing Office
dup	duplicate
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FDA	Food and Drug Administration
FTA	fire training area
GW	groundwater
HA	health advisory
HGL	HydroGeologic
Hi-Ex	high expansion
HQ	hazard quotient
ID	identification
IDW	investigation-derived waste
J	estimated value
JBA	Joint Base Andrews
mg/kg	milligrams per kilogram
mph	miles per hour
NA	not applicable
NAVD	North American Vertical Datum
ND	not detected at the method detection limit
NL	not listed
No.	number
OWS	oil/water separator
PA	Preliminary Assessment
PFAS	per- and polyfluorinated alkyl substance
PFBS	perfluorobutane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
pH	potential of hydrogen
QAPP	quality assurance project plan
RI	Remedial Investigation
ROD	Record of Decision



RSL	Regional Screening Level
SC	clayey sands
SD	sediment
SI	Site Inspection
SO	subsurface soil
SP	poorly graded or gravelly sands
SS	surface soil
SW	surface water
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
U	analyte not detected
USCS	Unified Soil Classification System
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
UST	underground storage tank
UV-IR	ultraviolet-infrared
WSCC	Washington Suburban Sanitary Commission

## 1.0 INTRODUCTION

Aerostar SES LLC (ASL) under contract to the U.S. Army Corps of Engineers (USACE) Savannah District (Contract No. W912HN-15-C-0022) conducted screening-level Site Inspections (SI) at nine areas: Eight areas at Joint Base Andrews (JBA) in Prince George's County, Maryland, and one at the former Brandywine Defense Reutilization and Marketing Office (DRMO) Yard, approximately 7 miles southeast of JBA in Brandywine, Maryland. The purpose of the SI is to determine the presence or absence of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in the environment at these areas. These compounds are a class of synthetic fluorinated chemicals used in industrial and consumer products, including defense-related applications. This class of compounds is also referred to as per- and polyfluorinated alkyl substances (PFAS).

In 1970, the U.S. Air Force (USAF) began using aqueous film forming foam (AFFF), firefighting agents containing PFOS and PFOA, to extinguish petroleum fires. AFFF may have entered the environment during routine fire training, equipment maintenance, storage, and use. The U.S. Environmental Protection Agency (EPA) continues to permit the use of PFOS-based AFFF; however, manufacturers have reformulated AFFF to eliminate PFOS. The USAF has excess inventory of PFOS-based AFFF. As of this report, the USAF is actively removing PFOS-based AFFF from its inventory and replacing it with formulations free of PFOS and containing little or no PFOA, which are less persistent and bioaccumulative in the environment.

The objectives of this study were to

- determine if a confirmed release of PFOS, PFOA, or perfluorobutane sulfonate (PFBS) has occurred at AFFF areas selected for inspection;
- determine if PFOS or PFOA are present in groundwater or surface water in the areas at concentrations exceeding the EPA lifetime health advisory (HA);
- determine if PFBS is present in groundwater or surface water in the areas at concentrations exceeding the EPA Regional Screening Levels (RSLs);
- determine if PFOA or PFOS is present in soil or sediment in the areas at concentrations exceeding the calculated RSLs,
- determine if PFBS is present in soil or sediment in the areas at concentrations exceeding the EPA RSLs, and
- identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS or PFOA above the HA or PFBS above the RSL).

This report does not include assessment of ecological exposure pathways, receptors, or risk from PFAS impacts to the environment. Confirmed releases may require further investigation to fully delineate the extent of contamination and perform a complete risk assessment that includes ecological receptors.

In the quality assurance project plan (QAPP) (ASL, January 2016) screening levels for soil and sediment were established in accordance with *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Closure and Realignment (BRAC) Installations* (USAF, August 2012). However, after publication of the QAPP, the USAF determined that more conservative screening levels were appropriate. Therefore, screening levels for PFOS and PFOA in soil and sediment were calculated using EPA's RSL calculator ([https://epaprgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epaprgs.ornl.gov/cgi-bin/chemicals/csl_search)). The calculations were conducted using the residential scenario with a hazard quotient (HQ) of 0.1. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.02 µg/kg per day derived by EPA in its drinking water health advisories for both PFOS (EPA, May 2016a) and PFOA (EPA, May 2016b). The calculations are available in Appendix F. The final site-specific QAPP addendum for JBA

(ASL, November 2016) used an HQ of 1.0. The USAF has decided to use the HQ of 0.1 in accordance with recently released EPA requirements.

Screening levels for PFOS and PFOA in groundwater and surface water are based on EPA lifetime drinking water HAs for PFOS (EPA, May 2016a) and PFOA (EPA, May 2016b); a release will be considered confirmed when exceedances of the following concentrations are identified:

**PFOS:**

- 0.07 micrograms per liter (µg/L) in groundwater/surface water (as an individual concentration and/or combined with the PFOA value).
- 126<sup>a</sup> micrograms per kilogram (µg/kg) in soil (calculated, in the absence of EPA RSL values).
- 126<sup>a</sup> µg/kg in sediment (calculated, in the absence of RSL values).

**PFOA:**

- 0.07 µg/L in groundwater/surface water (as an individual concentration and/or combined with the PFOS value).
- 126<sup>a</sup> µg/kg in soil (calculated, in the absence of RSL values).
- 126<sup>a</sup> µg/kg in sediment (calculated, in the absence of RSL values).

Although PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in this SI, EPA has also derived RSL values for PFBS, for which there is a Tier 2 toxicity value (Provisional Peer Reviewed Toxicity Value) (EPA, November 2017). The USAF will also consider a release to be confirmed if exceedances of the following concentrations are identified:

**PFBS:**

- 40 µg/L in groundwater/surface water.
- 130,000 µg/kg in soil/sediment.

**Notes:**

<sup>a</sup>Screening levels are calculated using the EPA RSL calculator ([https://epaprgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epaprgs.ornl.gov/cgi-bin/chemicals/csl_search)). The screening values for PFOA, PFOS, and PFBS are residential screening levels at a Hazard Quotient (HQ) of 0.1. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.02 µg/kg per day derived by EPA in its Drinking Water Health Advisories for both PFOS (EPA, May 2016b) and PFOA (EPA, May 2016a).

To facilitate reporting and discussion of the investigation, sampling, and analysis of PFOS, PFOA, and PFBS in this report, these compounds will hereafter be referred to collectively as “PFAS.” Table 1 presents the screening values for comparing the analytical results for these three PFAS compounds.

AFFF areas were selected for further inspection through the SI process at JBA during the Preliminary Assessment (PA) phase and documented in a PA report (HydroGeologic [HGL], May 2015). The PA (HGL, May 2015) identified 10 AFFF areas at JBA requiring additional evaluation through the SI process based on the reported or suspected release of AFFF material containing PFAS compounds. While developing the site-specific QAPP addendum, adjacent Hangars 6 and 7 (identified as two separate sites in the PA) were combined to one area and inspected together. Therefore, the number of areas in the SI was adjusted to nine. The nine AFFF areas selected for SI and the rationale for inclusion are listed in Table 2. Media evaluated during the SI included surface soil (0 to 6 inches in depth); subsurface soil (in the vadose zone collected immediately above the water saturated/unsaturated soil interface); groundwater (including samples from existing monitoring wells, temporary wells, and/or direct push sampling); and surface water and sediment.

**Table 1 Screening Values**

Parameter	Chemical Abstracts Number	EPA Regional Screening Level Table (November 2017) <sup>a</sup>		Calculated Regional Screening Levels for Soils and Sediments <sup>b</sup> (µg/kg)	EPA Health Advisory for Drinking Water (Surface Water or Groundwater) (µg/L) <sup>c</sup>
		Residential Soil (µg/kg)	Tap Water (µg/L)		
Perfluorobutane sulfonate (PFBS)	375-73-5	130,000	40	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	126	0.07*
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	126	

<sup>a</sup> EPA Regional Screening Levels (November 2017) (<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>)

<sup>b</sup> Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)). The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg per day derived by EPA in its Drinking Water Health Advisories for both PFOS and PFOA (May 2016).

<sup>c</sup> EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*.

\*Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds should be compared with the 0.07 µg/L health advisory value. Only groundwater and surface water were sampled during the SI, but analytical results have been compared to the tap water screening levels.

µg/kg = micrograms per kilogram

µg/L = micrograms per liter

EPA = U.S. Environmental Protection Agency

NL = not listed

**Table 2 Aqueous Film Forming Foam Areas and Selection Rationale for Site Inspection at Joint Base Andrews**

AFFF Area	AFFF Inspection Area	Associated Existing ERP Site	Area Selection Rationale
1	Former FTA 4 (FT-04) and ASA Facility (Building 2489)	FT-04	FTA 4 was used for fire training activities from 1973 to 1990. During the training, combustible fluids were ignited and then extinguished with AFFF, resulting in the release of an unknown quantity of AFFF in this area.
2	Hangar 16 (Building 3119)	SS-26	Constructed in 1955, the hangar was originally equipped with a foam fire suppression system. A release of AFFF at the hangar was reportedly caused by an electrical storm that triggered the AFFF fire suppression system, but the date and quantity of AFFF released were not documented.
3	East Side Fuel Cell (Building 3629)	ST-14	There have been five documented AFFF releases from Building 3629, including releases to the outside of the building. Three of the five known AFFF releases were complete system releases of 2,000 gallons.
4	Hangar 11 (Building 3635)	None (new site)	Multiple documented releases of AFFF have occurred at Hangar 11. AFFF releases have flowed outside the hangar onto the asphalt and concrete areas and then into the storm drain system. Significant foam was observed in Cabin Branch Creek as a result of at least one release.
5	Hangar 6 (Building 1280) and Hangar 7 (Building 1279)	AOC-26	Anecdotal information from JBA fire department personnel suggests that Hangar 6 was originally equipped with an AFFF system, and there were releases of AFFF in the hangar. Hangar 7 was originally equipped with an AFFF system, and releases of AFFF reportedly occurred at the hangar, but there are no records of the exact dates or quantities released.

AFFF Area	AFFF Inspection Area	Associated Existing ERP Site	Area Selection Rationale
6	Fire Station #1 (Building 1287)	FT-02	Fire trucks were filled with AFFF in front of the fire station and on some occasions overfilled, releasing AFFF to the ground surface. Fire training activities using AFFF were also occasionally conducted in front of the fire station, but the frequency and duration of these exercises are not documented. In December 2012, a crash truck leaked approximately 100 gallons of AFFF in front of the fire station, and some AFFF flowed to the nearby storm sewer and to the depression east of Hangar 19 (Building 5016).
7	Former Hare Berry Farms	None (new site)	In May 1992, approximately 500 gallons of AFFF entered Piscataway Creek, and the creek water was used to irrigate the crops on the farm. Given the location of the farm downstream of JBA, the documented release of AFFF to Piscataway Creek, and the subsequent use of the creek water to irrigate the fields, it is possible that PFAS has migrated to the groundwater in the area.
8	Brandywine DRMO Yard	SS-01	Although there are no documented AFFF releases at the Brandywine DRMO Yard, EPA requested that JBA investigate it for the presence of PFAS in the environment because of the presence of burn pits and a structure fire at the site.
9	Former FTA 3	FT-03	There are no records indicating AFFF was used at FT-03. However, because this was an FTA and the site has not been inspected for PFAS, EPA requested that the groundwater in the area be tested for PFAS prior to approving site closure.

ASA = Air Sovereignty Alert

DRMO = Defense Reutilization and Marketing Office

ERP = Environmental Restoration Program

JBA = Joint Base Andrews

AFFF = aqueous film forming foam

EPA = United States Environmental Protection Agency

FTA = fire training area

PFAS = per- and polyfluorinated alkyl substance

## 2.0 AFFF AREA DESCRIPTIONS

JBA is in a transition zone between a humid continental climate (with warm summers) to the north and west and a humid subtropical climate zone to the immediate south. The area has a continental-type climate with well-defined seasons. The climate is further influenced by nearby water bodies. JBA is on the upper end of a peninsula formed by the Potomac River on the west and south, and the Chesapeake Bay on the east. Prevailing winds vary in both direction and velocity depending on the season. Typically, winds are from the northwest from November to April (average wind speeds are 7 to 8 miles per hour [mph]) and from the southwest from May to September (average wind speeds are 5 to 6 mph). The mean annual temperature in the area is 54 degrees Fahrenheit. The warmest month is July (average temperature is 76 degrees Fahrenheit), and the coldest month is January (average temperature is 32 degrees Fahrenheit). The annual precipitation averages approximately 42 inches of rain and 20 inches of snow. The monthly distribution of precipitation is relatively uniform during the year, with the wettest month (July) averaging 4.46 inches of precipitation and the driest (February) averaging 2.75 inches of precipitation (Bay West, February 2014).

JBA encompasses approximately 4,300 acres adjacent to Camp Springs, Maryland, on Highway 337 near the center of Prince George's County, approximately 4 miles southeast of Washington, DC (HGL, May 2015). The history of JBA dates back to the Civil War, with the first military airfield becoming operational on what is now JBA as Camp Springs Army Air Field on May 2, 1943. Camp Springs became Andrews Field in 1945 to honor Lieutenant General Frank M. Andrews. The name was changed to Andrews Air Force Base (AFB) in 1947, shortly after the USAF became a separate service. Through the years, the facility has been home to a variety of aircrafts with diverse missions. However, the base is best

known for its special air mission of transporting senior government and military leaders, and in March 1962, it officially became the “Home of Air Force One.” On October 1, 2009, Andrews AFB along with Naval Air Facility Washington became known as JBA (USAF, September 2012).

JBA also administratively controls the former Brandywine DRMO Yard. This inactive facility covers approximately 8 acres in Brandywine, Maryland, approximately 7 miles southeast of the main Base. The Brandywine Storage Annex (later renamed the Brandywine DRMO Yard by the USAF) was active from 1943 to 1987 and served as a storage area for waste and excess government material generated by U.S. DoD operations at facilities, including JBA, Bolling AFB, the Washington Navy Yard, the Naval Ordnance Station-Indian Head, and White Oak Laboratory. According to USAF records, hazardous materials and wastes were not stored at the DRMO Yard after 1980. In January 1987, a fire destroyed the main warehouse building near the south end of the DRMO Yard (HGL, July 2013). Figure 1 (Appendix A) shows the location of JBA and the former Brandywine DRMO Yard.

## **2.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

Former Fire Training Area (FTA) 4 (FT-04) is at the south end of Building 2489. Building 2489 houses the Air National Guard 113<sup>th</sup> Air Sovereignty Alert (ASA) Facility. The building was constructed in 2008 over the footprint of the former FTA. The current FTA (Building 1249) is a concrete-lined pit approximately 200 feet south of Building 2489 and has been in use since 1995. AFFF Area 1 is in the southeastern portion of JBA adjacent to the southeast corner of the airfield. The former FTA area is bordered to the north by a parking area and Building 2488, to the east by wooded areas, to the west by the airfield, and to the south by the current FTA, a restricted airfield ramp, and lightly vegetated areas. The area includes a large impervious apron and hangar surrounded by grassy turf areas.

Building 2489 is equipped with a high-expansion (Hi-Ex) foam fire suppression system. The Hi-Ex foam mixing system is in the mechanical room in the interior of the building and consists of one 300-gallon capacity upright tank containing Hi-Ex fluid. Reportedly, the fire suppression system in the building has never used AFFF containing PFAS. However, Building 2489 was constructed over the former FTA, where AFFF was used extensively, so the potential exists for PFAS contamination to be in the area around Building 2489. Former FTA 4 was used for fire training activities from 1973 to 1990. Records indicate that approximately 300 gallons of a mix of JP-4, motor oil, and possibly solvents were released to the burn area through the fuel distribution system during weekly exercises. Standard practice for the exercises was to release the combustible liquids into the burn area, ignite them, then extinguish the fire with AFFF. The quantity of AFFF used during these exercises was not recorded. Excess fluids generated during the exercises flowed across the burn area into the oil/water separator (OWS), and oil was collected for off-site disposal. Residual foam and water passed through the OWS and flowed to a 44,700-gallon capacity leaching pond with gravel at the bottom. Liquids typically seeped through the gravel into the ground; also, the leaching pond often became plugged, causing the pond to overflow and discharge fluids to the ground surface. In some instances the excess fluids were collected and transported to another OWS for discharge to the sanitary sewer system.

## **2.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

Hangar 16 (Building 3119) is on the east side of the central portion of the JBA airfield. The hangar is bordered to the north by a lightly vegetated area and Buildings 3120 and 3121, to the east by a parking lot followed by Perimeter Road, to the west by the concrete tarmac apron, and to the south by lightly vegetated areas followed by Buildings 3108 and 3109. The hangar was constructed in 1955 and was originally equipped with a foam fire suppression system, which was reportedly converted to a Hi-Ex system in December 2009. The fire suppression system for the hangar is in the mechanical room on the

northeast side of the hangar. The system consists of one 500-gallon upright tank containing Hi-Ex fluid (HGL, May 2015). Prior to the conversion to Hi-Ex, the system consisted of one 850-gallon AFFF tank feeding four floor cannons. The system also included four portable 30-gallon AFFF cannons. Two trench drains flow to the OWS on the northeast corner of the hangar. According to available records, the OWS was installed around 1998. The hangar is also equipped with a containment system that seals off the pathway to the OWS in case of a release. The containment system was installed because of multiple historical releases of AFFF at JBA. One reported release of AFFF at Hangar 16 was caused by an electrical storm that activated the ultraviolet-infrared (UV-IR) detectors, triggering the AFFF fire suppression system. The date and quantity of AFFF released were not documented. No additional releases of AFFF were identified between 2000 and 2009, when the system was converted to Hi-Ex (HGL, May 2015). There was no documented cleanup effort for the release of AFFF at Hangar 16. Therefore, the release could potentially have impacted the areas around the hangar, and PFAS may have migrated to the groundwater in the area (HGL, May 2015).

### **2.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

The East Side Fuel Cell (Building 3629) is on the north side of the eastern portion of the JBA airfield. The hangar is bordered to the north by a restricted airfield ramp, to the east by a parking lot followed by Patrick Avenue, to the west by the concrete apron, and to the south by a driveway/parking area (HGL, May 2015). The building is equipped with an AFFF fire suppression system consisting of two 1,000-gallon tanks containing AFFF concentrate, feeding three floor cannons and an overhead system. The equipment for the AFFF system is contained in the hangar mechanical room on the south side of the hangar. There have been five documented AFFF releases in this area, including releases to the outside of the building. Three of the five known AFFF releases were complete system releases (2,000 gallons) occurring in the summers of 2003 and 2004 from sensor failures caused by electrical storms, triggering the AFFF fire suppression system. A release of approximately 15 gallons of AFFF to the sanitary sewer system occurred in March 2001. A release of AFFF occurred in 2013, but no details on the cause, quantity released, or disposal of AFFF were available. The trench drains in the hangar lead to the OWS on the west side of the building and then into the sanitary sewer system. The hangar drains are equipped with a diversion system that routes the drainage to a 500-gallon underground storage tank (UST) in the event of a release (HGL, May 2015). AFFF released outside the building would not be contained in the engineered drainage system and could potentially result in PFAS migrating to the groundwater.

