FINAL
Preliminary Assessment Report Joint Forces Headquarters, Rapid City, South Dakota

Perfluorooctane-Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

June 2020

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
Arlington, VA 22204

UNCLASSIFIED

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFFF	Army Aviation Support Facility
AOI	Area of Interest
ARNG	Army National Guard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EDR™	Environmental Data Resources, Inc.™
FTA	fire training area
ft	feet
JFHQ	Joint Forces Headquarter
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
SDARNG	South Dakota Army National Guard
SI	Site Inspection
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide. A PA for per- and polyfluoroalkyl substances (PFAS)-containing materials was completed for Joint Forces Headquarters (JFHQ; also referred to as the “facility”) in Rapid City, South Dakota, to assess potential PFAS release areas and exposure pathways to receptors. The JFHQ is constructed on a parcel of land owned by the South Dakota ARNG (SDARNG) since 1933. The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit 10 September 2019 and completed visual site inspections at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current SDARNG personnel, SDARNG environmental managers, and operations staff
- Completed visual site inspections at known or suspected potential PFAS release locations and documented with photographs

No Areas of Interest (AOIs) related to potential PFAS releases were identified at JFHQ during the PA. The summary of PA findings is shown on **Figure ES-1**.

Based on the documented absence of the use/release of PFAS-containing materials at JFHQ, evidence does not support current or former SDARNG activities having contributed to PFAS contamination in soil, groundwater, surface water, or sediment at the facility or adjacent areas. However, potential off-facility PFAS release areas exist upgradient of the JFHQ and it is unknown whether or not the off-facility sources affect the facility. The facility will not move forward in the Comprehensive Environmental Response, Compensation, and Liability Act process. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Based on the US Environmental Protection Agency (USEPA) Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the USEPA Lifetime Health Advisory within 20 miles of the facility. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/4/2019	GIS BY	MS	12/4/2019
SCALE	1:6,600	CHK BY	JW	12/4/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/4/2019

N

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure ES-1

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1. Introduction

1.1 Authority and Purpose

The Army National Guard (ARNG)-Installations & Environment Division is the lead agency in performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites at ARNG Facilities Nationwide*. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor AECOM Technical Services, Inc. (AECOM) under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017.

The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued Drinking Water Health Advisories for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. In the absence of federal maximum contaminant levels, some states have adopted their own drinking water standards for PFAS. The State of South Dakota does not currently have drinking water standards for PFAS.

This report presents the findings of a PA for PFAS-containing materials at the Joint Forces Headquarters (JFHQ; also referred to as the “facility”) in Rapid City, South Dakota, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and Army requirements and guidance.

This PA documents locations where PFAS may have been released into the environment at the JFHQ. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit on 10 September 2019 and completed visual site inspections (VSIs) at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current South Dakota ARNG (SDARNG) personnel, SDARNG environmental managers, and operations staff

- Completed visual site inspections at known or suspected potential PFAS release locations and documented with photographs

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA 1991). The report sections and descriptions of each are:

- **Section 1 – Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA
- **Section 2 – Fire Training Areas:** describes the fire training areas (FTAs) at the facility identified during the site visit
- **Section 3 – Non-Fire Training Areas:** describes other locations of potential PFAS releases at the facility identified during the site visit
- **Section 4 – Emergency Response Areas:** describes areas of potential PFAS release at the facility, specifically in response to emergency situations
- **Section 5 – Adjacent Sources:** describes sources of potential PFAS release adjacent to the facility that are not under the control of ARNG
- **Section 6 – Preliminary Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the Areas of Interest (AOIs) and the facility
- **Section 7 –Conclusions:** summarizes the data findings and presents the conclusions of the PA
- **Section 8 – References:** provides the references used to develop this document
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and Description

The JFHQ is located in Pennington County, approximately 13 miles southwest of Ellsworth Air Force Base (AFB) and approximately 13 miles northwest of Rapid City Regional Airport (**Figure 1-1**). The JFHQ is located within Camp Rapid National Guard Armory boundaries. The facility is accessible from Corning Avenue from the north and Hazel Avenue from the south.

The AASF was constructed in 1933 on a parcel of land, approximately 84.4-acres, owned by the SDARNG. See **Appendix A** for real estate documents. The current JFHQ facilities include utility buildings, administrative buildings, and classrooms.

1.5 Facility Environmental Setting

The JFHQ lies within the Black Hills region, which is characterized as an isolated eroded mountain region, ancient rock removal by stream erosion produces this mountain setting. From a distance the rounded hilltops, well-forested slopes, and deep valleys present a dark appearance, giving them their name. The Rapid Creek is the main stream channel near the facility.

1.5.1 Geology

JFHQ lies within the eastern side of the Black Hills, on an elliptically shaped crescentic asymmetrical double plunging anticline created by the tectonic movement during the Laramide Orogeny. During the movement, the tectonic plates uplifted crystalline rocks along with exposing the overlying Mesozoic and Paleozoic rock. Beneath the complex lies Precambrian-age crystalline basement rocks that are overlain by Cambrian through Lower Cretaceous deposits of dolomite, limestone, and sandstone (Aerostar, 2019).

The surface geology of the JFHQ and the immediate surrounding area is comprised of quaternary alluvial deposits that range from 20 feet (ft) to 40 ft in depth (South Dakota Geological Survey, 1989). Beneath the alluvium is the Triassic aged Spearfish Formation, which ranges from approximately 250 ft to 400 ft and contains layers of shale and siltstone with large lenses and beds of gypsum scattered throughout. Under the Spearfish Formation is approximately 40 ft of Permian aged, red and purple limestone, which makes up the Minnekahta Limestone (South Dakota Geological Survey, 1965). Next is the Opeche Shale, which consists of 100 ft of red shales and siltstones with discontinuous beds of gypsum at the base of the formation (Fahrenbach, 2001). Underlying the shale is the Minnelusa formation, which is approximately 500 ft thick and Pennsylvanian in age. The Minnelusa formation is made up of sandstone, shales, limestones and dolomites that range in colors from reds to pinks, purples and yellows (South Dakota Geological Survey, 1965). Located below the Minnelusa is the Pahasapa Limestone. This formation was deposited in the Mississippian and is about 300 ft thick. It is comprised of white limestone and dolomite layers with void spaces and fractures throughout (South Dakota Geological Survey, 1989). Beneath the Pahasapa Limestone is the Devonian aged Englewood Limestone followed by the Ordovician aged Deadwood Formation and finally the Precambrian aged basement rocks (Fahrenbach, 2001).

1.5.2 Hydrogeology

The JFHQ is in the Black Hills area, which is an important recharge area for aquifers within the northern Great Plains. JFHQ is within the Williston Basin, which flows into the Madison and Minnelusa aquifers. These aquifers are a part of the Paleozoic group, which occurs in areas that have high altitude and in uplifts like the Laramide Orogeny in the Black Hills. The Madison aquifer, also known as the Mississippian aquifer, has a siltstone, sandstone, limestone, and dolomite base. The water found in this location is typically in outcrop areas and flows to the recharge areas to the northeast. The discharge location occurs as a result of upward leakage to the lower Cretaceous aquifer located in central South Dakota. The Minnelusa aquifer has a limestone and sandstone base, and the aquifer moves from areas of recharge to the northeast much like the Madison aquifer does. A portion of the water will discharge upward by leakage into the lower Cretaceous aquifer. Sandstone composes the lower Cretaceous aquifer and is confined by shale except in areas where uplift can be found. Over one-half of the water found in these areas is moderately saline and can be described as briny in many parts. The salination of this water occurs from upward leakage of mineralized water from the Paleozoic aquifers (US Geological Survey, 2002).

One domestic water well and one irrigation well are located within the boundary of the JFHQ; however, four domestic, one commercial/business, one municipal, five monitoring, and one unknown well exist within 1 mile of the facility (**Figure 1-2**). Drinking water for the facility is supplied by the Rapid City Water Division, which uses the Jackson Springs Gallery and the Girl Scouts Gallery as infiltration galleries along the Rapid Creek alluvium. Water is also drawn from the Minnelusa and Madison aquifers through eight wells. Surface water collects in the Rapid Creek, which collects water from the Deerfield and Pactola Reservoirs. This surface water supplies water for treatment to the Mountain View and Jackson Springs treatment plants then used for municipal use (Rapid City Water Division, 2018).

Based on the USEPA Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the USEPA Health Advisory within 20 miles of the facility. PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

1.5.3 Hydrology

JFHQ has a streamflow that is influenced depending on the climate at the time and the geologic conditions. The base flow in Rapid City comes from the higher altitudes surrounding the city and occurs from events of high precipitation. Many of the surrounding streams have headwater springs that originate from the Paleozoic carbonate rocks. These streams generally flow eastward over the Precambrian rocks of the crystalline core and typically lose flow as the Paleozoic rock dissipates out of the Black Hills (US Geological Survey, 2002).

The surface water flow at the facility is primarily to the southeast towards Rapid Creek (**Figure 1-3**).

1.5.4 Climate

The climate at JFHQ consists of four clearly separated seasons, with warm and clear summers and dry, freezing, cloudy, windy winters. Temperatures vary from average highs of 59.1 degrees Fahrenheit (°F) to average lows of 33.5 °F. The average annual temperature is 46.3 °F. Average precipitation is 18.32 inches of rain (World Climate, 2019).

1.5.5 Current and Future Land Use

JFHQ is a controlled access facility with public roads. The facility consists of utility buildings, administration buildings, and classrooms. Exterior features are vehicle parking areas and roads. Infrastructure improvements, land acquisitions, land use controls, and reasonably anticipated future land use is not expected to change from the current land use.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/3/2019	GIS BY	MS	12/3/2019
SCALE	1:63,360	CHK BY	JW	12/3/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	12/3/2019

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Facility Location

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-1

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CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	6/12/2020	GIS BY	MS	6/12/2020
SCALE	1:12,000	CHK BY	JW	6/12/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	6/12/2020

Groundwater Features

AECOM
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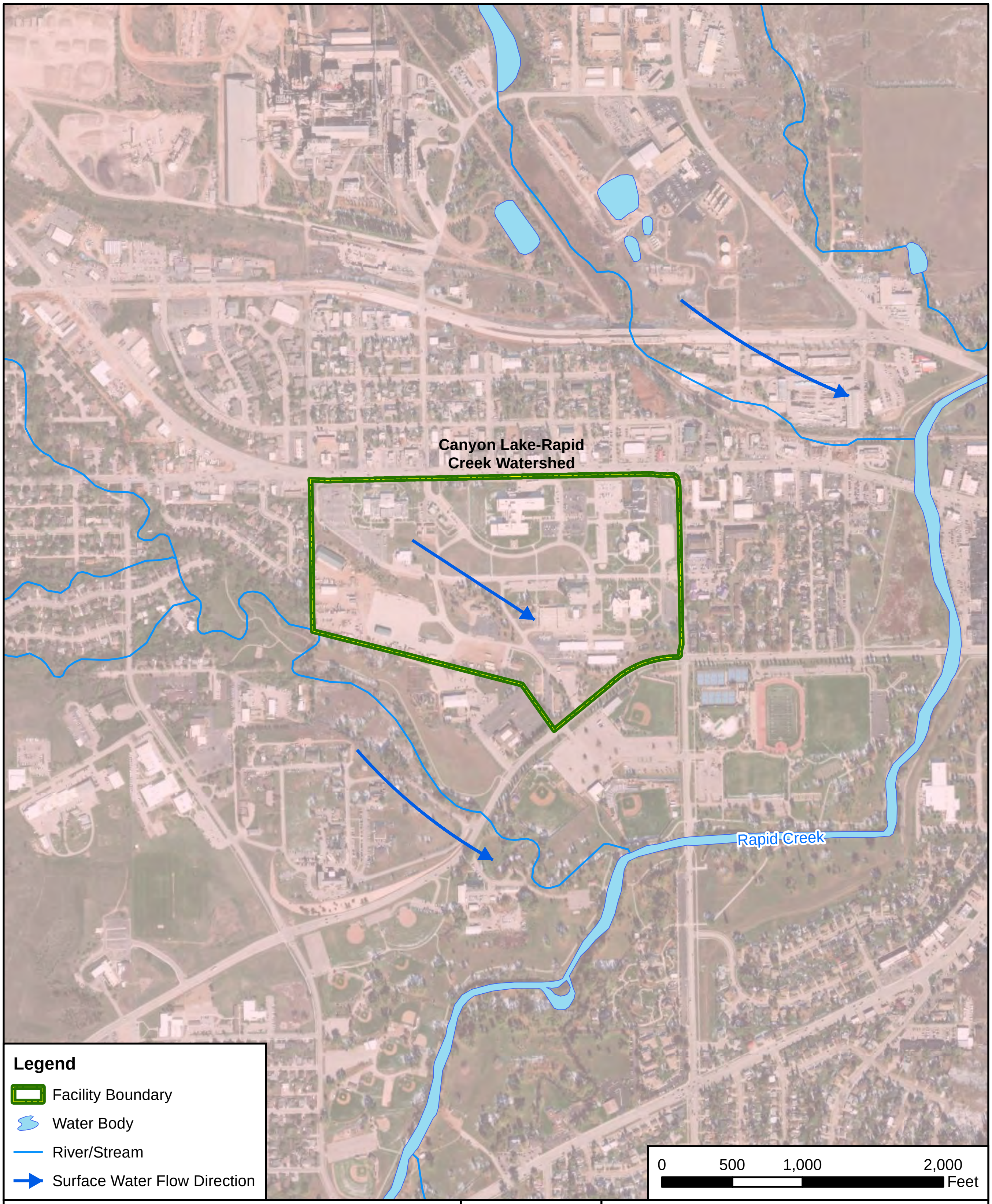
Figure 1-2

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\SD\JFHQ_SD_Figures\Fig_1-2_JFHQ_SD_Groundwater.mxd



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/4/2019	GIS BY	MS	12/4/2019
SCALE	1:12,000	CHK BY	JW	12/4/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/4/2019

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Surface Water Features

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Figure 1-3

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2. Fire Training Areas

No FTAs were identified within the facility during the PA through interviews or document review. Fire training exercises for the SDARNG are conducted at Ellsworth AFB.

3. Non-Fire Training Areas

In addition to FTAs, the PA evaluated areas where PFAS-containing materials may have been broadly used, stored, or disposed. This may include buildings with fire suppression systems, paint booths, AFFF storage areas, and areas of compliance demonstrations. Information on these features obtained during the PA are included in **Appendices A** and **B**. One non-FTA was identified within the JFHQ facility during the PA through interviews or document review. A description of the non-FTA is presented below and shown on **Figure 3-1**. Interview records and photographs are included in **Appendix B** and **Appendix C**, respectively.

3.1 Building 105

Building 105 is located on the west side of the facility and the geographical coordinates are 44°4'49.79"N and 103°16'11.04"W. Building 105 houses two crash rescue firetrucks that are used for fire training exercises off-facility. One firetruck is used as a water tender that only has the capability to hold and dispense water. The other firetruck is a ladder truck with the capability to hold and dispense AFFF or other fire suppressant material; however, the ladder firetruck has never been filled with AFFF. The firetrucks are stored in Building 105 to provide mission support during deployment. If AFFF is required to support the mission, the ladder firetruck would be filled and rinsed at the deployment destination or in “theater.” As a result, bulk AFFF has never been stored at the facility.

AFFF fire extinguishers have never been present at JFHQ. The current fire extinguishers are Class B fire extinguishers. There are no hangars, fire stations or other facilities at JFHQ that would have used or stored AFFF.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/4/2019	GIS BY	MS	12/4/2019
SCALE	1:6,600	CHK BY	JW	12/4/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/4/2019

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Non-Fire Training Area

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Figure 3-1

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4. Emergency Response Areas

No emergency response areas were identified within the JFHQ facility during the PA through interviews or document review. Rapid City Fire Department provides fire emergency services for the JFHQ.

5. Adjacent Sources

Two off-site PFAS sources adjacent to the JFHQ were identified during the PA through interviews (**Appendix B**), online research, and the Environmental Data Resource Report (**Appendix A**). **Figure 5-1** presents the location of potential adjacent source areas.

5.1 Car Washes

During PA interviews, several local interviewees noted two car washes located along the north boundary of JFHQ. There was some conjecture that the wax, and other products typically used at car washes have the potential to contain PFAS. More specifically, the waxes that provide a waterproof layer or barrier. The groundwater flows to the south and the two car washes are upgradient of JFHQ and it is unknown whether or not the off-facility sources affect the facility.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/3/2019	GIS BY	MS	12/3/2019
SCALE	1:6,600	CHK BY	JW	12/3/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/3/2019

N

Adjacent Sources

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Germantown, MD 20876

Figure 5-1

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6. Preliminary Conceptual Site Model

Based on the PA findings, no release areas were identified as AOIs at JFHQ. A conceptual site model identifies three components necessary for potentially complete exposure pathways related to a site: (1) source, (2) pathway, and (3) receptor. If any of these elements are missing, the pathway is considered incomplete. Based on the findings of this PA, there are no PFAS sources that originate at JFHQ or from activities associated with SDARNG activities.

7. Conclusions

This report presents a summary of available information gathered during the PA on the use and storage of AFFF and other PFAS-related activities at the JFHQ. The PA findings are based on the information presented in **Appendix A** and **Appendix B**.

7.1 Findings

The following area, which was discussed in **Section 3**, were determined to have no suspected release (**Table 7-1**).

Table 7-1: No Suspected Release Areas

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Building 105	SDARNG	Building 105 houses two firetrucks. One firetruck is capable of only holding water, and the other firetruck has the capability to hold AFFF; however, has never been filled with AFFF. Also, firetrucks were filled only while deployed and were emptied before returning to Building 105.

7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the facility or available during the PA on the use of PFAS in training, firefighting, or other non-traditional activities, or on its disposition.

The conclusions of this PA are based on all available information, including: previous environmental reports, EDRs™, observations made during the VSI, and interviews. Interviews of personnel with direct knowledge of a facility generally provided the most useful insights regarding a facility's historical and current PFAS-containing materials. Sometimes, the provided information was vague or conflicted with other sources. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge due to staffing changes, the time passed since PFAS were first used (1989 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS release locations, dates of release, volume of releases, and the concentration of AFFF used. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding the use and potential storage of PFAS were reviewed, retired and current personnel were interviewed, multiple persons were interviewed for the same potential source area, and the facility was visually inspected. **Table 7-2** summarizes the uncertainties associated with the PA.

Table 7-2: Uncertainties

Potential Adjacent Sources	Source of Uncertainty
Car Washes	It is unknown if the products used at car washes contain PFAS.

7.3 Potential Future Actions

Based on the documented absence (2005-present) of the use or release of PFAS-containing materials at JFHQ, no AOIs were identified during the PA. Evidence does not indicate that current or former ARNG activities contributed PFAS contamination to soil, groundwater, surface water, or sediment at the facility or adjacent areas. JFHQ will not move forward in the CERCLA process.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at JFHQ, SD			
REVISED	12/4/2019	GIS BY	MS	12/4/2019
SCALE	1:6,600	CHK BY	JW	12/4/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/4/2019

N

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 7-1

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8. References

Aerostar SES LLC (Aerostar). 2019. *Final Site Inspections Report of Aqueous Film Forming Form Areas at Ellsworth Air Force Base, Meade and Pennington Counties, South Dakota.* November.

Fahrenbach, M.D. and Sawyer J.F. 2001. *Geologic Map of the Rapid City West Quadrangle, South Dakota*. Available at: http://www.sdgs.usd.edu/pubs/pdf/GQ24K-01_20060814.pdf (Accessed 19 March 2020).

Rapid City Water Division. 2018. *Annual Water Quality Report.* November.

South Dakota Geological Survey. 1965. *Lithologic Log for 001N07E03CBAA 2.* Available at: http://cf.sddenr.net/lithdb/search_results_lith.cfm?Search1=6&search_type=simple&page_num=1&search=Search&input_box=001N07E03CBAA%202 (Accessed 19 March 2020).

South Dakota Geological Survey. 1989. *Lithologic Log for 001N07E03BBCC.* Available at: http://cf.sddenr.net/lithdb/search_results_lith.cfm?Search1=6&search_type=simple&page_num=1&search=Search&input_box=001N07E03BBCC (Accessed 19 March 2020).

United States Environmental Protection Agency (USEPA). 1991. *Guidance for Performing Preliminary Assessments under CERCLA.* September.

United States Geological Survey. 2002. *Hydrology of the Black Hills Area, South Dakota.* November.

World Climate. 2019. *Average Weather Data for Rapid City, South Dakota.* Available at http://www.worldclimate.com/climate/us (Accessed 8 November 2019).

Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for Joint Forces Headquarters.

Joint Forces Headquarters Leases, Licenses, and Permits

- 1933 Warranty Deed

Joint Forces Headquarters Documentation

- 2015 Final Preliminary Assessment Report for Perfluorinated Compounds at Ellsworth Air Force Base South Dakota
- 2019 Final Site Inspection Report of Aqueous Film Forming Foam Areas at Ellsworth Air Force Base Meade and Pennington Counties, South Dakota

EDR Report

- 2019 Joint Forces Headquarters EDR Report

S. F. 369—WARRANTY DEED—Statutory Form 15.40 2M—9-31—2456—News Printing Co., Aberdeen, S. D.

BOOK 131 PAGE 694

William A. Hazle, Trustee for the South Dakota National Guard, grantor, of Pennington County, State of South Dakota for and in consideration of Fourteen Thousand - DOLLARS, GRANTS, CONVEYS and WARRANTS to the State of South Dakota, [illegible], grantee, of Pierre, South Dakota P. O., the following described real estate in the County of Pennington in the State of South Dakota:

Beginning at the Northwest Corner Section 3, Township 1 north, Range 7 east of the Black Hills Meridian, South Dakota, thence south along the west line of said Section 3, 1115.0 feet, thence south 74 degrees and 40 minutes east, 1539.0 feet, thence south 34 degrees and 10 minutes east, 373.2 feet to a point on the north side of right of way of highway known as Indian School and Tourist Park Road; thence north 51 degrees and 05 minutes east, 805.3 feet along north side of said right of way, thence due east 286.7 feet along north side of said right of way, thence due north 1325.2 feet, thence due west 2607.0 feet to place of beginning, containing 84.4 acres.

Dated this 8th day of March 1933

William A. Hazle

William. A. Hazle
Trustee for the South Dakota
National Guard.

RECORDED
INDEXED

18811

STATE OF South Dakota
County of Pennington } ss.

STATE OF SOUTH DAKOTA, COUNTY OF PENNINGTON-SS Deed
FILED THIS 19 DAY OF May 1961 AT 2⁰⁰ O'CLOCK P M. BOOK 131 PAGE 694
Isabelle G. Holt BY ______ FEES $1.00
REGISTER OF DEEDS DEPUTY

On this 8th day of March in the year 1933, before me personally appeared William A. Hazle, Trustee for the South Dakota National Guard, known to me to be the person who is described in and who executed the within instrument, and acknowledged to me that he executed the same.

Florence Jones
Notary Public

My comm. expires Sept. 16, 1934.

FINAL
PRELIMINARY ASSESSMENT REPORT FOR PERFLUORINATED COMPOUNDS
AT
ELLSWORTH AIR FORCE BASE
SOUTH DAKOTA

Prepared for:

Air Force Civil Engineer Center
2261 Hughes Avenue, Suite 155
Lackland AFB, Texas 78236-9853

Contract No. FA8903-08-D-8772
Task Order 0065
CDRL A001A

May 2015

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This is a Preliminary Assessment Report of locations or locations at Ellsworth Air Force Base where perfluorinated compounds may have been released to the environment through the use or discharge of aqueous film-forming foam.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film-forming foam
ANG	Air National Guard
Base	Ellsworth Air Force Base
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EDR	Environmental Data Resources, Inc.
FTA	Fire Training Area
HGL	HydroGeoLogic, Inc.
OU	Operable Unit
NFRAP	no further remedial action planned
PA	preliminary assessment
PFC	perfluorinated compound
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
RI	Remedial Investigation
SCF	SES Construction and Fuel Services, LLC
SI	Site Inspection
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
WWTP	wastewater treatment plant

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FINAL
PRELIMINARY ASSESSMENT REPORT FOR PERFLUORINATED COMPOUNDS
ELLSWORTH AIR FORCE BASE
SOUTH DAKOTA

1.0 INTRODUCTION

The Air Force Civil Engineer Center (AFCEC) contracted with HydroGeoLogic, Inc. (HGL) and subcontractor CH2M HILL (the HGL Team) to perform preliminary assessment (PA) activities at multiple U.S. Air Force (Air Force or USAF) and Air National Guard (ANG) Fire Training Areas (FTAs) to determine probable environmental release of perfluorinated compounds (PFCs). Specifically, HGL is completing PA activities consistent with the U.S. Environmental Protection Agency (USEPA) Guidance for Preparing Preliminary Assessments under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (USEPA, 1991) to determine potential releases of PFCs at 82 Air Force and ANG installations from FTAs and other known and suspected PFCs or aqueous film-forming foam (AFFF) usage or storage areas. The work is being performed by HGL and its team subcontractor, CH2M HILL, under the existing 4P Architecture and Engineering Contract, Contract Number FA8903-08-D-8772, Task Order 0065.

Under authority of CERCLA and the Superfund Amendments and Reauthorization Act of 1986, CH2M HILL conducted a PA visit at Ellsworth Air Force Base (AFB) (Base) during the week of February 23, 2015. Ellsworth AFB is an active installation near Box Elder, South Dakota. The location of Ellsworth AFB and the locations identified on Ellsworth AFB during this PA visit are shown on Figure 1.1

1.1 BACKGROUND

PFCs are compounds used in the formulation of AFFF, which the Air Force has used in fire training exercises, suppressing aircraft and other vehicle fires, and in aircraft hangar fire suppression systems. Although PFCs are not regulated under CERCLA or the Resource Conservation and Recovery Act, there is evidence that perfluorooctane sulfonate (PFOS) (and less so perfluorooctanoic acid [PFOA]) is a possible environmental contaminant following AFFF release. Both compounds may present potential, non-carcinogenic risks to human health and the environment (Chang et al., 2014; Porter, 2011; Rak and Vogel, 2009; USAF, 2012).

Several federal government documents confirm the initial use of AFFF by the Air Force beginning in 1970:

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

Based on Air Force performance testing results on AFFF, the Air Force Director of Civil Engineering, M.G. Goddard, issued authorization in 1970 for the Air Force to procure AFFF. No usage within the Air Force is documented or suspected prior to 1970.

1.2 PURPOSE AND OBJECTIVES

The objective of this PA Report is to identify locations at Ellsworth AFB where PFCs may have been released into the environment and to provide an initial assessment of possible migration pathways and receptors of potential contamination.

This PA Report documents the known FTAs, as well as additional locations where AFFF may have been released into the environment at Ellsworth AFB (Table 1.1). The purpose of the PA is to determine the potential environmental release of PFCs specifically from AFFF usage and storage. This PA Report differentiates locations that pose little or no potential threat to human health and the environment from locations that warrant further investigation.

Table 1.1
Fire Training Areas and Non-Fire Training Areas Identified for Potential AFFF Releases
Ellsworth Air Force Base, South Dakota

Fire Training Areas
FT001 – Former FTA
Current FTA
Non-Fire Training Areas
Hangars/Buildings
70, 80, and 90 Rows
Building 618
Building 88240
Fire Stations
Former Fire Station 2
Former Fire Storage Area
Former Fire Station (Building 7506)
Current Fire Station (Building 7502)
Emergency Response
B-52 Crash (1970)
B-1 Crash (1988)
Delta Taxiway West Crash (2000)
Marten Crash (2003)
Crash 4 (2001)
Others
Hazmart
Wastewater Treatment Plant (WWTP)
Spray Nozzle Test Area
Alert Apron

1.3 BASEWIDE ENVIRONMENTAL SETTING

A description of the Basewide geology, hydrogeology, and hydrology is presented in the Site Investigation Report for Site Investigations of Fire Fighting Foam Usage at Various Air Force Bases in the United States for Ellsworth Air Force Base (SES Construction and Fuel Services, LLC [SCF], 2015) and is summarized in the sections below.

1.3.1 Geology

Ellsworth AFB lies on the extreme eastern flank of the Black Hills uplift, a north-south trending elliptically shaped dome (125 miles long and 45 miles wide), which resulted from tectonic movement during the Laramide Orogeny. During this event, basement crystalline rocks west of Ellsworth AFB were uplifted and exposed while overlying Mesozoic and Paleozoic strata were uplifted, eroded, and deformed. These strata today crop out as hogbacks flanking the Black Hills uplift. Beneath Ellsworth AFB these strata dip moderately to the east-northeast.

The oldest and deepest rocks present in the Ellsworth AFB subsurface are Precambrian age crystalline basement rocks. Overlying the basement crystalline rocks are Cambrian through Lower Cretaceous age deposits of limestone, sandstone, and dolomite. Several of these sedimentary deposits are known aquifers in the region. Overlying the Lower Cretaceous deposits is a sequence of Upper Cretaceous age marine shales with intermittent sandstone and limestone beds. This Upper Cretaceous sequence of fine-grained marine deposits extends to the surface and is more than 1,000 feet thick below Ellsworth AFB. The uppermost of these Cretaceous age deposits is the Pierre Shale, which forms the bedrock surface at Ellsworth AFB.

The Pierre Shale at Ellsworth AFB is a dark gray to light gray, organic-rich, noncalcareous, blocky, fragmented marine shale. Bentonite beds and ironstone concretion layers more than 1 foot thick are common, as are ironstone nodules and selenite crystals on weathered faces. Bentonite beds are typically yellow and are the result of volcanism that occurred during the Laramide Orogeny. The Pierre Shale may be considerably altered by weathering and typically weathers into an orange to brown clay material overlying fractured and iron-stained shale.

The depth to weathered shale or shale bedrock is variable across Ellsworth AFB, occurring anywhere from surface outcrops to depths of approximately 40 feet. The depth to the weathered shale/ bedrock contact (where both are present) is also variable across Ellsworth AFB. Generally, the Pierre Shale decreases in weathering and permeability with depth.

The location geology at Ellsworth AFB typically consists of unconsolidated materials underlain by the Pierre Shale. Unconsolidated materials can be divided into three basic categories based upon depositional history:

- Colluvial Deposits – loose, heterogeneous and incoherent sediment and/or rock fragments deposited by rainwash, sheetwash, or slow, continuous downslope creep. Typified by juxtaposition of sedimentary components not normally associated with one another (for example, gravelly clay).
- Alluvial Deposits – clay, silt, sand, gravel or similar unconsolidated, detrital ill material deposited during comparatively recent geologic time by running water as a sorted or semisorted deposit. These deposits are generally associated with the past or current drainage system of Boxelder Creek.

- Residual Material – unconsolidated material that has developed in place through the weathering of underlying consolidated rock. These materials may show relict textures associated with the parent rock. Residual deposits resemble weathered shale and the boundary between the two is not well defined.

The thickness of these unconsolidated materials varies widely across the installation but generally ranges from 10 to 30 feet. Toward the northern end of Ellsworth AFB, the Pierre Shale is predominantly covered by a thin veneer of soil, alluvium, or colluvium but is exposed along deeper channels and some steeper side slopes. Toward the southern end of Ellsworth AFB, older, relatively thicker, coarser alluvial deposits associated with Boxelder Creek fill the gentler, wider erosional channels, and exposures of Pierre Shale are less common.

1.3.2 Hydrogeologic Setting

One shallow unconfined aquifer and three confined aquifers (Inyan Kara, Minnelusa, and Madison) could be used for water supplies at Ellsworth AFB. None of the confined aquifers are in hydraulic communication with the overlying unconfined aquifer. The shallow unconfined aquifer at Ellsworth AFB is considered a federal Class II-B (potential source of drinking water) aquifer and possibly a Class II-A (discharge to surface water) aquifer. Groundwater within the shallow aquifer on the northern end of the Base flows southeast. Farther south on Ellsworth AFB, groundwater flows in a more southern direction within the shallow aquifer.

At Ellsworth AFB, the upper shallow aquifer consists of both alluvial and colluvial deposits and fractured Pierre Shale. The shallow aquifer is absent in some areas and extends in depth from only a few feet below the surface to 60 feet or less in depth in other areas. The thickness and yield of the shallow aquifer depend upon the extent of alluvial material and the thickness of water-yielding fractures in the Pierre Shale. In several areas toward the northern end of Ellsworth AFB, no groundwater-bearing zones were found, while in the southern area of the Base, alluvial sand and gravel beds and shallow fracture zones typically produce less than 2 gallons per minute to monitoring wells. The shallow, unconfined aquifer at Ellsworth AFB is present within the fractured shale horizon near the top of the Pierre Shale and the contiguous overlying deposits of unconsolidated material.

The Inyan Kara aquifer is a confined aquifer bounded by confining beds of the Pierre Shale and other relatively impermeable Upper Cretaceous strata above and Permian-Jurassic strata below. The aquifer lies about 1,900 feet beneath Ellsworth AFB and consists of 350 to 500 feet of permeable sandstone belonging to the Fall River and Lakota Formations. Groundwater flow direction is assumed based on published data; west of Ellsworth AFB, it is assumed to be toward the east-northeast based on the direction of dip.