### **2.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

Hangar 11 (Building 3635) is on the north side of the eastern portion of the JBA airfield and is behind the secured Pathfinder gate in a restricted area. The hangar is bordered to the north by a driveway/parking area, to the east by a parking lot followed by Patrick Avenue, to the west by the concrete apron, and to the south by a restricted airfield ramp. The hangar was constructed in 1944 and is equipped with an AFFF fire suppression system consisting of two 1,000-gallon tanks containing AFFF concentrate feeding six cannons and a closed overhead sprinkler system. The equipment for the AFFF system is in the mechanical room on the south side of the hangar. The hangar has two trench drains and prior to 2000, the trench drains discharged directly into the storm sewer system. After 2000, a 10,000-gallon capacity UST secondary containment tank was installed to capture AFFF during a release. When the AFFF system is triggered, sensors trip and close a valve diverting the foam to the secondary containment tank. AFFF is then removed by a contractor and disposed of off base. Multiple documented releases of AFFF have occurred at Hangar 11. One release prior to 2000 was caused by an electrical storm that activated the UV-IR detectors and triggered the AFFF system. During this spill, the trench drains discharged through the OWS to the sanitary sewer system. A second release occurred in July 2005, when pressurization issues in the AFFF system caused a release of 750 gallons of AFFF. The AFFF flowed outside the hangar onto the

asphalt and concrete areas and then into the storm drain system. Significant foam was observed in Cabin Branch Creek as a result of this release. A third release occurred in March 2007; a contractor working outside on the south side of the hangar hit an AFFF line, releasing approximately 15 gallons of AFFF, which flowed into the nearby storm drain. Because of the multiple releases of AFFF in and around the hangar, the potential exists for PFAS to have migrated to the groundwater.

## **2.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

Hangar 6 (Building 1280) and Hangar 7 (Building 1279) are adjacent to each other on the JBA airfield and were inspected together. The hangars are centrally positioned on the west side of the JBA airfield, behind the Pathfinder gate in a restricted area. The hangars are bordered to the north and south by restricted airfield ramps, to the east by lightly vegetated areas and walkways, and to the west by an asphalt parking lot. Both hangars were constructed in 1960. Records for Hangar 6 indicate that the building was not equipped with an AFFF fire suppression system. However, anecdotal information from JBA fire department personnel suggests that the hangar was originally equipped with an AFFF system prior to the conversion to the Hi-Ex foam system now in place. In addition, fire department personnel indicated that there were releases of AFFF in Hangar 6 from the previous system. The fire suppression system equipment in Hangar 6 consists of one 1,000-gallon Hi-Ex concentrate upright tank in the mechanical room on the west side of the hangar. Hangar 7 was also originally equipped with an AFFF system, but there are no records of when the AFFF fire suppression system was installed or records of when the AFFF system was converted to the Hi-Ex system now in place. The fire suppression system equipment in Hangar 7 consists of a 1,000-gallon Hi-Ex concentrate upright tank in the mechanical room on the east side of the hangar. Releases of AFFF reportedly occurred at Hangar 7, but there are no records of the exact dates or quantities released. Both hangars have floor drains that discharge to the sanitary sewer system. Each floor drain system has containment systems (installed in 2000) to block flow to the sanitary sewer system in the event of a foam release (HGL, May 2015). The potential exists for AFFF to have been released prior to the installation of the containment system in 2000. Therefore, there is potential for PFAS to have migrated to the groundwater in the area.

## **2.6 FIRE STATION #1 (AFFF AREA 6)**

Fire Station #1 (Building 1287), which has been in operation since 1976, is on the central portion of JBA on the west side of the airfield at the corner of Cabiglas Street and South Dakota Avenue. The fire station is bordered on the north by South Dakota Avenue, to the east by a large asphalt-covered parking lot followed by the airfield, to the south by Building 1285, and to the west by Cabiglas Street. Building 1287 has trench drains in the truck bays that discharge to an exterior containment tank. Reports indicate that in the past, fire trucks were filled in front of the fire station and on some occasions overfilled, releasing AFFF to the ground surface. Currently, fire trucks are filled inside Fire Station #1 using 5-gallon buckets. Fire training activities using AFFF were occasionally conducted in front of the fire station, but the frequency and duration of these exercises were not documented. In December 2012, a crash truck leaked approximately 100 gallons of AFFF in front of the fire station, and though most was captured in the containment drain, some of the AFFF flowed to the nearby storm sewer and to the depression east of Hangar 19 (Building 5016), approximately 1,000 feet south of the area. There are documented releases of AFFF in the area; therefore, PFAS may have migrated to the groundwater in the area (HGL, May 2015).

## **2.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

The former Hare Berry Farm is on the south side of JBA, adjacent to the security fence and within the installation boundary. The area is bordered to the north and west by wooded areas, to the south by a



residential area, and to the west by the JBA golf course. The farm was used to grow strawberry, raspberry, and blackberry crops. In May 1992 during aircraft fire suppression system testing, approximately 500 gallons of AFFF were released into Piscataway Creek, a source of irrigation water for the crops on the farm. Following the release, the property owner requested that the USAF evaluate whether the crops were safe for human consumption. The USAF tested the crops in August 1992 and determined they were fit for consumption in accordance with Food and Drug Administration (FDA) standards. In 1993, an assessment was prepared to evaluate risk associated with the potential effects of contaminants from compounds such as AFFF, deicing fluids, petroleum residues, solvents, and pesticides that enter Piscataway Creek with JBA stormwater runoff. The 1993 assessment concluded that Piscataway Creek did not pose a threat to human health or the environment; however, the USAF purchased Hare Berry Farms following the assessment (HGL, May 2015). Given the location of the farm downstream of JBA, the documented release of AFFF to Piscataway Creek, and the subsequent use of the creek water to irrigate the fields, it is possible that PFAS has migrated to the groundwater in the area (HGL, May 2015).

## **2.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

The former Brandywine DRMO Yard is managed by JBA and is approximately 8 miles south-southeast of the base in Brandywine, Maryland. The main entrance to the former DRMO Yard is at the south end of the fenced perimeter. The southern portion of the yard is mostly asphalt-paved with small, open areas covered with grass. The northern portion of the yard is open, unpaved, and mostly covered with grass except a gravel access road and small building that contains the groundwater treatment system. The former Brandywine DRMO Yard is bordered to the north by forest, to the east by forest and a dog training business, and to the south and west by an active CSX rail line. The 8-acre site consists of level, partially vegetated, fenced property and an inactive groundwater pump and treat system. While in operation from 1943 to 1987, the facility was used for temporary storage of scrap materials and hazardous waste generated from DoD facilities in the region. In 1987, a fire at the DRMO Yard burned a warehouse to the ground and resulted in the cessation of operations at the facility. According to the 1995 removal report (Halliburton NUS Corporation, July 1995), burn pits were present at the DRMO Yard, but there are no records of AFFF having been used at the facility. An interim Record of Decision (ROD) was approved in 2006 to address the plume of chlorinated solvents in the groundwater at the site. Under the provisions of the interim ROD, remedial actions, including the operation of a pump and treat system and multiple phases of bioremediation, were conducted in 2008. In 2012, a performance-based contract was awarded to obtain a final ROD and remedy at the former Brandywine DRMO Yard (HGL, May 2015). Although there are no documented AFFF releases at the Brandywine DRMO Yard, EPA requested that JBA investigate the possible presence of PFAS in the environment based on the presence of burn pits and a structure fire at the site.

## **2.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

Former FTA 3 (FT-03) is an Environmental Restoration Program (ERP) site approximately 2,000 feet southwest of the western runway in the south-central portion of JBA. The site is within the JBA golf course between South Perimeter Road and Wheeling Road. The site comprises approximately 16 acres and is bordered to the north by Wheeling Road, to the east by Wisconsin Road, and to the south by South Perimeter Road. In accordance with the ROD, institutional controls and long-term monitoring are in place for FT-03. Fire training operations at former FTA 3 occurred between 1959 and 1972. The FTA consisted of a 300- to 400-foot diameter bermed burn pit and an adjacent drum storage area. During fire training activities, the burn pit was saturated with water before an estimated 1,000 to 2,000 gallons of flammable liquids were added to the burn pit and ignited. Protein foams, carbon tetrachloride, and chlorobromomethane were reportedly used to extinguish the fires. Fire training activities reportedly occurred two or three times per day until the mid-1960s, when the frequency was reduced to once per day.

The burn pit was demolished in approximately 1972 and contaminated soil removed. There are no records of the volume of soil removed or if any cleanup criteria were established. According to the ROD, clean soil was brought in and sewage sludge was applied to the site in 1995 to promote grass growth when the area was converted to a golf course. There are no records indicating whether AFFF was ever used at the former FTA; however, if AFFF was used in the area, it is possible that PFAS may have migrated to the groundwater. The remedial action for ERP site FT-03 has been completed, but because the site has not been investigated for PFAS, EPA requested that the groundwater in the area be tested for PFAS prior to approving site closure.

### 3.0 FIELD ACTIVITIES

ASL personnel mobilized to JBA on Monday, November 7, 2016, to perform SI sampling activities for all nine AFFF areas. A readiness review was conducted with all ASL field personnel prior to mobilizing to JBA. Readiness review forms are presented in Appendix B. The readiness review covered anticipated hazards, types and proper use of equipment needed for the field activities, sampling procedures, and procedures to prevent cross-contamination of samples with PFAS containing compounds. The procedure included

- not allowing equipment containing Teflon (polytetrafluoroethylene) components to come into contact with the samples because they can be a potential source of PFAS contamination;
- not allowing sampling personnel to don Gore-Tex® clothing, Tyvek® suits, or clothes treated with stain- or rain-resistant coatings; and
- requiring site personnel to wash their hands thoroughly before coming on site after coming into contact with plastic wrappers, Post-It® notes, or Styrofoam® cups (these are also potential sources of PFAS contamination).

Field activities for the SI included collecting groundwater samples from existing monitoring wells and temporary direct push technology (DPT) wells, collecting surface and subsurface soil samples from DPT soil borings, and collecting surface water and sediment samples. In accordance with the quality assurance project plan (QAPP) (ASL, January 2016) and the site-specific field sampling plan (ASL, November 2016), ASL used a targeted sampling design to collect samples in locations most likely to have detectable concentrations of the target compounds as a result of an AFFF release. Field forms generated during the sampling activities are in Appendix B. Field forms include readiness review forms, boring logs, groundwater sampling and groundwater grab sampling logs, soil and sediment sampling logs, surface water sampling logs, and field instrument calibration logs. All field activities were completed by Tuesday, November 22, 2016. Samples were submitted via overnight courier to Maxxam Analytics International Corporation of Mississauga, Ontario, Canada, under chain of custody procedures. The samples were analyzed by modified EPA Method 537 for 18 PFAS compounds, including the following parameters, the only three PFAS compounds to have associated health-based screening levels.

<b>Analyte</b>	<b>*CAS Number</b>
• Perfluorooctane sulfonate (PFOS)	1763-23-1
• Perfluorooctanoic acid (PFOA)	335-67-1
• Perfluorobutane sulfonate (PFBS)	375-73-5

\*CAS = Chemical Abstracts Service

Third-party data validation was conducted on 100% of the analytical data for the PFAS compounds. The data validation report and laboratory data sheets are in Appendix C.

Field activities were conducted in accordance with the QAPP (ASL, January 2016) and the JBA site-specific addendum to the QAPP (ASL, November 2016). Soil borings in the area were advanced with a

track-mounted DPT system. Borings logs are presented in Appendix B. Surface soil samples were collected to 6 inches below ground surface (bgs) using a combination of stainless steel hand augers and stainless steel spoons. Subsurface soil samples were collected immediately above the water saturated/unsaturated soil interface using a DPT macro-core sampler with acetate liners. Groundwater samples were collected with peristaltic pumps through disposable polyvinyl tubing. The groundwater samples were collected from existing groundwater monitoring wells and/or temporary wells installed using either 3/4-inch diameter prepacked screens or hydropunch samplers installed in the DPT borings. Sediment samples were collected using a combination of dip samplers and stainless steel spoons. Surface water samples were collected directly from surface water bodies into the sample containers. For each site where borings were installed, a representative composite soil sample was collected for each depth where samples were collected for PFAS analysis. The composite soil samples were submitted to the project laboratory for analyses of soil physiochemical properties, including soil potential of hydrogen (pH), particle size, and total organic carbon (TOC). The physiochemical analytical results are presented in Appendix D.

The coordinates and surface elevations of the soil borings and temporary wells were established by land survey. Surface water and sediment sample locations were recorded with a Trimble GeoX7 handheld global positioning system (GPS) unit. Northing and easting coordinates were recorded in Maryland State Plane Coordinates based on the North American Datum (NAD) 1983. Elevations were recorded referenced to the North American Vertical Datum (NAVD) 1988.

### **3.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

The media of concern at Former FTA 4 and Building 2489 are subsurface soil, groundwater, surface water, and sediment. No surface soils were collected because the ground surface was regraded and covered during the construction of the ASA Facility.

#### **3.1.1 Sample Locations**

Subsurface soil samples and groundwater grab samples were collected from three locations inside the former FTA burn pit. Groundwater samples were also collected from existing monitoring wells MW0704-FT04 and MW0901-FT04 and from four DPT points downgradient of the former FTA burn pit. One surface water sample and one sediment sample were collected from the south branch of Piscataway Creek, approximately 1,800 feet south and west of the site where surface water drainage leaves the airfield. The sample locations for AFFF Area 1 are shown on Figure 3 (Appendix A).

#### **3.1.2 Lithology**

Soil borings ANDRW01-001 and ANDRW01-002 were terminated at 15 feet bgs, and soil boring ANDRW01-003 was terminated at 20 feet bgs. All three borings were terminated within the Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix B.

#### **3.1.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater at AFFF Area 1 flows to the northwest. During the SI, depth to groundwater measurements were taken from existing wells MW0901-FT04 and MW0704-FT04. Depth to groundwater measurements were also taken from temporary wells installed in boring ANDRW01-001, ANDRW01-002, and ANDRW01-003. The groundwater elevation measurements are presented in Appendix E. Figure 3 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours confirm that the groundwater flow direction at AFFF Area 1 is to the northwest.

### 3.1.4 Analytical Results

Five subsurface soil samples (three primary, one field duplicate, and one composite physiochemical sample); 10 groundwater samples (nine primary and one field duplicate sample); two surface water samples (one primary and one field duplicate); and two sediment samples (one primary and one field duplicate) were submitted to the project laboratory for analyses from AFFF Area 1.

#### *Subsurface Soil*

All three target compounds were detected in one or more of the three subsurface soil samples from AFFF Area 1. None of the detected concentrations of the target compounds exceeded the screening levels for soil. Table 3 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 4 (Appendix A) shows the sample locations and the results of the target compounds in soil at AFFF Area 1.

#### *Groundwater*

All three target compounds were detected in all 10 groundwater samples from AFFF Area 1. PFBS was not detected in any samples at a concentration exceeding the screening value (40 µg/L). All 10 groundwater samples had concentrations of PFOA and PFOS exceeding the individual screening value (0.07 µg/L for PFOA and PFOS) and the combined screening value for PFOA and PFOS (combined concentration of 0.07 µg/L). Table 4 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the groundwater samples. Figure 5 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 1.

#### *Sediment*

PFOA and PFOS were detected in the sediment sample (ANDRW01-008-SD-001) and field duplicate sample (ANDRW01-008-SD-901) from AFFF Area 1. None of the detected concentrations exceeded the screening levels for soil. Table 5 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the sediment sample. Figure 4 (Appendix A) shows the sample locations and concentrations in sediment at AFFF Area 1.

#### *Surface Water*

All three target compounds were detected in the surface water sample (ANDRW01-008-SW-001) and field duplicate sample (ANDRW01-008-SW-901) from AFFF Area 1. The detected concentration of PFBS (0.11 µg/L) in both samples did not exceed the screening value of 40 µg/L. PFOA and PFOS were detected in the samples at concentrations exceeding the screening level of 0.07 µg/L. The combined concentration of PFOA and PFOS detected in the samples also exceeded the combined concentration screening value of 0.07 µg/L in groundwater. Table 6 presents the screening values and the analytical results of PFBS, PFOA, and PFOS in the surface water samples. Figure 5 (Appendix A) shows the sample locations and concentrations in surface water at AFFF Area 1.

#### *Physiochemical Sample*

A composite sample for physiochemical analyses was submitted for AFFF Area 1. The subsurface soil sample (ANDRW01-009-SO-010) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth was consistently 12 feet bgs. The results of the analyses of the physiochemical sample are contained in Appendix D.

### 3.1.5 Conclusions

The former FTA-4 was used for fire training activities from 1973 to 1990. Records indicate that weekly exercises were conducted consisting of igniting combustible liquids in the burn pit and extinguishing the resulting fire with AFFF. The quantity of AFFF used during these exercises was not recorded. Excess fluids generated during the exercises flowed across the burn area into an OWS. Residual foam and water passed through the OWS into the gravel bottom leaching pond. Liquids typically seeped through the gravel into the ground, but the leaching pond often became plugged, causing the pond to overflow onto the ground surface in the area. Samples were collected where concentrations of the target compounds would be most likely to be detected in the area, based on surface drainage patterns and the groundwater flow direction. The results for the analyses of the subsurface soil samples and sediment samples from the south branch of Piscataway Creek indicate that concentrations of the target compounds do not remain in the soils or sediments in the area in excess of the screening criteria. However, PFOA and PFOS were detected in all 10 groundwater samples and the two surface water samples at concentrations exceeding the individual screening levels. All 10 groundwater samples and the two surface water samples also had combined concentrations of PFOA and PFOS exceeding the HAs. Based on the analytical results, a release of AFFF is confirmed that has impacted the groundwater and surface water at AFFF Area 1.

Field Sample ID		ANDRW01-001-SO-011	ANDRW01-002-SO-011	ANDRW01-003-SO-011	ANDRW01-003-SO-911 (Field Duplicate)
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.30 J	0.48 J	0.28 UJ	0.28 U
PFOA	126 <sup>b</sup>	0.41 J	0.67 J	0.29 J	0.71 J
PFOS	126 <sup>b</sup>	8.9	17	5.5 J	22 J

Note: A bold value indicates the concentration was detected above the Method Detection Limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.oml.gov/cgi-bin/chemicals/esl\\_search](https://epa-prgs.oml.gov/cgi-bin/chemicals/esl_search)).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the Method Detection Limit

ID = identification  
 PFBS = perfluorobutane sulfonate  
 PFOS = perfluorooctane sulfonate

Table 4 AFFF Area 1 (Former Fire Training Area 4 and Building 2489) Groundwater Analytical Results

Sample ID	ANDRW01-001-GW-010	ANDRW01-002-GW-010	ANDRW01-003-GW-014	ANDRW01-003-GW-914 (Field Duplicate)	ANDRW01-004-GW-014	ANDRW01-005-GW-014	ANDRW01-006-GW-014	ANDRW01-007-GW-014	ANDRW01-007-FT4MW704
Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
0 <sup>a</sup>	0.78	1.0	0.86	0.83	0.11	1.3	0.49	0.23	1.7
7 <sup>b</sup>	1.5	1.4	1.4	1.4	0.28	5.4	2.1	0.99	4.7
7 <sup>b</sup>	9.4	8.5	6.6	6.5	3.0	33	6.3	4.5	17
7 <sup>b</sup>	10.9	9.9	8.0	7.9	3.28	38.4	8.4	5.49	21.7

is the concentration was detected above the Method Detection Limit. A shaded value indicates the parameter met or exceeded the corresponding screening level.

vels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

g Water Health Advisory for Perfluorooctanoic Acid (PFOA) and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined with the 0.07 µg/L Health Advisory value.

ID = identification  
 PFBS = perfluorobutane sulfonate  
 PFOS = perfluorooctane sulfonate

acid

Field Sample ID		ANDRW01-008-SD-001	ANDRW01-008-SD-901 (Field Duplicate)
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.40 UJ	0.35 U
PFOA	126 <sup>b</sup>	<b>0.39 J</b>	<b>0.58 J</b>
PFOS	126 <sup>b</sup>	<b>3.3 J</b>	<b>2.7</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\_search)].

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 6 AFFF Area 1 (Former Fire Training Area 4 and Building 2489) Surface Water Analytical Results**

Field Sample ID		ANDRW01-008-SW-001	ANDRW01-008-SW-901 (Field Duplicate)
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	<b>0.11</b>	<b>0.11</b>
PFOA	0.07 <sup>b</sup>	<b>0.46</b>	<b>0.46</b>
PFOS	0.07 <sup>b</sup>	<b>1.9</b>	<b>1.9</b>
PFOA + PFOS	0.07 <sup>b</sup>	<b>2.36</b>	<b>2.36</b>

Note: A bold value indicates the parameter was detected at the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

## **3.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

The media of concern at Hangar 16 are subsurface soil, shallow groundwater, surface water, and sediment. Surface soil samples were not collected because the majority of the area where the AFFF was reportedly released is covered in pavement.

### **3.2.1 Sample Locations**

One subsurface soil sample was collected from DPT boring ANDRW02-001 installed in the grass area near the OWS on the northwest corner of Hangar 16. A groundwater grab sample was also planned for this boring, but groundwater was not encountered before DPT refusal at a depth of 17 feet bgs. A groundwater sample and one field duplicate sample were collected from existing groundwater monitoring well SS26-MW05, and a groundwater sample was collected from existing well SS26-MW08. These wells are adjacent to the OWS and wash rack at the northwest corner of the hangar. Groundwater samples were also collected from existing groundwater monitoring wells SS26-MW15S and SS26-MW15D. These wells are downgradient of the large doors on the front of Hangar 16. Three surface water and sediment samples were collected from the drainage ditch west of the apron where stormwater from Hangar 16 and the apron near it discharges. The sample locations for Hangar 16 are shown on Figure 6 (Appendix A).

### **3.2.2 Lithology**

One subsurface soil sample was collected from the DPT boring at AFFF Area 2. Soil boring ANDRW02-001 encountered DPT refusal at a depth of 17 feet bgs within Quaternary sediments of the Surficial Aquifer. The detailed boring log is contained in Appendix B.

### **3.2.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater in the area of Hangar 16 flows to the south-southwest. Depth to groundwater was measured in the existing wells (SS26-MW05, SS26-MW08, SS26-MW15S and SS26-MW15D). The groundwater elevation measurements are presented in Appendix E. Figure 6 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours confirm that the groundwater flow direction in AFFF Area 2 is to the southwest.

### **3.2.4 Analytical Results**

Two subsurface soil samples (one primary sample and one composite physiochemical sample), five groundwater samples (four primary and a field duplicate sample), three sediment samples, and three surface water samples were submitted to the project laboratory for analyses from AFFF Area 2.

#### *Subsurface Soil*

PFOS was the only target analyte detected in the subsurface soil sample from AFFF Area 2. The detected concentration (an estimated value of 0.41 µg/kg) did not exceed the screening level for soil (126 µg/kg). Table 7 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 7 (Appendix A) shows the sample location and results of the target analytes in the subsurface soil at AFFF Area 2.



#### *Groundwater*

All three target analytes were detected in the five groundwater samples from AFFF Area 2. None of the concentrations of PFBS detected in the groundwater samples exceeded the screening value of 40 µg/L. Only one sample (ANDRW02-SS26MW15S-023 with a PFOA concentration of 0.081 µg/L) had an individual concentration of PFOA exceeding the screening value of 0.07 µg/L. However, all five groundwater samples had detected individual concentrations of PFOS and combined concentrations of PFOA and PFOS that exceeded the screening levels for groundwater (0.07 µg/L for PFOS and 0.07 µg/L for the combined concentration of PFOA and PFOS). Table 8 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the groundwater samples. Figure 8 (Appendix A) shows sample locations and results of the target analytes in groundwater at AFFF Area 2.

#### *Sediment*

All three target analytes were detected in one or more of the sediment samples from AFFF Area 2. None of the detected concentrations exceeded the screening levels for soil. Table 9 presents the screening values and analytical results of PFBS, PFOA, and PFOS. Figure 7 (Appendix A) shows the sample locations and results of the target analytes in sediment at AFFF Area 1.

#### *Surface Water*

All three target analytes were detected in the surface water samples from AFFF Area 2. None of the detected concentrations of PFBS exceeded the screening value of 40 µg/L. However, both the individual and combined concentrations of PFOA and PFOS in all three samples exceeded the screening level of 0.07 µg/L. Table 10 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface water samples. Figure 8 (Appendix A) shows the sample locations and results of the target analytes in surface water at AFFF Area 2.

#### *Physiochemical Sample*

One composite sample for physiochemical analyses was submitted for AFFF Area 2. The subsurface soil sample (ANDRW02-005-SO-016) was composed of aliquots of the subsurface soil from the total depth of the boring (immediately above DPT refusal). The results of the analyses of the physiochemical sample are presented in Appendix D.

### **3.2.5 Conclusions**

Multiple releases of AFFF were reported during the operating life of Hangar 16. The date and quantity of AFFF released from the hangar were not documented, but no reported releases of AFFF were identified between 2000 and 2009, when the fire suppression system was converted from AFFF to a Hi-Ex system. Samples were collected in the most likely areas where concentrations of the target compounds would be detected in the area, based on surface drainage patterns and the groundwater flow direction. The results for the analyses of the subsurface soil and sediment samples do not indicate concentrations of the target compounds remain in the soils or sediments in excess of the screening criteria. However, PFOS was detected in all five groundwater samples at concentrations exceeding the individual screening levels, and PFOA was detected in one groundwater sample at a concentration exceeding the individual screening level. All five groundwater samples had combined concentrations of PFOA and PFOS exceeding the HAs. In addition, all three surface water samples had individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Based on the analytical results, a release of AFFF that has impacted the groundwater and surface water at AFFF Area 2 has been confirmed.

**Table 7 AFFF Area 2 (Hangar 16) Subsurface Soil Analytical Results**

Field Sample ID		ANDRW02-001-SO-016
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.28 U
PFOA	126 <sup>b</sup>	0.13 U
PFOS	126 <sup>b</sup>	<b>0.41 J</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017)  
[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram ID = identification

PFBS = perfluorobutane sulfonate J= estimated value

PFOA = perfluorooctanoic acid PFOS = perfluorooctane sulfonate

U = parameter not detected at the Method Detection Limit

**Table 8 AFFF Area 2 (Hangar 16) Groundwater Analytical Results**

Field Sample ID	ANDRW02-SS26MW05-029	ANDRW02-SS26MW05-929 (field duplicate)	ANDRW02-SS26MW08-030	ANDRW02-SS26MW15S-023	ANDRW02-SS26MW15D-035
Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	0.026	0.024	0.019 J	0.060
PFOA	0.07 <sup>b</sup>	0.060	0.056	0.027	0.081
PFOS	0.07 <sup>b</sup>	0.75	0.79	0.11	0.52
PFOA + PFOS	0.07 <sup>b</sup>	0.810	0.846	0.137	0.601

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening limit.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 9 AFFF Area 2 (Hangar 16) Sediment Analytical Results**

Field Sample ID	ANDRW02-002-SD-001	ANDRW02-003-SD-001	ANDRW02-004-SD-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.25 U	0.28 UJ
PFOA	126 <sup>b</sup>	0.23 J	0.13 UJ
PFOS	126 <sup>b</sup>	3.0	1.3 J

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 10 AFFF Area 2 (Hangar 16) Surface Water Analytical Results**

Parameter	Field Sample ID		ANDRW02-002-SW-001	ANDRW02-003-SW-001	ANDRW02-004-SW-001
	Screening Level (µg/L)		Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>		0.028	0.028	0.033
PFOA	0.07 <sup>b</sup>		0.17	0.16	0.17
PFOS	0.07 <sup>b</sup>		0.38	0.45	0.41
PFOA + PFOS	0.07 <sup>b</sup>		0.55	0.61	0.58

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

The media of concern at the East Side Fuel Cell (Building 3629) are surface soil, subsurface soil, and groundwater. A surface water and sediment sample were collected from the surface water drainage pathway downstream of Building 3629 as part of the investigation of Hangar 11 (Building 3635).

#### **3.3.1 Sample Locations**

One surface soil sample, one subsurface soil sample, and one groundwater grab sample were collected from DPT boring ANDRW03-001 installed in the low-lying area near a stormwater drain in the grass near the northeast corner of Building 3629. One surface soil sample, one subsurface soil sample, and one groundwater grab sample were collected from DPT boring ANDRW03-002 installed in the grass directly outside the mechanical room door on the south side of the building. One subsurface sample and one groundwater grab sample were collected from DPT boring ANDRW03-003 installed near the stormwater drain in the grass near the southeast corner of Building 3629 and downgradient of the OWS for the building. The sample locations for the East Side Fuel Cell are shown on Figure 9 (Appendix A).

#### **3.3.2 Lithology**

Soil samples were collected from three DPT borings in AFFF Area 3. All three borings were terminated at 25 feet bgs within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are in Appendix B.

#### **3.3.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater in the area of the East Side Fuel Cell was assumed to flow to the east. Depth to groundwater was measured in the three temporary wells installed in the DPT borings (ANDRW03-001, ANDRW03-002, and ANDRW03-002) at AFFF Area 3. The groundwater level measurements are presented in Appendix E. Figure 9 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours confirm that the groundwater flow direction is to the southeast at AFFF Area 3.

#### **3.3.4 Analytical Results**

Four surface soil samples (two primary samples, one field duplicate sample, and one composite physiochemical sample); four subsurface soil samples (three primary samples and a composite physiochemical sample); and three groundwater samples from AFFF Area 3 were submitted to the project laboratory for analyses.

##### *Surface Soil*

All three target analytes were detected in one or more of the surface soil samples from AFFF Area 3. None of the concentrations of PFBS or PFOA in any of the surface soil samples exceeded the corresponding screening levels for soil. The PFOS concentration in one sample (ANDRW03-002-SS-001 at 200 µg/kg) exceeded the screening level of 126 µg/kg. Table 11 presents the screening values and the analytical results of PFBS, PFOA, and PFOS in the surface soil samples. Figure 10 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 3.

#### *Subsurface Soil*

All three target analytes were detected in the subsurface soil samples from AFFF Area 3. None of the concentrations of PFBS or PFOA in any of the samples exceeded the corresponding screening levels for soil. The PFOS concentration in one sample (ANDRW03-003-SO-020 at 210 µg/kg) exceeded the screening level of 126 µg/kg. Table 12 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the subsurface soil samples. Figure 10 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 3.

#### *Groundwater*

All three target analytes were detected in the three groundwater samples from AFFF Area 3. The individual concentrations for PFOA and PFOS detected in all three samples exceeded the screening level (0.07 µg/L) and the combined value of the detected concentrations of PFOS and PFOA in all three groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Table 13 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the groundwater samples. Figure 11 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 3.

#### *Physiochemical Sample*

Two composite samples for physiochemical analyses were submitted for AFFF Area 3. The surface soil sample (ANDRW03-004-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (ANDRW03-004-SO-010) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. The depth to water in the borings was consistently 21 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix D.

### **3.3.5 Conclusions**

Five documented AFFF releases have occurred at AFFF Area 3, including releases to the outside of the building; three of the five known AFFF releases were complete system releases (2,000 gallons). Based on the analytical results, a release of AFFF is confirmed that has impacted the surface soil, subsurface soil, and groundwater at AFFF Area 3.

**Table 11 AFFF Area 3 (East Side Fuel Cell) Surface Soil Analytical Results**

Field Sample ID		ANDRW03-001-SS-001	ANDRW03-001-SS-901 (field duplicate)	ANDRW03-002-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.28 U	<b>0.27 J</b>	<b>1.0 J</b>
PFOA	126 <sup>b</sup>	<b>0.91 J</b>	<b>0.98 J</b>	<b>2.5</b>
PFOS	126 <sup>b</sup>	<b>22</b>	<b>23</b>	<b>200</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the method detection limit

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 12 AFFF Area 3 (East Side Fuel Cell) Subsurface Soil Analytical Results**

Field Sample ID		ANDRW03-001-SO-021	ANDRW03-002-SO-020	ANDRW03-003-SO-020
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	2.6	<b>0.39 J</b>	<b>0.92 J</b>
PFOA	126 <sup>b</sup>	<b>4.4 J</b>	<b>2.8</b>	<b>2.3</b>
PFOS	126 <sup>b</sup>	<b>0.27 J</b>	<b>37</b>	<b>210</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 13 AFFF Area 3 (East Side Fuel Cell) Groundwater Analytical Results**

Parameter	Field Sample ID Screening Level (µg/L)	ANDRW03-001-GW-024 Concentration (µg/L)	ANDRW03-002-GW-022 Concentration (µg/L)	ANDRW03-003-GW-022 Concentration (µg/L)
PFBS	40 <sup>a</sup>	0.44	0.092	6.1
PFOA	0.07 <sup>b</sup>	0.51	0.35	9.8
PFOS	0.07 <sup>b</sup>	0.39	2.6	21
PFOA + PFOS	0.07 <sup>b</sup>	0.90	2.95	30.8

Note: A bolded value indicates parameter was detected at or above the Method Detection Limit. A shaded value indicates that the concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for*

*Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate



### **3.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

The media of concern at Hangar 11 (Building 3635) are surface soil, subsurface soil, shallow groundwater, surface water, and sediment.

#### **3.4.1 Sample Locations**

Surface soil, subsurface soil, and groundwater samples were collected from DPT boring ANDRW04-001 installed in the grass near the southeast corner of Hangar 11 on the edge of the concrete apron, where surface water from the apron drains. Surface soil, subsurface soil, and groundwater grab samples were also collected from DPT boring ANDRW04-002 installed in the grass near the northeast corner of Hangar 11 on the edge of the concrete apron where surface water from the apron drains. Groundwater grab samples were collected from DPT borings ANDRW04-003 and ANDRW04-004 installed east of Hangar 11 near Patrick Avenue. Subsurface soil and groundwater grab samples were collected from DPT borings ANDRW04-005 and ANDRW04-006 installed adjacent to Building 3642 where stormwater from the East Side Fuel Cell (Building 3629) and Hangar 11 are collected in a covered drainage basin. A surface water and sediment sample were collected approximately 1,000 feet north of the hangar where the drainage channel from AFFF Areas 3 and 4 discharges into the north section of Cabin Branch. The sample locations for Hangar 11 are shown on Figure 12 (Appendix A).

#### **3.4.2 Lithology**

Soil samples were collected in four DPT borings at AFFF Area 4. Soil boring ANDRW04-001 was terminated at 25 feet bgs, and soil boring ANDRW04-002 was terminated at 35 feet bgs. Soil borings ANDRW04-005 and ANDRW04-006 were terminated at 20 feet bgs. All four borings were drilled within the Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix D.

#### **3.4.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater flow in the area of Hangar 11 was assumed to be to the east-northeast on the north side of the hangar and to the south-southeast on the south side of the hangar. Depth to groundwater measurements were collected from temporary wells installed in DPT borings ANDRW04-002, ANDRW04-003, and ANDRW04-006. The groundwater level measurements are presented in Appendix E. Figure 12 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours contradict the assumed direction of groundwater flow presented in the PA. The contours developed from the groundwater measurements indicate that groundwater flow in the area of Hangar 11 is to the northwest.

#### **3.4.4 Analytical Results**

Three surface soil samples (two primary and one composite physiochemical sample); six subsurface soil samples (four primary samples, one field duplicate sample, and one composite physiochemical sample); six groundwater samples; one sediment sample; and one surface water sample from AFFF Area 4 were submitted to the project laboratory for analyses.

##### *Surface Soil*

All three target analytes were detected in or more surface soil samples from AFFF Area 4. None of the concentrations of PFBS or PFOA in any of the surface soil samples exceeded the corresponding screening

levels for soil. The PFOS concentration in one sample (ANDRW04-001-SS-001 at 110 µg/kg) exceeded the screening level of 126 µg/kg. . Table 14 presents the screening values and analytical results of PFBS, PFOA, and PFOS of the surface soil samples. Figure 13 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 4.

#### *Subsurface Soil*

All three target analytes were detected in one or more of the subsurface soil samples from AFFF Area 4. None of the compounds were detected at concentrations exceeding the screening levels for soil. Table 15 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 13 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 4.

#### *Groundwater*

All three target analytes were detected in all six groundwater samples from AFFF Area 4. None of the detected concentrations of PFBS in the samples exceeded the screening value of 40 µg/L. All six samples had individual detected concentrations of PFOA and PFOS that exceeded the screening value of 0.07 µg/L. The combined value of the detected concentrations of PFOS and PFOA in all six groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Table 16 presents the screening values and analytical results of PFBS, PFOA, and PFOS detected in the groundwater samples. Figure 14 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 4.

#### *Sediment*

All three target analytes were detected in the sediment sample from AFFF Area 4. None of the detected concentrations exceeded the screening levels for soil. Table 17 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the sediment sample. Figure 13 (Appendix A) shows the sample location and results of the target analytes in sediment at AFFF Area 4.