The Minnelusa aquifer is a confined aquifer that lies beneath approximately 1,000 feet of Permian-Jurassic confining beds and above Pennsylvanian confining beds. The aquifer is a limestone unit approximately 600 feet thick and lies 3,460 feet beneath Ellsworth AFB. Groundwater flow direction is assumed to be toward the east-northeast based on the direction of dip.

The deepest aquifer used as a domestic water supply source in this region is the Madison (also known as Pahasapa) aquifer, which is beneath 240 to 450 feet of Lower Pennsylvanian confining strata. The aquifer is a limestone deposit that averages 350 feet thick and lies 4,150 feet beneath

Ellsworth AFB. Groundwater flow direction is assumed to be toward the east-northeast in the direction of dip.

Ellsworth AFB drinking water comes from off Base and is supplied by the Rapid City Municipal Distribution System (Jensen, 2015, personal communication; Appendix C). Sources of water for this system come from three infiltration galleries: Jackson Springs Gallery, Meadowbrook Gallery, and Girl Scout Gallery. Water is also drawn from the Minnelusa and Madison aquifers. In high demand times, the City also uses surface water from Rapid Creek, which originates in the Rapid Creek drainage areas west of Rapid City. This source includes the Deerfield and Pactola Reservoirs (USAF, 2008). This surface water source is upgradient of Ellsworth AFB.

Ellsworth AFB previously had several water supply wells that were used to supply the Base with drinking water. Five public water supply wells were installed in the deep bedrock aquifers of the Base but have all been abandoned/decommissioned (Pavek, 2015, personal communication; Appendix C).

Various private wells screened within the shallow aquifer may be or were historically present at off-Base locations. Two private wells were identified as being located within 1 to 2 miles of the data search location based on the Environmental Data Resources, Inc. (EDR) report; however, these wells were both noted as being inactive (EDR, 2015). Additionally, both of these wells are cross-gradient (east) or upgradient (north-northwest) of the Base, indicating no exposure potential.

1.3.3 Hydrologic Setting

The northern border of Ellsworth AFB is a steep northward-facing escarpment, which is drained by seven unnamed ephemeral drainages that discharge into Elk Creek, approximately 5 miles to the northeast. Surface drainage on the plateau follows the topographic slope, primarily flowing south-southeast via retention ponds, ditches, storm sewers, and ephemeral streams, eventually discharging into Boxelder Creek, 1 mile to the south. Some surface flow in the western and southwestern portions of Ellsworth AFB is southwest toward an unnamed drainage west of the Base that ultimately discharges to Boxelder Creek.

1.3.4 Ecological Receptors

The following endangered species are known to inhabit Meade and Pennington Counties:

- Whooping Crane – Bird
- Bald Eagle – Bird
- Interior Least Tern – Bird
- Black-footed Ferret – Mammal

It is possible that these endangered species may be found within the boundaries of Ellsworth AFB.

1.4 PRELIMINARY ASSESSMENT METHODS

This PA Report was prepared in accordance with the following:

- CERCLA Guidance (U.S. Environmental Protection Agency, 1991)
- Interim Air Force Guidance (USAF, 2012a)
- U.S. Fish and Wildlife Service (USFWS) Guidance (USFWS, 2015)

The performance of this PA included the following activities:

- Reviewing information and reports in the Administrative Record.
- Reviewing documents related to Air Force use of AFFF.
- Conducting a 2-day visit to Ellsworth AFB.
- Conducting interviews with government personal in Environmental Management, the Ellsworth AFB Fire Department, and Aircraft Hangar Maintenance and Operations.
- Visiting and photographing locations where AFFF has been used or may have been used.
- Performing an environmental data records search to document nearby populations and recording water supply well information and wetlands information.

1.5 REPORT ORGANIZATION

This PA Report is organized as follows:

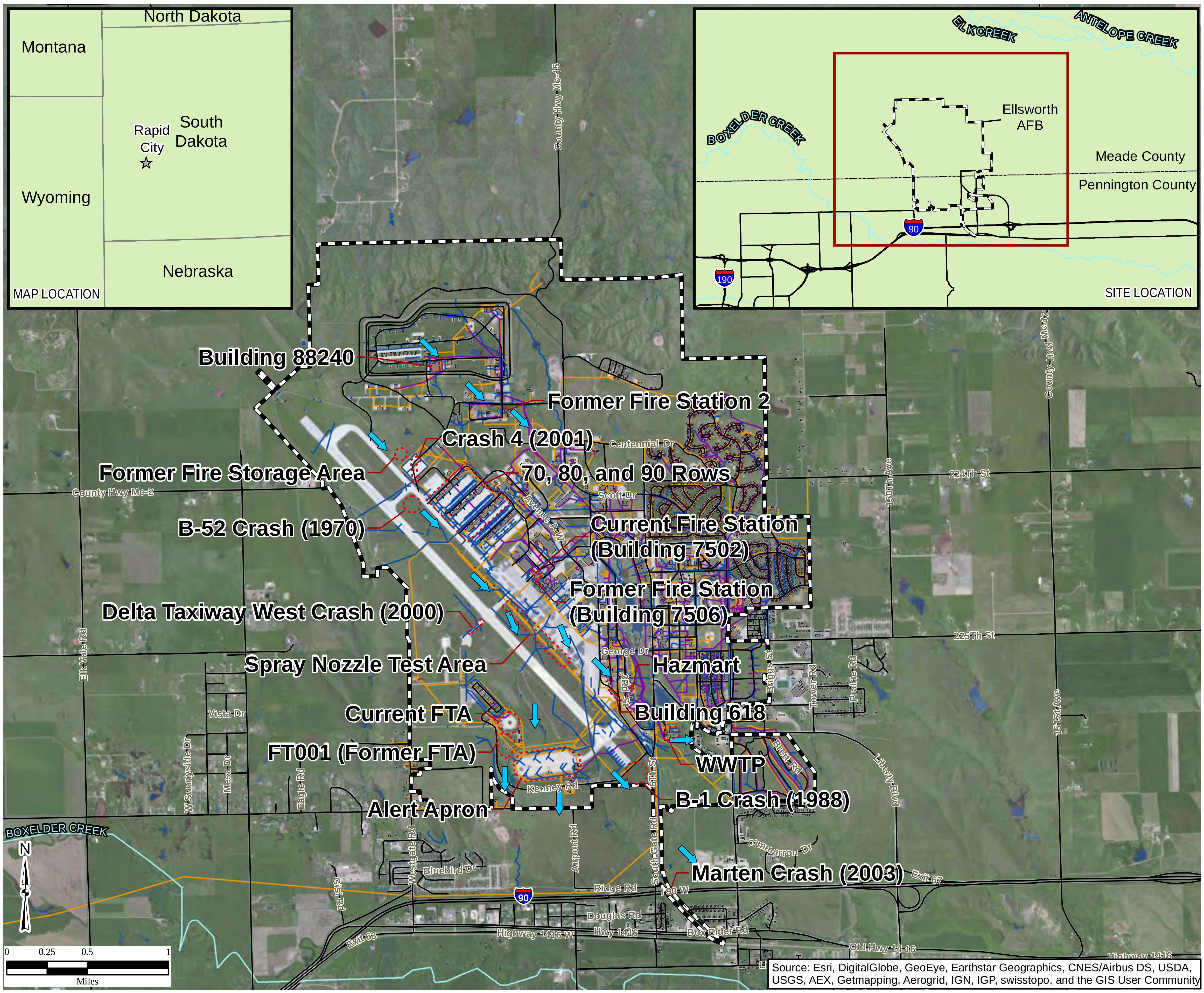
- Section 1.0, Introduction, provides a project overview and describes the methods used to conduct the PA.
- Section 2.0, Fire Training Areas, describes the FTAs identified during the visit.
- Section 3.0, Non-Fire Training Areas, describes the non-FTAs identified during the visit.
- Section 4.0, Summary and Conclusions, summarizes and provides conclusions for both FTAs and non-FTAs.
- Section 5.0, References, lists the references cited in this report.

In addition, the following support information is appended to this report:

- Appendix A, Photo Documentation
- Appendix B, Field Documentation
- Appendix C, Records of Communication

FIGURE

Figure 1.1
All Identified Locations
Ellsworth AFB, South Dakota



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

↑	Approximate Uppermost, Shallow Groundwater Flow Direction
—	Stream/River
—	Storm Sewer
—	Wastewater Line
—	Water Line
—	Road
⬚	Approximate Site Boundary
⬚	Base Boundary
■	Building
🟩	Shed

Wetland

■	Freshwater Forested/Shrub Wetland
■	Freshwater Emergent Wetland
■	Freshwater Pond
■	Other

Notes:
FTA = fire training area
WWTP = wastewater treatment plant

\\roswell\Arcinfo\Av_Proj\AFCEC\Ellsworth\GIS\MapFiles\Figure_1.1_rev3.mxd
3/30/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

2.0 FIRE TRAINING AREAS

2.1 FT001 – FORMER FIRE TRAINING AREA

2.1.1 Description and Operational History

Site FT001, the former FTA, is approximately 8 acres in size and is located in the southwestern segment of Ellsworth AFB (Figures 1.1 and 2.1). It is an Installation Restoration Program site and is included in Operable Unit 1 (OU 1), which includes FT001 as well as a portion of the downgradient drainages including Pond 1. FT001 is bordered to the north by the current FTA, to the south and east by unnamed drainages, and to the west by open grasslands. The geographic coordinates are 44°7' 51.83"N and 103°5' 56.05"W.

From 1942 to 1990, Site FT001 was the original FTA on Ellsworth AFB. Fire training activities were moved to the current FTA in 1993. No fire training activities were conducted in the interim time period. The tanks and pipelines associated with FT001 were removed at that time (USAF, 2012b). FT001 contained a shallow, unlined burn pit with a steel aircraft mockup that was set ablaze for fire training exercises. The location of the burn area within the former FTA has changed several times over the years. Aerial photographs of Ellsworth AFB dated May 28, 1952, October 8, 1954, August 25, 1962, and June 19, 1968, show numerous areas of staining presumed to be a result of fire training activities within the former training area. The training exercises conducted at the FTA involved simulation of aircraft fires and spills.

In 1995, a groundwater treatment system (Building 6908) was installed at FT001 to remediate fuels and chlorinated volatile organic compounds in groundwater. The system was located just east of FT001 (Figure 2.1). From 1995 to 2001, treated groundwater was discharged to the unnamed drainage located directly south of the site. As a result of elevated selenium in treated water, discharge to surface water was stopped in 2001 and was reinjected into groundwater via two injection trenches. However, groundwater from the southernmost injection trench was found to be daylighting into the drainages south of the site, and injection into this trench was stopped. Re-injection continued at a second infiltration trench located 1,700 feet north-northwest of Building 6908 until the pump and treatment system were turned off in November 2011 and replaced by passive treatment (in-situ reductive treatment) in accordance with the OU-11 (Basewide Groundwater) Record of Decision Amendment (USAF, 2012c).

A full description of the site and operational history is presented in previous investigation documents. The location of FT001 is shown on Figures 1.1 and 2.1.

2.1.2 Waste Characteristics

Various types of fuels, oils, and chlorinated solvents were dispersed within the burn pit area and subsequently ignited and then extinguished. AFFF was used to extinguish the fires used during these training activities starting in the early 1970s until the location was closed in 1990 (Beck, 2015a, personal communication; Appendix C). Mr. Beck of the Ellsworth AFB Fire Department did not have knowledge or record logs of the quantity of AFFF used/released during fire training activities (Beck, 2015a, personal communication; Appendix C).

In the early 2000s, Pond 1 was dredged, and the dredge materials were land applied west of the current FTA (USAF, 2012b) (Figure 2.1).

2.1.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located at least 1.6 miles hydrologically cross-gradient of FT001. The on-Base child development center is located approximately 1.4 miles hydrologically cross-gradient of FT001.

2.1.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater at this site flows south-southeast.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater in some areas (as shallow as 10 feet below ground surface [bgs]), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 2.3 miles east of FT001 (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well; although, the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base. Additionally, this well is hydrologically cross-gradient of the current FTA.

One private groundwater public water supply well is located 1.9 miles southeast of FT001 and serves a population of 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 1,490 feet downgradient of the site and is used to water cattle (Jensen, 2015, personal communication; Appendix C). Consequently, while ingestion of groundwater by humans is not anticipated, there is a complete ingestion and dermal exposure pathway for cattle and other ecological receptors. A second private well is located approximately 1,985 feet downgradient (south) of FT001 and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). As part of the future RI at FT001, an inventory of all nearby private wells will be conducted and sampling of each well and analysis of groundwater for PFCs will be performed (Jensen, 2015, personal communication; Appendix C).

Sampling was conducted at FT001 as part of a broad agency announcement in 2011. PFCs were detected in groundwater collected at and downgradient of this location. A remedial investigation (RI) to assess the extent of PFCs at this location and downgradient of the location is planned (Jensen, 2015, personal communication; Appendix C).

2.1.3.2 Surface Water Pathway and Targets

The surface water drainage from FT001 flows south from the site to unnamed drainages which discharge to Pond 1, and eventually enters into a private landowner's pond. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water. Groundwater beneath FT001 discharges into the unnamed drainages south of the site and could provide a complete exposure pathway for non-ingestion exposures, such as dermal exposure to humans. Ingestion by aquatic or other animals is also a potential pathway for ecological receptors.

The site is not located within a flood zone. The nearest body of water is Pond 1, located approximately 800 feet downgradient of the site. Discharge from Pond 1 leaves the Base via Outfall 1 and travels to a private landowner's pond located approximately 0.5 mile downgradient of FT001.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the site; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

2.1.3.3 Soil and Air Exposure Pathways and Targets

A release of AFFF to the soil surface during fire training activities has likely occurred. Additionally, dredge materials from Pond 1 were land applied to the west of the current FTA. The nearest residents are approximately 1,490 feet downgradient of FT001. Workers are not present at the location and, aside from the fire training activities that occur just north of FT001 at the current FTA, no workers are present within 0.5 mile of FT001. The well-vegetated area would preclude any fugitive dust emissions and potential exposures. Current and planned future land use does not involve any human health exposures, and no intrusive work is anticipated that would allow for dermal soil exposures to utility or construction workers. The potential of exposure to burrowing animals, if present, would exist.

The population within 4 miles of the site includes Rapid City and Box Elder residents, with a population of approximately 8,190. No schools or day care facilities are within a 200-foot radius of the site. The nearest school is Vandenberg Elementary School, located approximately 7,780 feet to the east-northeast of FT001 (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 8,700 feet to the northeast.

The FT001 area is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

Sampling was conducted at FT001 as part of a broad agency announcement in 2011. PFCs were detected in soils collected at and downgradient of this location. An RI to assess the extent of PFCs at this site is planned (Jensen, 2015, personal communication; Appendix C).

2.2 CURRENT FIRE TRAINING AREA

2.2.1 Description and Operational History

The current FTA, is approximately 7 acres in size and is located in the southwestern segment of Ellsworth AFB (Figures 1.1 and 2.1). The current FTA is bordered to the north by the open fields, to the south by FT001, to the east by unnamed drainages, and to the west by open grasslands. The geographic coordinates are 44°7' 59.56"N and 103°5' 53.96"W.

The current FTA was built in 1992 and began operation in 1993. This location contains a large concrete pad with a steel mockup aircraft in the center that is set ablaze for fire training exercises. The central area of the concrete pad consists of a lined pit in which the training activities are conducted. This pit holds the water and/or AFFF applied during fire training exercises. When the pit reaches capacity, the water is discharged via underground piping to a lined retention pond located just off the concrete pad to the southwest (Beck, 2015a, personal communication; Appendix C). When full, the retention pond is emptied using a 9,500-gallon tanker and a transfer pump and contents are disposed of at the 70 row diversion tank (see Section 3.1.1 for discussion regarding the 70 row diversion tank).

The location of the current FTA is shown on Figures 1.1 and 2.1.

2.2.2 Waste Characteristics

Fire training is typically conducted on a monthly basis using only water; however, AFFF is used up to a few times a year. Historically, 6 percent AFFF was used until the mid-1990s when the Base switched to 3 percent AFFF, which is currently still in use by the fire department (Beck, 2015a, personal communication; Appendix C).

Spray nozzle testing is also conducted annually at the current FTA. While the majority of AFFF discharged during this testing is contained on the concrete pad, it does occasionally run off into the grass surrounding the pad. No logs exist that document the volume of AFFF used during fire training activities; however, approximately 5 to 10 gallons of AFFF are used during each test (Beck, 2015a, personal communication; Appendix C).

After an emergency response call where AFFF is applied, the nozzle is always flushed at the current FTA.

Five-gallon buckets of AFFF are stored inside a conex storage container at the current FTA. As of February 2015, 1,635 gallons were reportedly stored here. No spills or releases have been reported or observed (Beck, 2015a, personal communication; Appendix C).

Based on the operational history and release of AFFF during these years, the potential for PFCs released to the environment is high. Because the location is currently in use, future impacts to environmental media would need to be investigated once the ongoing use of AFFF is discontinued.

2.2.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located at least 1.6 miles hydrologically cross-gradient of the current FTA. The on-Base child development center is located approximately 1.4 miles hydrologically cross-gradient of the location.

2.2.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. In the southern portion of Ellsworth AFB, groundwater flows in a southerly direction within the shallow aquifer.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater in some areas (as shallow as 10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 2.3 miles east of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well; although, the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base. Additionally, this well is hydrologically cross-gradient of the current FTA.

One private groundwater public water supply well is located 1.9 miles southeast of the current FTA and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 2,250 feet downgradient (south) of the location and is used to water cattle (Jensen, 2015, personal communication; Appendix C). Consequently, while ingestion of groundwater by humans is not anticipated, there is a complete ingestion and dermal exposure pathway for cattle and other ecological receptors. A second private well is located approximately 2,650 feet downgradient (south) of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b).As part of the RI at FT001, an inventory of all nearby private wells will be conducted and sampling of each well and analysis of the groundwater for PFCs will be performed (Jensen, 2015, personal communication; Appendix C). Because the current FTA is located directly north of FT001, any potential impacts to downgradient groundwater resources will be identified during this RI.

2.2.3.2 Surface Water Pathway and Targets

The surface water drainage from the current FTA either infiltrates into the soils, enters the unnamed drainages to the east, or travels south to FT001 where runoff eventually enters unnamed drainages and discharges to Pond 1 and eventually enters into a private landowners' pond. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water. Groundwater beneath the current FTA daylights into the unnamed drainages south of the location and could provide a complete exposure pathway for non-ingestion exposures, such as dermal exposure to humans. Ingestion by aquatic or other animals is also a potential pathway for ecological receptors.

The location is not located within a flood zone. The nearest body of water is Pond 1, located approximately 1,400 feet downgradient of the location. Discharge from Pond 1 leaves the Base via Outfall 1 and travels to a private landowners' pond located approximately 0.5 mile downgradient of FT001 (Goyer, 2015a, personal communication; Appendix C).

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

2.2.3.3 Soil and Air Exposure Pathways and Targets

A release of AFFF to the soil surface during fire training activities has likely occurred. The nearest residents are approximately 2,250 feet south of the location. Workers are present at the location during monthly fire training activities. Aside from fire department staff who conduct fire training activities at the location, workers are not present within 0.5 mile of the current FTA. The well-vegetated area would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if any, would be present at the perimeter of the location, although the majority of the location is concrete.

The population within 4 miles of the current FTA includes Rapid City and Box Elder residents, with a population of approximately 8,190. No schools or day care facilities are within a 200-foot radius of the current FTA. The nearest school is Vandenberg Elementary School, located approximately 7,750 feet to the east-northeast of the current FTA (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 8,600 feet to the northeast.

FIGURE

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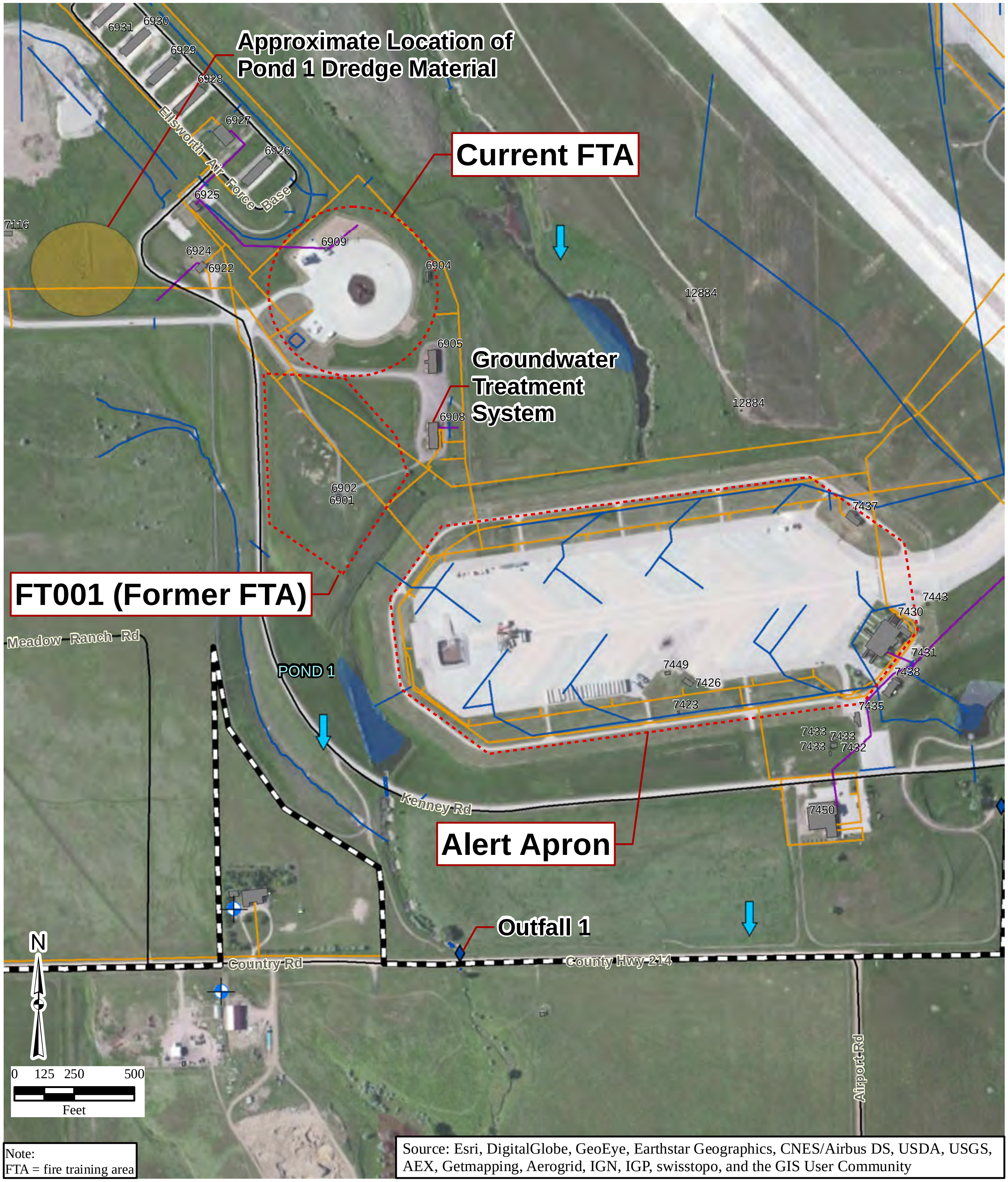

Note:
FTA = fire training area

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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3/30/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

Legend

⊕ Private Water Supply Well (Location Approximate)
◆ Outfall
↑ Approximate Uppermost, Shallow Groundwater Flow Direction
— Storm Sewer
— Wastewater Line
— Water Line
— Road

⬚ Approximate Site Boundary
▦ Base Boundary
■ Building
🟩 Shed
🟨 Approximate Location of Pond 1 Dredge Material

Wetland

▭ Freshwater Forested/Shrub Wetland
▭ Freshwater Emergent Wetland
🟦 Freshwater Pond

Figure 2.1
Locations Identified in the Southwestern Part of Ellsworth AFB, South Dakota

3.0 NON-FIRE TRAINING AREAS

3.1 HANGARS/BUILDINGS

3.1.1 70, 80, and 90 Rows

3.1.1.1 Description and Operational History

Docks 70, 71, 72, 73, 74, 81, 90, 91, 92, and 93 are aircraft hangars in the 70, 80, and 90 rows of hangars on the northeast side of the Ellsworth AFB runway (Figures 1.1 and 3.1). The area encompasses approximately 83 acres. The geographic coordinates are 44°9' 6.40"N and 103°6' 6.10"W.

Historically, these docks contained AFFF fire suppression systems. These systems were supplied with AFFF via Pumphouse 7263 located at the northeast end of 90 row. Pumphouse 7263 contained a 1,000-gallon AFFF tank that fed the 70, 80, and 90 rows of hangars via underground piping. According to the spills database, 310 gallons of AFFF was released at the pumphouse in September 1994 (Ellsworth, 2015). In 2000, the systems were upgraded and each dock had its own 500-gallon AFFF tank installed inside. AFFF underground piping from the pumphouse to the hangars is still in place but capped at the floor.

Inside each dock is a trench drain system that discharges to the 150,000-gallon 70 row diversion tank (underground storage tank [UST] 7246). The contents of the diversion tank were typically released to the WWTP but could have also been released to Outfall 3 on the southwest side of the runway at Ellsworth AFB through storm drains. In 2000, the systems were upgraded and each dock had its own 500-gallon AFFF tank installed inside. AFFF underground piping from the pumphouse to the hangars is still in place but capped at the floor.

According to Mr. Beck, when an AFFF system would activate, the diversion valve was closed automatically through Monaco system to prevent AFFF from traveling to the WWTP and the diversion tank would be opened. Released AFFF was held inside the facility and entered drain lines and the diversion tank. After the AFFF was drained, the lines were flushed with water and the diversion valves were re-opened. AFFF in the tank would be removed as hazardous waste (Beck, 2015a, personal communication; Appendix C).

In 2014, the WWTP was decommissioned. As of July 2014, the diversion tank now discharges to the off-Base publicly owned treatment works.

Conversion of all AFFF systems to high-expansion foam systems began in 2005 and was completed in 2012. AFFF is no longer used in any of the docks (Beck, 2015a, personal communication; Appendix C).

3.1.1.2 Waste Characteristics

According to the spills database, 310 gallons of AFFF was released at the pumphouse in September 1994 (Ellsworth, 2015). In 1993, the tank contents, approximately 150,000 gallons, were released into the storm drain, which flowed to Outfall 3 and then off-Base through an unnamed tributary of Boxelder Creek. The USEPA issued a Notice of Violation regarding this incident (USAF, 2012b).

Several releases of AFFF have occurred at the docks including the following:

- Dock 70:
    - 700 gallons of AFFF were released due to unknown reasons (November 2000) (Ellsworth, 2015).
    - An unknown amount of AFFF was released in due to a system malfunction (September 2002) (Ellsworth, 2015).
- Dock 71:
    - Inadvertent release/pipe break of 400 gallons of AFFF in foam pump room (September 2006). Contained in diversion tank (Beck, 2015a, personal communication; Appendix C).
    - A 300-foot by 30-foot spill occurred when testing repaired AFFF system (May 1998). Contained in diversion tank (Ellsworth, 2015).
    - An unknown amount of AFFF was released in the mechanical room of Dock 71 when a pipe broke in July 2000 (Ellsworth, 2015).
- Dock 74:
- 100 gallons released when system activated (October 1994). Contained in diversion tank (USAF, 2012b)
- Dock 81:
    - 30 gallons released from a leaking nozzle (June 1999) (Ellsworth, 2015).
    - 250 gallons released for unknown reasons (June 2000). The spills database also noted this as occurring at AFFF pumphouse; therefore, it is unclear whether this occurred in Dock 81 or at Pumphouse 7263 (Ellsworth, 2015).
    - An unknown amount of AFFF was released due to a leaking gasket (June 2000) (Ellsworth, 2015).
    - An unknown amount of AFFF was released from a deck gun (July 2002) (Ellsworth, 2015).
- Dock 90:
    - 12-gallon release when system activated (March 1995). Contained in diversion tank (USAF, 2012b).
    - Inadvertent release of 450 gallons of AFFF (March 2007). Contained in diversion tank (Beck, 2015a, personal communication; Appendix C).
    - An unknown amount of AFFF was released as a result of cold weather (January 2005) (Ellsworth, 2015).
- Dock 91:
    - Inadvertent release of 315 gallons of AFFF (May 2006). Contained in diversion tank (Beck, 2015a, personal communication; Appendix C).
    - Unknown amount of AFFF released from the pipe next to the monitor gun (December 2000) (Ellsworth, 2015).
- Dock 92:
    - 300 gallons released during system activation and equipment failure (November 1995). Contained in diversion tank (USAF, 2012b).

    - 25 to 50 gallons released due to nuisance tripping of fire alarm (June 2000) (Ellsworth, 2015).
    - 400 gallons released from aircraft 5086 (December 2000) (Ellsworth, 2015).
    - 400 gallons released due to a system leak (December 2005) (Ellsworth, 2015).
- Dock 93:
    - 60 to 70 gallons spilled from drums while transferring to tank (February 1994). Contained on concrete (USAF, 2012b).
    - 500 gallons released for unknown reasons (May 2002) (Ellsworth, 2015).

Mr. Beck, who has worked at Ellsworth AFB for 20 years, related that soil surrounding these docks may potentially be contaminated with PFCs because he often saw discharges coming out of the hangars (Beck, 2015a, personal communication; Appendix C).

3.1.1.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located at least 1.9 miles hydrologically downgradient (southeast) of the hangars. The on-Base child development center is located approximately 1.5 miles hydrologically downgradient (east-southeast) of the location.

3.1.1.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. In the northern portion of the Base, groundwater in the shallow groundwater aquifer generally flows southeast.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater in some areas (as shallow as 10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 3 miles southeast (cross-gradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 3.1 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 9,000 feet cross-gradient (south) of the location and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 9,400 feet cross-gradient (south) of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). However, because these wells are cross-gradient of the hangars, a complete exposure pathway does not exist.

Sampling for PFCs was conducted as part of the Site Inspection (SI) (SCF, 2015) at Docks 73 and 93. PFCs were detected in groundwater and confirm that PFCs have been released as a result of the AFFF fire suppression systems in the hangars.

3.1.1.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the hangars either infiltrates into the soils adjacent to the hangars or enters the storm drain system that flows to the west and discharges to Pond 3, eventually leaving the Base via Outfall 3. In 1993, the tank contents were released to the storm drain system and entered Pond 3, discharged off Base, and eventually discharged to Boxelder Creek. Additionally, while no surface waterbodies are present in the vicinity of the hangars, shallow groundwater beneath the hangar area could be hydrologically connected with downgradient surface waters such as Boxelder Creek. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within the immediate vicinity of the hangars or within 0.5 mile of the location. Discharge from the hangars either enters storm drains or infiltrates into grassy areas surrounding the hangars.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at Docks 73 and 93. PFCs were detected in surface water and sediments at Pond 3/Outfall 3 located downgradient of the hangars.

3.1.1.3.3 Soil and Air Exposure Pathways and Targets

A release of AFFF to the soil surface during fire training activities has likely occurred. This area has no residents, but workers are present at the location where staff work inside and around the hangars. The nearest residents are approximately 1 mile east of the location. The location consists primarily of hard surfaces with grassy areas along the perimeter. The unpaved areas surrounding the location are well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible, although the majority of the location is paved.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 5,660. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 8,875 feet to the southeast of the location (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 1.4 miles to the west-southwest.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at Docks 73 and 93. PFCs were detected in groundwater and confirm that PFCs have been released as a result of the AFFF fire suppression systems in the hangars.

3.1.2 Building 618

3.1.2.1 <u>Description and Operational History</u>

Building 618, the Logistics Readiness Squadron and refueling maintenance, is located near the southeast end of the runway (Figures 1.1 and 3.2). This building formerly had an AFFF fire suppression system. Discharge from the system was captured in floor drains and discharged to a 50,000-gallon diversion recovery tank (UST 618) via underground pipelines. The tank contents were released to the WWTP. The solids in the tank were periodically cleaned out by contractors. The dewatered sludge was shoveled out and disposed of at a local landfill (Ellefson, 2015, personal communication; Appendix C). The geographic coordinates are 44°8' 11.54"N and 103°5' 9.42"W.

Conversion of all AFFF systems to high-expansion foam systems started in 2005 and was completed in 2012. AFFF is no longer used at Building 618 (Beck, 2015a, personal communication; Appendix C).

3.1.2.2 <u>Waste Characteristics</u>

According to the spills database, 50 gallons of AFFF were inadvertently released inside Building 618 when electricians accidentally pressurized the system in November 2001 (Ellsworth, 2015). Based on data collected during the SI (SCF, 2015), AFFF releases have occurred at this location as discussed in Sections 3.1.2.3.1 and 3.1.2.3.3.