#### *Surface Water*

All three target analytes were detected in the surface water sample from AFFF Area 4. The detected concentration of PFBS (0.67 µg/L) in the sample did not exceed the screening level of 40 µg/L. PFOA and PFOS were both detected in the sample at concentrations exceeding the individual screening level of 0.07 µg/L. The combined concentration of PFOA and PFOS detected in the sample also exceeded the EPA HA (combined concentration screening value of 0.07 µg/L). Table 18 presents the screening values and detected concentrations of PFBS, PFOA, and PFOS in the surface water sample. Figure 14 (Appendix A) shows the sample location and detected concentrations of the target analytes in surface water at AFFF Area 4.

#### *Physiochemical Sample*

Two composite samples for physiochemical analyses were submitted for AFFF Area 4. The surface soil sample (ANDRW04-008-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (ANDRW04-008-SO-027) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 16 feet to 28 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix D.

### 3.4.5 Conclusions

Multiple documented releases of AFFF have occurred at Hangar 11. In July 2005, pressurization issues in the AFFF system caused a release of 750 gallons of AFFF. The AFFF flowed outside the hangar onto the asphalt and concrete areas and then into the storm drain system. Significant foam was observed in Cabin Branch Creek as a result of this release. Another release occurred at the hangar in March 2007, when an AFFF line on the south side of the hangar was damaged releasing approximately 15 gallons of AFFF that flowed into the storm drain. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. The analytical results of the subsurface soil and sediment samples indicate that concentrations of PFBS, PFOA, and PFOS do not remain in the subsurface soils or sediments at concentrations exceeding the screening criteria. However, based on the analytical results, a release of AFFF is confirmed that has impacted the surface soil, groundwater, and surface water at AFFF Area 4, and PFAS compounds are present in the surface soil, groundwater, and surface water at concentrations exceeding the screening values.

Parameter	Field Sample ID		ANDRW04-001-SS-001		ANDRW04-002-SS-001	
	Screening Level	(µg/kg)	Concentration		Concentration	
PFBS	130,000 <sup>a</sup>		0.36 J		0.24 U	
PFOA	126 <sup>b</sup>		0.45 J		0.33 J	
PFOS	126 <sup>b</sup>		110		4.1	

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.orml.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.orml.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the method detection limit

Table 15 AFFF Area 4 (Hangar 11) Subsurface Soil Analytical Results

Parameter	Field Sample ID		ANDRW04-001-SO-023		ANDRW04-002-SO-027		ANDRW04-005-SO-016		ANDRW04-005-SO-916 (field duplicate)		ANDRW04-006-SO-016	
	Screening Level	(µg/kg)	Concentration		Concentration		Concentration		Concentration		Concentration	
PFBS	130,000 <sup>a</sup>		1.3		0.28 U		0.48 J		0.48 J		0.28 J	
PFOA	126 <sup>b</sup>		0.64 J		0.13 U		0.46 J		0.36 J		0.27 J	
PFOS	126 <sup>b</sup>		8.4		0.18 U		7.9 J		2.9 J		9.0	

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.orml.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.orml.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the method detection limit

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

Table 16 AFFF Area 4 (Hangar 11) Groundwater Analytical Results

Parameter	Field Sample ID		ANDRW04-001-GW-024		ANDRW04-002-GW-030		ANDRW04-003-GW-030		ANDRW04-004-GW-027		ANDRW04-005-GW-018		ANDRW04-006-GW-018	
	Screening Level	(µg/L)	Concentration		Concentration		Concentration		Concentration		Concentration		Concentration	
PFBS	40 <sup>a</sup>		4.7		0.015 J		0.055		0.14		1.7		1.7	
PFOA	0.07 <sup>b</sup>		2.1		0.089		0.12		0.28		2.2		2.2	
PFOS	0.07 <sup>b</sup>		31		0.13		0.16		0.97		6.8		6.8	
PFOS	0.07 <sup>b</sup>		33.1		0.219		0.28		1.25		9.0		9.0	

Note: A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.orml.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.orml.gov/cgi-bin/chemicals/csl_search)). Note: When PFOA and PFOS are both present, the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L = micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 17 AFFF Area 4 (Hangar 11) Sediment Analytical Results**

Field Sample ID		ANDRW04-007-SD-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	<b>0.34 J</b>
PFOA	126 <sup>b</sup>	<b>0.61 J</b>
PFOS	126 <sup>b</sup>	<b>27</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 18 AFFF Area 4 (Hangar 11) Surface Water Analytical Results**

Field Sample ID		ANDRW04-007-SW-001
Parameter	Screening Level (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	<b>0.67</b>
PFOA	0.07 <sup>b</sup>	<b>0.91</b>
PFOS	0.07 <sup>b</sup>	<b>7.6</b>
PFOA + PFOS	0.07 <sup>b</sup>	<b>8.51</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

The media of concern at Hangars 6 and 7 are surface soil, subsurface soil, shallow groundwater, surface water, and sediment.

#### **3.5.1 Sample Locations**

Surface soil, subsurface soil, and groundwater grab samples were collected from DPT boring ANDRW05-001 installed in the low-lying area north of Hangar 7, on the north side of the concrete apron where stormwater drains and collects. Surface soil and subsurface soil samples were collected from DPT boring ANDRW05-002 installed in the grassy area near the northwest corner of Hangar 7, and surface soil and subsurface soil samples were collected from DPT boring ANDRW05-003 installed in the grassy area near the southwest corner of Hangar 7. Surface soil, subsurface soil, and groundwater grab samples were collected from DPT boring ANDRW05-004 installed at the southwest corner of Hangar 6 near the door to the mechanical room housing the fire suppression system. Surface soil, subsurface soil, and groundwater grab samples were collected from DPT boring ANDRW05-005 installed in the grassy area near the southeast corner of Hangar 6. Two DPT borings were installed in the grass on the south side of the apron south of Hangar 6, where surface water from the apron and groundwater from Hangars 6 and 7 flow. A groundwater grab sample was collected from DPT boring ANDRW05-006, and surface soil, subsurface soil, and groundwater grab samples were collected from DPT boring ANDRW05-007. A groundwater sample was also collected from groundwater monitoring well FT02-MW06 downgradient (southeast) of Hangar 6. A surface water and sediment sample were collected from Meetinghouse Branch west of the hangars near the intersection of West Perimeter Road and Menoher Drive, where stormwater discharges from Hangars 6 and 7. The sample locations for AFFF Area 5 are shown on Figure 15 (Appendix A).

#### **3.5.2 Lithology**

Soil samples were collected in six DPT borings at AFFF Area 5. Soil boring ANDRW05-001 was terminated at 15 feet bgs. Soil borings ANDRW05-002, ANDRW05-003, ANDRW05-004, ANDRW05-005, and ANDRW05-007 were terminated at 20 feet bgs. All six borings were drilled within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix D.

#### **3.5.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater flow in the area of Hangars 6 and 7 was assumed to be to the southeast. Depth to groundwater measurements were collected from the temporary wells installed in DPT borings ANDRW05-001, ANDRW05-004, ANDRW05-005 and in existing well FT02-MW06. The groundwater level measurements are presented in Appendix E. Figure 15 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours confirm that groundwater in the area of Hangars 6 and 7 flows to the southeast.

#### **3.5.4 Analytical Results**

Seven surface soil samples (six primary samples and one composite physiochemical sample), seven subsurface soil samples (six primary samples and one composite physiochemical sample), six groundwater samples, one sediment sample, and one surface water sample from AFFF Area 5 were submitted to the project laboratory for analyses.

### *Surface Soil*

All three target analytes were detected in one or more surface soil samples from AFFF Area 5. None of the surface soil samples had detected concentrations of the target analytes exceeding the screening values. Table 19 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface soil samples. Figure 16 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 5.

### *Subsurface Soil*

PFOA and PFOS were the only target analytes detected in one or more samples in the subsurface soil samples from AFFF Area 5. Neither of the compounds was detected at concentrations exceeding the screening levels for soil. Table 20 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 16 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 5.

### *Groundwater*

All three target analytes were detected in one or more of the six groundwater samples from AFFF Area 5. The detected concentrations of PFBS did not exceed the health-based screening level (40 µg/L) in any groundwater samples. The individual concentration of PFOA detected in four samples exceeded the screening level of 0.07 µg/L. The individual concentrations of PFOS detected in all six samples exceeded the screening level of 0.07 µg/L. The combined value of the detected concentrations of PFOS and PFOA in all six groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Table 21 presents the screening values and analytical results of PFBS, PFOA, and PFOS. Figure 17 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 5.

### *Sediment*

PFBS was not detected in the sediment sample from AFFF Area 5. PFOA and PFOS were detected in the sediment sample. Neither of the detected concentrations exceeded the screening levels for soil. Table 22 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the sediment sample. Figure 16 (Appendix A) shows the sample location and results of the target analytes in sediment at AFFF Area 5.

### *Surface Water*

All three target analytes were detected in the surface water sample from AFFF Area 5. However, none of the target analytes were detected at concentrations exceeding the screening levels. Table 23 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface water sample. Figure 17 (Appendix A) shows the sample location and results of the target analytes in surface water at AFFF Area 5.

### *Physiochemical Sample*

Two composite samples for physiochemical analyses were submitted for AFFF Area 5. The surface soil sample (ANDRW05-009-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (ANDRW05-009-SO-013) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 14.5 feet to 16 feet bgs. The results of the analyses of the physiochemical sample are presented in Appendix D.

### 3.5.5 Conclusions

Anecdotal information from fire department personnel suggests that Hangar 6 was originally equipped with an AFFF system prior to the conversion to a Hi-Ex foam system. There were releases of AFFF in Hangar 6 from the previous system, but there are no records to confirm the number of releases or the volume of AFFF released. Hangar 7 was also originally equipped with an AFFF system before being converted to the Hi-Ex system. Releases of AFFF reportedly occurred at Hangar 7, but there are no records to confirm the number of releases or the volume of AFFF released. The analytical results of the surface soil, subsurface soil, sediment, and surface water samples do not indicate concentrations of PFBS, PFOA, or PFOS remaining in the soils, sediments, or surface water in AFFF Area 5 at concentrations exceeding the screening criteria. However, based on the analytical results, an AFFF release is confirmed that has impacted groundwater at AFFF Area 5, and concentrations of PFOA and PFOS in the groundwater exceed the screening values at Hangars 6 and 7.





**Table 22 AFFF Area 5 (Hangars 6 and 7) Sediment Analytical Results**

Field Sample ID		ANDRW05-008-SD-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)
PFBS	130,000	0.30 UJ
PFOA	126 <sup>b</sup>	<b>0.41 J</b>
PFOS	126 <sup>b</sup>	<b>1.5 J</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/L micrograms per liter

ID = identification

J= estimated value

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

U = parameter not detected

**Table 23 AFFF Area 5 (Hangars 6 and 7) Surface Water Analytical Results**

Field Sample ID		ANDRW05-008-SW-001
Parameter	Screening Level (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	<b>0.0085 J</b>
PFOA	0.07 <sup>b</sup>	<b>0.027</b>
PFOS	0.07 <sup>b</sup>	<b>0.030</b>
PFOA + PFOS	0.07 <sup>b</sup>	<b>0.057</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

### **3.6 FIRE STATION #1 (AFFF AREA 6)**

The media of concern at Fire Station #1 are surface soil, subsurface soil, and shallow groundwater. There were no surface water bodies in the immediate vicinity of the area, so no surface water or sediment samples were collected for this area.

#### **3.6.1 Sample Locations**

Surface soil, subsurface soil, and groundwater grab samples were collected in DPT boring ANDRW06-001 installed in the low-lying area on the northeast side of the building, north of the main garage doors on the airfield side of the fire station. Subsurface soil and groundwater grab samples were collected from DPT boring ANDRW06-002 installed at the southeast corner of the building, south of the main garage doors of the fire station. A groundwater grab sample was collected from DPT boring ANDRW06-003 installed in the grassy area east of the concrete in front of the hangar doors and downgradient of the fire station. Groundwater samples were collected from groundwater monitoring wells SS28-MW15S and SS28-MW15D downgradient (southeast) of the fire station. A groundwater sample was also collected from monitoring well SS28-MW13D, adjacent to the OWS at the southwest corner of the fire station. Monitoring well SS28-MW13S was also proposed for sampling, but the well was removed during installation of the water line to the fire station. The sample locations for Fire Station #1 are shown on Figure 18 (Appendix A).

#### **3.6.2 Lithology**

Soil samples were collected in two DPT borings at AFFF Area 6. Both soil borings were terminated at 25 feet bgs within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix B.

#### **3.6.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater at AFFF Area 6 flows to the southeast. Depth to groundwater was measured in the temporary wells installed in the two DPT borings (ANDRW06-001 and ANDRW06-004) and in the three groundwater monitoring wells (SS28-MW13D, SS28-MW15S, and SS28-MW-15D). The groundwater elevation measurements are presented in Appendix E. Figure 18 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the groundwater flow direction in AFFF Area 6 is to the east.

#### **3.6.4 Analytical Results**

Three surface soil samples (one primary sample, one field duplicate sample, and one composite physiochemical sample); three subsurface soil samples (two primary samples and one composite physiochemical sample); and seven groundwater samples (six primary samples and one field duplicate sample) from AFFF Area 6 were submitted to the project laboratory for analyses.

##### *Surface Soil*

All three target analytes were detected in the surface soil samples. The concentration of PFOA detected in field duplicate sample ANDRW06-001-SS-901 (an estimated 150 µg/kg) exceeded the screening level for soil (126 µg/kg). The concentration of PFOS detected in both samples (ANDRW06-001-SS-001 at an estimated 17,000 µg/kg and field duplicate ANDRW06-001-SS-901 at an estimated 12,000 µg/kg) exceeded the screening levels for soil (126 µg/kg). Table 24 presents the screening values and the

analytical results of PFBS, PFOA, and PFOS. Figure 19 (Appendix A) shows the sample locations and results of the target analytes in surface soil at AFFF Area 6.

#### *Subsurface Soil*

All three target analytes were detected in the subsurface soil samples. The concentration of PFOS detected in two subsurface soil samples (ANDRW06-001-SO-018 at 200 µg/kg and ANDRW06-002-SO-018 at 170 µg/kg) exceeded the screening levels for soil (126 µg/kg). Table 25 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. Figure 19 (Appendix A) shows the sample locations and results of the target analytes in subsurface soil at AFFF Area 6.

#### *Groundwater*

All three target analytes were detected in the seven groundwater samples from AFFF Area 6. Table 26 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. PFBS was not detected at concentrations exceeding the screening level in any of the samples. PFOA and PFOS were detected at concentrations exceeding the individual screening level (0.07 µg/L) in all seven samples. The combined value of the detected concentrations of PFOS and PFOA in all seven groundwater samples exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Figure 20 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 6.

#### *Physiochemical Sample*

Two composite samples for physiochemical analyses were submitted for AFFF Area 6. The surface soil sample (ANDRW06-004-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (ANDRW06-004-SO-018) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth was between 15 and 20 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix D.

### **3.6.5 Conclusions**

Reports indicate periodic releases of AFFF have occurred on the concrete area in front of Fire Station #1 from spills while filling pumper trucks and from fire training activities. Samples were collected in the most likely areas for PFAS contamination to be detected based on surface drainage patterns and the groundwater flow direction. The analytical results of the surface and subsurface soil samples indicate concentrations of PFAS compounds remaining in the surface and subsurface soil exceeding the screening criteria. The analytical results of the groundwater samples also show that the detected individual concentrations of PFOA and PFOS and the combined detected concentrations of PFOA and PFOS in the groundwater exceed the screening values. Therefore, the sampling results indicate that the surface soil, subsurface soil, and groundwater at AFFF Area 6 have been impacted by the release of AFFF and that concentrations of PFOA and PFOS exceed the screening values in soil and groundwater at Fire Station #1.

**Table 24 AFFF Area 6 (Fire Station #1) Surface Soil Analytical Results**

Field Sample ID		ANDRW06-001-SS-001	ANDRW06-001-SS-901 (field duplicate)
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	75 J	110 J
PFOA	126 <sup>b</sup>	99 J	150 J
PFOS	126 <sup>b</sup>	17,000 J	12,000 J

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the concentration met or exceeded the corresponding screening value.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 25 AFFF Area 6 (Fire Station #1) Subsurface Soil Analytical Results**

Field Sample ID		ANDRW06-001-SO-018	ANDRW06-002-SO-018
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.85 J	6.9
PFOA	126 <sup>b</sup>	5.4	5.9 J
PFOS	126 <sup>b</sup>	200	170

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

Table 26 AFFF Area 6 (Fire Station #1) Groundwater Analytical Results

Parameter	Field Sample ID Screening Level (µg/L)	ANDRW06-001- GW-018	ANDRW06-002- GW-020	ANDRW06-002- GW-920 (field duplicate)	ANDRW06- 003-GW-020	ANDRW06- SS28MW13D- 042	ANDRW06- SS28MW15D-035	ANDRW06- SS28MW15S- 023
		Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	1.2	2.0 J	3.7 J	2.4	1.0	0.39	1.2
PFOA	0.07 <sup>b</sup>	4.5	7.2	8.7	14	16	3.3	12
PFOS	0.07 <sup>b</sup>	30	14 J	20 J	2.4	0.86	1.4	3.4
PFOA + PFOS	0.07 <sup>b</sup>	34.5	21.2 J	28.7 J	16.4	16.86	4.7	15.4

Note: A bolded value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening limit.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*.

Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

The media of concern at the former Hare Berry Farms are subsurface soil, groundwater, surface water, and sediment. Surface soil samples were not collected because agricultural activities had disrupted surface soil.

#### **3.7.1 Sample Locations**

Subsurface soil and groundwater grab samples were collected from two DPT borings (ANDRW07-001 and ANDRW07-002) installed in the planted pines where the former farm fields were situated. Surface water and sediment samples were collected from two locations (ANDRW07-003 and ANDRW07-004) in Piscataway Creek, downstream of the two ponds on the side of the property. A set of surface water and sediment samples (ANDRW07-005 and ANDRW07-006) were also collected from each of the two ponds. Groundwater samples were collected from two groundwater monitoring wells (LF07-MW14 and LF07-MW15) adjacent to the north side of the ponds. The sample locations for the former Hare Berry Farm are shown on Figure 21 (Appendix A).

#### **3.7.2 Lithology**

Soil samples were collected in two DPT borings at AFFF Area 7. Soil boring ANDRW07-001 was terminated at 35 feet bgs, and ANDRW07-002 was terminated at 25 feet bgs. Both borings were drilled within Quaternary sediments of the Surficial Aquifer. Detailed boring logs are contained in Appendix B.

#### **3.7.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater in the area of AFFF Area 7 was assumed to flow eastward toward Piscataway Creek. Depth to groundwater was measured in the temporary wells installed in the two DPT borings (ANDRW07-001 and ANDRW07-002) and in the two existing wells (LF07-MW14 and LF-MW15). The groundwater elevation measurements are presented in Appendix E. Figure 21 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the groundwater in the area of the former Hare Berry Farm flows to the southwest.

#### **3.7.4 Analytical Results**

Surface soils at the former Hare Berry Farm were disturbed by agricultural activities during the active life of the farm and were further disturbed during planting of pine trees in the area. Therefore, no surface soil samples were collected. Four subsurface soil samples (two primary samples, one field duplicate sample, and one composite physiochemical sample); four groundwater samples; four surface water samples; and four sediment samples were submitted to the project laboratory for analyses from AFFF Area 7.

##### *Subsurface Soil*

None of the target analytes were detected in any subsurface soil samples. Table 27 presents the screening values and the analytical results of PFBS, PFOA, and PFOS in subsurface soil. Figure 22 (Appendix A) shows the location and analytical results of the subsurface soil samples.

##### *Groundwater*

All three target analytes were detected in one or more of the four groundwater samples from AFFF Area 7. Table 28 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. PFBS was

not detected at a concentration exceeding the screening levels in any of the samples. Individual concentrations of PFOA and PFOS were detected at concentrations exceeding the screening level (0.07 µg/L) in only one sample (ANDRW07-LF07MW14-010 with PFOA at 0.083 µg/L and PFOS at 0.110 µg/L). The combined value of the detected concentrations of PFOS and PFOA in the same sample (PFOA at 0.193 µg/L) exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L). Figure 23 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 7.

#### *Sediment*

PFBS and PFOA were not detected in the sediment samples from AFFF Area 7. PFOS was detected in all four sediment samples, but none of the detected concentrations exceeded the screening levels for soil. Table 29 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the sediment sample. Figure 22 (Appendix A) shows the sample locations and results of the target analytes in sediment at AFFF Area 7.

#### *Surface Water*

All three target analytes were detected in the four surface water samples from AFFF Area 7. PFBS was not detected in any samples at a concentration exceeding the screening levels. PFOA was detected in two samples at concentrations exceeding the individual screening levels. PFOS was detected in three samples at concentrations exceeding the individual screening levels. The combined value of the detected concentrations of PFOS and PFOA in all four samples exceeded the EPA HA for drinking water. Table 30 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface water sample. Figure 23 (Appendix A) shows the sample locations and results of the target analytes in surface water at AFFF Area 7.

#### *Physiochemical Sample*

A composite soil sample for physiochemical analyses was submitted for AFFF Area 7. The subsurface soil sample (ANDRW07-007-SO-017) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth ranged from 17 feet to 23 feet bgs. The results of the analyses of the physiochemical sample are presented in Appendix D.

### **3.7.5 Conclusions**

In May 1992 approximately 500 gallons of AFFF were released at the JBA airfield and entered Piscataway Creek. Subsequently the creek water was used to irrigate the crops on the Hare Berry Farm. After testing, the USAF determined the crop was fit for consumption in accordance with FDA standards. In 1993, an additional assessment was prepared that concluded that Piscataway Creek did not pose a threat to human health or the environment. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected, based on surface drainage patterns and the groundwater flow direction. The analytical results of the subsurface soil samples and sediment samples from the ponds and Piscataway Creek do not indicate concentrations of PFBS, PFOA, or PFOS remaining in the soils or sediments exceeding the screening levels. The analytical results of the groundwater samples indicate that a release of AFFF has been confirmed that has impacted the shallow groundwater north of the ponds at concentrations exceeding the screening levels. The analytical results of the surface water samples indicate that the surface water in the ponds and in Piscataway Creek have also been impacted by the release of AFFF and contain concentrations of PFOA, PFOS, and/or combined concentrations of PFOA and PFOS that exceed the screening levels in AFFF Area 7.



**Table 27 AFFF Area 7 (Former Hare Berry Farm) Subsurface Soil Analytical Results**

Field Sample ID		ANDRW07-001-SO-023	ANDRW07-002-SO-017	ANDRW07-002-SO-917 (field duplicate)
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.33 UJ	0.33 UJ	0.38 U
PFOA	126 <sup>b</sup>	0.16 U	0.16 U	0.18 U
PFOS	126 <sup>b</sup>	0.21 UJ	0.21 UJ	0.24 UJ

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the concentration met or exceeded the corresponding screening value.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 28 AFFF Area 7 (Former Hare Berry Farm) Groundwater Analytical Results**

Field Sample ID		ANDRW07-001-GW-027	ANDRW07-002-GW-018	ANDRW07-LF07MW14-010	ANDRW07-LF07MW15-075
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	<b>0.0056 J</b>	<b>0.0044 J</b>	<b>0.012 J</b>	0.0019 U
PFOA	0.07 <sup>b</sup>	<b>0.048</b>	0.0053 U	<b>0.083</b>	0.0053 U
PFOS	0.07 <sup>b</sup>	<b>0.010 J</b>	<b>0.0090 J</b>	<b>0.11</b>	<b>0.0034 J</b>
PFOA + PFOS	0.07 <sup>b</sup>	<b>0.058 J</b>	<b>0.0090 J</b>	<b>0.193</b>	<b>0.0034 J</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J = estimated value

PFOA = perfluorooctanoic acid

U = parameter not detected at the method detection limit

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 29 AFFF Area 7 (Former Hare Berry Farm) Sediment Analytical Results**

Field Sample ID		ANDRW07-003-SD-001	ANDRW07-004-SD-001	ANDRW07-005-SD-001	ANDRW07-006-SD-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.33 U	0.28 U	0.45 UJ	0.35 UJ
PFOA	126 <sup>b</sup>	0.16 U	0.13 U	0.22 U	0.17 U
PFOS	126 <sup>b</sup>	<b>2.1</b>	<b>3.6</b>	<b>4.8 J</b>	<b>1.3 J</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.oiml.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.oiml.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

**Table 30 AFFF Area 7 (Former Hare Berry Farm) Surface Water Analytical Results**

Field Sample ID		ANDRW07-003-SW-001	ANDRW07-004-SW-001	ANDRW07-005-SW-001	ANDRW07-006-SW-001
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	<b>0.10</b>	<b>0.12</b>	<b>0.0077 J</b>	<b>0.0078 J</b>
PFOA	0.07 <sup>b</sup>	<b>0.42</b>	<b>0.40</b>	<b>0.028</b>	<b>0.029</b>
PFOS	0.07 <sup>b</sup>	<b>1.3</b>	<b>1.0</b>	<b>0.076 J</b>	<b>0.055</b>
PFOA + PFOS	0.07 <sup>b</sup>	<b>1.72</b>	<b>1.40</b>	<b>0.104 J</b>	<b>0.084</b>

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*.

Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J = estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

The media of concern at the former Brandywine DRMO Yard are surface soil, subsurface soil, and groundwater. No surface water or sediment samples were collected at this site because of the extensive remedial actions and drainage pathway alterations during implementation of the ROD that was approved in 2006.

#### **3.8.1 Sample Locations**

One surface soil sample, one subsurface soil sample, and one groundwater grab sample were collected from DPT boring ANDRW08-001 installed within the area of the former burn pit. Groundwater samples were collected from two existing groundwater monitoring wells (DP03-SS01 and DP18-SS01) and DPT boring ANDRW08-002 installed downgradient of the former burn pit. Groundwater grab samples were also collected from DPT borings ANDRW08-003 and ANDRW08-004 within the footprint of the former DRMO warehouse building and from existing monitoring wells DP19-SS01 and DP54-SS01 at the locations of other former buildings. The sample locations for the former Brandywine DRMO Yard are shown on Figure 24 (Appendix A).

#### **3.8.2 Lithology**

Soil samples were collected from a DPT boring installed within the border of the former burn pit. Soil boring ANDRW08-001 was terminated at 15 feet bgs within Quaternary sediments of the Surficial Aquifer. A detailed boring log is contained in Appendix B.

#### **3.8.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater in AFFF Area 8 was assumed to flow to the west. Depth to groundwater was measured in the four existing groundwater monitoring wells (DP03-SS01, DP18-SS01, DP19-SS01, and DP54-SS01). The groundwater elevation measurements are presented in Appendix E. Figure 24 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the groundwater in Area 8 flows to the south.

#### **3.8.4 Analytical Results**

Two surface soil samples (a primary sample and composite physiochemical sample), two subsurface soil samples (a primary sample and composite physiochemical sample), and nine groundwater samples were submitted to the project laboratory for analyses from AFFF Area 8.

##### *Surface and Subsurface Soils*

None of the target analytes were detected in either the surface soil or subsurface soil samples. Table 31 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the surface soil sample. Table 32 presents the screening values and analytical results of PFBS, PFOA, and PFOS in the subsurface soil samples. Figure 25 (Appendix A) shows the location and analytical results of the surface and subsurface soil samples.

##### *Groundwater*

All three target analytes were detected in the nine groundwater samples from AFFF Area 8. Table 33 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. PFBS was not

detected at concentrations exceeding the screening levels in any samples. Individual concentrations of PFOA exceeded the screening levels in six of the nine samples. Individual concentrations of PFOS exceeded the screening levels in five of the nine samples. The combined value of the detected concentrations of PFOS and PFOA exceeded the EPA HA for drinking water (combined PFOS and PFOA value of 0.07 µg/L) in seven of the nine groundwater samples. Figure 26 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 8.

#### *Physiochemical Sample*

Two composite samples for physiochemical analyses were submitted for AFFF Area 8. The surface soil sample (ANDRW08-005-SS-001) was composed of aliquots of the surface soil in the borings from 0 to 6 inches bgs. The subsurface soil sample (ANDRW08-005-SO-011) was composed of aliquots of the subsurface soil from the borings immediately above the water saturated/unsaturated soil interface. This depth was between 9 and 14 feet bgs. The results of the analyses of the physiochemical samples are presented in Appendix D.

### **3.8.5 Conclusions**

The former Brandywine DRMO Yard was used for temporary storage of scrap materials and hazardous waste generated from various DoD facilities in the region from 1943 to 1987. In 1987, a warehouse burned to the ground, resulting in the cessation of operations at the facility. Burns pits were reportedly present at the DRMO Yard, but there are no records of AFFF having been used at the facility. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected, based on surface drainage patterns and the groundwater flow direction. The analytical results of the soil samples do not indicate detectable concentrations of PFBS, PFOA, or PFOS remaining in the soils. However, the analytical results of the groundwater samples indicate that a release of AFFF is confirmed that has impacted the groundwater at AFFF Area 8 and that detected concentrations of PFOA, PFOS, and the combined detected concentrations of PFOA and PFOS in the groundwater exceed the screening values at the former Brandywine DRMO Yard.

**Table 31 AFFF Area 8 (Former Brandywine DRMO Yard) Surface Soil Analytical Results**

Field Sample ID		ANDRW08-001-SS-001
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.28 UJ
PFOA	126 <sup>b</sup>	0.13 UJ
PFOS	126 <sup>b</sup>	0.18 UJ

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the concentration met or exceeded the corresponding screening value.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

**Table 32 AFFF Area 8 (Former Brandywine DRMO Yard) Subsurface Soil Analytical Results**

Field Sample ID		ANDRW08-001-SO-010
Parameter	Screening Level (µg/kg)	Concentration (µg/kg)
PFBS	130,000 <sup>a</sup>	0.28 U
PFOA	126 <sup>b</sup>	0.13 U
PFOS	126 <sup>b</sup>	0.18 U

Note: A bold value indicates the parameter was detected at or above the method detection limit.

<sup>a</sup>EPA Regional Screening Levels for Residential Soil (November 2017)

[<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>Screening levels calculated using the EPA Regional Screening Level calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)).

µg/kg = micrograms per kilogram

ID = identification

J= estimated value

PFBS = perfluorobutane sulfonate

PFOA = perfluorooctanoic acid

PFOS = perfluorooctane sulfonate

**Table 33 AFFF Area 8 (Former Brandywine DRMO Yard) Groundwater Analytical Results**

Field Sample ID		ANDRW08-001-GW-011	ANDRW08-001-GW-911 (field duplicate)	ANDRW08-002-GW-012	ANDRW08-003-GW-024
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	0.015 J	0.024	0.025 J	0.10
PFOA	0.07 <sup>b</sup>	0.095	0.089	0.12 J	0.10
PFOS	0.07 <sup>b</sup>	0.40	0.30	0.14 J	0.35
PFOA + PFOS	0.07 <sup>b</sup>	0.495	0.389	0.26 J	0.45

**Table 33 AFFF Area 8 (Former Brandywine DRMO Yard) Groundwater Analytical Results (continued)**

Field Sample ID		ANDRW08-004-GW-024	ANDRW08-DP19SS01-GW-035	ANDRW08-DP18SS01-GW-042	ANDRW08-DP54SS01-GW-040	ANDRW08-DP03SS01-GW-023
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	0.0057 J	0.0094 J	0.0088 J	0.024	0.021
PFOA	0.07 <sup>b</sup>	0.021	0.024	0.048	0.32	0.22
PFOS	0.07 <sup>b</sup>	0.11	0.014 J	0.012 J	0.021	0.051
PFOA + PFOS	0.07 <sup>b</sup>	0.131	0.038 J	0.060 J	0.341	0.271

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the concentration met or exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

The media of concern at FT-03 is groundwater. The remedial action for ERP site FT-03 has been completed. However, because the site has not been investigated for PFAS, EPA requested that the groundwater in the area be tested for PFAS prior to approving site closure. Therefore, no other media (soil, surface water, or sediment) were sampled in this area.

#### **3.9.1 Sample Locations**

Groundwater samples were collected from two existing groundwater monitoring wells (FT03-MW04 and FT03-MW11) within the footprint of the former FTA. A third groundwater sample was collected from an existing groundwater monitoring well (FT03-MW18) downgradient (east) of the former FTA. The sample locations for the former FTA 3 (FT-03) are shown on Figure 27 (Appendix A).

#### **3.9.2 Lithology**

No soil borings were drilled during the SI, and no soil samples were collected.

#### **3.9.3 Groundwater Flow**

Based on the information in the PA (HGL, May 2015), groundwater in the area of AFFF Area 9 flows to the east. Depth to groundwater was measured in groundwater monitoring wells FT03-MW04, FT03-MW11, and FT03-MW18. The groundwater elevation measurements are presented in Appendix D. Figure 27 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that the groundwater flow direction is to the northeast.

#### **3.9.4 Analytical Results**

Surface soil and subsurface soil samples were not collected because of the remedial action at the FTA, which included soil removal and regrading of the site during construction of the golf course. Four groundwater samples (three primary and one field duplicate sample) were submitted to the project laboratory for analyses. All three target analytes were detected in the four groundwater samples from AFFF Area 9. Table 34 presents the screening values and the analytical results of PFBS, PFOA, and PFOS. PFBS was not detected at a concentration exceeding the screening levels in any sample. PFOA was detected at individual concentrations exceeding the screening levels in two of the four samples (0.22 µg/L in sample ANDRW09-FT03MW11-029 and 4.4 µg/L in sample ANDRW09-FT03MW18-018). PFOS was detected at a concentration exceeding the screening level in one of the four samples (0.25 µg/L in sample ANDRW09-FT03MW11-029). The combined detected concentrations of PFOA and PFOS in two of the four groundwater samples (0.47 µg/L in sample ANDRW09-FT03MW11-029 and 4.459 µg/L in sample ANDRW09-FT03MW18-018) exceeded the EPA HA for drinking water (combined PFOA and PFOS value of 0.07 µg/L). Figure 28 (Appendix A) shows the sample locations and results of the target analytes in groundwater at AFFF Area 9.

#### **3.9.5 Conclusions**

Fire training operations were conducted at FT-03 between 1959 and 1972. During fire training activities, protein foams, carbon tetrachloride, and chlorobromomethane were reportedly used to extinguish the fires. The burn pit was demolished in approximately 1972 and contaminated soil removed. Although there

are no records indicating AFFF was ever used at FT-03, EPA requested that the groundwater in the area be tested for PFAS prior to approving site closure. Samples were collected in the most likely areas for PFAS contamination to be detected, based on the groundwater flow direction. The analytical results of the groundwater samples confirm a release in AFFF Area 9 that has impacted the groundwater and that detected concentrations of PFOA, PFOS, and the combined detected concentrations of PFOA and PFOS in the groundwater exceed the screening levels at former FTA FT-03.



**Table 34 AFFF Area 9 (Former Fire Training Area FT-03) Groundwater Analytical Results**

Field Sample ID		ANDRW09-FT03MW18-018	ANDRW09-FT03MW11-029	ANDRW09-FT03MW04-034	ANDRW09-FT03MW04-934 (Field Duplicate)
Parameter	Screening Level (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)	Concentration (µg/L)
PFBS	40 <sup>a</sup>	0.069	0.014 J	0.012 J	0.012 J
PFOA	0.07 <sup>b</sup>	4.4	0.22	0.022	0.020
PFOS	0.07 <sup>b</sup>	0.059	0.25	0.018 J	0.018 J
PFOA + PFOS	0.07 <sup>b</sup>	4.459	0.47	0.040 J	0.038 J

Note: A bold value indicates the parameter was detected at or above the method detection limit. A shaded value indicates the detected concentration exceeded the corresponding screening level.

<sup>a</sup>EPA Regional Screening Levels for Tap Water (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

<sup>b</sup>EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.

µg/L micrograms per liter

J= estimated value

PFOA = perfluorooctanoic acid

ID = identification

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

### **3.10 INVESTIGATION-DERIVED WASTE**

All investigation-derived waste (IDW) was managed in accordance with the specific waste management guidance provided by JBA. IDW generated during the SI field effort consisted of soil and wastewater potentially impacted with PFAS and construction waste (such as used personal protective equipment, paper, rags, plastic sheeting, etc.).

#### **3.10.1 Waste Soil**

Waste soil generated during the installation of soil borings was placed in Department of Transportation (DOT)-approved steel drums for waste sampling and proper disposal. A representative sample was collected from the waste soil and submitted to the project laboratory to be analyzed for the full Toxicity Characteristic Leaching Procedure (TCLP) list (volatile organic compounds, semivolatile organic compounds, pesticides, herbicides, and metals), polychlorinated biphenyls, total petroleum hydrocarbons, flashpoint, reactivity, ignitability, corrosivity, pH, sulfide, and cyanide. The results of the analyses indicated the soils could be handled as nonhazardous. The drums were staged to a secure holding area until the USAF determines the proper disposal method.

#### **3.10.2 Wastewater**

Waste fluids generated during groundwater sampling and decontamination activities were placed in DOT-approved steel drums and staged to a secure location for waste sampling and proper disposal. A representative sample was collected from the waste fluids and submitted to the project laboratory to be analyzed for the full TCLP list. The results of the analyses indicated the soils could be handled as nonhazardous. The drums were staged to a secure holding area until the USAF determines the proper disposal method.

#### **3.10.3 Construction Waste**

Construction waste was placed in plastic garbage bags and put in dumpsters on JBA for disposal at an off-site Resource Conservation and Recovery Act Subtitle D industrial landfill.