3.1.2.3 <u>Pathway and Environmental Hazard Assessment</u>

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor’s body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located at least 1.1 miles hydrologically cross-gradient (east) of Building 618. The on-Base child development center is located approximately 1 mile hydrologically cross-gradient (northeast) of the location.

3.1.2.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. In the northern portion of the Base, groundwater in the shallow groundwater aquifer generally flows southeast.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater near Building 618 (12 to 15 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 1.8 miles southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 1.8 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 5,385 feet cross-gradient (southwest) of the location and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 5,600 feet cross-gradient (southwest) of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). However, because these wells are cross-gradient of Building 618, a complete exposure pathway does not exist.

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at Building 618. PFCs were detected in groundwater and confirm that PFCs have been released as a result of the AFFF fire suppression system.

3.1.2.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around Building 618 either infiltrates into the soils adjacent to the location or enters the storm drain system that flows to the south, discharges into Pond 2, and eventually discharges off Base from Outfall 2. Additionally, while no surface waterbodies are present in the vicinity of the building, shallow groundwater beneath the location could be hydrologically connected with downgradient surface waters such as Boxelder Creek. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No waterbodies or wetlands are located within the immediate vicinity of Building 618. Unnamed drainages and ponds are located within 1,380 feet east and northeast of the location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.1.2.3.3 Soil and Air Exposure Pathways and Targets

A release of AFFF to the soil surface has occurred based on recent sampling efforts during the SI. This area has no residents, but workers are present at the location where staff work inside and around the building. The nearest residents are approximately 3,200 feet east of the location. The location consists primarily of hard surfaces with grassy areas along the perimeter and surrounding the tank. The unpaved areas surrounding the location are well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible although the majority of the location is paved.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,210. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 4,600 feet to the east-northeast (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 5,450 feet to the northeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at Building 618. PFCs were detected in the soil and confirm that PFCs have been released as a result of the AFFF fire suppression system.

3.1.3 Building 88240

3.1.3.1 <u>Description and Operational History</u>

Building 88240 is located in the munitions storage area on the north side of Ellsworth AFB and formerly contained an AFFF fire suppression system (Figures 1.1 and 3.3). The building contains a trench drain system. Under normal operating conditions, flow from the trench drains goes into an oil-water separator prior to being released into the sanitary sewer. However, a valve can be switched to route drainage into the surface impoundment in the event that the AFFF system was activated. Consequently, any AFFF releases in Building 88240 would have drained via underground piping to a surface impoundment located south of Building 88240. There are no records of accidental AFFF releases from Building 88240. The approximate size of the location is 4.7 acres including the surface impoundment. The building currently supports a water-only fire suppression system. The geographic coordinates are 44°9' 54.73"N and 103°6' 23.53"W.

Pumphouse 88490, located just southwest of Building 88240, once contained a 500-gallon AFFF tank in the 1980s. This tank provided the AFFF to the fire suppression system located inside Building 88240. The AFFF tank was removed in the early 1990s (Goyer, 2015a, personal communication; Appendix C).

3.1.3.2 Waste Characteristics

No spills or releases are known to have occurred at Building 88240; however, sampling conducted during the SI (SCF, 2015) confirms that PFCs have been released, possibly as a result of the AFFF fire suppression system in the building.

3.1.3.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 2.5 miles hydrologically downgradient (southeast) of Building 88240. The on-Base child development center is located approximately 2.3 miles hydrologically downgradient (southeast) of the location.

3.1.3.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. In the northern portion of the Base, groundwater in the shallow groundwater aquifer generally flows southeast.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 3.7 miles southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 4 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. This aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 2.7 miles south of the location and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 2.75 miles south of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at the surface impoundment south of Building 88240. PFCs were detected in groundwater collected within and around the surface impoundment south of Building 88240; these samples confirm that PFCs have been released as a result of the AFFF fire suppression system in the building.

3.1.3.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around Building 88240 either infiltrates into the soils adjacent to the location or enters the surface impoundment south of Building 88240. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. In addition to the surface impoundment located 300 feet south of Building 88240, another pond is located 1,000 feet northwest of Building 88240 but is not within the surface drainage pathway.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at the surface impoundment south of Building 88240. PFCs were detected in sediment and surface water collected within and around the surface impoundment south of Building 88240; these samples confirm that PFCs have been released as a result of the AFFF fire suppression system in the building.

3.1.3.3.3 Soil and Air Exposure Pathways and Targets

A release of AFFF to the soil has occurred based on recent sampling efforts during the SI. This area has no residents, but workers are present at the location where staff work inside and around the building. The nearest residents are approximately 7,000 feet southeast of the location. The location consists primarily of grassy areas with hard surfaces surrounding the building. The unpaved areas surrounding the location are well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 4,970. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 2.5 miles to the southeast (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 2.3 miles to the southeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

Sampling for PFCs was conducted as part of the SI (SCF, 2015) at the surface impoundment south of Building 88240. PFCs were detected in soil collected around the surface impoundment south of Building 88240; these samples confirm that PFCs have been released as a result of the AFFF fire suppression system in the building.

3.2 FIRE STATIONS

3.2.1 Former Fire Station 2 (Building 7506)

3.2.1.1 <u>Description and Operational History</u>

Former Fire Station 2 was located in Building 7506. The building was demolished in 2010. The station was located in the northern portion of the Base (Figures 1.1 and 3.4). This fire station was used to support the munitions storage area until 1994. This station did not have access to and did not service the airfield. It is unknown whether this station had a crash truck, but a fire truck was located here in the late 1980s for structural fires. Foam rarely would have been used on structure fires. No known spills or leaks of AFFF at this location have occurred (Beck, 2015a, personal communication; Appendix C). Based on the information obtained about Fire Station 2, the potential for this location to be a source of AFFF is low and no complete exposure pathways are likely to exist. The geographic coordinates are 44°9' 40.63"N and 103°5' 49.46"W.

3.2.1.2 <u>Waste Characteristics</u>

Not applicable.

3.2.1.3 Pathway and Environmental Hazard Assessment

3.2.1.3.1 Groundwater Pathway and Targets

Not applicable.

3.2.1.3.2 Surface Water Pathway and Targets

Not applicable.

3.2.1.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

3.2.2 Former Fire Storage Area

3.2.2.1 Description and Operational History

A former storage area used by the fire department was located in the northern portion of the Base (Figures 1.1 and 3.1). No fire trucks were stored here but other miscellaneous equipment was stored here by the department. Additionally, this location may have historically supported an old fire station (Beck, 2015a, personal communication; Appendix C). The dates of this fire station are unknown and it is unknown whether AFFF was used or stored here. However, given that several other fire stations were located on Base by 1970 and were closer to the flightline operations and based on the location of this storage area, it is unlikely that AFFF was used here (Beck, 2015a, personal communication; Appendix C). Based on the information obtained about the Former Fire Storage Area, the potential for this location to be a source of AFFF is low and no complete exposure pathways are believed to exist.

3.2.2.2 Waste Characteristics

Not applicable.

3.2.2.3 Pathway and Environmental Hazard Assessment

3.2.2.3.1 Groundwater Pathway and Targets

Not applicable.

3.2.2.3.2 Surface Water Pathway and Targets

Not applicable.

3.2.2.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

3.2.3 Former Fire Station (Building 7506)

3.2.3.1 Description and Operational History

The former fire station was located in Building 7506 in the central portion of Ellsworth AFB (Figures 1.1 and 3.4). The building was built in 1952, used until 2000, and demolished in 2007. The geographical coordinates are 44°8’44.06"N and 103°5’40.36"W.

Fire department vehicles were stored, cleaned, and maintained in this building. The building was fitted with trench drains that contained any spills inside the building although discharges of AFFF were often observed outside the building (Beck, 2015a, personal communication; Appendix C). Trench drains discharged to the sanitary sewer system and ultimately to the WWTP (the WWTP is evaluated in Section 3.4.2).

Due to limited space in the fire station, trucks were sometimes stored in Dock 51. No maintenance of fire trucks was conducted in Dock 51 (Beck, 2015a, personal communication; Appendix C). Two minor spills were noted in Dock 51 in the spills database including a 3-gallon spill from a fire truck in May 1998 and a 2-gallon spill from a foam trailer in April 2000 (Ellsworth, 2015). Spills would have entered the trench drains inside the building and been contained in the 20 row diversion tank. Consequently, Dock 51 is not considered a potential release location for AFFF.

3.2.3.2 Waste Characteristics

AFFF was stored in two overhead storage tanks with a piping system that was used to gravity fill into the tops of the crash trucks. The tanks were 300 and 500 gallons. These tanks were not known to have any serious leaks or spills (Beck, 2015a, personal communication; Appendix C). However, the spills database documented a 5-gallon spill when a line broke in November 1994 (Ellsworth, 2015). The spill was contained on concrete (USAF, 2012b).

While the former fire station was in operation, it was not uncommon to see foam solution on the fire station driveways after foam operations had occurred on Base (Beck, 2015a, personal communication; Appendix C) indicating releases outside of the building footprint.

Based on the operational history and use of AFFF during these years, the potential for PFCs released to the environment is high.

3.2.3.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor’s body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 6,775 feet hydrologically downgradient (southeast) of the former fire station. The on-Base child development center is located approximately 6,610 feet hydrologically cross-gradient (east) of the location.

3.2.3.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. In the northern portion of the Base, groundwater in the shallow groundwater aquifer generally flows southeast.

Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 2.5 miles southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 2.6 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 1.4 miles southwest of the former fire station (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 1.45 miles southwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.2.3.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the former fire station either infiltrates into the soils adjacent to the location or enters the storm drain system and eventually drains off Base. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. Unnamed drainages and wetlands are located approximately 2,900 feet east of the former fire station but are not within the surface drainage pathway.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.2.3.3.3 Soil and Air Exposure Pathways and Targets

Because grassy areas are located around the former fire station, it is possible that AFFF migrated out of the bay and into nearby soils. This area has no residents, but workers are present at the location where staff work inside and around the buildings. The nearest residents are approximately 5,000 feet northeast of the location. The location consists primarily of hard surfaces with some adjacent grassy areas. The unpaved areas surrounding the location are well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 6,210. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 6,750 feet to the east-southeast (EDR, 2015). The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 6,620 feet to the east.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.2.4 Current Fire Station (Building 7502)

3.2.4.1 <u>Description and Operational History</u>

The current fire station, Building 7502, is located in the central portion of the Base between 50 row and 60 row (Figures 1.1 and 3.4). The building was built in 2000 at which time the fire department moved out of the former location (Building 7506). The building is in good condition with no cracking in floors or driveways. It is surrounded by a paved/concrete area with small grassy areas bordering it to the south.

AFFF is stored in the current fire station in a storage room and in fire trucks and trailers. As of February 2015, 220 gallons of AFFF were stored in the storage room (Beck, 2015a, personal communication; Appendix C). A total of 2,641 gallons of AFFF are stored in trucks at the fire station; this includes 500 gallons on three P-23s, 56 gallons on U-8, 30 gallons on Engine 9, 25 gallons on Engine 7, 30 gallons on Aerial, and 1,000 gallons on the foam trailer. Trucks are refilled with AFFF in the bays from 5-gallon buckets.

As noted in the spills database, only one minor spill has occurred at the current fire station. Five gallons were released from a fire truck in July 2012 in the northwest corner of the fire station. The spill was not washed down the drains and was allowed to evaporate on the floor (Ellsworth, 2015).

Cleaning, maintenance, and refilling of the vehicle is conducted inside the fire station bays where floor drains are present to capture any runoff and feed into the sanitary sewer line that discharged to the WWTP until 2014 when it was decommissioned. The sanitary sewer now discharges to an off-Base publicly owned treatment works. The WWTP is evaluated as a separate location in Section 3.4.2.The geographical coordinates of the current fire station are 44°8’47.24"N and 103°5’40.94"W.

3.2.4.2 Waste Characteristics

Not applicable.

3.2.4.3 Pathway and Environmental Hazard Assessment

Not applicable.

3.2.4.3.1 Groundwater Pathway and Targets

Not applicable.

3.2.4.3.2 Surface Water Pathway and Targets

Not applicable.

3.2.4.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

3.3 EMERGENCY RESPONSE

Only those crashes where AFFF was used are presented below. As documented in the Limited PA (USAF, 2012b) and as confirmed by Mr. Beck (Beck, 2015a, personal communication; Appendix C), a C-21 crashed in the southwest corner of the Base in 2002 but AFFF was not released at this crash location. Therefore, this crash location is not discussed further.

3.3.1 B-52 Crash (1970)

3.3.1.1 Description and Operational History

In April 1970, a B-52 caught fire and crashed during landing, skidding into a brick pumphouse containing six 25,000-gallon USTs. The crash occurred along the northern portion of the runway (Figures 1.1 and 3.1). The Ellsworth AFB Fire Department responded to the crash and extinguished the fire with an unknown quantity of foam (Beck, 2015a, personal communication; Appendix C). It is unlikely that AFFF would have been present in the Ellsworth inventory by early 1970. The geographic coordinates are 44°9' 8.92"N and 103°6' 36.22"W.

3.3.1.2 Waste Characteristics

Not applicable.

3.3.1.3 Pathway and Environmental Hazard Assessment

Not applicable.

3.3.1.3.1 Groundwater Pathway and Targets

Not applicable.

3.3.1.3.2 Surface Water Pathway and Targets

Not applicable.

3.3.1.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

3.3.2 B-1 Crash (1988)

3.3.2.1 Description and Operational History

In 1988, a B-1 crashed while landing just short of the southern end of the runway (Figures 1.1 and 3.5). The geographic coordinates are 44°7' 43.33"N and 103°5' 58.77"W.

3.3.2.2 Waste Characteristics

The Ellsworth AFB Fire Department responded to the B-1 crash and extinguished the fire with an unknown quantity of AFFF (Beck, 2015a, personal communication; Appendix C). AFFF applied would have infiltrated into the grass at the crash location.

3.3.2.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 5,350 feet hydrologically cross-gradient (northeast) of the crash location. The on-Base child development center is located approximately 6,610 miles hydrologically cross-gradient (east) of the location.

3.3.2.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows southeast.

Residual AFFF released to grass or dirt surfaces at the crash location may have infiltrated to groundwater. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 1.5 miles east (cross-gradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 1.2 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically downgradient of the location.

One known private well is located approximately 4,700 feet southwest of the crash location (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 4,730 feet southwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.3.2.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the crash location infiltrates into the soils or enters the unnamed drainages just south of the location. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within 200 feet of the location. Unnamed drainages and ponds are located approximately 1,300 feet southwest of the crash location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.3.2.3.3 Soil and Air Exposure Pathways and Targets

AFFF was likely released to soils in this area. This area has no residents and no workers are present at the location. The nearest residents are approximately 3,350 feet northeast of the location. The location consists entirely of grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of 7,530. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 5,350 feet to the northeast. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 6,900 feet to the northeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.3.3 Delta Taxiway West Crash (2000)

3.3.3.1 Description and Operational History

In August 2000, a P-15 fire truck rear ended an AFFF foam trailer on Delta Taxiway West (Figures 1.1 and 3.4) (Beck, 2015a, personal communication; Appendix C). The geographic coordinates are 44°8' 30.33"N and 103°6' 8.94"W.

3.3.3.2 Waste Characteristics

Approximately 100 gallons of AFFF was spilled at the scene (USAF, 2012b). AFFF released on the taxiway may have run off to the adjacent soils and infiltrated into the grass.

3.3.3.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 8,400 feet hydrologically cross-gradient (east) of the crash location. The on-Base child development center is located approximately 8,750 miles hydrologically cross-gradient (east) of the location.

3.3.3.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows southeast.

Residual AFFF released to grass or dirt surfaces at the crash location may have infiltrated to groundwater. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 2.7 miles east-southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 2.6 miles south-southeast of the location and serves a population of 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically downgradient of the location.

One known private well is located approximately 4,700 feet southwest of the crash location (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 4,730 feet southwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.3.3.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the crash location infiltrates into the soils or enters the storm drain system that flows to Pond 1 and eventually discharges into a private waterbody. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within 200 feet of the location. Unnamed drainages and ponds are located approximately 1,300 feet southwest of the crash location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.3.3.3.3 Soil and Air Exposure Pathways and Targets

AFFF was likely released to soils in this area. This area has no residents and no workers are present at the location. The nearest residents are approximately 3,350 feet northeast of the location. The location consists entirely of grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,530. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 5,350 feet to the northeast. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 6,900 feet to the northeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.3.4 Marten Crash (2003)

3.3.4.1 Description and Operational History

In February 2003, a privately owned semi-truck traveling west crashed off of an overpass on I-90 and landed in a grassy field on Ellsworth AFB property (Figures 1.1 and 3.5). The geographic coordinates are 44°7' 4.79"N and 103°4' 45.47"W.

3.3.4.2 Waste Characteristics

The Ellsworth AFB Fire Department responded to the crash and an unknown amount of AFFF was used at the scene (Beck, 2015a, personal communication; Appendix C).

3.3.4.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor’s body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 7,860 feet hydrologically upgradient (northeast) of the crash location. The on-Base child development center is located approximately 9,950 miles hydrologically upgradient (northeast) of the location.

3.3.4.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows southeast.

Residual AFFF released to grass or dirt surfaces at the crash location may have infiltrated to groundwater. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 1.5 miles northeast (cross-gradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 0.6 mile southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located approximately 6,260 feet northwest of the crash location (upgradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 6,170 feet northwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.3.4.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the crash location infiltrates into the soils or enters nearby unnamed tributaries that eventually discharge to Boxelder Creek. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within 200 feet of the location. Unnamed drainages are located approximately 500 feet south of the crash location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities. Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.3.4.3.3 Soil and Air Exposure Pathways and Targets

AFFF was likely released to soils in this area. This area has no residents and no workers are present at the location. The nearest residents are approximately 3,350 feet northeast of the location. The location consists entirely of grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,250. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Badger Clark Elementary School, located approximately 7,860 feet to the northeast. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 10,080 feet to the northeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.3.5 Crash 4 (2001)

3.3.5.1 Description and Operational History

In March 2000, Crash 4, a P-23 fire truck, apparently released 10 gallons of AFFF near the vicinity of Building 7140 (Figures 1.1 and 3.1). The fire department has no records or knowledge of this crash but according to Mr. Beck, it likely happened on the road leading from taxiway alpha to Building 7140, which has since been demolished. Mr. Beck indicated that the area was often used for staging fire trucks during war training exercises (Beck, 2015b, personal communication; Appendix C). The geographic coordinates are 44°9' 23.90"N and 103°6' 33.81"W.

3.3.5.2 Waste Characteristics

The spills database indicates that a spill resulted in the release of 10 gallons of AFFF (Ellsworth, 2015).

3.3.5.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor’s body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 11,750 feet hydrologically downgradient (southeast) of the crash location. The on-Base child development center is located approximately 11,050 miles hydrologically downgradient (southeast) of the location.

3.3.5.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows southeast.

Residual AFFF released to grass or dirt surfaces at the crash location may have infiltrated to groundwater. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 3.5 miles southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 3.6 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located approximately 11,500 feet south of the location (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 11,900 feet south of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.3.5.3.2 Surface Water Pathway and Targets

The surface water drainage from the area around the crash location infiltrates into the soils or enters nearby drainages. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of

Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within 200 feet of the location. Unnamed drainages are located approximately 500 feet north of the location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities. Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.3.5.3.3 Soil and Air Exposure Pathways and Targets

AFFF was potentially released to soils in this area. This area has no residents and no workers are present at the location. The nearest residents are approximately 6,950 feet east of the location. The location consists of paved areas surrounded by grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,250. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Badger Clark Elementary School, located approximately 11,750 feet to the southeast. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 11,050 feet to the southeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.4 OTHER

3.4.1 Hazmart (Building 1911)

3.4.1.1 Description and Operational History

Hazmart (Building 1911) is a chemical storage facility located on the southern portion of the Base (Figures 1.1 and 3.2). The Hazmart currently stores about 3,965 gallons of AFFF (Beck, 2015a, personal communication; Appendix C). Based on a visit on February 24, 2015, most containers are shrink-wrapped and stored on pallets. The storage room has floor drains that would contain spills. No known spills or releases are documented (Ellsworth, 2015). The geographic coordinates are 44°8' 9.52"N and 103°4' 58.93"W.

3.4.1.2 Waste Characteristics

Not applicable.

3.4.1.3 Pathway and Environmental Hazard Assessment

3.4.1.3.1 Groundwater Pathway and Targets

Not applicable.

3.4.1.3.2 Surface Water Pathway and Targets

Not applicable.

3.4.1.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

3.4.2 Wastewater Treatment Plant

3.4.2.1 Description and Operational History

The Base WWTP is located in the southeast portion of the Base (Figures 1.1 and 3.6) and was decommissioned in July 2014. The geographic coordinates are 44°7' 54.49"N and 103°4' 41.05"W.

During operations, all waste in the sanitary sewer and industrial sewer lines went to the WWTP. Treated water was discharged to Outfall 5, which flowed to unnamed drainages then to Golf Course Lake and to Outfall 6 where it went off Base and discharged to Boxelder Creek. When the WWTP was operating, approximately 300,000 to 500,000 gallons per day were discharged from the Golf Course Lake to off Base. Sludge from the WWTP was disposed of at the local landfill in accordance with the permit (Goyer, 2015a, personal communication; Appendix C).

3.4.2.2 Waste Characteristics

The WWTP received discharge from several locations which have had AFFF releases such as the diversion tanks at 70 row and Building 618 and any discharge from fire station floor drains (Goyer, 2015a, personal communication; Appendix C). Sludge and treated water from the WWTP are likely to contain PFCs. While the WWTP was a closed system, AFFF was likely released as a result of treated water discharge and sludge management. Additionally, water from Golf Course Lake was sometimes used for irrigation of the golf course (Goyer, 2015a, personal communication; Appendix C).

3.4.2.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 3,780 feet hydrologically cross-gradient (northeast) of the WWTP. The on-Base child development center is located approximately 5,265 feet hydrologically cross-gradient (northeast) of the location.

3.4.2.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows east near the WWTP.

The sludge drying bed at the WWTP is a potential source of AFFF to groundwater. The drying beds do not have an impervious layer beneath them. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (as shallow as 10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 1.3 miles east (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 1.3 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 6,220 feet southwest of the location (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 6,350 feet southwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells are not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.4.2.3.2 Surface Water Pathway and Targets

Surface runoff from the area runs into nearby unnamed drainages that drain to Golf Course Lake which discharges off Base via Outfall 6. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. Wetlands are located 120 feet south of the location and unnamed drainages are located directly east of the location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

As part of the SI (SCF, 2015), surface water and sediment samples were collected from the drainage system that leaves the WWTP and discharges to the Golf Course Lake, and these samples contained PFCs.

3.4.2.3.3 Soil and Air Exposure Pathways and Targets

AFFF is likely present in soils of the sludge drying beds, which are still in place. This area has no residents and no workers are present at the location. The nearest residents are approximately 1,500 feet northeast of the location. The majority of the location consists of grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,530. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 3,650 feet to the northeast. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 5,200 feet to the east.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.4.3 Spray Nozzle Test Area

3.4.3.1 <u>Description and Operational History</u>

In the 1970s and 1980s, equipment testing was conducted near Pumphouses 1, 2, and 3 at the end of the runway using 6 percent AFFF. This routine equipment testing was often conducted when crash trucks were checked out. A truck would be driven to the edge of the ramp and the operator would discharge foam out across the grass (Beck, 2015a, personal communication; Appendix C). Figures 1.1 and 3.4 show the spray nozzle test area location. The geographic coordinates are 44°8' 25.23"N and 103°5' 35.30"W.

3.4.3.2 <u>Waste Characteristics</u>

AFFF was sprayed onto the grassy area of the flightline and likely infiltrated soils.

3.4.3.3 Pathway and Environmental Hazard Assessment

A complete exposure pathway typically includes the following components: a source of contamination (an environmental medium contaminated at the source or a release mechanism by which chemicals are released from a source medium and transported), an exposure medium by which a receptor comes into contact, and a route of intake for the contaminant into the receptor's body at the exposure point. If any of these elements are missing, the pathway is incomplete. Other release mechanisms resulting in exposure media for receptors may include the uptake of soil contaminants by plants and animals and the emission of soil contaminants into the air in association with dust particles.

Database research (EDR, 2015) shows one day care facility, six schools, three hospitals, and two colleges within the potential migration area of 4 miles from any given potential release location of PFCs. No elementary schools are located on Base. The closest elementary school is located approximately 6,000 feet hydrologically cross-gradient (east) of the location. The on-Base child development center is located approximately 6,460 feet hydrologically cross-gradient (east-northeast) of the location.

3.4.3.3.1 Groundwater Pathway and Targets

The Basewide geologic and hydrogeological settings are provided in Section 1.3. Groundwater in the shallow groundwater aquifer generally flows southeast.

AFFF applied to soils likely infiltrated to the groundwater. Ellsworth AFB drinking water sources are all located more than 4 miles cross-gradient or upgradient of Ellsworth AFB and do not support a complete drinking water exposure pathway. The fact that Ellsworth does not use the shallow unconfined aquifer below the Base as a supply of drinking water would render this drinking water exposure pathway incomplete for Ellsworth AFB workers and residents. However, because of the relatively shallow depth to groundwater (10 feet bgs), excavation workers could be exposed to groundwater.

One public water supply well, owned by Box Elder, is located approximately 2.5 miles southeast (downgradient) of the location (EDR, 2015). The well serves a population of approximately 7,800 (EDR, 2015). This is a groundwater well, although the aquifer in which the well is zoned is unknown. However, it is likely to be installed in the deeper confined aquifer that would not be impacted by shallow groundwater migrating off Base.

One private groundwater public water supply well is located 2.2 miles south-southeast of the location and serves a population of approximately 90 in Whispering Willows. The aquifer in which the well is zoned is unknown (EDR, 2015). This well is hydrologically cross-gradient of the location.

One known private well is located 5,680 feet southwest of the location (cross-gradient) and is used to water cattle (Jensen, 2015, personal communication; Appendix C). A second private well is located approximately 5,890 feet southwest of the location and is owned by a landscape/nursery company. It is not known whether this well is used for potable water (USAF, 2012b). Because these wells area not located downgradient (groundwater flow from the location is southeast), a complete exposure pathway for cattle and other ecological receptors or people via drinking water or dermal contact does not exist.

3.4.3.3.2 Surface Water Pathway and Targets

Surface runoff from the area either infiltrates into the soil or runs into nearby storm drains that discharge off Base via Outfall 1. Consequently, complete exposure pathways for dermal exposure to humans and dermal exposure and ingestion by aquatic or other animals are present. Ellsworth AFB drinking water does not come from surface water sources located within the watershed of Ellsworth AFB, so there is no exposure pathway for surface water to residents or workers through domestic drinking water.

The location is not located within a flood zone. No wetlands are located within 200 feet of the location. Unnamed drainages are located 1,400 feet west of the location.

No surface water intakes, downstream fisheries, or sensitive environments are adjacent to the surface water migration path within 15 miles downstream of the location; however, several wetlands are present (EDR, 2015; USFWS, 2015). Local waterways may be used for recreational fishing by residents of nearby communities while crayfish and fish are known to be consumed from on-Base ponds (Goyer, 2015b, personal communication; Appendix C). Additionally, nearly all of the surface water along the tributaries and Boxelder Creek is available for use for stock watering (Goyer, 2015a, personal communication; Appendix C).

3.4.3.3.3 Soil and Air Exposure Pathways and Targets

AFFF is likely present in soils of the location. This area has no residents and no workers are present at the location. The nearest residents are approximately 3,870 feet east of the location. The majority of the location consists of grass. The area is well-vegetated and would preclude any fugitive dust emissions and potential exposures. Construction activities or other ground-disturbing activities could result in potential worker exposure. The potential of exposure to burrowing animals, if present, would be possible.

The population within 4 miles of the location includes Rapid City and Box Elder residents, with a population of approximately 7,090. No schools or day care facilities are within a 200-foot radius of the location. The nearest school is Vandenberg Elementary School, located approximately 6,130 feet to the east. The nearest day care facility is the Ellsworth AFB Child Development Center, located approximately 6,450 feet to the east-northeast.

The location is not used for hunting, fishing, or harvesting of wild or farmed foods, and such activities are not anticipated in the future. No sensitive environments have been identified within 200 feet or within 4 miles.

3.4.4 Alert Apron

3.4.4.1 <u>Description and Operational History</u>

The alert apron is located in the southern portion of the Base just west of the southern end of the runway (Figures 1.1 and 2.1). During the Cold War, B-52s were parked down in this location to be on standby for quick takeoff. Crash trucks were also located here in the event of an emergency (Beck, 2015a, personal communication; Appendix C). AFFF may have been stored in some of the crash trucks that were on standby at the alert apron. However, no known emergency response was conducted at the alert apron, and no leaks or spills are known or reported (Beck, 2015a, personal communication; Appendix C). Therefore, this area likely has not had any AFFF releases. The geographical coordinates are 44°7’45.61"N and -103°5’37.75"W.

3.4.4.2 Waste Characteristics

Not applicable.

3.4.4.3 Pathway and Environmental Hazard Assessment

3.4.4.3.1 Groundwater Pathway and Targets

Not applicable.

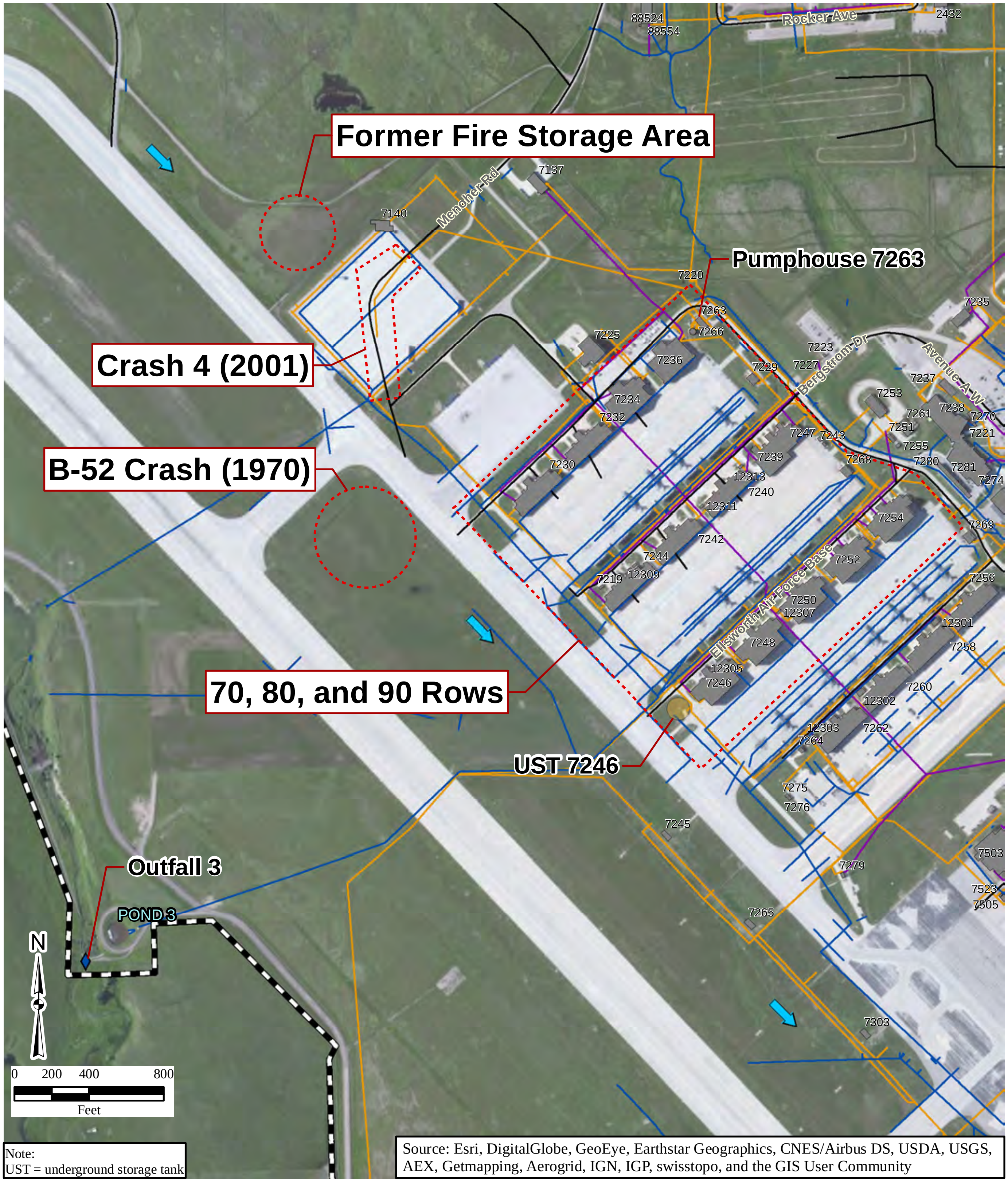
3.4.4.3.2 Surface Water Pathway and Targets

Not applicable.

3.4.4.3.3 Soil and Air Exposure Pathways and Targets

Not applicable.

FIGURES



Note:
UST = underground storage tank

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

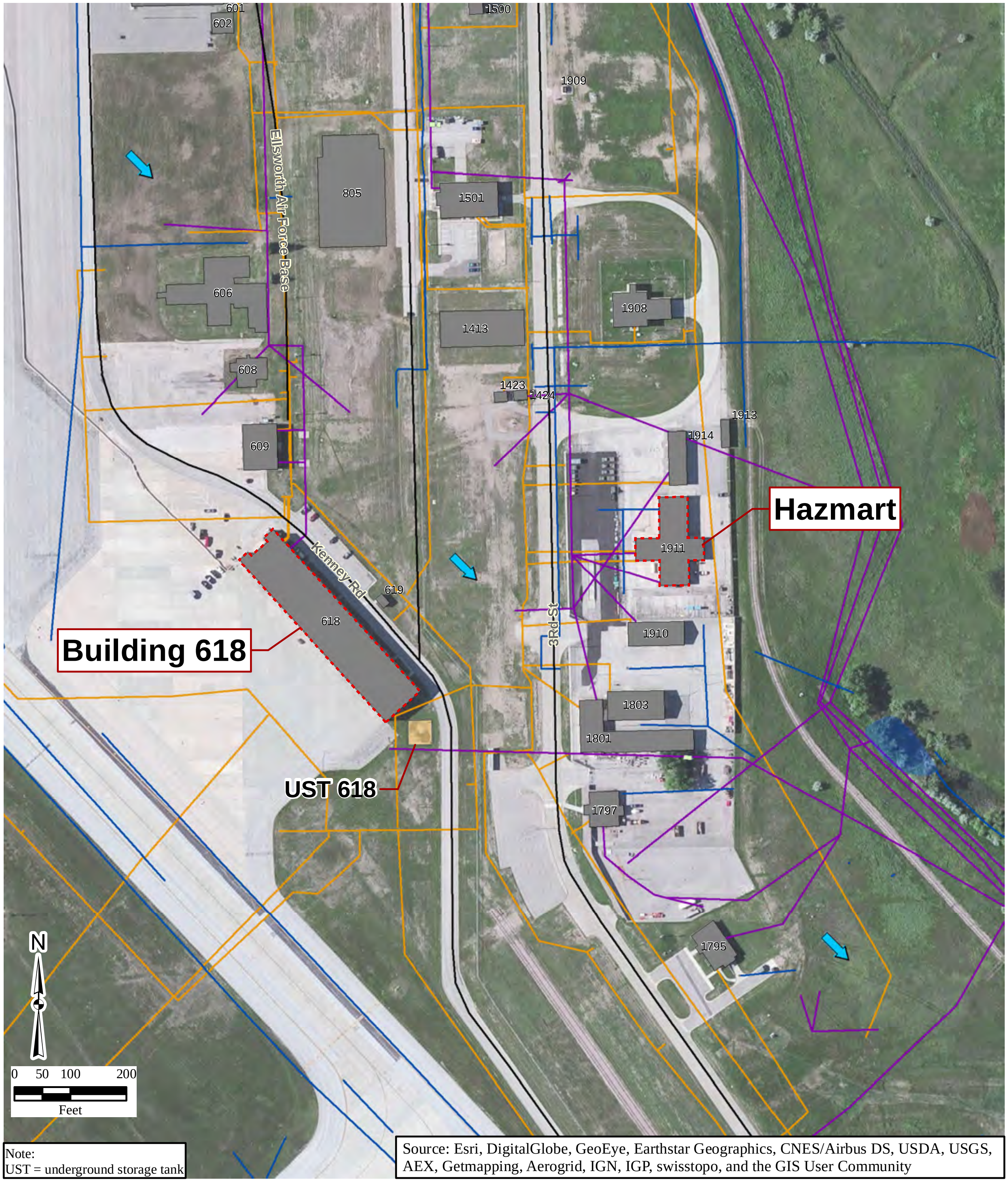
*\\roswell\Arcinfo\Av_Proj\AFCEC\Ellsworth\GIS\MapFiles\
Figure_3.1_rev3.mxd
3/30/2015 AR*

CH2MHILL.

Legend

◆	Outfall
⬆	Approximate Uppermost, Shallow Groundwater Flow Direction
—	Storm Sewer
—	Wastewater Line
—	Water Line
—	Road
⬚	Approximate Site Boundary
■	Building
🟩	Shed
🟨	UST 7246

Figure 3.1
Locations Identified in the North-central Part of Ellsworth AFB, South Dakota



Note:
UST = underground storage tank

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

\\roswell\Arcinfo\Av_Proj\AFCEC\Ellsworth\GIS\MapFiles\Figure_3.2_rev1.mxd
3/30/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

Legend

⬆ Approximate Uppermost, Shallow Groundwater Flow Direction
— Storm Sewer
— Wastewater Line
— Water Line
— Road
⬚ Approximate Site Boundary

■ Building
🟩 Shed
🟨 UST 618

Wetland
🟪 Freshwater Emergent Wetland
🟦 Freshwater Pond

Figure 3.2
Locations Identified in the Southeastern Part of Ellsworth AFB, South Dakota

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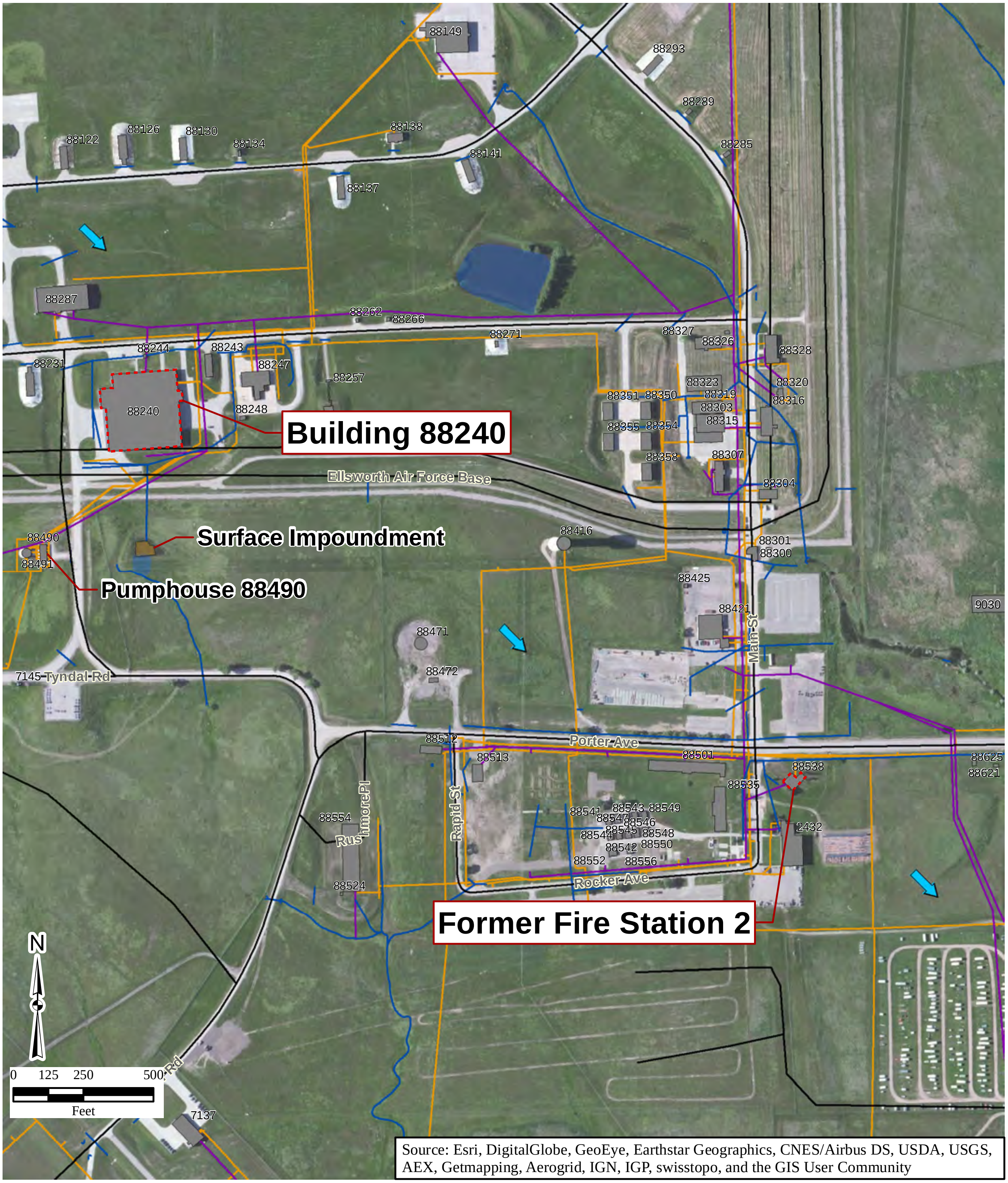

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

\\roswell\Arcinfo\Av_Proj\AFCEC\Ellsworth\GIS\MapFiles\Figure_3.3_rev1.mxd
3/30/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

Legend

- ⬆ Approximate Uppermost, Shallow Groundwater Flow Direction
- ⬚ Approximate Site Boundary
- ■ Building
- 🟩 Shed
- 🟨 Surface Impoundment
- ― Storm Sewer
- ― Wastewater Line
- ― Water Line
- ― Road

Wetland

- 🟦 Freshwater Pond

Figure 3.3
Locations Identified in the Northern Part of Ellsworth AFB, South Dakota

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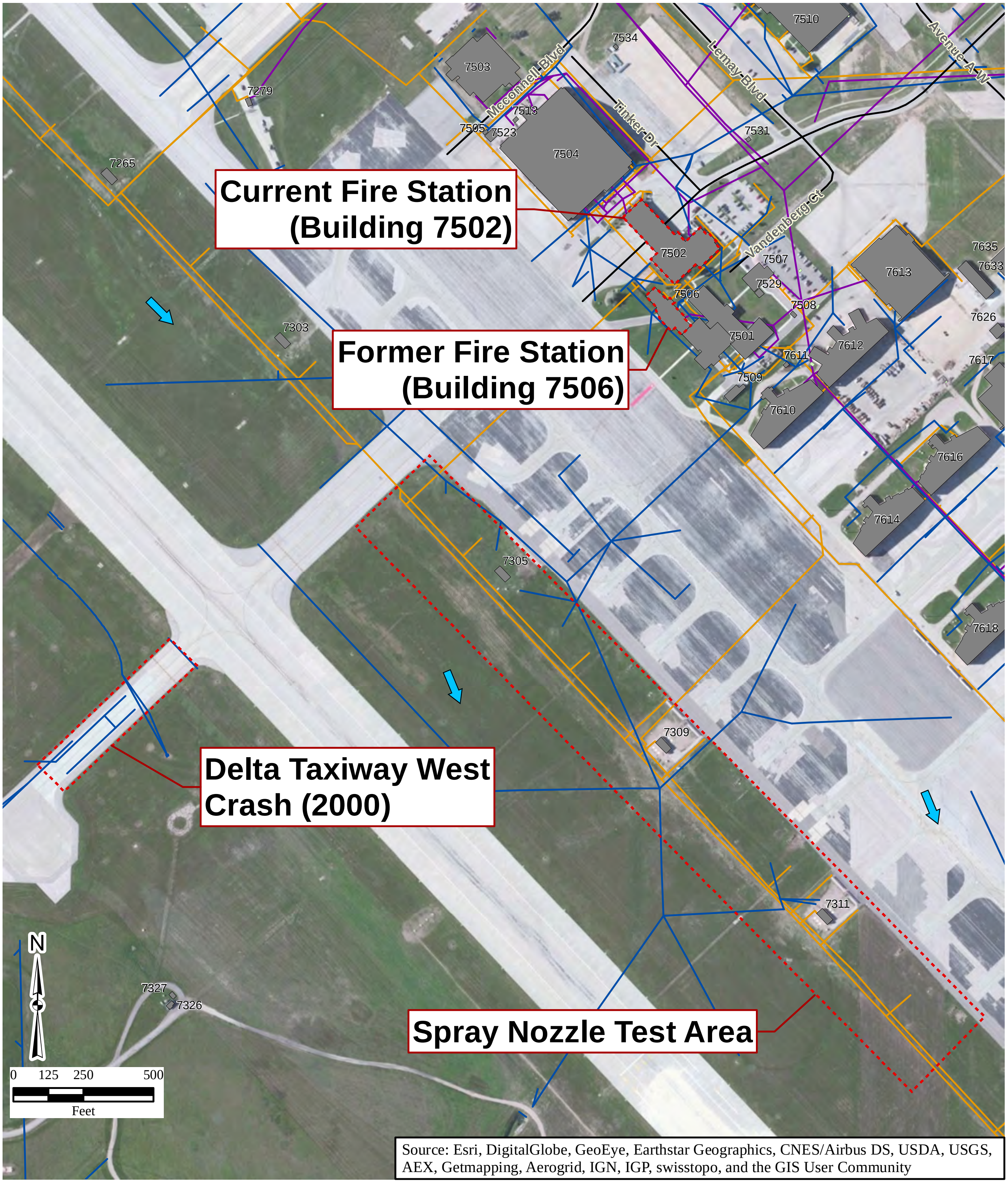

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure_3.4_rev1.mxd
3/30/2015 AR*

Legend

- ⬆ Approximate Uppermost, Shallow Groundwater Flow Direction
- — Storm Sewer
- — Wastewater Line
- — Water Line
- — Road
- ⬚ Approximate Site Boundary
- ■ Building
- 🟩 Shed

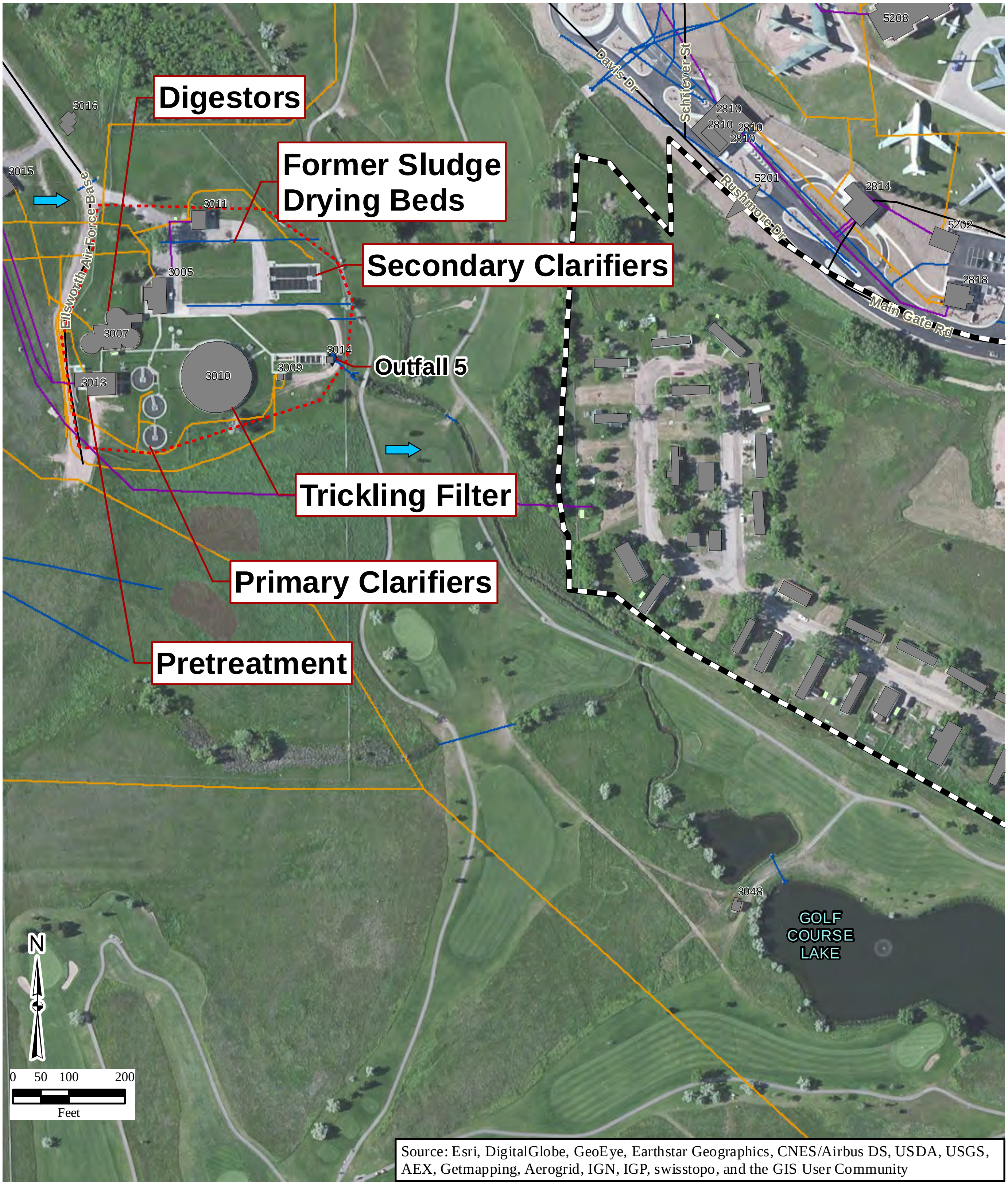
**Figure 3.4
Locations Identified in the Central Part of Ellsworth AFB, South Dakota**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

\\roswell\Arcinfo\Av_Proj\AFCEC\Ellsworth\GIS\MapFiles\Figure_3.5_rev1.mxd
3/30/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

Figure 3.5
Locations Identified in the Southern Part of Ellsworth AFB, South Dakota



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

C:\ArcGIS\Projects\AFCEC\Ellsworth\GIS\MapFiles\Figure_3.6.mxd
3/16/2015 AR
Source: Wetland, National Wetlands Inventory - Wetland Polygons, Published September 2012, U.S. Fish and Wildlife Service, Division of Habitat and Resource Conservation, Washington, D.C. http://www.fws.gov/wetlands/

CH2MHILL.

Legend

- ◆ Outfall
- ⬆ Approximate Uppermost, Shallow Groundwater Flow Direction
- — Storm Sewer
- — Wastewater Line
- — Water Line
- — Road
- ⬚ Approximate Site Boundary
- ■ Building
- 🟩 Shed

Wetland

- ▨ Freshwater Emergent Wetland

Figure 3.6
Location of Wastewater Treatment Plant
Ellsworth AFB, South Dakota

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4.0 SUMMARY AND CONCLUSIONS

The sections below summarize the findings of the PA for AFFF on Ellsworth AFB and provide conclusions based on those findings.

4.1 SUMMARY

Based on background research and visits to Ellsworth AFB, a total of 2 FTAs, 3 fire stations, 1 fire station storage area, 10 hangars (evaluated as 1 location), 2 buildings, 5 emergency response locations, 1 area where AFFF spray testing has occurred, and 3 additional miscellaneous locations have been identified as being active during the timeframe when AFFF has been used by the USAF for fire suppression. The sections below summarize the PA findings for these 18 locations.

4.1.1 Fire Training Areas

4.1.1.1 FT001 – Former Fire Training Area

Ellsworth AFB has only one former FTA (FT001) that is currently an Environmental Restoration Program location. FT001 contained a shallow, unlined burn pit with a steel aircraft mockup that was set ablaze for fire training exercises. The location of the burn area within the former FTA has changed several times over the years. This location has known releases of AFFF and soil, groundwater, and downgradient soil and sediment have been sampled as part of an SI. An RI is planned for FT001 in 2017 (Jensen, 2015, personal communication; Appendix C).

4.1.1.2 Current Fire Training Area

The current FTA was built in 1992 and began operation in 1993. This location contains a large concrete pad with a steel mockup aircraft in the center that is set ablaze for fire training exercises. The central area of the concrete pad consists of a lined pit in which the training activities are conducted. This pit holds the water and/or AFFF applied during fire training exercises. When the pit reaches capacity, the water is discharged via underground piping to a lined retention pond located just off the concrete pad to the southwest (Beck, 2015a, personal communication; Appendix C). When full, the retention pond is emptied using a 9,500-gallon tanker and a transfer pump and contents are disposed of at the 70 row diversion tank. Spray nozzle testing and flushing occurs on the concrete pad at the location but runoff is likely to have impacted adjacent soils.

4.1.2 Non-Fire Training Areas

4.1.2.1 Hangars/Buildings

Ten docks located in 70, 80, and 90 rows previously contained AFFF fire suppression systems. One pumphouse (7263) and one underground diversion tank (7246) also contained AFFF. Pumphouse 7263 contained a 1,000-gallon AFFF tank that fed 70, 80, and 90 row hangars via underground piping. Inside each dock is a trench drain system that discharged to the 150,000-gallon 70 row diversion tank (UST 7246). The contents of the diversion tank were typically released to the WWTP but could also be released to Outfall 3 on the southwest side of the runway at Ellsworth AFB through storm drains. In 1993, the entire contents of the diversion tank were released to the storm drains. In addition, 8 of the 10 docks had known discharges of AFFF inside of them and discharges were often seen coming outside of the hangar doors.

Based on sampling conducted during SI outside two of the docks with known releases (Docks 73 and 93), soil and groundwater around the hangars are contaminated. Based on these data, there is a high likelihood of contamination in soil and groundwater at all docks. Additionally, as a result of releases to the storm drains, PFCs likely impacted downgradient waterbodies.

Two additional buildings (618 and 88240) had AFFF fire suppression systems. Discharges from Building 618 went to an underground diversion tank (UST 618) while Building 88240 released AFFF discharges to a surface impoundment located south of the location. Sampling conducted during the SI at both locations indicated that media (soil, groundwater, sediment, and surface water at the surface impoundment and soil and groundwater near UST 618) have been impacted by PFCs.

4.1.2.2 Fire Stations

Former Fire Station 2 was used to support the munitions storage area until 1994. This fire station did not have access to and did not service the airfield. The likelihood of AFFF being used or released at this fire station is low. Similarly, a former fire storage area was located near the northern portion of the runway. No fire trucks were stored at this location, but the fire department stored other miscellaneous equipment here. Additionally, this location may have historically supported an old fire station (Beck, 2015a, personal communication; Appendix C). The operational dates of this fire station are unknown, and it is unknown whether AFFF was used or stored here. However, given that several other fire stations were located on Base by 1970, and they were closer to the flightline operations, and based on the location of this storage area, it is unlikely that AFFF was used here (Beck, 2015a, personal communication; Appendix C).

AFFF was used and stored at the former fire station (Building 7506). While the former fire station was in operation, it was not uncommon to see AFFF solution on the fire station driveways after AFFF operations had occurred on Base (Beck, 2015a, personal communication; Appendix C). Additionally, the spills database documented a known 5-gallon AFFF spill inside of the station (Ellsworth, 2015). Based on the history, there is potential for AFFF to have been released to adjacent soils and groundwater beneath the location.

While AFFF is used at the current fire station, no known spills have been reported, and trench drains within the building and outside of the building would prevent migration of AFFF to outside soils. Consequently, releases from the current fire station are unlikely.

4.1.2.3 Emergency Response

AFFF was known to have been used or released at five crash locations. All crash locations were located either in grassy fields adjacent to the runways or on the runway adjacent to grassy fields. The AFFF could have infiltrated soils and may have entered nearby waterbodies or storm drains.

4.1.2.4 Other

Other areas include the Hazmart, the WWTP, a spray nozzle test area, and an alert apron. Of these, only the WWTP and the spray nozzle test area location are likely to be potential release areas for AFFF. The Hazmart (Building 1911) is a chemical storage facility located on Base. While the Hazmart stores a large amount of AFFF, it is stored on pallets in shrink-wrap, and spills would be contained via the floor drain system. While crash trucks may have been present at the alert apron, no emergency response efforts are known to have been needed, and no spills or releases are documented.

The WWTP is likely to have released PFCs to soils through the sludge drying beds as well as to nearby waterbodies via discharges to Outfall 5. As part of the SI (SCF, 2015), surface water and sediment samples were collected from the drainage system that leaves the WWTP and discharges to the Golf Course Lake; these samples contained PFCs.

In the 1970s and 1980s, equipment testing was conducted near Pumphouses 1, 2, and 3 at the end of the runway using 6 percent AFFF. This routine equipment testing was often conducted when crash trucks were checked out. A truck would be driven to the edge of the ramp and the operator would shoot AFFF out across the grass (Beck, 2015a, personal communication; Appendix C). Soil and groundwater beneath this area is likely to be impacted with PFCs.

4.2 CONCLUSIONS

Table 4.1 summarizes the findings from this PA Report and presents possible future location management decisions. The identified locations are categorized by group as follows:

- Group 1 – High mass of AFFF released and probability of groundwater contamination.
- Group 2 – Unknown mass or medium mass of AFFF released.
- Group 3 – Low mass of AFFF released.
- Group 4 – No AFFF released.

Based on the group designation and rationale for each location, recommendations are provided in Table 4.1. In accordance with the USEPA CERCLA Preliminary Assessment and SI guidance documents (USEPA, 1991; USEPA, 1992), each identified location is recommended for one of the following actions: Implement removal action due to imminent threat; Close out due to no release; Initiate an RI; or Initiate an SI.

- Removal actions, as defined in CERCLA Section 104, are actions taken to eliminate, control, or otherwise mitigate a threat posed to public health or the environment due to a release or threatened release of hazardous substances (USEPA, 1991).
- Close out or no further remedial action planned (NFRAP) is defined as a disposition decision that further response under the federal Superfund is not necessary (USEPA, 1991).
- RI is defined as a field investigation to characterize the nature and extent of contamination at a location. The RI supports development, evaluation, and selection of the appropriate response alternative (USEPA, 1991).
- SI is defined as an investigation to collect and analyze waste and environmental samples to support an evaluation (USEPA, 1992).

Table 4.1
Preliminary Assessment Report Summary and Findings
Ellsworth Air Force Base, South Dakota

Locations	Group	Rationale	Recommendation
FT001 – Former FTA	Group 1	• Used for fire training from 1942 to 1990. • Known discharges to downgradient waterbodies. • Sampling conducted during broad agency announcement supports elevated PFCs in soil and groundwater.	Continue with RI that is planned for 2017.
Current FTA	Group 2	• In operation since 1993; still using AFFF. • All nozzle spray testing and flushing occurs at this location. • Most AFFF is contained within the retention pond. • Some AFFF may be released to adjacent soils.	Initiate SI.
70, 80, 90 Rows	Group 1	• Known releases in 8 of 10 hangars. • SI (SCF, 2015) indicated soil and groundwater contamination associated with Docks 73 and 93, and the 70 row diversion tank.	Initiate SI.
Building 618	Group 1	• SI (SCF, 2015) indicated soil and groundwater contamination. • Spills noted in the spills database.	Initiate SI.
Building 88240	Group 1	• SI (SCF, 2015) indicated soil, sediment, surface water, and groundwater contamination.	Initiate SI.
Former Fire Station 2	Group 4	• No known use of AFFF. • Served munitions storage area; no access to flightline.	Close out with no additional investigation.
Former Fire Storage Area	Group 4	• No known storage of AFFF.	Close out with no additional investigation.
Former Fire Station (Building 7506)	Group 3	• Overhead AFFF tanks. • Known spill (5 gallons). • Several engines/trailer contained AFFF. • AFFF seen on station driveways.	Initiate SI.

Table 4.1
Preliminary Assessment Report Summary and Findings
Ellsworth Air Force Base, South Dakota

Locations	Group	Rationale	Recommendation
Current Fire Station (Building 7502)	Group 4	• Activities occur inside fire station. • Any releases are contained within the building. • Only one spill reported but contained inside building.	Close out with no additional investigation.
B-52 Crash (1970)	Group 3	• Based on crash date, unknown whether AFFF was applied but possible.	Initiate SI.
B-1 Crash (1988)	Group 3	• Unknown amount of AFFF applied during emergency response.	Initiate SI.
Delta Taxiway West Crash (2000)	Group 3	• 100 gallons of AFFF spilled; likely migrated to adjacent soils.	Initiate SI.
Marten Crash (2003)	Group 3	• Based on crash photos, a moderate amount of AFFF was applied at the crash location.	Initiate SI.
Crash 4 (2001)	Group 3	• 10 gallons released from fire truck.	Initiate SI.
Hazmart	Group 4	• Storage of AFFF but no known spills; all spills would be contained in floor drain system.	Close out with no additional investigation.
WWTP	Group 1	• SI (SCF, 2015) indicates that downgradient sediment and surface water are impacted.	Initiate SI.
Spray Nozzle Test Area	Group 2	• AFFF applied to grassy area for up to 20 years (1970s and 1980s).	Initiate SI.
Alert Apron	Group 4	• No known emergency response or AFFF releases occurred here.	Close out with no additional investigation.

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5.0 REFERENCES

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APPENDIX A

PHOTO DOCUMENTATION

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PHOTOGRAPH LOG

Team: Elsworth AFB
Date: 2-24-15
Project Number:
Observation Period: Start: 2-24-15 Stop: 2-25-15
Weather: 2-24-15 sunny 50s, 2-25-15 cold, snowy

Photo No.	*Time*	*View Direction*	*Location/Description*
1	2:10	N	Pond #1
2	2:10	S	Current FTA
3	2:11	W	Retention Pond @ FTA
4	2:12	E	Looking @ FTA from retention pond
5	2:13	—	AFFF storage @ conex @ FTA
6	2:14	~~S~~ —	AFFF 5 gallon bucket
7	2:21	S	FT001 (old FTA)
8	2:30	SW	Drainages near FT001 → (GW daylights)
9	2:35	S	C-21 Crash @ OU 4 (drains to South) - NO AFFF used
10	2:45	N	Taxiway delta crash site (from trailer)
11	2:50	N	Taxiway delta crash site (from trailer)
12	2:52	N	Pond 3 (lined but previously unlined) Northern Docks drain here
13	2:55	S	Pond 3 beyond OWS
14	3:02	S	Pond 3 drain to unknown drainage
15	3:09	W	Alert Apron B-52s (drainage → pond 1 + 2)
16	3:12	N	Alert Apron B-52s
17	3:13	SE	1988 B-1 crash @ end of runway
18	3:15	SW	"
19	3:20	~~NW~~ —	Current Fire Dept. Trench Drains - built in 2000
20	3:20	—	Red Trucks 25 gallon
21	3:20	—	Green Trucks 500 gallon
22	3:21	—	1000 gallon truck
23	3:22	—	AFFF storage
24	3:23	—	" storage
25	3:24	—	Trench drain to OWS to
			~~old fire station~~
26	3:26	NE	Trench drains outside FD (goes to storm drain)
27	3:29	SW	Old Fire Station location (7511 Based ps)
28	3:39	—	Dock 51 - FD truck storage pre-2000 → had floor drains
29	3:40	—	Dock 51 - floor drain
30	3:46	—	Dock 51 - door tracks
31	3:58	N	70 Raw Diversion Tank Sign
32	3:58	N	70 Raw Diversion Tank
33	4:08	SW	70 " "
34	4:21	N	88240 retention pond
35	4:21	NE	" " "
36	4:26	SE	Fire Station 2 (potential AFFF source)
37	4:26	S	"
38	5:25	E	Truck crash - off overpass onto base property - beyond 2nd fence
39	5:25	E?	Truck crash - nearby drainage ditch
40	10:18		7263 Pumphouse
41	10:18	—	" inside
42	10:19	—	7263 Trench Drains
43	10:20	—	" Floor Drains
44	10:28	—	7263 AFFF storage
45	10:30	—	Dock 73 Trench Drains
46	10:31	—	Dock 73 HEF Cannons
47	10:33	—	Dock 93 HEF ~~in~~ system in MEC
48	10:33	—	" HEF control panel

HGL

PHOTOGRAPH LOG

Team:

Date:

Project Number:

Observation Period: Start: ________ Stop: ________

Weather:

Photo No.	Time	View Direction	Location/Description
49	10:35	SW	Dock 93 - PFCs detected in soil beneath pavement
50	10:36	NE	Grassy area behind Dock 93 - PFCs detected
51	10:52	W	1972 B-52 crash
52	11:01	NW	1970s to 1980s nozzol clean out / testing area
53	11:05	—	Hazmart Storage (~ 800 + buckets)
54	11:06	—	"
55	11:08	SW	618 Diversion Tank 50,000 gal
56	11:09	N	"
57	11:25	SE	WWTP - trickling Filter, digesters
58	11:25	E	" - belt filter press
59	11:35	N	Fire Station 2 (possible had AFFF on trucks)
60	11:36	NE	"
61	12:00	—	Bldg 88240 Trench Drains
62	12:03	—	" " Trench Drains @ hangar doors
63	12:08	—	~~Water~~ 88240 Fire suppression System - Water

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

Photo 20

Photo 21

Photo 22

Photo 23

Photo 24

Photo 25

Photo 26

Photo 27

Photo 28

Photo 29

Photo 30

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Photo 36

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Photo 38

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Photo 40

Photo 41

Photo 42

Photo 43

Photo 44

Photo 45

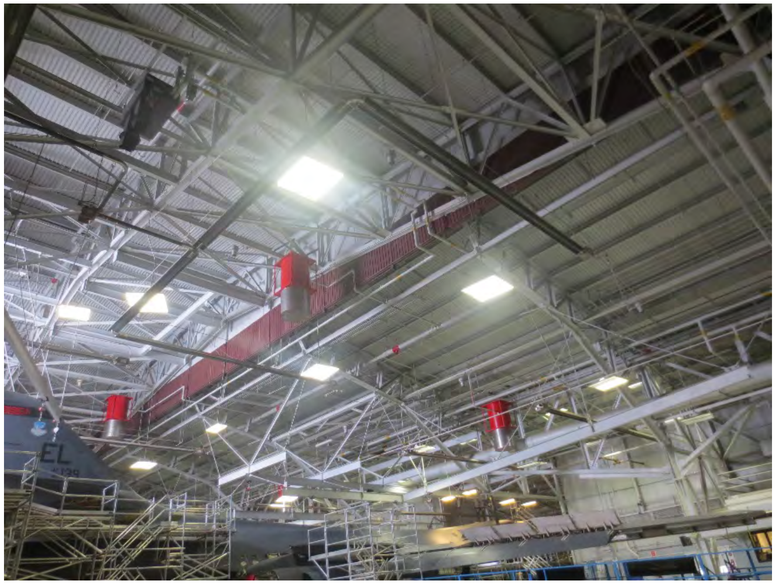

Photo 46

Photo 47

Photo 48

Photo 49

Photo 50

Photo 51

Photo 52

Photo 53

Photo 54

Photo 55

Photo 56

Photo 57

Photo 58

Photo 59

Photo 60

Photo 61

Photo 62

Photo 63

APPENDIX B

FIELD DOCUMENTATION

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POTENTIAL HAZARDOUS WASTE SITE FORMS

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°7' 51.83"

Longitude: 103°5' 56.05"

Approximate Area of Site:
_10________ Acres
____________ Square Ft

Status of Site:
☐ Active
☐ Not Specified
☑ Inactive
☐ NA (GW plume, etc.)