## **4.0 GROUNDWATER PATHWAY**

JBA is in the Atlantic Coastal Plain physiographic province, approximately 12 miles east of the fall line. The fall line is the boundary between the Atlantic Coastal Plain and the Piedmont physiographic provinces. The fall line also marks the contact where older Piedmont rocks exposed to the northwest dip beneath Coastal Plain sediments that thicken to the east. The coastal plain deposits are characterized by an eastward thickening wedge of unconsolidated sediments consisting of sand, silt, and clay and are underlain by crystalline basement rocks. The coastal plain sediments are approximately 2,000 feet thick in the vicinity of JBA and consist of the

- Quaternary Age Upland Deposits (20 to 50 feet thick);
- Upper Tertiary Age Calvert Formation (90 to 100 feet thick);
- Lower Tertiary Age Nanjemoy Formation (90 to 125 feet thick), Marlboro Clay (15 to 30 feet thick), and Aquia Formation (100 to 140 feet thick); and
- Upper Cretaceous Age Formation (more than 800 feet thick).

The predominant lithology encountered in the Upland Deposits is a yellowish-brown, well-graded sand and gravel with scattered thin clay lenses. The Upland Deposits form the surficial (unconfined) aquifer at JBA. The Calvert Formation consists of greenish-gray silt and clay with interbedded fine sand. The Nanjemoy Formation is comprised of greenish gray, micaceous, glauconitic clayey silt with fine-to-medium grained, interbedded sands. Both the Calvert and Nanjemoy Formations are considered leaky confining units below the Upland Deposits. The Marlboro Formation consists of red-brown and light gray clays and forms a tight confining unit. The underlying Aquia Formation consists of greenish-black glauconitic silty clays and fine sands, along with some fine-medium sand and glauconite. The Aquia Formation is a principal aquifer in the northern parts of Prince George's County. Below the Aquia Aquifer, the Severn Formation forms the confining unit for the Magothy and Patapsco Aquifers, which are the major water-bearing units in the area (CH2M Hill, March 2004). Figure 29 (Appendix A) contains a generalized hydrogeologic column of the coastal plain in the vicinity of JBA.

Ground surface elevations at JBA range from 215 to 281 feet above mean sea level (amsl). Based on depth to water measurements in the groundwater monitoring wells on the facility, the depth to groundwater ranges from 0.29 to 21.87 feet below top of casing, and the elevation of the groundwater surface ranges from 210.27 to 266.12 feet amsl (HGL, May 2015). The central portions of JBA serve as areas of groundwater recharge, and groundwater generally flows radially outward from these areas toward the streams and base boundaries. Regional groundwater flow in the surficial aquifer mirrors surface water flow and is generally to the south-southeast. The relationship between the groundwater and surface water drainage suggests that a portion of the groundwater discharges as base flow to six streams discharging from JBA. JBA and most of Prince George's County obtain their public water supply from the Washington Suburban Sanitary Commission (WSSC) water utility. The source of the public water supply is surface water from the Potomac and Patuxent Rivers. No active drinking water supply wells are on JBA, and new drinking water supply wells are not permitted on JBA (HGL, May 2015).

The former Brandywine DRMO Yard is approximately 7 miles southeast of the main JBA facility. Previous investigations conducted at the former DRMO yard identified the Brandywine Formation beneath the DRMO Yard and immediate surroundings. The Brandywine Formation is composed of Quaternary and Upland deposits consisting of clay, silt, sand, and gravel. The Brandywine Formation is separated into four distinct strata: the Shallow Brandywine, the Upper Intermediate Brandywine, the Lower Intermediate Brandywine, and the Deep Brandywine. The Shallow Brandywine is 2 to 12 feet thick, predominantly brown to yellowish-brown clay with some silt, sand, and gravel and is typically above the water table. The Upper Intermediate Brandywine ranges from 0 to 7.5 feet in thickness and consists of a brownish-gray to yellowish-brown, well-graded, fine sand with minor amounts of medium sand, silt, and clay. The Lower Intermediate Brandywine is a water-bearing stratum from 8 to 23 feet thick, consisting of yellowish-brown, poorly graded sand with gravel and occasional silt and clay lenses (typically less than 1 foot thick). The Deep Brandywine is typically less than 2.5 feet thick, consisting of yellow, oxidized, poorly graded sand and gravelly sand, with clay and silt lenses. The Calvert Formation underlies the Brandywine sediments at depths ranging from 21 to 30 feet bgs. Borings installed during previous investigations indicate the Calvert Formation is approximately 100 feet thick in the area of the former DRMO yard (HGL, July 2013).

Environmental Data Resources (EDR) of Shelton, Connecticut, researched state and federal databases for the area surrounding the JBA main base and the former Brandywine DRMO Yard. The report showed wells in the vicinity of the base to the south-southeast (in the direction of regional groundwater flow), but none of them are shown as private drinking water supply wells, and the majority of the wells are shown as sources of irrigation water. The nearest public drinking water supply well is part of the Cheltenham Boys Village system, approximately 4.5 miles southeast of the main JBA base. JBA and most of Prince George's County obtain their public water supply from the WSSC water utility, whose source is surface

water from the Potomac and Patuxent Rivers. There are no active drinking water supply wells on base, and new drinking water supply wells are not permitted on JBA.

#### **4.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

The analytical results for all 10 groundwater samples collected in the area during the SI showed individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding screening levels. Therefore, the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (upgradient). Therefore, the groundwater at AFFF Area 1 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 1 is approximately 54,000 residents. The closest residential area is approximately 2,900 feet to the south with a population of 3,188 residents (HGL, May 2015).

#### **4.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

The analytical results for all five groundwater samples collected in the area during the SI showed individual concentrations of PFOS and combined concentrations of PFOA and PFOS exceeding screening levels. Therefore, the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (sidegradient). Therefore, the groundwater at AFFF Area 2 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 2 is approximately 54,000 residents. The closest residential area is approximately 2,000 feet southeast (HGL, May 2015).

#### **4.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

The analytical results of the three groundwater samples collected during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (downgradient). Therefore, the groundwater at AFFF Area 3 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 3 is approximately 54,000 residents. The closest residential area is approximately 1.7 miles to the southeast (HGL, May 2015).

#### **4.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

The analytical results of the six groundwater samples collected during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (upgradient). Therefore, the groundwater at AFFF Area 4 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 4 is

approximately 54,000 residents. The closest residential area is approximately 1.8 miles to the southeast with a population of 3,995 residents (HGL, May 2015).

#### **4.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

The analytical results of six groundwater samples collected during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (downgradient). Therefore, the groundwater at AFFF Area 5 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 5 is approximately 60,000 residents. The closest residential area is approximately 2,300 feet to the southwest (HGL, May 2015).

#### **4.6 FIRE STATION #1 (AFFF AREA 6)**

The analytical results of the seven groundwater samples collected during the SI indicate that the groundwater in the area contains individual concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (sidegradient). Therefore, the groundwater at AFFF Area 6 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 6 is approximately 64,000 residents. The closest residential area is approximately 1,600 feet to the west with a population of 2,973 residents (HGL, May 2015).

#### **4.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

The analytical results of the four groundwater samples collected during the SI indicate that only the shallow groundwater north of the ponds contains concentrations of PFOA, PFOS, and combined concentrations (PFOA and PFOS) exceeding screening values. This indicates that the groundwater in the area north of the ponds has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (sidegradient). Therefore, the groundwater at AFFF Area 7 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 7 is approximately 54,000 residents. The closest residential area is approximately 1,500 feet to the southeast with a population of 3,995 residents (HGL, May 2015).

#### **4.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

The analytical results of the nine groundwater samples collected during the SI indicate that the groundwater in the area contains concentrations of PFOA, PFOS, and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source at the former Brandywine DRMO Yard, and the nearest public water supply well to AFFF Area 8 is part of the Cheltenham Boys Village system, approximately 2.5 miles north (upgradient) of the former Brandywine DRMO Yard. Therefore, the groundwater at AFFF Area 8 does not present an immediate hazard to human health. The population of Brandywine, Maryland, in the vicinity of AFFF

Area 8 is approximately 6,719 residents (City-Data, February 2017). The closest residential area is approximately 350 feet to the west.

#### **4.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

The analytical results of the four groundwater samples collected during the SI indicate that the groundwater in the area contains concentrations of PFOA, PFOS, and combined concentrations of PFOA and PFOS exceeding screening values. This indicates that the groundwater in the area has been impacted to an extent that would create a potential hazard to human health. However, groundwater is not used as a drinking water source on base, and the nearest public water supply well is more than 4 miles southeast (sidegradient). Therefore, the groundwater at AFFF Area 9 does not present an immediate hazard to human health. The off-base population within 4 miles of AFFF Area 9 is approximately 64,000 residents. The closest residential area is approximately 3,000 feet to the southwest. (HGL, May 2015).

#### **5.0 SURFACE WATER AND SEDIMENT PATHWAY**

JBA and most of Prince George's County obtain their public water supply from the WSSC water utility. The source of the public water supply is surface water from the Potomac and Patuxent Rivers mainly held in two reservoirs: the Triadelphia Reservoir near Unity, Maryland (more than 25 miles upgradient/upstream to the northwest of JBA), and the T. Howard Duckett Reservoir (also known as the Rocky Gorge Reservoir) near Burtonsville, Maryland (more than 20 miles upgradient/upstream to the north of JBA).

JBA covers approximately 4,300 acres and, given its size, drainage occurs in two watersheds fed by multiple streams. JBA straddles a drainage divide between the Potomac River Basin to the west and the Patuxent River Basin to the east. Henson Creek, Meetinghouse Branch, Paynes Branch, and Piscataway Creek are all tributaries of the Potomac River. This area makes up the Middle Potomac-Anacostia-Occoquan Watershed. Charles Branch and Cabin Branch are tributaries of the Patuxent River. The northeastern section of JBA feeds into the Patuxent Watershed. Base flow for these streams is maintained through surface runoff originating from precipitation and hydrologically connected surficial Upland Deposits (HGL, May 2015). The Meetinghouse and Paynes Branches both originate in the southwestern quadrant of the base and flow southwest into Tinkers Creek. Tinkers Creek flows through highly forested areas as it nears its confluence with Piscataway Creek. Piscataway Creek originates in the southeastern corner of the base and flows through primarily forested and agricultural lands before it discharges to the Potomac River. Henson Creek is northwest of JBA and flows west-southwest through predominantly forested areas, eventually discharging to the Potomac River. The headwaters of Cabin and Charles Branches are within the northern portion of the base boundary and drain eastward to the Patuxent River (CH2M Hill, March 2004).

Surface water runoff from the former Brandywine DRMO yard discharges to perimeter drains that funnel the runoff to the northwest corner of the property. The majority of the surface water drainage leaving the site is directed northeast along the east side of the CSX railroad tracks to two 16-inch culverts north of the northwest corner of the site boundary fence. The raised elevation of the railroad tracks, relative to the site, causes stormwater runoff to pool in this area, leaving the culverts submerged for extended periods of time. The culverts direct stormwater runoff under the railroad tracks to an unnamed intermittent drainage channel and forested wetland along the west side of Cherry Tree Crossing Road. The drainage channel flows to the southwest and discharges to a highly braided channel system, eventually joining with a southern and northern drainage system to form an unnamed tributary of Timothy Branch. Timothy Branch flows south from the Brandywine area to join Mattawoman Creek, approximately 3 miles south of the

site. Mattawoman Creek ultimately discharges to the Potomac River near Indian Head, Maryland, approximately 18 miles southwest of the site (HGL, July 2013).

### **5.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

The surface water drainage from former FTA 4 and Building 2489 flows toward the southwest ultimately discharging to Piscataway Creek. Piscataway Creek is known to be used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. AFFF Area 1 is not within any floodplains, and the nearest body of water is Base Lake, approximately 4,900 feet southwest of the area. The analytical results of sediment sample collected from the drainage channel during the SI indicate that the sediment has not been impacted by the release of AFFF at concentrations exceeding the screening levels. The surface water sample collected in the drainage channel south of AFFF Area 1 had concentrations of PFOA, PFOS, and combined concentrations (PFOA and PFOS) exceeding the screening levels. In addition, all 10 samples from the groundwater in the area had detected concentrations of PFOA, PFOS, and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to surface waters discharged from the AFFF Area 1.

### **5.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

Surface drainage originating from Hangar 16 drains to the west into a drainage channel adjacent to the concrete tarmac. The drainage channel discharges to Piscataway Creek at the south end of the airfield. Piscataway Creek is known to be used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. The hangar and surrounding area are not within any floodplains, and the nearest body of water is Base Lake, approximately 7,800 feet southwest of the hangar. The analytical results of sediment sample collected from the drainage ditch during the SI indicate that the sediment has not been impacted by the release of AFFF at concentrations exceeding the screening levels. Surface water samples collected from the drainage ditch during the SI had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater samples collected in the area also had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies, forming the base flow of streams in the region. Based on the results of the analyses of the surface water and groundwater samples, there is a potentially complete pathway for human exposure to surface waters discharged from AFFF Area 2.

### **5.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

Surface drainage originating from the East Side Fuel Cell drains to the north and discharges to Cabin Branch. Cabin Branch joins several other streams to become the Western Branch of the Patuxent River. The Patuxent River is used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. The hangar is not within any floodplains, and the nearest body of water is Base Lake, approximately 11,000 feet southwest of the East Side Fuel Cell. No surface water samples or sediment samples were collected during the SI in the immediate vicinity of the East Side Fuel Cell. However, a surface water and sediment sample were collected from Cabin Branch where the drainage channel from the hangar area discharges. The analytical results of the sediment sample indicate that the sediment in Cabin Branch has not been impacted by the

release of AFFF at concentrations exceeding the screening levels. The surface water sample had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. In addition, all three groundwater samples collected at the East Side Fuel Cell had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies, forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to surface waters discharged from AFFF Area 3.

#### **5.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

Surface drainage originating from Hangar 11 drains to the north and discharges to Cabin Branch. Cabin Branch joins several other streams to become the Western Branch of the Patuxent River. The Patuxent River is known to be used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. The hangar and surrounding area are not within any floodplains, and the nearest body of water is Base Lake, approximately 12,000 feet southwest of the hangar. A surface water and sediment sample were collected from Cabin Branch where the drainage channel from the hangar area discharges. The analytical results of the sediment sample indicate that the sediment in Cabin Branch has not been impacted by the release of AFFF at concentrations exceeding the screening levels. The surface water sample had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. In addition, all five groundwater samples collected at Hangar 11 had detected concentrations of PFOA and PFOS, and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies, forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to surface waters discharged from the AFFF Area 4.

#### **5.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

Based on the topography of the surrounding area, surface water drainage from Hangars 6 and 7 flows southeast toward Meetinghouse Branch. Meetinghouse Branch joins Paynes Branch to form Tinkers Creek, ½ mile off base. Tinkers Creek is known to be used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. The area surrounding the hangars is not within any floodplains, and the nearest body of water is Base Lake, approximately 1.4 miles southeast of Hangars 6 and 7. A surface water and sediment sample were collected where surface drainage from the hangar area discharges into Meeting House Branch. The analytical results of the sediment sample indicate that the sediment in Meeting House Branch has not been impacted by the release of AFFF at concentrations exceeding the screening levels. The surface water sample did not have detected concentrations of PFAS compounds exceeding the screening levels. However, one or more of the six groundwater samples collected at Hangars 6 and 7 had detected concentrations of PFOA and PFOS exceeding the screening levels, and all six samples had combined concentrations of PFOA plus PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to groundwater discharged as surface waters from AFFF Area 4.



## **5.6 FIRE STATION #1 (AFFF AREA 6)**

Surface drainage originating from Fire Station #1 drains to the southeast and discharges to Piscataway Creek. Piscataway Creek is known to be used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. The area surrounding Fire Station #1 is not within any floodplains, and the nearest body of water is Base Lake, approximately 1 mile south of the building. There were no surface water bodies or discharge points in the immediate vicinity, so no surface water samples were collected for this area. However, the surface soil sample (primary and duplicate) collected on the north side of the garage bay doors detected PFOS and PFOA at concentrations exceeding the screening levels, and the subsurface soil samples collected on the north and south sides of the garage bay doors detected PFOS at concentrations exceeding the screening level. This indicates that PFAS is available to dissolve into surface water and be carried to discharge points in local streams. In addition, all seven groundwater samples at Fire Station #1 had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies, forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to surface waters from the area and from groundwater discharged as surface waters from AFFF Area 6.

## **5.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

Surface drainage from the former Hare Berry Farm drains to the south and east into Piscataway Creek. In addition, a significant portion of the surface water drainage from JBA flows to the south and also discharges into Piscataway Creek. Piscataway Creek is used for recreational fishing by residents of nearby communities and could provide exposure pathways to humans through dermal contact and ingestion of fish. Hare Berry Farms is not within any floodplains, and the nearest body of water is Piscataway Creek, adjacent to the east side of the former farm area. Surface water and sediment samples were collected from Piscataway Creek and from the ponds on the north side of the area. The analytical results of the sediment samples from Piscataway Creek and from the ponds indicate that the sediment in the area has not been impacted by the release of AFFF at concentrations exceeding the screening levels. Surface water samples collected from Piscataway Creek had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. One surface water sample collected from the two ponds on the north side of the area had a concentration of PFOS exceeding the screening level, and both samples from the ponds had combined concentrations of PFOA and PFOS exceeding the screening levels. Only one of the four groundwater samples collected at the former Hare Berry Farm had detected concentrations of PFOA and PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. This groundwater sample was collected on the north side (upgradient) of the ponds from 10 feet bgs. Being on the upgradient side indicates that the former farm may not be the source of the PFAS compounds observed in the surface water samples. However, the concentration of PFAS compounds detected in the surface water samples indicate that the surface waters are a potentially complete pathway for human exposure from AFFF Area 7.

## **5.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

Surface water runoff from the former Brandywine DRMO yard discharges northeast along the east side of the CSX railroad tracks to two 16-inch culverts north of the northwest corner of the site boundary fence. The culverts direct stormwater runoff under the railroad tracks to an unnamed intermittent drainage channel and forested wetland. The drainage channel flows to the southwest and discharges to a highly braided channel system, eventually joining with a southern and northern drainage system to form an

unnamed tributary of Timothy Branch. Timothy Branch flows south from the Brandywine area to join Mattawoman Creek, approximately 3 miles south of the site. Mattawoman Creek ultimately discharges to the Potomac River near Indian Head, Maryland, approximately 18 miles southwest of the site. No water bodies are on the site, so no surface water samples were collected during the SI. However, six of the nine groundwater samples collected at the former Brandywine DRMO Yard had detected concentrations of PFOA and/or PFOS and combined concentrations of PFOA and PFOS exceeding the screening levels. Groundwater in the area may discharge to surface water bodies forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to groundwater discharged as surface waters from AFFF Area 8.