Site Name: FT001 - Former Fire Training Area

Site Description: FT001 is the former fire training area operated from 1942 to 1990.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator:

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: __________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: __________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☑ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☑ Suburban
☑ Rural

Beginning Year _1942_

Ending Year _1990_

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☑ Yes
☐ No

Distance to Nearest Dwelling, School, or Workplace:

_1,490__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	_____________	____
☐ Surface Impoundment	_____________	____
☐ Drums	_____________	____
☐ Tanks and Non-Dum Containers	_____________	____
☐ Chemical Waste Pile	_____________	____
☐ Scrap Metal or Junk Pile	_____________	____
☐ Tailings Pile	_____________	____
☐ Trash Pile (open drum)	_____________	____
☐ Land Treatment	_____________	____
☐ Contaminated GW Plume (unidentified source)	_____________	____
☐ Contaminated SW/Sediment (unidentified source)	_____________	____
☐ Contaminated Soil		
☐ Other_________	_____________	____
☐ No Sources	_____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☐ Yes
☑ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_250_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
____________________	_________
____________________	_________
____________________	_________
____________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

____________ __________ __________
____________ __________ __________
____________ __________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

______________ __________ ____________________
______________ __________ ____________________
______________ __________ ____________________
______________ __________ ____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_______ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________
0-1/4 Mile ____________
>1/4-1/2 Mile ____________
>1/2-1 Mile ____________
>1-2 Miles ____________
>2-3 Miles ____________
>3-4 Miles ____________
Total Within 4 Miles [3-5] _8,190_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade Pennington	Co. Code:	Cong. Dist:
Latitude: 44°7' 59.93"	Longitude: 103°5' 54.61"	Approximate Area of Site: ____7______ Acres ____________ Square Ft	Status of Site: ☑ Active ☐ Not Specified ☐ Inactive ☐ NA (GW plume, etc.)		

Site Name: Current Fire Training Area (FTA)

Site Description: Current fire training area in use since 1993. Located north of the former FT001. AFFF still in use here.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code: 57769	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership:

☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Type of Ownership:

☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:

☐ Yes
☐ No

Date: __________

CERCLIS Recommendation:

☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: __________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all that apply):

☐ Industrial
☐ Commercial
☑ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

Site Setting:

☐ Urban
☐ Suburban
☑ Rural

Years of Operation:

Beginning Year 1993

Ending Year present

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_2,250__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil	____________	____
☐ Other_________	____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
1,400 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

_____________ __________ __________
_____________ __________ __________
_____________ __________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

________________ _________ ______________________
________________ _________ ______________________
________________ _________ ______________________
________________ _________ ______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

__________ People[2]

Number of Workers Onsite[4]:

☐ None
☑ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_______ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________

0-1/4 Mile ____________

>1/4-1/2 Mile ____________

>1/2-1 Mile ____________

>1-2 Miles ____________

>2-3 Miles ____________

>3-4 Miles ____________

Total Within 4 Miles [3-5] _8,190_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands_______________________________

*Refer to PA Table 10 for calculations on air pathway exposures

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°9' 6.40"

Longitude: 103°6' 6.10"

Approximate Area of Site:
_83_____ Acres
____________ Square Ft

Status of Site:
☑ Active ☐ Not Specified
☐ Inactive ☐ NA (GW plume, etc.)

Site Name: 70, 80, 90 Row Hangars

Site Description: Hangars where AFFF fire suppression systems used to be present (docks 70, 71, 72, 73, 74, 81, 90, 91, 92, and 93). These systems were supplied with AFFF via Pumphouse 7263 located at the northeast end of 90 row. Pumphouse 7263 contained a 1,000 gallon AFFF tank that fed hangars 70, 80, and 90 via underground piping. In 2000, the systems were upgraded and each dock had its own 500-gallon AFFF tank installed inside.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: _________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year _?_

Ending Year present

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_5,660__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_3,685_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	_________
______________________	_________
______________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

______________ __________ ___________
______________ __________ ___________
______________ __________ ___________

Water Body : Flow (cfs): Sensitive Environment Type:

_________________ __________ _______________________
_________________ __________ _______________________
_________________ __________ _______________________
_________________ __________ _______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☐ None
☑ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_______ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	____________
0-1/4 Mile	____________
>1/4-1/2 Mile	____________
>1/2-1 Mile	____________
>1-2 Miles	____________
>2-3 Miles	____________
>3-4 Miles	____________
Total Within 4 Miles [3-5]	_5,660__

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None_____________________________
0-1/4 Mile	_Wetlands_______________________________
>1/4-1/2 Mile	_Wetlands_________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:

Latitude: 44°8' 11.54"	Longitude: 103°5' 9.42"	Approximate Area of Site: _0.9________ Acres ____________ Square Ft	Status of Site: ☑ Active ☐ Not Specified ☐ Inactive ☐ NA (GW plume, etc.)

Site Name: Building 618

Site Description: Building where AFFF fire suppression system used to be present. Discharge from the system was captured in floor drains and discharged to a 50,000-gallon diversion recovery tank (UST 618) via underground pipelines. The contents of the tank were released to the WWTP. The system was converted to HEF system between 2005 and 2012.

2. Owner/Operator Information

Owner: Ellsworth AFB	Operator: same as owner
Street Address: 1000 N Ellsworth Rd	Street Address:
City:	City:

State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership: ☐ Private ☐ County ☑ Federal Agency ☐ Municipal Name: _DOD__ ☐ Not Specified ☐ State ☐ Other_________ ☐ Indian	Type of Ownership: ☐ Private ☐ County ☐ Federal Agency ☐ Municipal Name: _____ ☐ Not Specified ☐ State ☐ Other_________ ☐ Indian

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO

Name of EPA or State Agency Contact:	Street Address:

City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation: ☐ Yes ☐ No Date: _________	CERCLIS Recommendation: ☐ Higher Priority SI ☐ Lower Priority SI ☐ NFRAP ☐ RCRA ☐ Other: ________ Date: _________	Signature: Name (typed): Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year _?_

Ending Year 2012

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_3,200__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile	__NA______
>1/2 - 1 Mile	__NA______
>1 - 2 Mile	__NA______
>2 - 3 Mile	__NA______
>3 - 4 Mile	__NA______
Total Within 4 Miles[4]	_NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_1,380_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	__________
______________________	__________
______________________	__________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

_____________ __________ __________
_____________ __________ __________
_____________ __________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_______ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	____________
0-1/4 Mile	____________
>1/4-1/2 Mile	____________
>1/2-1 Mile	____________
>1-2 Miles	____________
>2-3 Miles	____________
>3-4 Miles	____________

Total Within 4 Miles [3-5] _7,210_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°9' 54.73"

Longitude: 103°6' 23.53"

Approximate Area of Site:
_4.7_____ Acres
____________ Square Ft

Status of Site:
☑ Active ☐ Not Specified
☐ Inactive ☐ NA (GW plume, etc.)

Site Name: Building 88240

Site Description: Building 88240 is located in the munitions storage area on the north side of Ellsworth AFB and formerly contained an AFFF fire suppression system. Any AFFF releases in Building 88240 would have drained via underground piping to a surface impoundment located south of Building 88240.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: __________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: __________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year _?_

Ending Year present

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_7,000__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water^1:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_300_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
____________________	_________
____________________	_________
____________________	_________
____________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

____________ _________ __________
____________ _________ __________
____________ _________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

____________ _________ ________________
____________ _________ ________________
____________ _________ ________________
____________ _________ ________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☐ None
☑ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_______ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________
0-1/4 Mile ____________
>1/4-1/2 Mile ____________
>1/2-1 Mile ____________
>1-2 Miles ____________
>2-3 Miles ____________
>3-4 Miles ____________

Total Within 4 Miles [3-5] _4,970_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None__________________________
0-1/4 Mile	_Wetlands___________________________
>1/4-1/2 Mile	_Wetlands_____________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°9' 40.63"

Longitude: 103°5' 49.46"

Approximate Area of Site:
less than 1 Acres
____________ Square Ft

Status of Site:
☐ Active ☐ Not Specified
☐ Inactive ☐ NA (GW plume, etc.)

Site Name: Former Fire Station 2

Site Description: Former Fire Station 2, located in building 88538, was under air mobility command starting in 1957 and was transferred to Ellsworth in 1962. This fire station was used to support the munitions storage area until 1994. This station did not have access to and did not service the airfield. It is unknown if this station had a crash truck but a fire truck was located here in the late 1980s for structural fires. Foam rarely would have been used on structure fires.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: __________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: __________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year 1957

Ending Year 1994

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_4,550__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	_____________	____
☐ Surface Impoundment	_____________	____
☐ Drums	_____________	____
☐ Tanks and Non-Dum Containers	_____________	____
☐ Chemical Waste Pile	_____________	____
☐ Scrap Metal or Junk Pile	_____________	____
☐ Tailings Pile	_____________	____
☐ Trash Pile (open drum)	_____________	____
☐ Land Treatment	_____________	____
☐ Contaminated GW Plume (unidentified source)	_____________	____
☐ Contaminated SW/Sediment (unidentified source)	_____________	____
☐ Contaminated Soil	_____________	____
☐ Other_________	_____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☐ Yes
☑ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile	__NA______
>1/2 - 1 Mile	__NA______
>1 - 2 Mile	__NA______
>2 - 3 Mile	__NA______
>3 - 4 Mile	__NA______
Total Within 4 Miles[4]	_NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_2,100_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	__________
_______	________	__________	_________
_______	________	__________	_________
_______	________	__________	_________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	__________
______________________	__________
______________________	__________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:
____________	_________	__________
____________	_________	__________
____________	_________	__________

Water Body :	Flow (cfs):	Sensitive Environment Type:
______________	_________	____________________
______________	_________	____________________
______________	_________	____________________
______________	_________	____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

__________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_0__ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	__________
0-1/4 Mile	__________
>1/4-1/2 Mile	__________
>1/2-1 Mile	__________
>1-2 Miles	__________
>2-3 Miles	__________
>3-4 Miles	__________

Total Within 4 Miles [3-5] _5,010_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands____________________________
>1/4-1/2 Mile	_Wetlands______________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°9' 26.51"

Longitude: 103°6' 40.85"

Approximate Area of Site: _Less than 1____ Acres
____________ Square Ft

Status of Site:
☐ Active
☑ Inactive
☐ Not Specified
☐ NA (GW plume, etc.)

Site Name: Former Fire Storage Area

Site Description: A former storage area used by the fire department was located in the northern portion of the base. No fire trucks were stored here but other miscellaneous equipment was stored here by the department. Additionally, this site may have historically supported an old fire station but dates are unknown.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: _________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°8' 44.06"

Longitude: 103°5' 30.36"

Approximate Area of Site: _Less than 1____ Acres

____________ Square Ft

Status of Site:
- ☐ Active
- ☑ Inactive
- ☐ Not Specified
- ☐ NA (GW plume, etc.)

Site Name: Former Fire Station Building 7506

Site Description: The building was built in 1952, used until 2000, and demolished in 2007. Fire department vehicles were stored, cleaned, and maintained in this building. The building was fitted with trench drains which contained any spills inside the building. Trench drains discharged to the sanitary sewer system and ultimately the WWTP.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
- ☐ Private
- ☑ Federal Agency
  Name: _DOD__
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
- ☐ Private
- ☐ Federal Agency
  Name: _____
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
- ☐ Yes
- ☐ No

Date: __________

CERCLIS Recommendation:
- ☐ Higher Priority SI
- ☐ Lower Priority SI
- ☐ NFRAP
- ☐ RCRA
- ☐ Other: ________

Date: __________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year 1956

Ending Year 2000

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_20__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply) Source Waste Quantity: (include unit) Tier*:

☐ Landfill ____________ ____
☐ Surface Impoundment ____________ ____
☐ Drums ____________ ____
☐ Tanks and Non-Dum Containers ____________ ____
☐ Chemical Waste Pile ____________ ____
☐ Scrap Metal or Junk Pile ____________ ____
☐ Tailings Pile ____________ ____
☐ Trash Pile (open drum) ____________ ____
☐ Land Treatment ____________ ____
☐ Contaminated GW Plume (unidentified source) ____________ ____
☐ Contaminated SW/Sediment (unidentified source) ____________ ____
☐ Contaminated Soil
☐ Other_________ ____________ ____
☐ No Sources ____________ ____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☐ Yes
☑ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People³

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles⁴ _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area⁶:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_2,930_ Feet
________ Miles

Is There a Suspected Release to Surface Water¹:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles⁶

If Yes, Enter Population Served by Target Intake:

NA__ People⁴

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________

Total within 15 Miles ⁴ __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries¹⁰:

Water Body/ Fishery Name :	Flow (cfs):
____________________	_________
____________________	_________
____________________	_________
____________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments¹¹:

Water Body :	Flow (cfs):	Frontage miles:
____________	_________	__________
____________	_________	__________
____________	_________	__________

Water Body :	Flow (cfs):	Sensitive Environment Type:
_______________	_________	____________________
_______________	_________	____________________
_______________	_________	____________________
_______________	_________	____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_0__ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	____________
0-1/4 Mile	____________
>1/4-1/2 Mile	____________
>1/2-1 Mile	____________
>1-2 Miles	____________
>2-3 Miles	____________
>3-4 Miles	____________

Total Within 4 Miles [3-5] _6,210_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands______________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:
Latitude: 44°8' 47.24"	Longitude: 103°5' 40.94"	Approximate Area of Site: _Less than 1____ Acres ____________ Square Ft	Status of Site: ☑ Active ☐ Not Specified ☐ Inactive ☐ NA (GW plume, etc.)		

Site Name: Current Fire Station (Building 7502)

Site Description: The current fire station, Building 7502, is located in the central portion of the base between 50 row and 60 row. The building was built in 2000 at which time the fire department moved out of the former location (Building 7506). AFFF is stored in the fire department in a storage room and in fire trucks/trailers.

2. Owner/Operator Information

Owner: Ellsworth AFB	Operator: same as owner
Street Address: 1000 N Ellsworth Rd	Street Address:
City:	City:
State: SD Zip Code: Telephone:	State: Zip Code: Telephone:

Type of Ownership:
- ☐ Private
- ☑ Federal Agency
  Name: _DOD__
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

Type of Ownership:
- ☐ Private
- ☐ Federal Agency
  Name: _____
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
- ☐ Yes
- ☐ No

Date: _________

CERCLIS Recommendation:
- ☐ Higher Priority SI
- ☐ Lower Priority SI
- ☐ NFRAP
- ☐ RCRA
- ☐ Other: ________

Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year 2000

Ending Year present

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_0__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil	____________	____
☐ Other_________	____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☐ Yes
☑ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile	__NA______
>1/2 - 1 Mile	__NA______
>1 - 2 Mile	__NA______
>2 - 3 Mile	__NA______
>3 - 4 Mile	__NA______
Total Within 4 Miles[4]	_NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_2,950_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________
_______	________	_________	_________

Total within 15 Miles [4] _________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
____________________	_________
____________________	_________
____________________	_________
____________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

_____________ __________ __________
_____________ __________ __________
_____________ __________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☐ None
☑ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_0__ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________

0-1/4 Mile ____________

>1/4-1/2 Mile ____________

>1/2-1 Mile ____________

>1-2 Miles ____________

>2-3 Miles ____________

>3-4 Miles ____________

Total Within 4 Miles [3-5] _6,210_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°9' 8.92"

Longitude: 103°6' 36.22"

Approximate Area of Site: _Less than 1____ Acres
____________ Square Ft

Status of Site:
☐ Active
☐ Not Specified
☑ Inactive
☐ NA (GW plume, etc.)

Site Name: B-52 Crash (1970)

Site Description: In 1970, a B-52 caught fire and crashed during landing, skidding into brick pumphouse containing six 25,000 gallon USTs. The crash occurred along the northern portion of the runway. Because this occurred in 1970, the same year AFFF was put into use, it is unknown if the truck was carrying AFFF or not.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: _________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year NA

Ending Year NA

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

1,100__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil	____________	____
☐ Other_________	____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_1,875 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________
_______	________	_________	__________

Total within 15 Miles[4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	_________
______________________	_________
______________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

___________ ___________ ___________
___________ ___________ ___________
___________ ___________ ___________

Water Body : Flow (cfs): Sensitive Environment Type:

___________ ___________ ___________
___________ ___________ ___________
___________ ___________ ___________
___________ ___________ ___________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

_0__ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________

0-1/4 Mile ____________

>1/4-1/2 Mile ____________

>1/2-1 Mile ____________

>1-2 Miles ____________

>2-3 Miles ____________

>3-4 Miles ____________

Total Within 4 Miles [3-5] _6,250_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________
0-1/4 Mile	_Wetlands____________________
>1/4-1/2 Mile	_Wetlands____________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification	
State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:
Latitude: 44°7' 43.33"	Longitude: 103°5' 58.77"	Approximate Area of Site: _Less than 1____ Acres ____________ Square Ft	Status of Site: ☐ Active ☐ Not Specified ☑ Inactive ☐ NA (GW plume, etc.)		

Site Name: B-1 Crash (1988)

Site Description: In 1988, a B-1 crashed while landing just short of the southern end of the runway.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership: ☐ Private ☑ Federal Agency Name: _DOD__ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________	Type of Ownership: ☐ Private ☐ Federal Agency Name: _____ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation: ☐ Yes ☐ No Date: _________	CERCLIS Recommendation: ☐ Higher Priority SI ☐ Lower Priority SI ☐ NFRAP ☐ RCRA ☐ Other: ________ Date: _________	Signature: Name (typed): Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year NA

Ending Year NA

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

1,550__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream
☐ Bay
☐ River
☐ Ocean
☑ Pond
☐ Other________
☐ Lake

Shortest Overland Distance From Any Source to Surface Water:

_1,300 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	________	_________	__________
_______	________	__________	_________
_______	________	__________	_________
_______	________	__________	_________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	__________
______________________	__________
______________________	__________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

______________ ___________ ___________
______________ ___________ ___________
______________ ___________ ___________

Water Body : Flow (cfs): Sensitive Environment Type:

________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________
0-1/4 Mile ____________
>1/4-1/2 Mile ____________
>1/2-1 Mile ____________
>1-2 Miles ____________
>2-3 Miles ____________
>3-4 Miles ____________
Total Within 4 Miles [3-5] _7,530_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands_________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:
Latitude: 44°8' 30.33"	Longitude: 103°6' 8.94"	Approximate Area of Site: _Less than 1____ Acres ____________ Square Ft		Status of Site: ☐ Active ☐ Not Specified ☑ Inactive ☐ NA (GW plume, etc.)	

Site Name: Delta Taxiway West Crash (2000)

Site Description: In August 2000, a P-15 fire truck rear ended an AFFF foam trailer on Delta Taxiway West. Approximately 100 gallons of AFFF was spilled at the scene.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership:
- ☐ Private
- ☑ Federal Agency
  Name: _DOD__
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

Type of Ownership:
- ☐ Private
- ☐ Federal Agency
  Name: _____
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
- ☐ Yes
- ☐ No

Date: _________

CERCLIS Recommendation:
- ☐ Higher Priority SI
- ☐ Lower Priority SI
- ☐ NFRAP
- ☐ RCRA
- ☐ Other: ________

Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year NA

Ending Year NA

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

2,500__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	_____________	____
☐ Surface Impoundment	_____________	____
☐ Drums	_____________	____
☐ Tanks and Non-Dum Containers	_____________	____
☐ Chemical Waste Pile	_____________	____
☐ Scrap Metal or Junk Pile	_____________	____
☐ Tailings Pile	_____________	____
☐ Trash Pile (open drum)	_____________	____
☐ Land Treatment	_____________	____
☐ Contaminated GW Plume (unidentified source)	_____________	____
☐ Contaminated SW/Sediment (unidentified source)	_____________	____
☐ Contaminated Soil	_____________	____
☐ Other_________	_____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_1,300 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	_________
______________________	_________
______________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

____________ __________ __________
____________ __________ __________
____________ __________ __________

Water Body : Flow (cfs): Sensitive Environment Type:

______________ _________ ____________________
______________ _________ ____________________
______________ _________ ____________________
______________ _________ ____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________

0-1/4 Mile ____________

>1/4-1/2 Mile ____________

>1/2-1 Mile ____________

>1-2 Miles ____________

>2-3 Miles ____________

>3-4 Miles ____________

Total Within 4 Miles [3-5] _7,090_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None_________________________
0-1/4 Mile	_Wetlands___________________________
>1/4-1/2 Mile	_Wetlands______________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:

Latitude: 44°7' 4.79"	Longitude: 103°4' 45.77"	Approximate Area of Site: _Less than 1____ Acres ____________ Square Ft	Status of Site: ☐ Active ☐ Not Specified ☑ Inactive ☐ NA (GW plume, etc.)

Site Name: Marten Crash (2003)

Site Description: In February 2003, a privately owned semitruck crashed off of an overpass on I-90 while heading west and landed in a grassy field on Ellsworth AFB property. The Ellsworth AFB Fire Department responded to the crash and applied AFFF.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership: ☐ Private ☑ Federal Agency Name: _DOD__ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________	Type of Ownership: ☐ Private ☐ Federal Agency Name: _____ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation: ☐ Yes ☐ No Date: _________	CERCLIS Recommendation: ☐ Higher Priority SI ☐ Lower Priority SI ☐ NFRAP ☐ RCRA ☐ Other: ________ Date: _________	Signature: Name (typed): Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year NA

Ending Year NA

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing

☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☐ Onsite checked: ☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:
☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

850__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_500 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	_________
______________________	_________
______________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:

Water Body :	Flow (cfs):	Sensitive Environment Type:

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________
0-1/4 Mile ____________
>1/4-1/2 Mile ____________
>1/2-1 Mile ____________
>1-2 Miles ____________
>2-3 Miles ____________
>3-4 Miles ____________
Total Within 4 Miles [3-5] _7,250_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:
Latitude: 44°9' 23.90"	Longitude: 103°6' 33.81"	Approximate Area of Site: _Less than 1____ Acres ____________ Square Ft	Status of Site: ☐ Active ☐ Not Specified ☑ Inactive ☐ NA (GW plume, etc.)		

Site Name: Crash 4 (2001)

Site Description: In March 2000, Crash 4, a P-23 fire truck, apparently released 10 gallons of AFFF near the vicinity of Building 7140.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership: ☐ Private ☑ Federal Agency Name: _DOD__ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________	Type of Ownership: ☐ Private ☐ Federal Agency Name: _____ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation: ☐ Yes ☐ No Date: _________	CERCLIS Recommendation: ☐ Higher Priority SI ☐ Lower Priority SI ☐ NFRAP ☐ RCRA ☐ Other: ________ Date: _________	Signature: Name (typed): Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields
☐ Agriculture
☐ Mining
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year NA

Ending Year NA

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  - ☐ Lumber and Wood Products
  - ☐ Inorganic Chemicals
  - ☐ Plastic and/or Rubber Products
  - ☐ Paints, Varnishes
  - ☐ Industrial Organic Chemicals
  - ☐ Agricultural Chemicals
  - ☐ Miscellaneous Chemical Products
  - ☐ Primary Metals
  - ☐ Metal Coating, Plating, Engraving
  - ☐ Metal Forging, Stamping
  - ☐ Fabricated Structural Metal Products
  - ☐ Electronic Equipment
  - ☐ Other Manufacturing

☐ Mining
  - ☐ Metals
  - ☐ Coal
  - ☐ Oil and Gas
  - ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  - ☐ Treatment, Storage, or Disposal
  - ☐ Large Quantity Generator
  - ☐ Small Quantity Generator
  - ☐ Subtitle D
    - ☐ Municipal
    - ☐ Industrial
  - ☐ "Converter"
  - ☐ "Protective Filer"
  - ☐ "Non-or Late Filer"

☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

1,210__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste
☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_890 Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	_________
______________________	_________
______________________	_________
______________________	_________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:	Water Body :	Flow (cfs):	Sensitive Environment Type:
___________	________	_________	_____________	________	___________________
___________	________	_________	_____________	________	___________________
___________	________	_________	_____________	________	___________________
			_____________	________	___________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

__________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ___________
0-1/4 Mile ___________
>1/4-1/2 Mile ___________
>1/2-1 Mile ___________
>1-2 Miles ___________
>2-3 Miles ___________
>3-4 Miles ___________
Total Within 4 Miles [3-5] _5,010_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands_______________________________

*Refer to PA Table 10 for calculations on air pathway exposures

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification	
State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:

Latitude: 44°8' 9.52"	Longitude: 103°4' 58.93"	Approximate Area of Site: _0.2____ Acres ____________ Square Ft	Status of Site: ☑ Active ☐ Not Specified ☐ Inactive ☐ NA (GW plume, etc.)

Site Name: Hazmart

Site Description: Hazmart (Building 1911) is a chemical storage facility located on base. It is located in the southern portion of the base . The hazmart currently stores about 3,965 gallons of AFFF (Beck, 2015, personal communication). Most containers are shrink wrapped and on pallets. The storage room has floor drains that would contain any spills.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership: ☐ Private ☑ Federal Agency Name: _DOD__ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________	Type of Ownership: ☐ Private ☐ Federal Agency Name: _____ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation: ☐ Yes ☐ No Date: __________	CERCLIS Recommendation: ☐ Higher Priority SI ☐ Lower Priority SI ☐ NFRAP ☐ RCRA ☐ Other: ________ Date: __________	Signature: Name (typed): Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year ?

Ending Year present

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  - ☐ Lumber and Wood Products
  - ☐ Inorganic Chemicals
  - ☐ Plastic and/or Rubber Products
  - ☐ Paints, Varnishes
  - ☐ Industrial Organic Chemicals
  - ☐ Agricultural Chemicals
  - ☐ Miscellaneous Chemical Products
  - ☐ Primary Metals
  - ☐ Metal Coating, Plating, Engraving
  - ☐ Metal Forging, Stamping
  - ☐ Fabricated Structural Metal Products
  - ☐ Electronic Equipment
  - ☐ Other Manufacturing

☐ Mining
  - ☐ Metals
  - ☐ Coal
  - ☐ Oil and Gas
  - ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  - ☐ Treatment, Storage, or Disposal
  - ☐ Large Quantity Generator
  - ☐ Small Quantity Generator
  - ☐ Subtitle D
    - ☐ Municipal
    - ☐ Industrial
  - ☐ "Converter"
  - ☐ "Protective Filer"
  - ☐ "Non-or Late Filer"

☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_0__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	_____________	____
☐ Surface Impoundment	_____________	____
☐ Drums	_____________	____
☐ Tanks and Non-Dum Containers	_____________	____
☐ Chemical Waste Pile	_____________	____
☐ Scrap Metal or Junk Pile	_____________	____
☐ Tailings Pile	_____________	____
☐ Trash Pile (open drum)	_____________	____
☐ Land Treatment	_____________	____
☐ Contaminated GW Plume (unidentified source)	_____________	____
☐ Contaminated SW/Sediment (unidentified source)	_____________	____
☐ Contaminated Soil		
☐ Other_________	_____________	____
☐ No Sources	_____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☐ Yes
☑ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile	__NA______
>1/2 - 1 Mile	__NA______
>1 - 2 Mile	__NA______
>2 - 3 Mile	__NA______
>3 - 4 Mile	__NA______
Total Within 4 Miles[4]	_NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_790_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
______________________	__________
______________________	__________
______________________	__________
______________________	__________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:
____________	_________	__________
____________	_________	__________
____________	_________	__________

Water Body :	Flow (cfs):	Sensitive Environment Type:
_______________	_________	_____________________
_______________	_________	_____________________
_______________	_________	_____________________
_______________	_________	_____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☐ None
☑ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	____________
0-1/4 Mile	____________
>1/4-1/2 Mile	____________
>1/2-1 Mile	____________
>1-2 Miles	____________
>2-3 Miles	____________
>3-4 Miles	____________
Total Within 4 Miles [3-5]	__

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None____________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands_______________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°7' 54.49"

Longitude: 103°4' 41.05"

Approximate Area of Site:
_4.3_______ Acres
____________ Square Ft

Status of Site:
☐ Active ☐ Not Specified
☑ Inactive ☐ NA (GW plume, etc.)

Site Name: Waste Water Treatment Plant

Site Description: The base WWTP is located in the southeast portion of the base. The WWTP was decommissioned in July of 2014. During operations, all waste within the sanitary sewer and the industrial sewer lines went to the WWTP. Treated water was discharged to outfall 5, which flowed to unnamed drainages then to Golf Course Lake and to outfall 6 where it went offbase and discharged to Boxelder Creek.

2. Owner/Operator Information

Owner: Ellsworth AFB	Operator: same as owner
Street Address: 1000 N Ellsworth Rd	Street Address:
City:	City:
State: SD	State:
Zip Code:	Zip Code:
Telephone:	Telephone:
Type of Ownership: ☐ Private ☑ Federal Agency Name: _DOD__ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________	Type of Ownership: ☐ Private ☐ Federal Agency Name: _____ ☐ State ☐ Indian ☐ County ☐ Municipal ☐ Not Specified ☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: _________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields

☐ Agriculture
☐ Mining
☑ DOD
☐ DOE

☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year ?

Ending Year 2014

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing

☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_1,500__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill		
☐ Surface Impoundment		
☐ Drums		
☐ Tanks and Non-Dum Containers		
☐ Chemical Waste Pile		
☐ Scrap Metal or Junk Pile		
☐ Tailings Pile		
☐ Trash Pile (open drum)		
☐ Land Treatment		
☐ Contaminated GW Plume (unidentified source)		
☐ Contaminated SW/Sediment (unidentified source)		
☐ Contaminated Soil		
☐ Other_________		
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste

☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream
☐ Bay
☐ River
☐ Ocean
☑ Pond
☐ Other________
☐ Lake

Shortest Overland Distance From Any Source to Surface Water:
_120_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:
____________	__________	__________
____________	__________	__________
____________	__________	__________

Water Body :	Flow (cfs):	Sensitive Environment Type:
________________	_________	______________________
________________	_________	______________________
________________	_________	______________________
________________	_________	______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite	____________
0-1/4 Mile	____________
>1/4-1/2 Mile	____________
>1/2-1 Mile	____________
>1-2 Miles	____________
>2-3 Miles	____________
>3-4 Miles	____________

Total Within 4 Miles 3-5 _7,530_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands______________________________

1-11 Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD	CERCLIS #:
CERCLIS Discovery Date:	

1. General Site Information

Name: Ellsworth AFB	Street Address: 1000 N Ellsworth Rd				
City:	State: SD	Zip Code: 57769	County: Meade	Co. Code:	Cong. Dist:
Latitude: 44°8' 25.23"	Longitude: 103°5' 35.30"	Approximate Area of Site: _6.8_______ Acres ____________ Square Ft	Status of Site: ☐ Active ☐ Not Specified ☑ Inactive ☐ NA (GW plume, etc.)		