## **5.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

Surface topography indicates that surface water runoff from the former FTA 3 is toward Base Lake, approximately 1,300 feet to the south and east. Base Lake discharges through drainage channels to Piscataway Creek, approximately 1,300 feet downstream of the lake. Surface water was not a media of concern for AFFF Area 9 during the SI, so no surface water samples were collected. However, groundwater samples collected from two of the three monitoring wells sampled at FT-03 had detected concentrations of PFOA exceeding the screening level. One of those two groundwater samples had a PFOS concentration exceeding the screening level, and the combined concentrations of PFOA and PFOS in the two wells also exceed the EPA HA. Groundwater in the area may discharge to surface water bodies forming the base flow of streams in the region. Therefore, there is a potentially complete pathway for human exposure to groundwater discharged as surface waters from AFFF Area 9.

## **6.0 SOIL EXPOSURE AND AIR PATHWAYS**

The objective of soil sampling during the SI was to determine if soils in the individual areas had been impacted by the release of AFFF and whether concentrations of PFBS, PFOA, and PFOS remain in the soils exceeding the screening levels.

### **6.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

The analytical results of the subsurface soil samples collected during the SI indicate that there is no source of PFAS contamination in the subsurface soils at the former FTA that could impact human health. Surface soil was not evaluated because the surface soil had been disrupted during the construction of the ASA Facility.

### **6.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

The analytical results of the environmental samples collected during the SI indicate that there is no source of PFAS contamination in the subsurface soils at the hangar that could impact human health. Surface soil samples were not collected because the majority of the area where the AFFF was reportedly released is covered in pavement.

### **6.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

PFOS exceeded the screening values in the surface soil sample taken near the mechanical room door and the subsurface soil sample taken at the stormwater drain on the south side of the East Side Fuel Cell (Building 3629), indicating that the surface and subsurface soils in this area could potentially impact

human health and provide a source of PFAS compounds to dissolve into surface water runoff and groundwater.

#### **6.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

The analytical results of the environmental samples collected during the SI indicate that there is no source of PFAS contamination in the surface or subsurface soils at Hangar 11 that could impact human health.

#### **6.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

The analytical results of the environmental samples collected during the SI indicate there is no source of PFAS contamination in the surface or subsurface soils at Hangars 6 and 7 that could impact human health.

#### **6.6 FIRE STATION #1 (AFFF AREA 6)**

The analytical results of the environmental samples collected during the SI indicate that there is no source of PFAS contamination in the subsurface soils at Fire Station #1 that could impact human health. However, the analytical results of the surface (primary and duplicate samples) and subsurface soil samples collected on the north side of the garage bay doors and the subsurface soil sample collected on the south side of the garage bay doors had PFAS concentrations exceeding screening values, indicating that the surface and subsurface soil in this area could potentially impact human health and provide a source of PFAS compounds to dissolve into surface water runoff and groundwater.

#### **6.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

The analytical results of the environmental samples collected during the SI indicate that there is no source of PFAS contamination in the subsurface soils at the former Hare Berry Farm that could impact human health. Surface soil samples were not collected in this area because agricultural activities had disrupted the surface soil.

#### **6.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

The analytical results of the environmental samples collected during the SI indicate that there is no source of PFAS contamination in the surface or subsurface soils in the burn pit at the former Brandywine DRMO Yard that could impact human health.

#### **6.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

Surface soil and subsurface soil samples were not collected because of the remedial action at the FTA, which included soil removal and regrading of the site during construction of the golf course. Therefore, it is unlikely that the soils in AFFF Area 9 could impact human health.

### **7.0 UPDATE TO CONCEPTUAL SITE MODELS**

The following sections are updates to the conceptual site models (CSM) for each area presented in Worksheet #10 of the QAPP addendum (ASL, November 2016). It should be noted that the screening levels for PFAS compounds in soil used in the SI were derived based on direct contact under a residential

exposure scenario, and these values may not be protective of groundwater (through soil-to-groundwater migration) or surface water (through surficial runoff or groundwater discharge).

### **7.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

The CSM for the former FTA presented in Worksheet #10 of the QAPP addendum (ASL, November 2016) identified subsurface soil and groundwater as media of concern at the location of the former FTA and surface water and sediment in the surface water drainage pathway discharging into Piscataway Creek. The PA identified construction workers and/or Base personnel exposed to impacted subsurface soil, groundwater, surface water, or sediment as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.1, soil and sediment have been eliminated as potentially impacted media (Neither had detected concentrations exceeding the RSLs.). However, both groundwater at the FTA and the surface water discharging into Piscataway Creek downstream of the area have been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. The evaluation of the groundwater pathway in Section 4.1 indicates an incomplete pathway for human exposure because there are no drinking water wells in use in the vicinity of the area and the nearest public water supply well is 4.5 miles southeast (upgradient) of the area. However, based on the evaluation of the surface water pathway in Section 5.1, the discharges of impacted surface waters from the area and from impacted groundwater in the area into surface water bodies are potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

### **7.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for Hangar 16 identified subsurface soil, groundwater, surface water, and sediment as media potentially impacted by previous releases of AFFF in the area. The PA identified construction workers and/or Base personnel exposed to impacted subsurface soil, groundwater, surface water, or sediment as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.2, subsurface soils and sediment have been eliminated as potentially impacted media (Neither had detected concentrations exceeding the RSLs.). However, groundwater and surface water in the area have been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.2 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 4.5 miles southeast (upgradient) of the area. However, based on the evaluation of the surface water pathway in Section 5.2, the discharges of impacted surface waters from the area and from impacted groundwater in the area into surface water bodies are potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

### **7.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for East Side Fuel Cell (Building 3629) identified surface soil, subsurface soil, and groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified construction workers and/or Base personnel exposed to impacted surface soil, subsurface soil, or groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.3, surface and subsurface soils in the area have been impacted by PFOS at concentrations exceeding the screening level of 126 µg/L. Groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.3 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 4.5 miles southeast

(downgradient) of the area. However, as indicated in Section 5.3, the discharges of impacted groundwater in the area into surface water bodies is a potentially complete pathway for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for Hangar 11 identified surface soil, subsurface soil, surface water, sediment, and groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified construction workers and/or Base personnel exposed to impacted subsurface soil, surface water, sediment, or shallow groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.4, surface soils, subsurface soils, and sediment have been eliminated as potentially impacted media (No detected concentrations exceeded the RSLs in these media.). However, groundwater in the area and the surface water in Cabin Branch have been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.4 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 4.5 miles southeast (upgradient) of the area. However, as indicated in Section 5.4, the impacted surface water in Cabin Branch is a potentially complete pathway for human exposure, and the discharges of impacted groundwater in the area into surface water bodies are also potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for Hangars 6 and 7 identified surface soil, subsurface soil, and groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified construction workers and/or Base personnel exposed to impacted surface soil, subsurface soil, or shallow groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.5, surface and subsurface soils have been eliminated as potentially impacted media (No detected concentrations exceeded RSLs in these media.). However, groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.5 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 5.3 miles southwest of the area. As indicated in Section 5.5, surface water in Meeting House Branch was eliminated as a potentially complete pathway for human exposure because the surface water sample did not exceed the screening level. However, as indicated in Section 5.5, the discharges of impacted groundwater in the area into surface water bodies are potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.6 FIRE STATION #1 (AFFF AREA 6)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for Fire Station #1 identified surface soil, subsurface soil, and groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified site construction workers and/or Base personnel exposed to impacted subsurface soil or shallow groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.6, surface and subsurface soil samples in the area had detected concentrations of PFOS exceeding screening levels and, therefore, represent a potentially complete pathway for human exposure. The groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater

pathway in Section 4.6 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 5.3 miles southwest of the area. However, as indicated in Section 5.6, the discharges of impacted groundwater in the area into surface water bodies are potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for the former Hare Berry Farm identified subsurface soil, groundwater, surface water, and sediment as media potentially impacted by previous releases of AFFF in the area. The PA identified construction workers and/or Base personnel exposed to impacted subsurface soil or shallow groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.6, subsurface soils and sediments have been eliminated as potentially impacted media (No detected concentrations exceeded the RSLs.). However, shallow groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.6 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 5.3 miles southeast of the area. However, as indicated in Section 5.7, the impacted surface water in Piscataway Creek and in the ponds on the north side of the former farm are potentially complete pathways for human exposure. In addition, the discharges of impacted groundwater in the area into surface water bodies are also potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for the former Brandywine DRMO Yard identified surface soil, subsurface soil, and groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified site construction workers and/or Base personnel exposed to impacted surface soil, subsurface soil, or shallow groundwater as potential human receptors (HGL, May 2015). Based on the findings discussed in Section 3.6, surface and subsurface soils have been eliminated as potentially impacted media (No detected concentrations exceeded the RSLs.). However, groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.8 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 2.5 miles north of the area. However, as indicated in Section 5.8, the discharges of impacted groundwater in the area into surface water bodies is a potentially complete pathway for direct human exposure and for PFOA and PFOS to enter the food chain.

#### **7.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

The CSM in Worksheet #10 of the QAPP addendum (ASL, November 2016) for the former FTA 3 identified groundwater as media potentially impacted by previous releases of AFFF in the area. The PA identified site construction workers and/or Base personnel exposed to impacted groundwater as potential human receptors. Groundwater in the area has been impacted by PFOA and PFOS at concentrations exceeding the EPA HA screening level of 0.07 µg/L. Evaluation of the groundwater pathway in Section 4.9 indicates an incomplete pathway for direct human exposure because the nearest public water supply well is approximately 5.3 miles southwest of the area. However, as indicated in Section 5.9, the discharges of impacted groundwater in the area into surface water bodies are potentially complete pathways for direct human exposure and for PFOA and PFOS to enter the food chain.

## 8.0 SUMMARY AND CONCLUSIONS

The PA (HGL, May 2015) identified 10 AFFF areas at JBA requiring additional evaluation through the SI process based on the reported or suspected release of AFFF material containing PFAS compounds.

During the SI process, the number of areas was adjusted to nine.

- AFFF Area 1 – Former FTA 4 and the ASA Facility (Building 2489) were listed as two areas recommended for further inspection in the PA. However, Building 2489 was constructed over the footprint of the former FTA, so the two areas were combined and inspected together during the SI.
- AFFF Area 2 – Hangar 16 (Building 3119) was recommended for further inspection in the PA.
- AFFF Area 3 – East Side Fuel Cell (Building 3629) was recommended for further inspection in the PA.
- AFFF Area 4 – Hangar 11 (Building 3635) was recommended for further inspection in the PA.
- AFFF Area 5 – Hangar 6 (Building 1280) and Hangar 7 (Building 1279) were listed as two areas recommended for further inspection in the PA. However, because of the proximity of the two buildings, they were combined into one area and inspected together during the SI.
- AFFF Area 6 – Fire Station #1 (Building 1287) was recommended for further inspection in the PA.
- AFFF Area 7 – Former Hare Berry Farm was recommended for further inspection in the PA.
- AFFF Area 8 – Former Brandywine DRMO Yard was recommended for further inspection in the PA.
- AFFF Area 9 – Former FTA 3 (FT-03) was recommended for closeout with no further inspection in the PA. However, the EPA requested that the groundwater in the area be tested for PFAS prior to approving closure of the ERP site.

Media evaluated during the SI included surface soil (0 to 6 inches in depth); subsurface soil (vadose zone in the source area); groundwater (including samples from existing monitoring wells, temporary wells, and/or direct push sampling); and surface water/ sediment. The objectives of the SI were to

- determine if a confirmed release of PFOA or PFOS has occurred at AFFF areas selected for inspection;
- determine if PFOA or PFOS is present in groundwater, soil, surface water, or sediment in the area in concentrations exceeding the EPA lifetime HA; and
- identify potential receptor pathways with immediate impacts to human health.

All samples were analyzed for PFBS, PFOA, and PFOS using modified EPA Method 537. Soil and sediment PFBS analytical results were compared to published EPA RSLs. PFOA and PFOS analytical results were compared to calculated RSLs (126 µg/kg for both PFOA and PFOS). Groundwater and surface water PFBS analytical results were compared to the published EPA RSL; PFOA and PFOS analytical results were compared to the EPA HA of 0.07 µg/L for the combined concentrations of PFOA and PFOS.

The maximum detected concentrations of PFBS did not exceed the screening criteria in any media at any of the nine areas. Table 35 presents a summary of the maximum detected concentrations of PFBS, PFOA, and PFOS for each media at the nine areas and indicates where those concentrations exceeded the corresponding screening levels. All nine AFFF areas had concentrations of PFOA or PFOS in one or more media that exceeded the corresponding screening levels.





AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	*Number of Samples/ Number of Exceedances	Exceeds Screening Value	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 3 East Side Fuel Cell (Building 3629)	ST-14	<b>Sediment</b>							
		PFBS	0.32 J	130,000	µg/kg	3 / 0	No		
		PFOA	0.30 J	126	µg/kg	3 / 0	No		
		PFOS	3.9	126	µg/kg	3 / 0	No		
		<b>Surface Soil (0 to 6 inches)</b>							
		PFBS	1.0 J	130,000	µg/kg	2 / 0	No		
		PFOA	2.5	126	µg/kg	2 / 0	No		
		PFOS	<b>200</b>	<b>126</b>	<b>µg/kg</b>	<b>2 / 1</b>	<b>Yes</b>		
		<b>Subsurface Soil</b>							
		PFBS	2.6	130,000	µg/kg	3 / 0	No		
		PFOA	4.4 J	126	µg/kg	3 / 0	No		
		PFOS	<b>210</b>	<b>126</b>	<b>µg/kg</b>	<b>3 / 1</b>	<b>Yes</b>		
		<b>Groundwater</b>							
		PFBS	6.1	40	µg/L	3 / 0	No		
		PFOA	<b>9.8</b>	<b>0.07</b>	µg/L	<b>3 / 3</b>	<b>Yes</b>		
		PFOS	<b>21</b>	<b>0.07</b>	µg/L	<b>3 / 3</b>	<b>Yes</b>		
		PFOA + PFOS	<b>30.8</b>	<b>0.07</b>	µg/L	<b>3 / 3</b>	<b>Yes</b>		
AFFF Area 4 Hangar 11 (Building 3635)	None (new site)	<b>Surface Soil (0 to 6 inches)</b>							
		PFBS	0.36 J	130,000	µg/kg	2 / 0	No		
		PFOA	0.45 J	126	µg/kg	2 / 0	No		
		PFOS	110	126	µg/kg	2 / 0	No		
		<b>Subsurface Soil</b>							
		PFBS	1.3	130,000	µg/kg	4 / 0	No		
		PFOA	0.64 J	126	µg/kg	4 / 0	No		
		PFOS	9	126	µg/kg	4 / 0	No		
		<b>Groundwater</b>							
		PFBS	4.7	40	µg/L	6 / 0	No		
		PFOA	<b>2.2</b>	<b>0.07</b>	µg/L	<b>6 / 6</b>	<b>Yes</b>		
		PFOS	<b>31</b>	<b>0.07</b>	µg/L	<b>6 / 6</b>	<b>Yes</b>		
		PFOA + PFOS	<b>33.1</b>	<b>0.07</b>	µg/L	<b>6 / 6</b>	<b>Yes</b>		
		<b>Sediment</b>							
		PFBS	0.34 J	130,000	µg/kg	1 / 0	No		
		PFOA	0.61 J	126	µg/kg	1 / 0	No		

AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	*Number of Samples/ Number of Exceedances	Exceeds Screening Value	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 5 Hangar 6 (Building 1280) and Hangar 7 (Building 1279)	AOC - 26	PFOA	27	126	µg/kg	1 / 0	No	No	Advance to an RI
		Surface Water							
		PFBS	0.67	40	µg/L	1 / 0	No		
		PFOA	0.91	0.07	µg/L	1 / 1	Yes		
		PFOS	7.6	0.07	µg/L	1 / 1	Yes		
		PFOA + PFOS	8.51	0.07	µg/L	1 / 1	Yes		
		Surface Soil (0 to 6 inches)							
		PFBS	0.28 J	130,000	µg/kg	6 / 0	No		
		PFOA	0.64 J	126	µg/kg	6 / 0	No		
		PFOS	19	126	µg/kg	6 / 0	No		
		Subsurface Soil							
		PFBS	ND	130,000	µg/kg	6 / 0	No		
		PFOA	0.21 J	126	µg/kg	6 / 0	No		
		PFOS	3.9	126	µg/kg	6 / 0	No		
AFFF Area 6 Fire Station #1 (Building 1287)	FT-02	Groundwater						No	Advance to an RI
		PFBS	0.077	40	µg/L	6 / 0	No		
		PFOA	0.34	0.07	µg/L	6 / 4	Yes		
		PFOS	0.54	0.07	µg/L	6 / 6	Yes		
		PFOA + PFOS	0.68	0.07	µg/L	6 / 6	Yes		
		Sediment							
		PFBS	ND	130,000	µg/kg	1 / 0	No		
		PFOA	0.41 J	126	µg/kg	1 / 0	No		
		PFOS	1.5 J	126	µg/kg	1 / 0	No		
		Surface Water							
		PFBS	0.0085 J	40	µg/L	1 / 0	No		
		PFOA	0.027	0.07	µg/L	1 / 0	No		
		PFOS	0.03	0.07	µg/L	1 / 0	No		
		PFOA + PFOS	0.057	0.07	µg/L	1 / 0	No		
		Surface Soil (0 to 6 inches)							
		PFBS	110 J	130,000	µg/kg	1 / 0	No	No	Advance to an RI
		PFOA	150 J	126	µg/kg	1 / 1	Yes		
		PFOS	17,000 J	126	µg/kg	1 / 1	Yes		

AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	*Number of Samples/ Number of Exceedances	Exceeds Screening Value	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Area 7 Former Hare Berry Farm	None (new site)	Subsurface Soil							
		PFBS	6.9	130,000	µg/kg	2 / 0	No		
		PFOA	5.9 J	126	µg/kg	2 / 0	No		
		PFOS	200	126	µg/kg	2 / 2	Yes		
		Groundwater							
		PFBS	3.7 J	40	µg/L	6 / 0	No		
		PFOA	16	0.07	µg/L	6 / 6	Yes		
		PFOS	30	0.07	µg/L	6 / 6	Yes		
		PFOA + PFOS	34.5	0.07	µg/L	6 / 6	Yes		
		Subsurface Soil							
		PFBS	ND	130,000	µg/kg	3 / 0	No		
		PFOA	ND	126	µg/kg	3 / 0	No		
AFFF Area 8 Former Brandywine DRMO Yard	SS-01	PFOS	ND	126	µg/kg	3 / 0	No		
		Groundwater							
		PFBS	0.012 J	40	µg/L	4 / 0	No		
		PFOA	0.083	0.07	µg/L	4 / 1	Yes		
		PFOS	0.11	0.07	µg/L	4 / 1	Yes		
		PFOA + PFOS	0.193	0.07	µg/L	4 / 1	Yes		
		Sediment							
		PFBS	ND	130,000	µg/kg	4 / 0	No		
		PFOA	ND	126	µg/kg	4 / 0	No		
		PFOS	4.8 J	126	µg/kg	4 / 0	No		
		Surface Water							
		PFBS	0.12	40	µg/L	4 / 0	No		
AFFF Area 8 Former Brandywine DRMO Yard	SS-01	PFOA	0.42	0.07	µg/L	4 / 2	Yes		
		PFOS	1.3	0.07	µg/L	4 / 3	Yes		
		PFOA + PFOS	1.72	0.07	µg/L	4 / 4	Yes		
		Surface Soil (0 to 6 inches)							
		PFBS	ND	130,000	µg/kg	1 / 0	No		
		PFOA	ND	126	µg/kg	1 / 0	No		
		PFOS	ND	126	µg/kg	1 / 0	No		
		Subsurface Soil							
		PFBS	ND	130,000	µg/kg	1 / 0	No		

AFFF Area	Associated Existing ERP Site	Parameter	Maximum Detected Concentration	Screening Value	Units	*Number of Samples/ Number of Exceedances	Exceeds Screening Value	Potentially Complete DW Exposure Pathway	Recommendation
		PFOA	ND	126	µg/kg	1 / 0	No		
		PFOS	ND	126	µg/kg	1 / 0	No		
		<b>Groundwater</b>							
		PFBS	0.1	40	µg/L	8 / 0	No		
		PFOA	<b>0.32</b>	0.07	µg/L	<b>8 / 5</b>	<b>Yes</b>		
		PFOS	<b>0.4</b>	0.07	µg/L	<b>8 / 4</b>	<b>Yes</b>		
		PFOA + PFOS	<b>0.495</b>	0.07	µg/L	<b>8 / 6</b>	<b>Yes</b>		
		<b>Groundwater</b>							
<b>AFFF Area 9 Former FTA 3</b>	<b>FT-03</b>	PFBS	0.069	40	µg/L	3 / 0	No	No	<b>Advance to an RI</b>
		PFOA	<b>4.4</b>	0.07	µg/L	<b>3 / 2</b>	<b>Yes</b>		
		PFOS	<b>0.25</b>	0.07	µg/L	<b>3 / 1</b>	<b>Yes</b>		
		PFOA + PFOS	<b>4.459</b>	0.07	µg/L	<b>3 / 2</b>	<b>Yes</b>		

\*The number of samples does not include the field duplicate unless the field duplicate has a higher result than the primary sample; if the field duplicate is higher, then that result is used.

Note: Bold value indicates an exceedance of the corresponding screening value.

µg/kg = micrograms per kilogram

AFFF = aqueous film forming foam

DRMO = Defense Reutilization and Marketing Office

ERP = Environmental Restoration Program

J = estimated value

PFBS = perfluorobutane sulfonate

PFOS = perfluorooctane sulfonate

µg/L = micrograms per liter

ASA = Air Sovereignty Alert

DW = drinking water

FTA = fire training area

ND = not detected at the method detection limit

PFOA = perfluorooctanoic acid

RI = Remedial Investigation

### **8.1 FORMER FIRE TRAINING AREA 4 AND BUILDING 2489 (AFFF AREA 1)**

Fire training operations using AFFF were conducted at FTA 4 from 1973 to 1990. Samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Four subsurface soil samples (two primary, one duplicate, and a composite physiochemical sample); a surface water sample; a sediment sample; and 10 groundwater samples (nine primary and a duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 1. The results for the analyses of the subsurface soil samples and sediments do not indicate concentrations of any of the target analytes remain in the soils or sediments in the area in excess of the screening criteria. However PFOA and PFOS were detected in all 10 groundwater samples and in the surface water sample at concentrations exceeding the screening criteria. Based on the analytical results, a release of AFFF has been confirmed at AFFF Area 1, and the shallow groundwater and surface water have been impacted. Because PFAS concentrations exceeded human health screening levels in surface water and groundwater, a Remedial Investigation (RI) is recommended to determine the extent of contamination in the area of the former FTA 4 and in the drainage channel leading to Piscataway Creek.

### **8.2 HANGAR 16 (BUILDING 3119) (AFFF AREA 2)**

Hangar 16 was constructed in 1955 and was originally equipped with an AFFF fire suppression system but was reportedly converted to a Hi-Ex system in December 2009. Releases of AFFF from the system reportedly occurred prior to the conversion to the Hi-Ex system, but the dates and quantities released were not documented. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Two subsurface soil samples (a primary sample and a composite physiochemical sample), five groundwater samples (four primary and a field duplicate sample), three surface water, and three sediment samples were submitted to the project laboratory for analyses from AFFF Area 2. The results for the analyses of the subsurface soil and sediment samples do not indicate concentrations of PFAS remain in the soils or sediments in the area in excess of the screening criteria. However, one groundwater sample had a concentration of PFOA exceeding the screening criteria, all five groundwater samples had concentrations of PFOS exceeding the screening criteria, and all five groundwater samples had combined PFOA and PFOS concentrations exceeding the screening criteria. In addition, all four surface water samples had concentrations of PFOA and PFOS exceeding the screening criteria, and all four surface water samples had combined PFOA and PFOS concentrations exceeding the screening criteria. Based on the analytical results, the release of AFFF in the area has not impacted the soils or sediments, but it has impacted the surface water and groundwater at AFFF Area 2. Because PFAS concentrations exceeded human health screening levels in surface water and groundwater, an RI is recommended to determine the extent of contamination in the area of Hangar 16 (Building 3119) and in the drainage channel on the west side of the area.

### **8.3 EAST SIDE FUEL CELL (BUILDING 3629) (AFFF AREA 3)**

Five documented AFFF releases have occurred at the East Side Fuel Cell, including releases to the outside of the building. Three of the five known AFFF releases were complete system releases (2,000 gallons) occurring in the summers of 2003 and 2004. A release of approximately 15 gallons of AFFF to the sanitary sewer system occurred in March 2001. A release of AFFF occurred in 2013, but no details on the cause, quantity released, or disposal of AFFF were available. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Four surface soil samples (two primary samples, a field

duplicate sample, and a composite physiochemical sample); four subsurface soil samples (three primary and a composite physiochemical sample); and three groundwater samples were submitted to the project laboratory for analyses from AFFF Area 3. The results for the analyses of the surface and subsurface soil samples indicate that surface and subsurface soils have been impacted at concentrations exceeding the screening levels. In addition, the results of the groundwater samples indicated concentrations of PFOA and PFOS remain in the groundwater at AFFF Area 3 at concentrations exceeding the screening criteria. Based on the analytical results, the soils and groundwater at AFFF Area 3 have been impacted by the release of AFFF. Because PFAS concentrations exceeded human health screening levels in soils and groundwater, an RI is recommended to determine the extent of contamination in the area of the East Side Fuel Cell (Building 3629).

#### **8.4 HANGAR 11 (BUILDING 3635) (AFFF AREA 4)**

Hangar 11 is equipped with an AFFF fire suppression system, and multiple releases from the AFFF system have been documented. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Three surface soil samples (two primary samples and a composite physiochemical sample); six subsurface soil samples (four primary samples, a field duplicate sample, and a composite physiochemical sample); six groundwater samples; a sediment sample; and a surface water sample were submitted to the project laboratory for analyses from AFFF Area 4. The analytical results of the surface soil, subsurface soil, and sediment samples do not indicate concentrations of the target analytes remaining in the soils or sediments exceeding the screening criteria. However, the analytical results for the surface water and groundwater samples indicate that the surface water and groundwater at AFFF Area 4 have been impacted by the release of AFFF. Because PFAS concentrations exceeded human health screening levels in surface water and groundwater, an RI is recommended to determine the extent of contamination in the area of Hangar 11 (Building 3635) and in Cabin Branch Creek.

#### **8.5 HANGAR 6 (BUILDING 1280) AND HANGAR 7 (BUILDING 1279) (AFFF AREA 5)**

Anecdotal information from JBA fire department personnel suggests that Hangar 6 was originally equipped with an AFFF system prior to the conversion to the Hi-Ex foam system now in place. Fire department personnel also indicated that there were releases of AFFF in Hangar 6 from the previous system. Hangar 7 was also originally equipped with an AFFF system but now has a Hi-Ex system. There are no records of when the AFFF fire suppression system was installed or records of when the AFFF system was converted to the Hi-Ex system. Releases of AFFF reportedly occurred at Hangar 7, but there are no records of the exact dates or quantities released. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Seven surface soil samples (six primary samples and a composite physiochemical sample), seven subsurface soil samples (six primary samples and a composite physiochemical sample), six groundwater samples, one surface water sample, and one sediment sample were submitted to the project laboratory for analyses from AFFF Area 5. The analytical results for the surface soil, subsurface soil, and sediment samples do not indicate concentrations of the target analytes remaining in the soils or sediments exceeding the screening criteria. The analytical results of the groundwater samples show that the groundwater at AFFF Area 5 has been impacted by the release of AFFF and that concentrations of PFOA and PFOS in the groundwater exceed the screening values. However, the results of the surface water sample collected where surface water draining from the area discharges into Meeting House Branch indicate that the surface water drainage from the site has not been impacted by the release of AFFF. Because PFAS concentrations exceeded human health screening levels

in groundwater, an RI is recommended to determine the extent of contamination in the area of Hangar 6 (Building 1280) and Hangar 7 (Building 1279).

#### **8.6 FIRE STATION #1 (BUILDING 1287) (AFFF AREA 6)**

There are documented releases of significant quantities of AFFF at Fire Station #1, both from filling trucks with AFFF and from fire training activities. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Three surface soil samples (one primary sample, one field duplicate sample, and one composite physiochemical sample); three subsurface soil samples (one primary sample, one field duplicate sample, and one composite physiochemical sample); and seven groundwater samples (six primary and a field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 6. The analytical results for the surface and subsurface soil samples indicate that the surface soil and subsurface soil at AFFF Area 6 have been impacted by the release of AFFF and concentrations of PFOS in the surface and subsurface soil exceed the screening value. In addition, the analytical results of the groundwater samples show that the groundwater at AFFF Area 6 has also been impacted by the release of AFFF and that concentrations of PFOA and PFOS in the groundwater exceed the screening values. Because PFAS concentrations exceeded human health screening levels in soil and groundwater, an RI is recommended to determine the extent of contamination in the area of Fire Station #1 (Building 1287).

#### **8.7 FORMER HARE BERRY FARM (AFFF AREA 7)**

In May 1992 approximately 500 gallons of AFFF entered Piscataway Creek from an incident at the JBA airfield. Subsequently the creek water was used to irrigate the crops on the former Hare Berry Farm. Evaluations following the incident indicated that the crops were safe for human consumption and that the materials entering Piscataway Creek with the stormwater runoff from JBA did not pose a threat to human health or the environment. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow direction. Four subsurface soil samples (three primary samples and a composite physiochemical sample), four groundwater samples, four surface water samples, and four sediment samples were submitted to the project laboratory for analyses from AFFF Area 7. The analytical results for the subsurface soil sample and sediment samples do not indicate concentrations of the target analytes remaining in the soils and sediments exceeding the screening criteria. The analytical results of the groundwater samples show that the groundwater north of the ponds has concentrations of PFOA and PFOS in the groundwater exceeding the screening values and has been impacted by the release of AFFF, but the groundwater in the rest of the area has not been impacted by the release of AFFF. The results of the surface water samples indicate that the waters in Piscataway Creek and in the ponds on the north side of the former farm have concentrations of PFOA and PFOS exceeding the screening values and have been impacted by the release of AFFF. Because PFAS concentrations exceeded human health screening levels in surface water and groundwater, an RI is recommended to determine the extent of contamination in the area of the former Hare Berry Farm and in Piscataway Creek.

#### **8.8 FORMER BRANDYWINE DRMO YARD (AFFF AREA 8)**

There are no documented AFFF releases at the Brandywine DRMO Yard, but EPA requested that JBA investigate for the presence of PFAS in the environment because of a structure fire at the site and the presence of burn pits. During the SI, samples were collected in the most likely areas for PFAS contamination to be detected in the area, based on surface drainage patterns and the groundwater flow

direction. Two surface soil samples (one primary sample and one composite physiochemical sample), two subsurface soil samples (one primary sample and one composite physiochemical sample), and nine groundwater samples (eight primary samples and a field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 8. The analytical results for the surface and subsurface soil samples do not indicate concentrations of the target analytes remaining in the soils exceeding the screening criteria. The analytical results of the groundwater samples show that the groundwater at AFFF Area 8 has been impacted by the release of AFFF and that concentrations of PFOA and PFOS in the groundwater exceed the screening values. Because PFAS concentrations exceeded human health screening levels in groundwater, an RI is recommended to determine the extent of contamination in the area of the former Brandywine DRMO Yard.

## **8.9 FORMER FIRE TRAINING AREA 3 (FT-03) (AFFF AREA 9)**

There are no records indicating whether AFFF was ever used at former FTA 3, and the remedial action for the area (ERP site FT-03) has been completed. However, because the site has not been investigated for PFAS, EPA requested that the shallow groundwater in the area be tested for PFAS prior to approving site closure. Samples were collected during the SI in the most likely areas for PFAS contamination to be detected in the area, based on the groundwater flow direction. Four groundwater samples (three primary samples and a field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 9. The analytical results for the groundwater samples show that the groundwater at AFFF Area 9 has been impacted by the release of AFFF and that concentrations of PFOA and PFOS in the groundwater exceed the screening values. Because PFAS concentrations exceeded human health screening levels in groundwater, an RI is recommended to determine the extent of contamination in the area of the former FTA 3 (FT-03).

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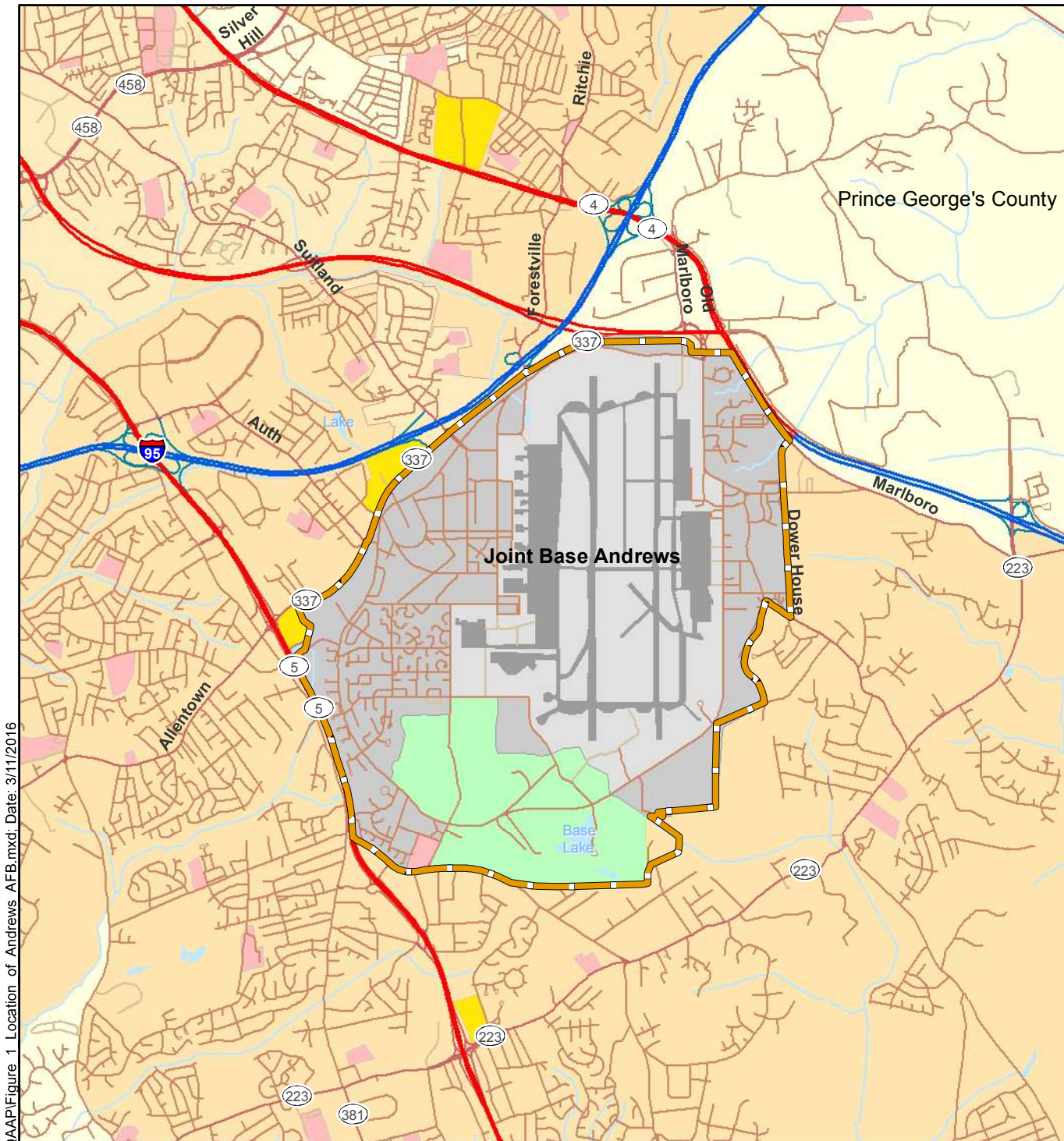
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**Appendix A**  
**AFFF Area-Specific Figures**



G:\M2032\_0001 Savannah\Andrews\MXD\QAAP\Figure 1 Location of Andrews AFB.mxd; Date: 3/11/2016



Figure 1 Location of Joint Base Andrews  
Prince George's County, Maryland

**Legend**

- Installation Boundary
- County Line

Service Layer Credits: Esri StreetMap North America

Drawn: B Baxter

Date: 3/11/2016

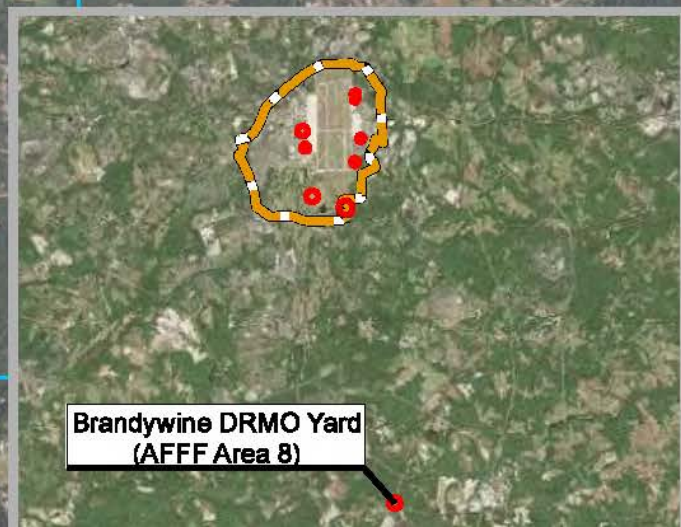






**Legend**

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