Site Name: Spray Nozzle Test Area

Site Description: In the 1970s and 1980s, equipment testing was conducted near pumphouses 1-3 at the end of the runway using 6% AFFF. This routine equipment testing was often conducted when crash trucks were checked out. The truck would be driven to the edge of the ramp and the operator would shoot foam out across the grass.

2. Owner/Operator Information

Owner: Ellsworth AFB			Operator: same as owner		
Street Address: 1000 N Ellsworth Rd			Street Address:		
City:			City:		
State: SD	Zip Code:	Telephone:	State:	Zip Code:	Telephone:

Type of Ownership:

☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Type of Ownership:

☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky	Agency/Organization: CH2M HILL	Date Prepared: 03/03/2015
Street Address: 9191 South Jamaica Street	City: Englewood	State: CO
Name of EPA or State Agency Contact:	Street Address:	
City:	State:	Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:

☐ Yes
☐ No

Date: _________

CERCLIS Recommendation:

☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all	Site Setting:	Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields
☐ Agriculture
☐ Mining
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year 1970s

Ending Year 1980s

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_1,050__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil	____________	____
☐ Other_________	____________	____
☐ No Sources		

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste
☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☑ Yes
☐ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:

________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:

_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

Depth to Shallowest Aquifer:

~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

*Use population #s for PA Table 2

*Note nearest well for #5 on GW Pathway Scoresheet

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:

_1,400_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☑ Yes
☐ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________
_______	_________	__________	__________

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:

_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):
_______________________	__________
_______________________	__________
_______________________	__________
_______________________	__________

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body :	Flow (cfs):	Frontage miles:
____________	_________	__________
____________	_________	__________
____________	_________	__________

Water Body :	Flow (cfs):	Sensitive Environment Type:
_______________	_________	_____________________
_______________	_________	_____________________
_______________	_________	_____________________
_______________	_________	_____________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

__________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ___________
0-1/4 Mile ___________
>1/4-1/2 Mile ___________
>1/2-1 Mile ___________
>1-2 Miles ___________
>2-3 Miles ___________
>3-4 Miles ___________
Total Within 4 Miles [3-5] _7,090_

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands______________________________
>1/4-1/2 Mile	_Wetlands_________________________________

*Refer to PA Table 10 for calculations on air pathway exposures

[1-11] Refers to question number on the PA scoresheet for each particular pathway

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: SD

CERCLIS #:

CERCLIS Discovery Date:

1. General Site Information

Name: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code: 57769

County: Meade

Co. Code:

Cong. Dist:

Latitude: 44°7' 46.17"

Longitude: 103°5' 37.53"

Approximate Area of Site:
_43____ Acres
____________ Square Ft

Status of Site:
☐ Active
☑ Inactive
☐ Not Specified
☐ NA (GW plume, etc.)

Site Name: Alert Apron

Site Description: The alert apron is located in the southern portion of the base just west of the southern end of the runway. During the cold war, B-52s were parked down here on stand-by for quick take off. Crash trucks were also located here in the event of an emergency.

2. Owner/Operator Information

Owner: Ellsworth AFB

Street Address: 1000 N Ellsworth Rd

City:

State: SD

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☑ Federal Agency
Name: _DOD__
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

Operator: same as owner

Street Address:

City:

State:

Zip Code:

Telephone:

Type of Ownership:
☐ Private
☐ Federal Agency
Name: _____
☐ State
☐ Indian
☐ County
☐ Municipal
☐ Not Specified
☐ Other_________

3. Site Evaluator Information

Name of Evaluator: Kelly Teplitsky

Agency/Organization: CH2M HILL

Date Prepared: 03/03/2015

Street Address: 9191 South Jamaica Street

City: Englewood

State: CO

Name of EPA or State Agency Contact:

Street Address:

City:

State:

Telephone:

4. Site Disposition *(for EPA use only)*

Emergency Response/Removal Assessment Recommendation:
☐ Yes
☐ No
Date: _________

CERCLIS Recommendation:
☐ Higher Priority SI
☐ Lower Priority SI
☐ NFRAP
☐ RCRA
☐ Other: ________
Date: _________

Signature:

Name (typed):

Position:

5. General Site Characteristics

Predominant Land Use Within 1 Mile of Site (check all

Site Setting:

Years of Operation:

that apply):

☐ Industrial
☐ Commercial
☐ Residential
☐ Forest/Fields
☐ Agriculture
☐ Mining
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility: __________
☐ Other _______

☐ Urban
☐ Suburban
☑ Rural

Beginning Year 1947

Ending Year 1991

☐ Unknown

Type of Site Operations (check all that apply):

☐ Manufacturing (must check subcategory)
  ☐ Lumber and Wood Products
  ☐ Inorganic Chemicals
  ☐ Plastic and/or Rubber Products
  ☐ Paints, Varnishes
  ☐ Industrial Organic Chemicals
  ☐ Agricultural Chemicals
  ☐ Miscellaneous Chemical Products
  ☐ Primary Metals
  ☐ Metal Coating, Plating, Engraving
  ☐ Metal Forging, Stamping
  ☐ Fabricated Structural Metal Products
  ☐ Electronic Equipment
  ☐ Other Manufacturing
☐ Mining
  ☐ Metals
  ☐ Coal
  ☐ Oil and Gas
  ☐ Non-metallic Minerals

☐ Retail
☐ Recycling
☐ Junk/Salvage Yard
☐ Municipal Landfill
☐ Other Landfill
☑ DOD
☐ DOE
☐ DOI
☐ Other Federal Facility _______
☐ RCRA
  ☐ Treatment, Storage, or Disposal
  ☐ Large Quantity Generator
  ☐ Small Quantity Generator
  ☐ Subtitle D
    ☐ Municipal
    ☐ Industrial
  ☐ "Converter"
  ☐ "Protective Filer"
  ☐ "Non-or Late Filer"
☐ Note Specified
☐ Other_____________

Waste Generated:

☑ Onsite
☐ Offsite
☐ Onsite and Offsite

Waste Deposition Authorized By:

☑ Present Owner
☐ Former Owner
☐ Present & Former Owner
☐ Unauthorized
☐ Unknown

Waste Accessible to the Public:

☐ Yes
☑ No

Distance to Nearest Dwelling, School, or Workplace:

_2,075__ Feet

6. Waste Characteristics Information

(Refer to PA Table 1 for WC Score)

Source Type: (check all that apply)	Source Waste Quantity: (include unit)	Tier*:
☐ Landfill	____________	____
☐ Surface Impoundment	____________	____
☐ Drums	____________	____
☐ Tanks and Non-Dum Containers	____________	____
☐ Chemical Waste Pile	____________	____
☐ Scrap Metal or Junk Pile	____________	____
☐ Tailings Pile	____________	____
☐ Trash Pile (open drum)	____________	____
☐ Land Treatment	____________	____
☐ Contaminated GW Plume (unidentified source)	____________	____
☐ Contaminated SW/Sediment (unidentified source)	____________	____
☐ Contaminated Soil		
☐ Other_________	____________	____
☐ No Sources	____________	____

*C=Constituent, W=Wastestream, V=Volume, A=Area

General Type of Waste (check all that apply):

☐ Metals
☐ Organics
☐ Inorganics
☐ Solvents
☐ Paints/Pigments
☐ Laboratory/Hospital Waste
☐ Radioactive Waste
☐ Construction/Demolition Waste
☐ Pesticides/Herbicides
☐ Acids/Bases
☐ Oily Waste
☐ Municipal Waste
☐ Mining Waste
☐ Explosives
☑ Other _AFFF_

Physical State of Waste as Deposited (check all that apply):

☐ Solid
☐ Sludge
☐ Powder
☑ Liquid
☐ Gas

7. Ground Water Pathway

Is Ground Water Used for Drinking Within 4 Miles:

☑ Yes
☐ No

If Yes, Distance to nearest

Is There a Suspected Release to Ground Water[1]:

☐ Yes
☑ No

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile __NA_____

>1/4 - 1/2 Mile NA

Drinking Well:
________ Feet

Type of Drinking Water Wells Within 4 Miles
(check all that apply):

☑ Municipal
☐ Private
☐ None

Have Primary Target Drinking Water Wells Been Identified:

☐ Yes
☑ No

If Yes, Enter Primary Target Population:
_________ People[3]

>1/4 - 1/2 Mile __NA______

>1/2 - 1 Mile __NA______

>1 - 2 Mile __NA______

>2 - 3 Mile __NA______

>3 - 4 Mile __NA______

Total Within 4 Miles[4] _NA______

*Use population #s for PA Table 2
*Note nearest well for #5 on GW Pathway Scoresheet

Depth to Shallowest Aquifer:
~ 10 to 50 Feet

Karst Terrain/Aquifer Present:

☐ Yes
☑ No

Nearest Designated Wellhead Protection Area[6]:

☐ Underlies Site
☐ >0-4 Miles
☑ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):

☑ Stream ☐ River ☑ Pond ☐ Lake
☐ Bay ☐ Ocean ☐ Other________

Shortest Overland Distance From Any Source to Surface Water:
_1,250_ Feet
________ Miles

Is There a Suspected Release to Surface Water[1]:

☐ Yes
☑ No

Site is Located in:

☐ Annual - 10 yr Floodplain
☐ >10yr - 100yr Floodplain
☐ >100yr - 500yr Floodplain
☐ >500yr Floodplain

Drinking Water Intake Located Along the Surface Water Migration Path:

☐ Yes
☑ No

Have Primary Target Drinking Water Intakes Been Identified:

☐ Yes
☑ No

If Yes, Distance to Nearest Drinking Water Intake : _________ Miles[6]

If Yes, Enter Population Served by Target Intake:

NA__ People[4]

List All Secondary Target Drinking Water Intakes:

Name:	Water Body:	Flow (cfs):	Population Served:

Total within 15 Miles [4] __________

Fisheries Located Along the Surface Water Migration Path:

☐ Yes ☑ No

If Yes, Distance to Nearest Fishery:
_________ Miles

Have Primary Target Fisheries Been Identified:

☐ Yes ☑ No

List All Secondary Target Fisheries[10]:

Water Body/ Fishery Name :	Flow (cfs):

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:

☑ Yes
☐ No

Have Primary Target Wetlands Been Identified:

☐ Yes
☑ No

List All Wetlands:

Other Sensitive Environments Located Along the Surface Water Migration Path:

☐ Yes
☑ No

If Yes, Distance to Nearest Sensitive Environment: _________ Miles

Have Primary Target Sensitive Environments Been Identified:

☐ Yes
☑ No

List All Sensitive Environments[11]:

Water Body : Flow (cfs): Frontage miles:

______________ __________ ___________
______________ __________ ___________
______________ __________ ___________

Water Body : Flow (cfs): Sensitive Environment Type:

________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________
________________ __________ ______________________

9. Soil Exposure Pathway

Are People Occupying Residence or Attending School or Daycare on or Within 200 Feet of Area of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, Enter Total Residential Population:

___________ People[2]

Number of Workers Onsite[4]:

☑ None
☐ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Population Within 1 Mile:

___ People[7]

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:

☐ Yes
☑ No

If Yes, List Each Terrestrial Sensitive Environment[5]:

____
____
____

*Refer to PA Table 7 for environment types

10. Air Pathway

Is there a Suspected Release to Air[1]:

☐ Yes
☑ No

Enter Total Population on or Within:

Onsite ____________

0-1/4 Mile ____________

>1/4-1/2 Mile ____________

>1/2-1 Mile ____________

>1-2 Miles ____________

>2-3 Miles ____________

>3-4 Miles ____________

Total Within 4 Miles [3-5] __

Wetlands Located Within 4 Miles of the Site[6]:

☑ Yes
☐ No

If Yes, How Many Acres: _______ Acres

Other Sensitive Environments Located Within 4 Miles of the Site:

☐ Yes
☑ No

List All Sensitive Environments Within 1/2 Mile of the Site[6]:

Distance:	Sensitive Environment Type/Wetlands Area (acres):
Onsite	None___________________________
0-1/4 Mile	_Wetlands_____________________________
>1/4-1/2 Mile	_Wetlands________________________________

[1-11] Refers to question number on the PA scoresheet for each particular pathway

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APPENDIX C

RECORDS OF COMMUNICATION

Ellsworth AFB AFFF Preliminary Assessment Meeting
Feburary 23, 2015 10am-noon
Sign In Sheet

Meeting Attendee	Organization	Job Title	How Long in Current Position?	How Long at this Base in Current and Previous Positions?	Have you held similar positions at other bases? Which Bases?	How Long?
Name Daniel Ellefson Phone	28 CES utilities Shop	Fire System Specialist	15 yrs.	15 yrs.	Yes Malmstrom AFB.	5 mths.
Name DAID Merrill Phone Email	28 WFSM Shop ↑	NCOIC, WFSM Shop	1.5 years	21 yrs.	Yes, Ellsworth AFB, Ramstein AB, Cannon AFB, Elmendorf AFB, & Spangdalhem AB	17 yrs Fire Sys mx
Name GEORGE WALTERS Phone Email	AFCEC/CZO WRIGHT-PATT AFB OH	RESTORATION BRANCH chief	2	0	Air Force Plants 3, 4, 59,	20 yr.
Name Bill Beck Phone Email	28 CES/CEF Fire Dept	Fire Inspector	4 yrs	20 yrs.	Vandenberg AFB McClellan AFB	7 yrs 2 yrs.
Name Chris LeBlanc Phone Email	28 CES WFSM	Assit. NCOIC WFSM	2 ½ yrs	18 yrs	Eielson AFB, AK	6 yrs
Name Kevin Goyer Phone Email	28 CES/CEIEC mil	Water Qual PM	5 yr	10 yr	NO	N/A
Name Melody Jensen Phone Email	AFCEC/CZO	Ellsworth RPM	3 yrs	17 yrs	No	N/A

Ellsworth AFB AFFF Preliminary Assessment Meeting
Feburary 23, 2015 10am-noon
Sign In Sheet

Meeting Attendee	Organization	Job Title	How Long in Current Position?	How Long at this Base in Current and Previous Positions?	Have you held similar positions at other bases? Which Bases?	How Long?
Name TIM PAVEK Phone Email [redacted]	AFCEC/CZOM	RPM	10-15 yrs	30 yrs	No	N/A
Name Phone Email						
Name Phone Email						
Name Phone Email						
Name Phone Email						

Subject: Meeting Minutes for Preliminary Assessment Kickoff Meeting at Ellsworth Air Force Base

Date: February 24, 2015

Time: 10:00 a.m. to 12:00 p.m.

Attendees: See attached sign in sheet

FT001 – Former Fire Training Area (OU 1)

Operated from 1942 to 1990.

Surface runoff discharges to Pond 1, which discharges offbase at outfall 001 (a regulated outfall) and goes off base. Enters into a private landowner's waterbody. (Mr. Goyer) Sampling was conducted at OU 1 during Broad Agency Announcement at the boundary and results exceeded EPA PAL (Ms. Jensen).

Outfall 001 also drains 60 and 70 row hangars (70 row contained AFFF systems) and south operational apron and center section of runway (Mr. Goyer).

RI being conducted at FT001. (Ms. Jensen).

Depth to groundwater is roughly 15 feet bgs. Possible groundwater contact because the groundwater daylights just south of FT001 into a drainage north of Pond 1. (Mr. Pavik and Ms. Jensen).

Outfall 003 –

Drains the north portion of the runway, taxiway, and hangars 80, 90, and 100 row and live ordnance loading area (Mr. Goyer). Surface water at pond 3 has AFFF in it based on recent sampling. This pond was lined sometime between 1997 and 2001 (Ms. Jensen).

Outfall 002 –

Stormwater discharge point serves south flightline. Potential for discharges to storm drain (Mr. Goyer).

Current FTA (6909) –

Fire training activities occur w/in a lined pit. Edge of the pad beyond pit has likely been impacted by surface water runoff (Mr. Beck).

Foam testing occurs here and a lot of AFFF runs off edge of pad (Mr. Beck).

Water from the FTA is piped via underground piping to a lined retention pond. The retention pond is emptied by utilities using 9,500-gallon tanker and transfer pump when full and disposed of at the 70 row diversion tank which eventually discharges to the WWTP (Mr. Ellefson). As of

July 2014, the diversion tank now discharges to the state-owned POTW. POTW also discharges to Box Elder Creek.

Three spills reported to SDDENR based on spills database per limited PA.

Still using 3% AFFF at FTA. 5-gallon buckets currently stored at conex at FTA (Mr. Beck).

Estimate that 2641 gallons in trucks and trailers. Use it most frequently on foam testing of equipment. May use 5-10 gallons per test. May use another 10-15 gallons for training. Less than a few hundred gallons a year (Mr. Beck).

Fire training is typically conducted monthly using only water. AFFF is used maybe a few times a year (Mr. Beck).

WWTP –

Shutdown in July 2014. Formerly discharged to outfall 005 to unnamed drainage to golf course lake to outfall 006 and goes off base. Year-round discharge from golf course lake to off base (300,000 to 500,000 gallons per day). Sludge from the WWTP was disposed of at landfill in accordance with permit. When WWTP was recently decommissioned, the biosolids were not land applied as suggested in the Limited PA. Dewatering water would go back through the clarifier. All biosolids will be disposed of at landfill (Mr. Goyer).

One time, the solids from WWTP were land applied on nearby private property (Ms. Jensen, Mr. Goyer).

Sampled from WWTP to tributary and at lake and found in surface water at both sampling points (Ms. Jensen).

New AFI says that Ellsworth will not discharge any PFCs. Will need to discuss future releases with the state. Will need to get approval from receiving POTW (Mr. Goyer).

Spray Nozzle Testing –

Yearly spray nozzle testing conducted to ensure correct % . Testing was typically conducted at the FTAs and runoff likely went into the nearby grass because they have to do spray pattern testing (Mr. Beck).

Mr. Beck indicated that equipment testing was conducted near pumphouses 1-3 at the end of the runway in 1980s using 6% AFFF. Routine equipment testing (refractometer test) when they would check out crash trucks. Drive to edge of ramp, shoot foam out. Across from Fire Station. This occurred using 6% AFFF and occurred in 1970s and 1980s.

Fire Truck Maintenance –

Conducted at fire stations in bays (Mr. Beck). Bays drain to OWS. OWS’ go to sanitary sewer (Mr. Goyer). No pre-treatment beyond OWS. Eventually combines with effluent from industrial waste water line (Mr. Goyer).

Spill Logs –

Access database contains records of spills reported to SDDENR. Goyer to provide on CD.

Mr. Beck is not aware of any AFFF usage logs or emergency response logs that document AFFF usage.

618 Waste Diversion Tank –

Logistics Readiness Squadron and refueling maintenance. Outside 50,000 gallon underground tank. Tank cleaned by contractor. Dewatered sludge shoveled out and disposed of at landfill (Mr. Goyer).

Building 618 formerly had an AFFF system (Mr. Goyer, Mr. Beck).

Sampled and PFCs in groundwater (Ms. Jensen).

Building 88240 –

AFFF system. Now only water fire suppression system.

Drainage in building to trench drains which go via sanitary sewer and discharges to surface impoundment. There is a valve which can route drainage into the OWS. Under normal operations flow goes into OWS to sanitary sewer. PFCs detected in sediments of surface impoundment (Mr. Goyer).

MSA pumphouse (88490) used to contain 500 gallon AFFF tank in 1980s. Now supports water pressure/hydrants. Used to contain AFFF tank. Removed in early 1990s.

Hangars –

70 row diversion tank is 150,000 gallon. Limited PA indicated that entire tank released into the storm drain in 1993. Violation issues.

All AFFF systems were converted to HEF systems. Started in 2005 and completed in 2012. AFFF piping is still in place but capped at the floor. Could still be sitting inside old piping coming from pumphouses to docks (Mr. Ellefson).

Because old design in 80s did not have appropriate check valves so it got pushed back through systems and back to the storage tanks. Groundwater storage tanks for firefighting capabilities may be contaminated (Mr. Ellefson).

Pumphouse 7246 had 1,000 gallon AFFF tank and fed hangars 70, 80, and 90. In 2000, systems were upgraded and each dock had own 500 gallon AFFF tank installed.

Assume all soil around hangars has potential to be contaminated. Mr. Beck indicated he saw discharges coming out of hangars.

Old Fire Station (Bldg. 7506)–

Vehicles stored here, maintenance etc. Old fire station tore down. Currently Building 7501 Base Ops is present (Mr. Beck).

Fire trucks with AFFF were stored in Dock 51 when old fire house was in operation due to space limitations. No other action done with AFFF here. Trench drains in Dock 51 drain to 20 Row diversion tank (20,000 gallon tank) which drains to industrial wastewater line (Mr. Beck).

The old fire station (where bldg. 7501 now sits) had two overhead storage tanks with a piping system we could use to gravity fill into the tops of the crash trucks. I think one was 500 gallons and a second 300 gal. Never had any significant spills that we're aware of (Mr. Beck).

Pre-2000 it wasn't uncommon to see foam solution on the fire station driveways after foam ops (Mr. Beck).

Current Fire Station (Bldg. 7502)–

2,641 gallons in vehicles. 5 gallon bucket storage (Mr. Beck).

Station 2 –

Very old fire station. Was under air mobility command in 1952. Was transferred to Ellsworth in 1962 (Mr. Pavik). Mr. Beck noted that it may have had a structural engine that may have held 50 gallons of AFFF here in early 1990s. Unsure if this had a crash truck. Fire truck was there for housing in late 80s but all gone by early 90s. Foam rarely would have been used on structure fires (Mr. Beck).

Fire Storage Area –

Storage facility with no fire trucks but historically was an old fire station. May have had AFFF (Mr. Beck).

Alert Aprons –

Crash trucks would stand by when B-52s were sitting here on alert. No known spills but possible (Mr. Beck).

Hazmart –

Building 1911. Stores 5-gallon buckets of foam. Beck provided an inventory of AFFF on base – Hazmart contained 3,965 gallons as of Feb 2015 (Mr. Beck).

Facility Number 12835 –

Fire protection water mns. Noted as having AFFF. Ask Patience to look at history.

Building 6908 Groundwater Treatment System –

Injections trenches released contaminated groundwater via daylighting to unnamed ephemeral drainage which flows to Pond 1 (Ms. Jensen and Mr. Pavik).

Crash Sites –

Delta Taxiway West – foam trailer rear ended and released 100 gallons as noted in limited PA.

1970 B-52 Crash – Limited PA had year wrong. Crash occurred in 1970, not 1972.

1988 B-1 Crash – south of runway.

2002 Learjet crash – crashed after taking off from runway 31. OU 4. No AFFF used as only a small grass fire that was put out with water.

2003 Semitrailer crash – Truck went off overpass on north side. Referred to as Marten Crash Site. Used AFFF. Goyer provided photos.

AFFF –

6% until mid-90s and then converted to 3% (Mr. Beck).

2005 HEF Test Spill –

Included in Limited PA but was high expansion foam, not AFFF.

Systems were very sensitive when set up to UVIR detectors sometimes reflections would set them off. Should be captured in spills database. All drainage to same trench drains, diversion tanks etc. (Mr. Ellefson).

No chrome plating shops on base. Rivet mile did some chromium plating done by the missile sites. There was a corrosion control shop for missiles. But likely down out at missile sites. Sodium chromate solution that was part of the guidance control set. Had hex chrom but not associated with plate. Operated in mid-80s (Mr. Pavik).

Water supply is from Rapid City. No water supply wells on base currently. Any former water supply wells were decommissioned. All drinking water was from deep water wells (confined aquifers). Stopped using them when? Check admin record, original RI (Mr. Pavik).

Private wells located 250 feet south of base. In shallow aquifer. Used to water cattle. They may connect him now to base waterline anyway. Almost all of surface water and groundwater is available for use for stock watering (Mr. Goyer), all along the tributaries and Box Elder Creek.

Historically Sanders had private well, was connected to base supply in late 90s (Mr. Pavik).

RI being conducted at FT001 will include inventory of private wells and will require sampling of the wells (Ms. Jensen).

CDC located on base. No schools (Ms. Jensen).

Other tenants: 432nd Squadron. National Guard Civil Support (Bldg. 1012). Federal Credit Union, Air Force Financial Services Center (Bldg. 2010 and 4040). Pre-1960 – bombing was host wing. 1960 to 1990, missile wing was host wing. After 1990, bombing was host wing again.

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Final
Site Inspection Report
of Aqueous Film Forming Foam Areas at
Ellsworth Air Force Base
Meade and Pennington Counties, South Dakota

March 2019

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
Omaha District
1616 Capitol Avenue
Omaha, Nebraska 68102-4901

Prepared by:

Aerostar SES LLC
1006 Floyd Culler Court
Oak Ridge, Tennessee 37830-8022
under
Contract No. W9128F-15-D-0051
Delivery Order No. 0003

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Acronyms and Abbreviations

µg/L	micrograms per liter
µg/kg	microgram per kilogram
AFB	Air Force Base
AFFF	aqueous film forming foam
AOC	area of concern
ARSD	Administrative Rules of South Dakota
ASL	Aerostar SES LLC
bgs	below ground surface
btoc	below top of casing
CAS	Chemical Abstracts Service
CSM	conceptual site model
dup	duplicate
EA	EA Engineering, Science, and Technology, Inc.
EPA	Environmental Protection Agency
ERPIMS	Environmental Restoration Program Information Management System
EZ	exclusion zone
ft	foot/feet
FTA	fire training area
HA	health advisory
HQ	hazard quotient
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
LDPE	low-density polyethylene
N/A	not applicable
NAD83	North American Datum 1983
NAVD 88	North American Vertical Datum 1988
NFRAP	no further response action planned
ND	not detected
NL	not listed
OU-1	Operable Unit-1
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonate
PFC	perfluorinated compound
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
pH	potential of hydrogen
PID	photoionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride
QAPP	quality assurance project plan
RSL	regional screening level
RI	remedial investigation
SCF	SES Construction and Fuel Services LLC
SD DENR	South Dakota Department of Environment and Natural Resources
SI	site inspection
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon

USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USCS	Unified Soil Classification System
UST	underground storage tank
WWTP	wastewater treatment plant

1.0 INTRODUCTION

Aerostar SES LLC (ASL) under contract to the U.S. Army Corps of Engineers (USACE) Omaha District (Contract No. W9128F-15-D-0051, Delivery Order No. 0003) conducted screening-level site inspections (SIs) at 12 known or suspected aqueous film forming foam (AFFF) release areas at Ellsworth Air Force Base (AFB) (Figure 1 in Appendix A). The purpose of the inspections was to determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and perfluorobutane sulfonate (PFBS) in the environment at these areas. PFOA, PFOS, and PFBS are included in 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 polyfluoroalkyl substances (PFAS).

In 1970, the United States Air Force (USAF) began using AFFF, firefighting agents containing PFOS and PFOA, to extinguish petroleum fires. Releases of AFFF to the environment routinely occur during fire training, equipment maintenance, storage, and use. Although manufacturers have reformulated AFFF to eliminate PFOS, the USAF maintains a significant 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 based on shorter carbon chains, which may be less persistent and bioaccumulative in the environment. This was accomplished at Ellsworth AFB on November 23, 2016.

SIs were conducted at Ellsworth AFB from April 19 to July 31, 2018, in accordance with contract requirements (USACE, July 2015), a quality assurance project plan (QAPP) (ASL, March 2016), and a site-specific addendum to the QAPP (ASL, November 2017). The QAPP and QAPP addendum were prepared in accordance with Environmental Protection Agency (EPA) guidance (EPA, March 2012) and Air Force Civil Engineer Center requirements.

The objectives of the SIs are to

- determine if a confirmed release of PFAS has occurred at sites selected for SI;
- determine if PFAS are present in soil, groundwater, surface water, or sediment at the site in concentrations exceeding the EPA lifetime HAs or tap water RSLs, residential soil screening levels, or a state standard;
- identify potential receptor pathways with immediate impacts to human health; and
- provide recommendations for follow-on investigations if detected concentrations of PFAS equal or exceed project action levels (PALs).

This report identifies any releases of AFFF that resulted in PFOS, PFOA, or PFBS contamination in the environment above the project screening levels and any possible human exposure to drinking water above the HA levels. 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.

The screening level for PFOS and PFOA in soil and sediment was calculated using EPA's RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) based on a hazard quotient (HQ) of 0.1 (Appendix B). The toxicity value input for the calculator was the Tier 3 value reference dose of 0.00002 milligrams per kilogram per day derived by the EPA in its drinking water HAs for PFOS (EPA, May 2016a) and PFOA (EPA, May 2016b). 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 PFAS release was considered confirmed when exceedances of the following concentrations were identified.

PFOS:
0.07 micrograms per liter (µg/L) in groundwater or surface water (combined with PFOA value).
126 micrograms per kilogram (µg/kg) in soil or sediment.

PFOA:
0.07 µg/L in groundwater or surface water (combined with PFOS value).
126 µg/kg in soil or sediment.

Although PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in this SI, the EPA has also derived RSLs for PFBS, for which there is a Tier 2 toxicity value (Provisional Peer Reviewed Toxicity Value). The USAF also considered a release to be confirmed if exceedances of the RSL concentrations (HQ=0.1) were identified.

PFBS:
40 µg/L in groundwater or surface water.
130,000 µg/kg in soil or sediment (residential soil RSL).

A summary of all PFAS compounds detected in groundwater at all AFFF Areas is also included in Appendix H as additional information.

Published generic regional and calculated screening levels presented in the QAPP and QAPP addendum were based on an HQ of 1.0. The screening levels have subsequently been revised to reflect an HQ of 0.1. This change affects PFBS screening levels for all media and calculated PFOS and PFOA screening levels for soil and sediment. Screening levels for PFOA and PFOS in groundwater and surface water remain at 0.07 µg/L and are based on the EPA lifetime HA for drinking water. Table 1 presents the screening values for comparing the analytical results for each of the PFAS compounds.

Table 1 Regulatory Screening Values

Parameter	CAS Number	EPA Regional Screening Level Table (November 2018)[a]			Calculated Screening Level for Soil and Sediment[b] (µg/kg)	EPA Health Advisory for Drinking Water (Surface Water or Groundwater)[c] (µg/L)
		Residential Soil (µg/kg)	Protection of Ground-water (µg/kg)	Tap Water (µg/L)		
Perfluorobutane sulfonate (PFBS)	29420-43-3	130,000	13	40	N/A	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	NL	126	0.07[d]
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	NL	126	

[a] EPA Regional Screening Levels (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] Residential screening levels calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
[c] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[d] The EPA health advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/kg = micrograms per kilogram
µg/L = micrograms per liter
CAS = Chemical Abstracts Service
EPA = Environmental Protection Agency
N/A = not applicable
NL = not listed
RSL = regional screening level

Previous and On-Going PFAS-Related Activities at Ellsworth AFB

In 2012, Ellsworth AFB conducted a limited preliminary assessment (PA) summarizing AFFF use, releases, and disposal at the Base. This assessment documented AFFF releases at several areas including the former fire training area (FTA) designated as Operable Unit-1 (OU-1). Sampling conducted during a limited investigation at OU-1 indicated PFOS and PFOA in groundwater and soil were above screening levels (Ellsworth AFB, November 2012).

A screening-level site investigation was conducted at Ellsworth AFB in June 2014 (SES Construction and Fuel Services LLC [SCF], January 2015) to determine the presence or absence of PFAS in soil, groundwater, surface water, and sediment at four areas (identified in the 2012 limited PA) where PFAS releases were known or suspected to have occurred. Areas investigated in 2014 included Docks 73 and 93, Underground Storage Tank (UST) 7246 and Outfall #3, UST 88240 Retention Lagoon, and UST 618 and the Base wastewater treatment plant (WWTP). Analytical results for samples collected during this effort indicated the presence of PFAS above screening levels and are discussed further in Section 2.

A second PA conducted in February 2015 (CH2M Hill, May 2015) recommended SIs for 12 areas at Ellsworth AFB (in addition to the former FTA) because of known or suspected releases of AFFF. These 12 areas (now identified as AFFF Areas 1 through 12) are listed in Table 2 and shown on Figure 2 in Appendix A.

A remedial investigation (RI) of the former FTA and three additional potential source areas (shown on Figure 2 in Appendix A) is currently being conducted by others. These four potential source areas and the area south of the Ellsworth AFB boundary are designated Area of Concern (AOC) PFC-1 (Ayuda Partners Joint Venture, December 2015). In March 2016, a residential well survey was conducted by others as part of the delineation of PFAS at AOC PFC-1 (Ayuda Partners Joint Venture, June 2017). This survey identified three private wells to be sampled for PFAS. Owners of these three wells were identified as Newman, Sanders, and Farrar (note the Farrar well is currently owned by Thunderbird Properties, LLC).

Sampling and analysis of the Newman and Sanders wells indicated the wells to be impacted by PFAS; however, pre-existing water use restrictions precluded their use and no response action was needed. Sampling and analysis of the Thunderbird Realty, LLC, well also indicated PFAS impacts. This well (south of AOC PFC-1) was also used by the adjacent Walter property. In January 2017, an alternate source of potable water was provided to both the Thunderbird Realty and Walter properties and the private well was decommissioned (CB&I, August 2017). Note that the pump was removed but the well is still present.

Stage 1 RI sampling conducted in March 2016 at AOC PFC-1 indicated concentrations of PFOS and PFOA in soil, groundwater, and surface water above current screening levels; PFOS in sediment above the screening level, and PFBS in groundwater above the current screening level (Ayuda Partners Joint Venture, November 2017). Stage 2 RI sampling was conducted in 2017–2018. The lateral extent of PFOS and PFOA in groundwater was not determined and a Stage 3 field effort is currently in the planning stages. A door-to-door well survey effort to locate and sample possible off-Base drinking water wells has been completed by others subsequent to field activities conducted for this ESI. Preliminary results from this effort indicate the presence of previously unknown drinking water wells, some of which have been impacted by PFAS.

Between May and September 2017, field sampling was conducted on the Thunderbird Realty, LLC, and Walter properties to determine if PFAS have migrated from the Base. Surface soil, groundwater, sediment, and surface water were sampled. PFOS was detected in surface soil and sediment above the current screening level and PFOS and PFOA were detected in groundwater and surface water above the screening level (Aptim Federal Services, LLC, July 2018). It should be noted that the field sampling conducted by Aptim was not conducted under a regulator-approved QAPP, so the results should be treated as "screening level" data.

Table 2 AFFF Areas and Selection Rationale for Site Inspections at Ellsworth Air Force Base

AFFF Area	Location	Associated Existing IRP ID	Rationale	Media of Concern
1	Current FTA	Not an existing site	• In operation since 1993. • All nozzle spray testing and flushing occurred at the FTA. • Most AFFF was contained within the retention pond, but some AFFF may have been released to adjacent soils.	Surface soil Subsurface soil Groundwater
2	70, 80, 90 Rows and Outfall #3	Not an existing site	• Known AFFF releases in eight of 10 hangars. • 2014 SI indicated the presence of PFOS and PFOA above current screening levels in shallow groundwater at Dock 73 (on 70 Row), the 70 Row diversion tank (UST 7246), Dock 93 (on 90 Row), and Outfall #3/Pond #3 (SCF, January 2015).	Surface soil Subsurface soil Groundwater Sediment Surface Water
3	Building 618	Not an existing site	• 2014 SI indicated the presence of PFOS and PFOA above current screening levels in shallow groundwater at Building 618 (SCF, January 2015). • AFFF spills noted in the Ellsworth spills database (Ellsworth AFB, February 2015).	Subsurface soil Groundwater
4	Former Fire Station (Building 7506)	Not an existing site	• Overhead AFFF tanks. • Known AFFF spill (five gallons). • Several engines/trailer contained AFFF. • AFFF has been observed on fire station driveways in the past.	Surface soil Subsurface soil Groundwater
5	B-52 Crash (1972)	Not an existing site	• AFFF use is unknown, but possible.	Surface soil Subsurface soil Groundwater
6	B-1 Crash (1988)	Not an existing site	• Unknown amount of AFFF used during emergency response.	Surface soil Subsurface soil Groundwater
7	Delta Taxiway West Crash (2000)	Not an existing site	• 100 gallons of AFFF spilled; likely migrated to adjacent soils.	Surface soil Subsurface soil Groundwater
8	Marten Crash (2006)	Not an existing site	• Based on crash photos, AFFF was applied at the crash location.	Surface soil Subsurface soil Groundwater
9	Crash 4 (2001)	Not an existing site	• 10 gallons of AFFF released from fire truck.	Surface soil Subsurface soil Groundwater

AFFF Area	Location	Associated Existing IRP ID	Rationale	Media of Concern
10	Wastewater Treatment Plant	Not an existing site	• WWTP received discharge from several locations which had AFFF releases such as the diversion tank at 70 row, Building 618, and fire station floor drains. • During operation, the WWTP discharged approximately 300,000 to 500,000 gallons of treated water per day off-Base and to Golf Course Lake. The WWTP ceased operations in 2014. • AFFF was likely released as result of treated water discharge and sludge management. • Water from Golf Course Lake was sometimes used for irrigation of the golf course. • 2014 SI indicated the presence of PFOS and PFOA above current screening levels in sediment and surface water downstream from the WWTP (SCF, January 2015).	Surface soil Subsurface soil Groundwater Sediment Surface Water
11	Spray Nozzle Test Area	Not an existing site	• During nozzle testing, AFFF was sprayed on a grassed area for up to 20 years in the 1970s and 1980s.	Surface soil Subsurface soil Groundwater Sediment Surface Water
12	Building 88240	Not an existing site	• Formerly contained an AFFF fire suppression system. • 2014 SI indicated the presence of PFBS, PFOS, and PFOA above current screening levels in sediment and surface water and the presence of PFOS and PFOA above screening levels in groundwater near a retention pond south of the building (SCF, January 2015).	Surface soil Subsurface soil Groundwater Sediment Surface Water

Modified from Table 4.1 Preliminary Assessment Report Summary and Findings Ellsworth Air Force Base (CH2M Hill, May 2015)

AFB = Air Force Base
AFFF = aqueous film forming foam
bgs = below ground surface
ID = identification
FTA = fire training area
IRP = Installation Restoration Program
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SCF = SES Construction and Fuel Services LLC
SI = site inspection
UST = underground storage tank
WWTP = wastewater treatment plant

2.0 AREA DESCRIPTIONS

2.1 ELLSWORTH AIR FORCE BASE

Ellsworth AFB is approximately 10 miles northeast of Rapid City, South Dakota, and adjacent to the City of Box Elder (Figure 1, Appendix A). The Base covers approximately 4,858 acres within Meade and Pennington counties and includes runways, airfield operations, industrial areas, housing, and recreational facilities. Ranches lie to the north and west of Ellsworth AFB and residences, ranches, and commercial areas lie to the east and south.

Topography

The Base lies within the Missouri Plateau subdivision of the Great Plains Physiographic Province. The topography in this region is typified by nearly level upland plateaus interspersed among rolling hills. Erosional dissection of the landscape is often pronounced, especially along upland margins and adjacent to stream valleys. The Base is situated on a gently sloping north-south upland plateau between Elk Creek to the north and Box Elder Creek to the south. Mean elevation is 3,250 feet above mean sea level, and relief across the Base ranges from 40 to 210 feet (EA Engineering, Science, and Technology, Inc. [EA], May 1994).

Surface Water Hydrology

Surface drainage at the Base follows topography primarily flowing south-southeast via retention ponds, ditches, storm sewers, and ephemeral streams with eventual discharge into Box Elder Creek one mile to the south. Box Elder Creek is considered an ephemeral stream containing water only when sufficient runoff is available to support flow, typically during or immediately following precipitation events. Floodplains occur along the main Base drainage, as well as along several of the creek drainages on the northern and southern portion of the Base. The northern limit of the Box Elder Creek floodplain is approximately 50 feet south of the southern Base boundary.

Geology

Ellsworth AFB lies on the extreme eastern flank of the Black Hills uplift, a north-south trending, elliptically shaped dome that resulted from tectonic movement during the Laramide Orogeny. During this event, basement crystalline rocks west of the Base were uplifted and exposed while overlying Mesozoic and Paleozoic strata were uplifted, eroded, and deformed. These strata now crop out as the hogbacks flanking the Black Hills uplift. Beneath the Base, the strata dip moderately to the east-northeast. Figure 3 (Appendix A) presents a generalized stratigraphic column of the strata beneath Ellsworth AFB. A geologic map of the area is included as Figure 4 (Appendix A).

The oldest and deepest rocks beneath the Base are Precambrian-age crystalline basement rocks. The basement rocks are overlain by Cambrian through Lower Cretaceous deposits of limestone, sandstone, and dolomite. Several sedimentary deposits are known aquifers in the region. Overlying the Jurassic deposits is a sequence of Upper Cretaceous age marine shales with intermittent sandstone and limestone beds. This Upper Cretaceous sequence of fine-grained marine deposits extends to the surface and is greater than 1,000 feet thick below the Base. The uppermost of these Cretaceous-age deposits is the Pierre Shale, which forms the bedrock surface at the Base.

The Pierre Shale is a dark gray to light gray, organic-rich, noncalcareous, blocky, fragmented marine shale. Bentonite beds and ironstone concretion layers greater than 1 foot thick are common, as are ironstone nodules and selenite crystals on weathered faces. Bentonite beds are typically yellow and are the result of volcanism that occurred during the Laramide Orogeny. The Pierre Shale may be considerably altered by weathering and typically weathers into an orange to brown clay material overlying fractured and iron-stained shale.

Previous investigations indicate that the depth to the Pierre Shale is variable, ranging from surface outcrops to depths of approximately 40 feet. Weathering and permeability within the shale generally decrease with depth.

Overburden at the Base typically consists of unconsolidated Tertiary through Quaternary-age strata overlying the Pierre Shale. These unconsolidated materials can be divided into three basic categories based upon depositional history:

- Colluvial deposits – loose, heterogeneous sediment and/or rock fragments deposited on slopes and the toe of slopes primarily by gravity rainwash, sheetwash, or slow, continuous downslope creep, typified by juxtaposition of sedimentary components not normally associated with one another (gravelly clay).

- Alluvial deposits – clay, silt, sand, gravel, or similar unconsolidated, detrital material deposited during comparatively recent geologic time by running water as sorted or semi-sorted deposit. These deposits are generally associated with the past or current drainage system of Box Elder Creek.

- Residuum –unconsolidated soils that developed in-place through the weathering of underlying consolidated rock. These soils may show relic textures associated with the parent rock (also known as saprolite or saprolitic soil). The boundaries between residual soils, weathered shale, and competent bedrock are often gradual and not well-defined.

Overburden thicknesses vary widely across the Base, but in general, range from 10 feet to 40 feet. Toward the northern end of Ellsworth AFB, the Pierre Shale is predominately covered by a thin veneer of alluvial or colluvial soil but is exposed along deeper channels and some steeper side slopes. Toward the southern end of Ellsworth AFB, older, relatively thicker, coarser alluvial deposits associated with Box Elder Creek fill the gentler, wider erosional channels, and exposures of Pierre Shale are less common (EA, May 1995).

Climate

The climate at Ellsworth AFB is characterized as semi-arid continental with the Black Hills to the west affecting the climate in this area. The average summer temperature is 68 degrees Fahrenheit, and the daily high average is 81 degrees Fahrenheit. Winters are relatively mild due to protection from the Black Hills and the frequent occurrence of Chinook winds. The average winter temperature is 26 degrees Fahrenheit, with an average daily minimum of 14.9 degrees Fahrenheit. Average annual precipitation is 16.3 inches with most precipitation falling during the spring and early summer months. Prevailing winds are from the north and northwest (EA, May 1995).

2.2 CURRENT FIRE TRAINING AREA (FTA) – AFFF AREA 1

The current FTA occupies approximately seven acres in the southwestern portion of Ellsworth AFB as shown on Figures 2 and 5 in Appendix A. The FTA has been in use since 1993 and is still used for fire training activities. All current nozzle spray testing and flushing performed by the Ellsworth AFB Fire Department occurs at the FTA. Although most AFFF was contained by the lined fire training pit and adjacent retention pond, some AFFF may have been released to surrounding grassed areas.

Media potentially impacted by PFAS at the current FTA include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the current FTA.

2.3 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

The 70, 80, and 90 Rows of aircraft hangars (also known as docks) are on the northeast side of the Ellsworth AFB runway and encompass approximately 83 acres as shown on Figures 2 and 6a in Appendix A. Of the 13 docks on these three rows, ten docks (Docks 70, 71, 72, 73, 74, 81, 90, 91, 92, and 93) previously contained AFFF fire suppression systems and AFFF releases have been documented for at least eight of the docks. Releases have not been confirmed at Docks 72 and 73.

Pumphouse 7263, at the northeast end of 90 Row, contained a 1,000-gallon AFFF tank that fed the hangars on 70, 80, and 90 Rows via underground piping. According to the Ellsworth spills database, 310 gallons of AFFF were released at the pumphouse in September 1994 and the material went through cracks in the floor and into the soil under the building. In 2000, the AFFF systems were upgraded and each dock had its own 500-gallon AFFF tank installed inside. AFFF underground piping from the pumphouse to the hangars is still in place but capped at the floor (CH2M Hill, May 2015).

Trench drains inside each dock discharge to a 150,000-gallon diversion tank (underground storage tank [UST] 7246) at the southwest end of 70 Row. The contents of the diversion tank were typically released to the WWTP but could have also been released to Outfall #3 on the southwest side of the runway through storm drains (CH2M Hill, May 2015).

SCF investigated possible PFAS impacts at Docks 73 and 93, UST 7246, and Outfall #3 in 2014 (SCF, January 2015). Groundwater, surface soil, and subsurface soil were sampled at Docks 73 and 93. Groundwater and subsurface soil were sampled at UST 7246. Subsurface soil, groundwater, sediment, and surface water were sampled at Outfall #3 (and adjacent Pond #3). Both individual and combined PFOS and PFOA concentrations exceeded the current screening level in groundwater at each of these areas and in surface water at Pond #3 and Outfall #3. PFOS was also detected in the sediment sample from Pond #3 above the current screening level. PFOS and PFOA concentrations were below screening levels in all surface and subsurface soil samples. PFBS was not detected above screening levels in any of the media sampled. PFBS, PFOS, and PFOA analytical results from the 2014 investigation (at Outfall #3) are shown on Figure 6b.

Media known to be, or are potentially, impacted by PFAS include surface soil, subsurface soil, and groundwater at 70, 80, and 90 Rows, and subsurface soil, groundwater, sediment, and surface water at Outfall #3. Surface soil was not identified as media of concern at Outfall #3. Because AFFF impacts were assumed to be from surface water discharge to the outfall, the presence of PFAS impacts would be most likely identified in sediment rather than surface soil.

2.4 BUILDING 618 – AFFF AREA 3

Building 618, 28th Logistics Readiness Squadron and refueling maintenance, is near the southeast end of the runway as shown on Figures 2 and 7. Building 618 formerly had an AFFF fire suppression system; discharge from the system was captured in floor drains and discharged to a 50,000-gallon diversion recovery tank (UST 618) via underground pipelines. The Ellsworth spills database documented the inadvertent release of 50 gallons of AFFF inside Building 618 when electricians accidentally pressurized the system in November 2001 (CH2M Hill, May 2015).

Although no AFFF releases to the environment were reported prior to this investigation, a limited SI was conducted in 2014. To confirm the presence or absence of PFAS at Building 618, subsurface soil and groundwater samples were collected near UST 618. Both individual and combined PFOS and PFOA concentrations exceeded the current screening level in groundwater. PFOS and PFOA concentrations were below the screening level in subsurface soil. PFBS was not detected above screening levels in either groundwater or subsurface soil (SCF, January 2015).

Media known to be, or are potentially, impacted by PFAS at Building 618 include subsurface soil and groundwater. Surface soil was not identified as media of concern because potential releases were assumed to be from the UST (i.e., below ground and not on the ground surface). Surface water and sediment were not identified as media of concern because there are no surface water bodies near Building 618.

2.5 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

The site of the former Fire Station (Building 7506) is near the center of the Base as shown on Figures 2 and 8. The station was constructed in 1952, remained in operation until 2000, and was subsequently demolished in 2007. The building had a trench drain system that contained any spills inside the building; although, discharges of AFFF were often observed outside the building. Trench drains discharged to the sanitary sewer system and ultimately to the WWTP. AFFF was stored in two overhead storage tanks with a piping system that was used to gravity fill into the tops of the crash trucks. The Ellsworth spills database documented a 5-gallon spill (contained on concrete) when a line broke in November 1994. During interviews for the 2015 PA, Base personnel indicated it was not uncommon to see foam solution on the fire station driveways after foam operations indicating AFFF releases outside of the building footprint (CH2M Hill, May 2015).

Media potentially impacted by PFAS at Building 7506 include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the former fire station.

2.6 B-52 CRASH (1972) – AFFF AREA 5

The 2015 PA indicated a B-52 caught fire and crashed during landing, skidding into Pumphouse 7 on the north side of the runway and west of 70 Row as shown on Figures 2 and 9. It should be noted that Figure 3.1 in the 2015 PA incorrectly shows the location of the crash to be further northwest, but available documentation indicates the crash occurred at Pumphouse 7. The Ellsworth AFB Fire Department responded to the crash and extinguished the fire with an unknown quantity of foam (CH2M Hill, May 2015). The 2015 PA also indicated the crash occurred in 1970; however, additional review of the Air Force Administrative Record found an Installation Restoration Program (IRP) records search (Engineering-Science, September 1985) that indicated the crash occurred in 1972 and also confirmed the crash occurred at Pumphouse 7. Although the 2015 PA could not verify that the type of foam used, based on the revised date of the crash (1972), use of AFFF is likely since the Air Force began using AFFF in 1970.

Media potentially impacted by PFAS at the B-52 crash site include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the B-52 crash site

2.7 B-1 CRASH (1988) – AFFF AREA 6

The B-1 crash occurred in 1988 on the southeastern end of the runway as shown on Figures 2 and 10. During the emergency response, an unknown amount of AFFF was used at the crash site (CH2M Hill, May 2015).

Media potentially impacted by PFAS at the B-1 crash site include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the B-1 crash site.

2.8 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

A vehicle crash in 2000 involving a fire truck and an AFFF trailer occurred on Taxiway West as shown on Figures 2 and 11. The crash resulted in the release of 1000 gallons of AFFF. According to South Dakota Department of Environment and Natural Resources (SD DENR) spill records, approximately 900 gallons were recovered and 100 gallons infiltrated soil in adjacent grassed areas. The spill report indicates the contaminated soil was excavated and disposed of at the Rapid City Landfill (SD DENR, 2000).

Media potentially impacted by PFAS at the Delta Taxiway West crash site include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the crash site.

2.9 MARTEN CRASH (2006) – AFFF AREA 8

In 2006, a tractor trailer owned by Marten Transport Ltd crashed off of the Interstate 90 overpass onto Ellsworth AFB property below as shown on Figures 2 and 12 (SD DENR, 2006). Photographs of the crash scene show that AFFF was applied to the wreckage and collected in low-lying areas on either side of the abandoned railroad tracks in the area. Note that the 2015 PA incorrectly indicated the crash occurred in 2003 (CH2M Hill, May 2015).

Media potentially impacted by PFAS at the Marten crash site include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the crash site.

2.10 CRASH 4 (2001) – AFFF AREA 9

In 2001, 10 gallons of AFFF were spilled from a Base fire department crash truck designated as "Crash 4." The spill occurred near former Building 7140 as shown on Figures 2 and 13. The 2015 PA indicated the spill likely occurred along Menoher Road that led to Building 7140. Building 7140 has been demolished and a live ordnance loading area was constructed over the likely release area.

Media potentially impacted by PFAS at the Crash 4 spill site include surface soil, subsurface soil, and groundwater. Surface water and sediment were not identified as media of concern because there are no surface water bodies near the spill site.

2.11 WASTEWATER TREATMENT PLANT – AFFF AREA 10

The WWTP is in the southeast portion of the Base as shown on Figures 2 and 14. The WWTP ceased operations in July 2014, but according to Base personnel, it has not been decommissioned as was indicated in the 2015 PA.

The WWTP received discharge from several locations on Base where AFFF releases have occurred, including the diversion tanks at 70 row, Building 618, and the fire station. Treated wastewater discharged to Outfall #5, flowed via an unnamed drainage to a golf course lake, and ultimately to Outfall #6 where the water left the Base and discharged to Box Elder Creek. AFFF was likely released in the WWTP effluent and sludge. Additionally, water from Golf Course Lake was sometimes used for irrigation of the golf course.

SCF conducted a limited SI in 2014 to assess impacts from effluent from the WWTP, collecting sediment and surface water samples downstream from Outfall #5. Both individual and combined PFOS and PFOA concentrations exceeded current screening levels in surface water and PFOS concentrations exceeded the current screening level in sediment.

Media known to be, or are potentially, impacted by PFAS at the WWTP include surface soil, subsurface soil, groundwater, sediment, and surface water.

2.12 SPRAY NOZZLE TEST AREA – AFFF AREA 11

Spray nozzle testing was conducted in the grassed infield between the aircraft apron and the runway as shown on Figures 2 and 15. The test area was active in the 1970s and 1980s and unknown quantities of AFFF were sprayed on the ground surface during testing (CH2M Hill, May 2015).

Media potentially impacted by PFAS at the spray nozzle test area include surface soil, subsurface soil, groundwater, sediment, and surface water.

2.13 BUILDING 88240 – AFFF AREA 12

Building 88240 is in the munitions storage area on the northern portion of the Base as shown on Figures 2 and 16. The building formerly contained an AFFF fire suppression system and has a trench drain system inside the building. Under normal operating conditions, flow from the trench drains enters an oil/water separator before being released into the sanitary sewer. However, when the AFFF system was activated, a valve was used to route released AFFF into a retention pond south of Building 88240. A limited PA conducted by Ellsworth AFB indicated this pond is either unlined or clay lined (Ellsworth, November 2012). During heavy rainfall, surface water flows from the pond to a culvert south of the pond. Surface drainage in this area flows south toward the live ordnance loading area and Row 100. There are no records of accidental AFFF releases from Building 88240 and the AFFF system has been replaced with a water-only sprinkler system (CH2M Hill, May 2015).

SCF conducted a limited SI in 2014 at the Building 88240 retention pond, collecting subsurface soil, groundwater, sediment, and surface water samples. PFBS and individual and combined PFOS and PFOA concentrations exceeded the current screening level in surface water. Individual and combined PFOS and PFOA concentrations also exceeded the current screening level in groundwater. PFBS, PFOA, and PFOS were also detected above screening levels in sediment. Where detected, PFOS and PFOA concentrations in subsurface soil samples were below the current screening level. PFBS was not detected above screening levels in subsurface soil (surface soil was not sampled in 2014) (SCF, January 2015).

Media known to be, or are potentially, impacted by PFAS at Building 88240 include surface soil, subsurface soil, groundwater, sediment, and surface water.

3.0 FIELD ACTIVITIES AND FINDINGS

ASL conducted SI field activities at Ellsworth AFB between April 17, 2018, and July 31, 2018. Fieldwork was conducted in accordance with the QAPP (ASL, March 2016) and the Base-specific field sampling plan addendum to the QAPP (ASL, November 2017). A readiness review (documented in Appendix C) conducted prior to fieldwork covered anticipated hazards, types and proper use of equipment needed for the field activities, sampling procedures, and procedures to be used to prevent cross-contamination of samples with PFAS-containing compounds. Cross-contamination avoidance procedures followed during field activities are detailed in Section 3.2.

3.1 FIELD ACTIVITIES AND SAMPLING PROCEDURES

3.1.1 Sampling Methodology

Field activities included installing monitoring wells and sampling surface soil, subsurface soil, groundwater, surface water, and sediment; samples were analyzed for PFAS compounds, including PFBS, PFOA, and PFOS. Sample locations were selected in areas most likely to have been impacted by known or suspected AFFF releases. Soil borings were advanced with a track-mounted, compact sonic drill rig.

Soil cores were collected by advancing a 4-inch, inner core barrel to the desired sample depth (typically in 5-foot or 10-foot intervals) and over-drilling with a 6-inch outer casing. The core barrel and soil core were retrieved, leaving the 6-inch outer casing to maintain the integrity of the borehole. Soil cores were then vibrated from the core barrel into plastic sleeves for logging, field screening, and sample collection. Prior to logging, slits were cut in the sample sleeve and the soil cores screened with a photoionization detector (PID). After recording the PID readings on the boring log, the soil core was measured and the recovered length recorded in the boring log. The sample sleeve was then opened and the core visually logged. All borings were logged by a trained geologist (with a degree from an accredited university) experienced in describing soil core and overseen by a senior geologist. The soil descriptions were in accordance with the Geology Supplement to the Scope of Services (USACE, June 2013) and followed the general format:

- Soil type (fat clay, lean clay, sand, silty gravel, etc.);
- Color (using Munsell soil color charts);
- Grading, grain size, consistency/density, moisture content, cementing;
- Other notable features (staining, organics, fossils, odors, etc.); and
- Unified Soil Classification System (USCS) designation (CH, CL, SP, GM, etc.).

Surface soil samples were collected from 0 to 6 inches below ground surface (bgs) with a combination of stainless steel hand augers and stainless steel spoons. Subsurface soil samples were collected immediately above the water saturated/unsaturated soil interface either with hand augers or from the soil core generated during sonic drilling.

Sediment samples were collected using stainless steel spoons. Surface water samples were collected by attaching the sample container to an extendable rod designed for sampling and dipping the container into the water.

Field duplicate samples were collected at a frequency of one for every 10 samples for each media sampled. Matrix spike/matrix spike duplicate samples were collected at a frequency of one for every 20 samples for each media. Boring logs and sample collection forms are in Appendix C.

All soil, groundwater, sediment, and surface water samples were submitted via overnight courier to Maxxam Analytics International Corporation of Mississauga, Ontario, Canada (Maxxam), under chain of custody procedures and analyzed for PFBS, PFOA, and PFOS using modified EPA Method 537, "Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/ Tandem Mass Spectrometry (LC/MS/MS)." Eighteen PFAS compounds are included in this analysis; however, only the three analytes listed below have health-based screening levels associated with them.

Analyte	*CAS Number
Perfluorobutane sulfonate (PFBS)	29420-43-3
Perfluorooctanoic acid (PFOA)	335-67-1
Perfluorooctane sulfonate (PFOS)	1763-23-1

*CAS = Chemical Abstracts Service

Laboratory case narratives and analytical data sheets for modified EPA Method 537 are presented in Appendix D.

To provide basic soil parameter information, ASL collected representative composite surface soil and subsurface soil samples and submitted the samples to CT Laboratories of Baraboo, Wisconsin, for physiochemical parameters from each area. These analyses included potential of hydrogen (pH), particle size distribution, percent solids, and total organic carbon (TOC). Laboratory data sheets for the physiochemical parameters and a summary this data (Table E-1) are included in Appendix E.

3.1.2 Soil Borings and Monitoring Well Installation

Fifty-one soil borings were completed during the SI and monitoring wells were installed in 38 of the borings. Typically wells were constructed with 2-inch-diameter, 10-foot long schedule 40 polyvinyl chloride (PVC) screens (continuous wrap 0.010-inch slot) and risers with flush threads. In two cases, 15-foot-long screens were used to increase the likelihood of intercepting adequate groundwater to sample (wells MW18PFC0403 and MW18PFC0801). Sand filter packs were installed by tremieing the sand through the outer sonic casing and vibrating it in place. Thirty-one wells were installed with flushmount completions and seven wells were installed with above ground stickup completions (three wells at the current FTA [AFFF Area 1], three wells at Building 88240 [AFFF Area 12], and one well at Outfall #3 [AFFF Area 2]). Borings where monitoring wells were not installed (13 total) were abandoned by pumping cement bentonite grout through a tremie pipe placed near the bottom of the borehole and backfilling the borehole to the surface. Boring logs and well construction diagrams are included in Appendix C. Construction details for the 38 newly installed wells are included in Table F-1 in Appendix F.

3.1.3 Well Development

Newly installed monitoring wells were developed and existing monitoring well MW930107 was redeveloped prior to sampling. Monitoring wells were developed with either air displacement or electric submersible pumps. Wells were developed until pH, temperature, turbidity, and specific conductivity stabilized. Because the wells were screened within lean clay, turbidities remained high during development with most being above the instrument upper range of 1000 nephelometric turbidity units (NTUs). One well (MW18PFC0206) produced very little water and could not be developed. Groundwater samples were collected with peristaltic pumps at 32 wells. Water levels in the seven remaining wells were below the effective range of a peristaltic pump and were sampled using electric submersible pumps. All samples were collected using new disposable low-density polyethylene (LDPE) tubing. Sampling was conducted at least 24 hours after development. Well development logs, groundwater sampling logs, and sample collection forms are included in Appendix C.

3.1.4 Data Quality

Third-party data validation was conducted on 100% of the analytical data. Overall, the quality of the data was acceptable; no data was rejected and all data is considered usable for decision-making. The precision, accuracy, and completeness results were acceptable for the project. Further details are included in the data validation report in Appendix D.

3.1.5 Surveying

Coordinates and elevations for soil borings and monitoring wells were established by Ferber Engineering Company, Inc., of Rapid City, South Dakota. All newly installed wells and existing well MW930107 were surveyed. Northing and easting coordinates were based on the South Dakota State Plane Coordinate System, South Zone, North American Datum 1983 (NAD83). Elevations were referenced to North American Vertical Datum 1988 (NAVD 88). ASL personnel recorded sediment/surface water sample points using a Trimble Geo7X handheld global positioning system (GPS) unit.

3.2 PFAS CROSS-CONTAMINATION AVOIDANCE PROCEDURES

Field personnel complied with PFAS cross-contamination avoidance procedures and considerations, which are included in ASL Standard Operating Procedure 028, "Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Compounds (PFCs) Sites."

3.2.1 Field Equipment

The following steps were taken to avoid cross-contamination from field equipment:

- Teflon®-containing materials (Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) were not used because Teflon® contains fluorinated compounds.
- Peristaltic pumps equipped with silicon tubing were used to sample groundwater at depths of approximately 25 feet or shallower. A submersible electric pump was used to sample groundwater at depths greater than 25 feet.
- LDPE tubing was used downhole for all sampling and well development.
- Field notes were recorded in a bound logbook that did not have waterproof paper.
- All personnel changed gloves between recording and sampling activities to prevent cross-contamination.
- Post-It Notes® were not allowed on site.
- Only Sharpie® brand markers were used. Pens were used to document field activities in the logbooks and on field forms, to label sample containers, and to prepare the chains of custody.
- Chemical (blue) ice packs were not used to store samples, food, or drinks.

3.2.2 Field Clothing and Personal Protective Equipment (PPE)

The following requirements for field clothing and PPE were followed to avoid cross-contamination:

- The sampling personnel wore field clothing made of synthetic and natural fibers (preferably cotton). The clothing had to have been laundered at least six times without using a fabric softener since it was purchased. New clothing was not allowed because it could contain PFAS-related treatments.

- Only rain gear made from polyurethane and wax-coated materials was allowed.
- Clothing or boots containing Gore-Tex™ was not allowed because it consists of a PFAS membrane.
- Tyvek® clothing was not allowed on site because it contains fluorinated compounds.
- Disposable nitrile gloves were worn at all times when field activities were being conducted, and a new pair was donned prior to the following activities at each sample location:
    - Decontamination of reusable sampling equipment;
    - Contact with sample bottles or water containers;
    - Insertion of anything into the well (LDPE tubing, HydraSleeve® bailer, etc.);
    - Insertion of silicon tubing into the peristaltic pump;
    - Completion of monitor well purging;
    - Sample collection; and
    - Handling of any quality assurance/quality control samples, including field blanks and equipment blanks.
- A new pair of nitrile gloves were worn after handling any non-dedicated sampling equipment, after contact with surfaces that had not been decontaminated, or when field personnel thought it was necessary.

3.2.3 Sample Containers

Sample containers met the following requirements to avoid cross-contamination:

- All samples were collected in high-density polyethylene bottles with screw caps made of the same materials. The liners of lined screw caps were not made of Teflon® and did not contain PFAS.
- Glass sample containers were not used.
- Container labels were completed using a Sharpie® pen after the caps had been placed on each bottle.

3.2.4 Wet Weather

The following requirements were followed during wet weather to avoid cross-contamination:

- Field personnel who were sampling during wet weather (such as rainfall or snowfall) wore appropriate clothing that did not pose a risk of cross-contamination. Sampling personnel avoided synthetic gear treated with water-repellant finishes containing PFAS. Only rain gear made from polyurethane and wax-coated materials was allowed.
- Field personnel wore gloves when erecting or moving a gazebo tent overtop used for protection from rain at sampling locations because the canopy material may have been treated with a PFAS-based coating. Gloves were changed immediately after handling the tent, and any further contact with the tent was avoided until all sampling activities were finished and the team was ready to move on to the next sample location.

3.2.5 Equipment Decontamination

Field sampling equipment was decontaminated using Alconox® or Liquinox® soap. Decon 90® was not used during decontamination activities. Laboratory-certified PFAS-free water was used for the final decontamination rinse of sampling equipment. Larger equipment, such as drill rigs, was decontaminated using potable water and a high-pressure washer and then rinsed with potable water.

3.2.6 Personnel Hygiene

The following personal hygiene requirements were followed to avoid cross-contamination:

- Field personnel did not use cosmetics, moisturizers, hand cream, or other related products as part of their personal hygiene routine before a sampling event because these products may contain surfactants and be a potential source of PFAS.
- Because many manufactured sunblock and insect repellants contain PFAS, only sunblock and insect repellants that contain 100% natural ingredients were allowed.
- For restroom breaks, field personnel left the exclusion zone (EZ) before removing PPE. Before returning to the EZ, field personnel washed as normal, allowing extra time to rinse with water after using soap. Field personnel used a mechanical dryer to avoid using paper towels if possible.

3.2.7 Food Considerations

Field personnel did not eat or drink inside the EZ.

3.2.8 Visitors

Site visitors remained outside the EZ during all sampling activities.

3.3 DATA USABILITY

The quality of all analytical data was acceptable; no data was rejected and all data was considered usable for decision-making.

3.4 DEVIATIONS FROM THE FIELD SAMPLING PLAN

There were no significant deviations from the field sampling plan (ASL, November 2017). Minor deviations included the installation of 15-foot screens in two wells—instead of 10-foot screens—(see Section 3.1.2) and the inability to achieve low turbidities during development of some wells (see Section 3.1.3).

3.5 CURRENT FIRE TRAINING AREA (FTA) – AFFF AREA 1

3.5.1 Sample Locations

To assess possible PFAS impacts from use of AFFF at the current FTA, five surface soil samples (four primary and one duplicate), five subsurface soil samples (four primary and one duplicate), and five groundwater samples (four primary and one duplicate) were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0101, MW18PFC0102, and MW18PFC0103 and from soil boring SB18PFC0102. Groundwater samples were collected from each new monitoring well and from existing monitoring well MW930107. Sample locations for AFFF Area 1 are shown on Figure 5 in Appendix A.

3.5.2 Soil Descriptions

Four soil borings completed at the current FTA were terminated at depths ranging from 15.0 to 40.0 feet bgs. Soil types and USCS designations encountered primarily consisted of lean clay (CL) with intervals of well and poorly graded sand (SW and SP) and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.5.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells and one existing well at the current FTA on June 1, 2018. Groundwater was detected at depths ranging from 14.69 feet to 31.75 feet below top of casing (btoc) and at elevations ranging from 3156.63 feet above NAVD 88 (at existing well MW930107) to 3175.98 feet above NAVD 88 (at MW18PFC0101). Groundwater contours developed from these water level measurements indicate shallow groundwater flows east-southeast as shown on Figure 5 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.5.4 Analytical Results

Surface Soil

Five surface soil samples (four primary and one duplicate) were collected at the current FTA. PFBS and PFOA were detected in all five samples, but at concentrations below their respective screening levels. PFOS was detected at concentrations above the screening level in all five samples. Surface soil analytical results are summarized in Table 3 and shown on Figure 17 in Appendix A.

Table 3 Current Fire Training Area (AFFF Area 1) Surface Soil Analytical Results

	Sample ID	**ELSWH01-001-SS-001**	**ELSWH01-001-SS-901 (dup)**	**ELSWH01-002-SS-001**
	Date Sampled	**05/17/18**	**05/17/18**	**05/16/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**4.9 J**	**4.1 J**	**0.58 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**4.1 J**	**15 J**	**2.7**
Perfluorooctane Sulfonate (PFOS)	126[c]	**1,900 J**	**3,300 J**	**740**

Table 3 Current Fire Training Area (AFFF Area 1) Surface Soil Analytical Results (continued)

Analyte	Sample ID	ELSWH01-003-SS-001	ELSWH01-004-SS-001
	Date Sampled	05/15/18	05/16/18
	Sample Depth (ft bgs)	0 - 0.5	0 - 0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.32 J**	**3.6 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**2.3**	**21**
Perfluorooctane Sulfonate (PFOS)	126[c]	**300**	**1,800 J**

Bold values indicate analyte detected at concentration indicated. Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Subsurface Soil

Five subsurface soil samples (four primary and one duplicate) were also collected from soil borings at the current FTA. PFBS and PFOA were detected in all five samples, but at concentrations below their respective screening levels. PFOS was detected in all five samples, and exceeded the screening level in two samples. Subsurface soil analytical results are summarized in Table 4 and shown on Figure 17 in Appendix A.

Table 4 Current Fire Training Area (AFFF Area 1) Subsurface Soil Analytical Results

Analyte	Sample ID	ELSWH01-001-SO-013	ELSWH01-001-SO-913 (dup)	ELSWH01-002-SO-012
	Date Sampled	05/17/18	05/17/18	05/16/18
	Sample Depth (ft bgs)	13 - 14	13 - 14	12 - 13
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.71 J**	**0.82 J**	**2.5 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**1.4**	**1.2**	**4.1 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**72**	**70 J**	**630**

Table 4 Current Fire Training Area (AFFF Area 1) Subsurface Soil Analytical Results (continued)

	Sample ID	ELSWH01-003-SO-025	ELSWH01-004-SO-012
	Date Sampled	05/15/18	05/16/18
	Sample Depth (ft bgs)	25 - 26	12 - 13
Analyte	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.40 J**	**0.89**
Perfluorooctanoic Acid (PFOA)	126[c]	**3.4**	**2.6**
Perfluorooctane Sulfonate (PFOS)	126[c]	**0.55 J**	**540 J**

Bold values indicate analyte detected at concentration indicated. Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 1 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH01-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the four borings completed at Area 1. Subsurface soil sample ELSWH01-005-SO-025 was composed of equal aliquots of soil collected from the same borings at depths ranging from 12 to 26 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Five groundwater samples (four primary and one duplicate) were collected from three new monitoring wells and one existing well at the current FTA. PFBS was detected in all five samples, but at concentrations below the screening level. PFOA and PFOS were also detected in each of the five groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 5 and shown on Figure 18 in Appendix A.

Table 5 Current Fire Training Area (AFFF Area 1) Groundwater Analytical Results

	Well Number	**MW18PFC0101**	**MW18PFC0101**	**MW18PFC0102**
	Sample ID	**ELSWH01-001-GW-015**	**ELSWH01-001-GW-915 (dup)**	**ELSWH01-003-GW-035**
	Date Sampled	**05/20/18**	**05/20/18**	**05/21/18**
	Screened Interval (ft bgs)	**9.2 - 19.2**	**9.2 - 19.2**	**27.8 - 37.8**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**13**	**9.9**	**22**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**9.7**	**8.3**	**12**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**41**	**44**	**17**
Combined PFOA+PFOS	0.07[c]	**50.7**	**52.3**	**29**

	Well Number	**MW18PFC0103**	**MW930107**
	Sample ID	**ELSWH01-004-GW-018**	**ELSWH01-MW930107-GW-034**
	Date Sampled	**05/21/18**	**05/16/18**
	Screened Interval (ft bgs)	**9.4 - 19.4**	**24.5-34.5**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**2.6**	**28**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**9.0**	**15**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**82**	**72**
Combined PFOA+PFOS	0.07[c]	**91.0**	**87**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
AFFF = aqueous film forming foam
bgs = below ground surface
ID = identification
ft = foot or feet
GW = groundwater
ELSWH = ERPIMS designation for Ellsworth Air Force Base
dup = duplicate

3.5.5 Conclusions

Past use of AFFF at the current FTA has resulted in releases of PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 1 include surface and subsurface soil (PFOS) and groundwater (PFOS and PFOA).

3.6 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

3.6.1 Sample Locations

To further assess PFAS impacts from previous releases of AFFF at the 70, 80, 90 Rows, three surface soil samples, two subsurface soil samples, and five groundwater samples (four primary and one duplicate) were collected. Surface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0205, MW18PFC0206, and MW18PFC0207 and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0204 and MW18PFC0205. Groundwater samples were collected from each monitoring well. Sample locations for the 70, 80, 90 Rows are shown on Figure 6a in Appendix A.

To assess possible PFAS impacts at Outfall #3, three subsurface soil samples and three groundwater samples were collected. Subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0201, MW18PFC0202, and MW18PFC0203 and groundwater samples were collected from each of the three monitoring wells.

Four paired sediment and surface water samples were also collected at Outfall #3. During the initial field effort in April-June 2018, paired sediment and surface water samples (one primary and one duplicate for each media) were mistakenly collected from Pond #3 (location SW18PFC0204) rather than from a low lying wet area west of Pond #3. On July 31, 2018, paired sediment and surface water samples (one primary and one duplicate from each media) were collected in the correct location west of Pond #3 (location SW18PFC0204A). Sample locations for samples collected at Outfall #3 are shown on Figure 6b in Appendix A.

3.6.2 Soil Descriptions

Four soil borings completed at the 70, 80, 90 Rows were terminated at depths ranging from 35.0 to 45.0 feet bgs and three soil borings completed at Outfall #3 were terminated at depths ranging from 20.0 to 50.0 feet bgs. Soil types encountered were variable and included lean clay (CL), fat clay (CH), poorly graded sand (SP), silty sand (SM) and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.6.3 Groundwater Flow

Groundwater levels were gauged at four new monitoring wells at the 70, 80, 90 Rows and at three new monitoring wells at Outfall #3 on June 1, 2018. Groundwater at the 70, 80, 90 Rows was detected at depths ranging from 19.51 feet to 33.74 feet btoc and at elevations ranging from 3201.48 feet above NAVD 88 (at MW18PFC0207) to 3214.85 feet above NAVD 88 (at MW18PFC0206). Groundwater contours developed from these water level measurements and from adjacent AFFF Areas 5 and 9 indicate shallow groundwater flows southeast as shown on Figure 6a in Appendix A.

Groundwater at Outfall #3 was detected at depths ranging from 4.47 feet to 14.07 feet btoc and at elevations ranging from 3194.73 feet above NAVD 88 (at MW18PFC0203) to 3198.31 feet above NAVD 88 (at MW18PFC0202). Groundwater contours developed from these water level measurements indicate shallow groundwater flows southwest as shown on Figure 6b in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.6.4 Analytical Results

Surface Soil

Three surface soil samples were collected at the 70, 80, 90 Rows. PFBS was not detected in any of the samples. PFOS and PFOA were detected in all three samples, but at concentrations below the screening level. Surface soil was not identified as media of concern at Outfall #3 and was not sampled (ASL, November 2017). Surface soil analytical results are summarized in Table 6 and shown on Figure 19a in Appendix A.

Table 6 70, 80, 90 Rows (AFFF Area 2) Surface Soil Analytical Results[1]

	Sample ID	**ELSWH02-006-SS-001**	**ELSWH02-007-SS-001**	**ELSWH02-008-SS-001**
	Date Sampled	**05/01/18**	**05/03/18**	**05/02/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.65 U	0.55 U	0.55 U
Perfluorooctanoic Acid (PFOA)	126[c]	**1.4**	**1.4**	**0.83 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**47**	**9.1**	**4.6**

[1]Surface soil was not identified as media of concern at Outfall #3 and was not sampled.
Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Subsurface Soil

Five subsurface soil samples were collected at AFFF Area 2; two samples were collected at the 70, 80, 90 Rows and three samples were collected at Outfall #3. PFBS and PFOA were not detected in any of the samples. PFOS was detected in both subsurface soil samples collected at the 70, 80, 90 Rows and in one of three subsurface soil samples collected at Outfall #3. All detected PFOS concentrations were below the screening level. Subsurface soil analytical results are summarized in Table 7 and shown on Figures 19a and 19b in Appendix A.

Table 7 70, 80, 90 Rows and Outfall #3 (AFFF Area 2) Subsurface Soil Analytical Results

	Sample ID	ELSWH02-001-SO-030	ELSWH02-002-SO-031	ELSWH02-003-SO-004
	Location	Outfall #3	Outfall #3	Outfall #3
	Date Sampled	04/26/18	04/25/18	04/25/18
	Sample Depth (ft bgs)	30 - 31	31 - 32	4 - 5
Analyte	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.48 U	0.50 U	0.55 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.77 U	0.80 U	0.88 U
Perfluorooctane Sulfonate (PFOS)	126[c]	0.77 U	0.80 U	**4.0**

	Sample ID	ELSWH02-005-SO-034	ELSWH02-006-SO-024
	Location	70, 80, 90 Rows	70, 80, 90 Rows
	Date Sampled	05/07/18	05/01/18
	Sample Depth (ft bgs)	34 - 35	24 - 25
Analyte	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.41 U	0.55 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.66 U	0.88 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**27 J**	**1.1 J**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 2 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH02-009-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at three of the five borings at Area 2 (where surface soil was sampled). Subsurface soil sample ELSWH2-009-SO-024 was composed of equal aliquots of soil collected from all five borings at Area 2 at depths ranging from 4 to 35 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Eight groundwater samples (seven primary and one duplicate) were collected from seven new monitoring wells at AFFF Area 2 (four wells at the 70, 80, 90 Rows and three wells at Outfall #3). PFBS was detected in each of the four primary samples and in the duplicate sample at the 70, 80, 90 Rows, all at concentrations below the screening level. PFBS was also detected in two of the three samples collected at Outfall #3 at concentrations below the screening level. PFOA and PFOS were also detected in the four primary samples and in the duplicate sample at the 70, 80, 90 Rows, all at individual and/or combined concentrations above the screening level. PFOA and PFOS were also detected in two of the three samples collected at Outfall #3 with both individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 8 and shown on Figures 20a and 20b in Appendix A.

Table 8 70, 80, 90 Rows and Outfall #3 (AFFF Area 2) Groundwater Analytical Results

	Well Number	**MW18PFC0201**	**MW18PFC0202**	**MW18PFC0203**	**MW18PFC0204**
	Location	**Outfall #3**	**Outfall #3**	**Outfall #3**	**70, 80, 90 Rows**
	Sample ID	**ELSWH02-001-GW-035**	**ELSWH02-002-GW-035**	**ELSWH02-003-GW-013**	**ELSWH02-005-GW-040**
	Date Sampled	**05/04/18**	**05/04/18**	**04/26/18**	**05/23/18**
	Screened Interval (ft bgs)	**30 - 40**	**29.3 - 39.3**	**5.8 - 15.8**	**34 - 44**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	0.015 U	**0.63**	**0.017 J**	**0.69**
Perfluorooctanoic Acid (PFOA)	0.07[b]	0.010 U	**0.78**	**0.48**	**0.30**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	0.015 U	**0.28**	**0.74**	**0.56**
Combined PFOA+PFOS	0.07[c]	ND	**1.06**	**1.22**	**0.86**

	Well Number	**MW18PFC0205**	**MW18PFC0206**	**MW18PFC0207**	**MW18PFC0207**
	Location	**70, 80, 90 Rows**	**70, 80, 90 Rows**	**70, 80, 90 Rows**	**70, 80, 90 Rows**
	Sample ID	**ELSWH02-006-GW-030**	**ELSWH02-007-GW-018**	**ELSWH02-008-GW-029**	**ELSWH02-008-GW-929 (dup)**
	Date Sampled	**05/04/18**	**05/18/18**	**05/18/18**	**05/18/18**
	Screened Interval (ft bgs)	**23.8 - 33.8**	**10.1 - 20.1**	**24.2 - 34.2**	**24.2 - 34.2**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.011 J**	**0.0096 J**	**0.055 J**	**0.019 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.030**	**0.024**	**0.12 J**	**0.040 J**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.074**	**0.17**	**2.5 J**	**0.97 J**
Combined PFOA+PFOS	0.07[c]	**0.104**	**0.194**	**2.62 J**	**1.01 J**

Bold values indicate analyte detected at concentration indicated. Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
AFFF = aqueous film forming foam
bgs = below ground surface
dup = duplicate
ft = foot or feet
ID = identification
GW = groundwater
ND = not detected
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value

Sediment

Four sediment samples (two primary and two duplicate) were collected near Outfall #3. PFBS was not detected in any of the samples. PFOS and PFOA were detected in all four samples, but at concentrations below the screening level. Sediment analytical results are summarized in Table 9 and shown on Figure 19b in Appendix A.

Table 9 Outfall #3 (AFFF Area 2) Sediment Analytical Results[1]

	Sample ID	**ELSWH02-004-SD-001**	**ELSWH02-004-SD-901 (dup)**	**ELSWH02-004-SD-001A**	**ELSWH02-004-SD-901A (dup)**
	Sample Date	**04/26/18**	**04/26/18**	**07/31/18**	**07/31/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	3.4 U	4.9 U	0.60 U	0.65 U
Perfluorooctanoic Acid (PFOA)	126[c]	**5.2 J**	**9.2 J**	**0.69 J**	**0.90 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**57 J**	**90 J**	**23 J**	**11 J**

[1] Sediment was not identified as media of concern at the 70, 80, 90 Rows and was not sampled.

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SD = sediment
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = the analyte was not detected at the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Surface Water

Four surface water samples (two primary and two duplicate) were also collected at Outfall #3. PFBS was detected in all four samples, but at concentrations below the screening level. PFOS and PFOA were detected in all four samples at both individual and combined concentrations above the screening level. Surface water analytical results are summarized in Table 10 and shown on Figure 20b in Appendix A.

Table 10 Outfall #3 (AFFF Area 2) Surface Water Analytical Results[1]

	Sample ID	ELSWH02-004-SW-001	ELSWH02-004-SW-901 (dup)	ELSWH02-004-SW-001A	ELSWH02-004-SW-901A (dup)
	Date Sampled	**04/26/18**	**04/26/18**	**07/31/18**	**07/31/18**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.015 J**	**0.015 J**	**0.030**	**0.029**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.35**	**0.38**	**0.13**	**0.14**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.44**	**0.42**	**0.37**	**0.32**
Combined PFOA+PFOS	0.07[c]	**0.79**	**0.80**	**0.50**	**0.46**

[1] Surface water was not identified as media of concern at the 70, 80, 90 Rows and was not sampled.
Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
AFFF = aqueous film forming foam
ID = identification
SW = surface water
dup = duplicate

3.6.5 Conclusions

Past releases of AFFF at the 70, 80, 90 Rows and Outfall #3 have resulted in releases of PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 2 include groundwater (PFOS and PFOA) at both the 70, 80, 90 Rows and Outfall #3 and surface water (PFOS and PFOA) at Outfall #3.

3.7 BUILDING 618 – AFFF AREA 3

3.7.1 Sample Locations

To further assess PFAS impacts from apparent AFFF releases at Building 618, five subsurface soil samples (four primary and one duplicate) and three groundwater samples were collected. Subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0301, MW18PFC0302, and MW18PFC0303 and from soil boring SB18PFC0304. Groundwater samples were collected from each monitoring well. Sample locations for AFFF Area 3 are shown on Figure 7 in Appendix A.

3.7.2 Soil Descriptions

Four soil borings completed at Building 681 were terminated at depths ranging from 15.0 to 20.0 feet bgs. Soil types encountered were highly variable and included lean clay (CL), fat clay (CH), silt (ML), clayey sand (SC), poorly graded sand (SP), clayey gravel (GC), poorly graded gravel (GP) and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.7.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at Building 618 on June 1, 2018. Groundwater was detected at depths ranging from 8.91 feet to 11.28 feet btoc and at elevations ranging from 3168.04 feet above NAVD 88 (at MW18PFC0302) to 3170.39 feet above NAVD 88 (at MW18PFC0301). Groundwater contours developed from these water level measurements indicate shallow groundwater flows southeast as shown on Figure 7 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.7.4 Analytical Results

Surface Soil
Surface soil was not identified as media of concern at AFFF Area 3 and was not sampled (ASL, November 2017).

Subsurface Soil
Five subsurface soil samples (four primary and one duplicate) were collected at AFFF Area 3 around UST 618. PFBS was not detected in any of the samples. PFOA was detected in one primary sample, and PFOS was detected in three of four primary samples and in the duplicate sample, all at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 11 and shown on Figure 21 in Appendix A.

Table 11 Building 618 (AFFF Area 3) Subsurface Soil Analytical Results

	Sample ID	**ELSWH03-001-SO-009**	**ELSWH03-002-SO-011**	**ELSWH03-002-SO-911 (dup)**
	Date Sampled	**05/17/18**	**05/06/18**	**05/06/18**
	Sample Depth (ft bgs)	**9 - 10**	**11 - 12**	**11 - 12**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.49 U	0.50 U	0.49 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.69 J**	0.80 U	0.78 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**110 J**	0.80 U	**0.47 J**

Table 11 Building 618 (AFFF Area 3) Subsurface Soil Analytical Results (continued)

Analyte	Sample ID	ELSWH03-003-SO-011	ELSWH03-004-SO-011
	Date Sampled	05/06/18	05/07/18
	Sample Depth (ft bgs)	11 - 12	11 - 12
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.47 U	0.45 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.74 U	0.72 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**8.5**	**5.6**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, a composite subsurface soil sample was collected from AFFF Area 3 soil borings for pH, TOC, percent solids, and grain size analysis. Subsurface soil sample ELSWH03-005-SO-011 was composed of equal aliquots of soil collected from the four borings at Area 3 at depths ranging from 9 to 12 feet bgs. No surface soil samples were collected at Area 3. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells at UST 618, adjacent to Building 618. PFBS was detected in all three samples, but at concentrations below the screening level. PFOA and PFOS were also detected in each of the three groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 12 and shown on Figure 22 in Appendix A.

Table 12 Building 618 (AFFF Area 3) Groundwater Analytical Results

	Well Number	**MW18PFC0301**	**MW18PFC0302**	**MW18PFC0303**
	Sample ID	**ELSWH03-001-GW-015**	**ELSWH03-002-GW-017**	**ELSWH03-003-GW-016**
	Date Sampled	**05/24/18**	**05/10/18**	**05/10/18**
	Screened Interval (ft bgs)	**9 - 19**	**9.6 - 19.6**	**9 - 19**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.044**	**0.059**	**0.086**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.073**	**0.12**	**0.10**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**1.6**	**1.4**	**1.3**
Combined PFOA+PFOS	0.07[c]	**1.673**	**1.52**	**1.40**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b]EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[c]The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
GW = groundwater
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

3.7.5 Conclusions

Past releases of AFFF at Building 618 have resulted in releases of PFAS to the environment. Groundwater is the only sampled media impacted by PFAS (PFOS and PFOA) above screening levels at AFFF Area 3.

3.8 Former Fire Station (Building 7506) – AFFF Area 4

3.8.1 Sample Locations

To assess possible PFAS impacts from reported releases of AFFF at the former Fire Station (Building 7506), three surface soil samples, five subsurface soil samples, and three groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0401, MW18PFC0402, and MW18PFC0403; subsurface soil samples were also collected from soil borings SB18PFC0404 and SB18PFC0405. Groundwater samples were collected from each monitoring well. Sample locations for AFFF Area 4 are shown on Figure 8 in Appendix A.

3.8.2 Soil Descriptions

Five soil borings completed at the former fire station were terminated at depths ranging from 35.0 to 50.0 feet bgs. Soil types encountered were variable, consisting primarily of lean clay (CL) with some intervals of silty sand (SM) and lesser amounts of fat clay (CH), silt (ML), clayey sand (SC), clayey gravel (GC), and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.8.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the former fire station (Building 7506) on June 1, 2018. Groundwater was detected at depths ranging from 20.39 feet to 29.28 feet btoc and at elevations ranging from 3183.14 feet above NAVD 88 (at MW18PFC0403) to 3191.24 feet above NAVD 88 (at MW18PFC0401). Groundwater contours developed from these water level measurements indicate shallow groundwater flows south-southeast as shown on Figure 8 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.8.4 Analytical Results

Surface Soil

Three surface soil samples were collected at the site of the former fire station (Building 7506). PFBS and PFOA were detected in all three samples at concentrations below their respective screening levels. PFOS was also detected in all three samples and exceeded the screening level in one sample. Surface soil analytical results are summarized in Table 13 and shown on Figure 23 in Appendix A.

Table 13 Former Fire Station (Building 7506) (AFFF Area 4) Surface Soil Analytical Results

	Sample ID	**ELSWH04-001-SS-001**	**ELSWH04-002-SS-001**	**ELSWH04-003-SS-001**
	Date Sampled	**05/22/18**	**05/18/18**	**05/18/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.38 J**	**0.40 J**	**8.2 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**3.0**	**2.9**	**62**
Perfluorooctane Sulfonate (PFOS)	126[c]	**48**	**82**	**3,000**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SS = surface soil
ID = identification
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value

Subsurface Soil

Five subsurface soil samples were collected at the site of the former fire station (Building 7506). PFBS and PFOA were detected in all five samples and PFOS was detected in four samples. All PFBS, PFOA, and PFOS detections were below their respective screening levels. Subsurface soil analytical results are summarized in Table 14 and shown on Figure 23 in Appendix A.

Table 14 Former Fire Station (Building 7506) (AFFF Area 4) Subsurface Soil Analytical Results

	Sample ID	**ELSWH04-001-SO-029**	**ELSWH04-002-SO-035**	**ELSWH04-003-SO-027**
	Date Sampled	**05/22/18**	**05/18/18**	**05/18/18**
	Sample Depth (ft bgs)	**29 - 30**	**35 - 36**	**27 - 28**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.62 J**	**0.61 J**	**0.53 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**1.9**	**1.6**	**2.1**
Perfluorooctane Sulfonate (PFOS)	126[c]	1.0 U	**7.6**	**11**

	Sample ID	**ELSWH04-004-SO-031**	**ELSWH04-005-SO-020**
	Date Sampled	**05/18/18**	**05/18/18**
	Sample Depth (ft bgs)	**31 - 32**	**20 - 21**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**0.41 J**	**0.28 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**0.86 J**	**0.24 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**10**	**1.5**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 4 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH04-006-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at three of the five borings completed at Area 4 (where surface soil was sampled). Subsurface soil sample ELSWH04-006-SO-035 was composed of equal aliquots of soil collected from each of the five borings at depths ranging from 20 to 36 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells at the former fire station (Building 7506). PFBS was detected in all three samples, but at concentrations below the screening level. PFOA and PFOS were also detected in each of the three groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 15 and shown on Figure 24 in Appendix A.

Table 15 Former Fire Station (Building 7506) (AFFF Area 4) Groundwater Analytical Results

	Well Number	**MW18PFC0401**	**MW18PFC0402**	**MW18PFC0403**
	Sample ID	**ELSWH04-001-GW-032**	**ELSWH04-002-GW-038**	**ELSWH04-003-GW-033**
	Date Sampled	**05/31/18**	**05/31/18**	**05/31/18**
	Screened Interval (ft bgs)	**24.3 - 34.3**	**33.9 - 43.9**	**24.0 - 39.0**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.11**	**0.048**	**0.40**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.31**	**0.11**	**0.76**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.16**	**0.71**	**0.79**
Combined PFOA+PFOS	0.07[c]	**0.47**	**0.82**	**1.55**

Bold values indicate analyte detected at concentration indicated.

Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ID = identification
GW = groundwater

3.8.5 Conclusions

Past releases of AFFF at the former fire station have resulted in releases of PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 4 include surface soil (PFOS) and groundwater (PFOS and PFOA).

3.9 B-52 CRASH (1972) – AFFF AREA 5

3.9.1 Sample Locations

To assess possible PFAS impacts from use of AFFF at the B-52 crash site, three surface soil samples, four subsurface soil samples (three primary and one duplicate), and two groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0501 and MW18PFC0502. A subsurface soil sample was also collected from soil boring SB18PFC0503 and groundwater samples were collected from both monitoring wells. Sample locations for AFFF Area 5 are shown on Figure 9 in Appendix A.

3.9.2 Soil Descriptions

Three soil borings completed at the B-52 crash site were terminated at depths ranging from 15.0 to 35.0 feet bgs. Soil types encountered were variable, consisting primarily of lean clay (CL) with some intervals of silty sand (SM) and lesser amounts of fat clay (CH), silt (ML), clayey sand (SC), and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.9.3 Groundwater Flow

Groundwater levels were gauged at two new monitoring wells at the B-52 crash site on June 1, 2018. Groundwater was detected at depths of 17.43 feet and 19.40 feet btoc and at elevations of 3202.83 feet above NAVD 88 (at MW18PFC0501) and 3203.08 feet above NAVD 88 (at MW18PFC0502). Groundwater contours developed from these water level measurements and from adjacent AFFF Area 2 (70, 80, 90 Rows) indicate shallow groundwater flows southeast as shown on Figure 9 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.9.4 Analytical Results

Surface Soil

Three surface soil samples were collected at the B-52 crash site. PFBS was not detected in any of the three samples. PFOA and PFOS were detected in all three samples at concentrations below the screening level. Surface soil analytical results are summarized in Table 16 and shown on Figure 25 in Appendix A.

Table 16 B-52 Crash (AFFF Area 5) Surface Soil Analytical Results

	Sample ID	**ELSWH05-001-SS-001**	**ELSWH05-002-SS-001**	**ELSWH05-003-SS-001**
	Date Sampled	**05/02/18**	**05/01/18**	**05/02/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.50 U	0.60 U	0.55 U
Perfluorooctanoic Acid (PFOA)	126[c]	**1.8**	**0.62 J**	**3.1**
Perfluorooctane Sulfonate (PFOS)	126[c]	**68**	**11**	**75**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SS = surface soil
ID = identification
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Subsurface Soil

Four subsurface soil samples (three primary and one duplicate) were collected at the B-52 crash site. PFBS was not detected in any of the samples. PFOA was detected in one sample and PFOS was detected in three samples; all at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 17 and shown on Figure 25 in Appendix A.

Table 17 B-52 Crash (AFFF Area 5) Subsurface Soil Analytical Results

Analyte	Sample ID	ELSWH05-001-SO-028	ELSWH05-002-SO-020	ELSWH05-003-SO-009	ELSWH05-003-SO-909 (dup)
	Date Sampled	**05/02/18**	**05/01/18**	**05/02/18**	**05/02/18**
	Sample Depth (ft bgs)	**28 - 29**	**20 - 21**	**9 - 10**	**9 - 10**
	Screening Level (µg/kg)	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.48 U	0.46 U	0.50 U	0.47 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.77 U	0.73 U	0.80 U	**0.37 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**0.37 J**	0.73 U	**0.90 J**	**1.4**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected at the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 5 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH05-004-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the three borings completed at Area 5. Subsurface soil sample ELSWH05-004-SO-020 was composed of equal aliquots of soil collected from the same borings at depths ranging from 9 to 29 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Two groundwater samples were collected from two new monitoring wells at the B-52 crash site. PFBS was detected in both samples, but at concentrations below the screening level. PFOA and PFOS were also detected in both groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 18 and shown on Figure 26 in Appendix A.

Table 18 B-52 Crash (AFFF Area 5) Groundwater Analytical Results

Analyte	Well Number	MW18PFC0501	MW18PFC0502
	Sample ID	ELSWH05-001-GW-030	ELSWH05-002-GW-025
	Date Sampled	05/04/18	05/03/18
	Screened Interval (ft bgs)	24.1 - 34.1	19 - 29
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.015 J**	**0.014 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.095**	**0.088**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.34**	**0.24**
Combined PFOA+PFOS	0.07[c]	**0.435**	**0.328**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b]EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[c]The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
AFFF = aqueous film forming foam
ID = identification
GW = groundwater

3.9.5 Conclusions

Use of AFFF at the B-52 crash site has resulted in a release of PFAS to the environment. Groundwater is the only media impacted by PFAS (PFOS and PFOA) above screening levels at AFFF Area 5.

3.10 B-1 CRASH (1988) – AFFF AREA 6

3.10.1 Sample Locations

To assess possible PFAS impacts from use of AFFF at the B-1 crash site in 1988, five surface soil samples (four primary and one duplicate), four subsurface soil samples, and four groundwater samples (three primary and one duplicate) were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0601, MW18PFC0602, and MWPFC0603 and from soil boring SB18PFC0604. Groundwater samples were collected from each monitoring well. Sample locations for AFFF Area 6 are shown on Figure 10 in Appendix A.

3.10.2 Soil Descriptions

Four soil borings completed at the B-1 crash site were terminated at depths ranging from 20.0 to 60.0 feet bgs. Soil types encountered were variable, consisting primarily of lean clay (CL) with occasional intervals of silty sand (SM), silt (ML), clayey sand (SC), and well graded sand (SW). Detailed boring logs are included in Appendix C.

3.10.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the B-1 crash site on June 1, 2018. Groundwater was detected at depths ranging from 10.77 feet to 14.92 feet btoc and at elevations ranging from 3150.99 feet above NAVD 88 (at MW18PFC0603) to 3160.98 feet above NAVD 88 (at MW18PFC0601). Groundwater contours developed from these water level measurements indicate shallow groundwater flows south as shown on Figure 10 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.10.4 Analytical Results

Surface Soil

Five surface soil samples (four primary and one duplicate) were collected at the B-1 crash site. PFBS was not detected in any of the samples. PFOS and PFOA were detected in all five samples, but at concentrations below the screening level. Surface soil analytical results are summarized in Table 19 and shown on Figure 27 in Appendix A.

Table 19 B-1 Crash (AFFF Area 6) Surface Soil Analytical Results

	Sample ID	**ELSWH06-001-SS-001**	**ELSWH06-002-SS-001**	**ELSWH06-003-SS-001**
	Date Sampled	**05/06/18**	**05/05/18**	**05/05/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.45 U	0.55 U	0.49 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.79 J**	**0.73 J**	**0.57 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**61**	**6.8**	**4.6**

Table 19 B-1 Crash (AFFF Area 6) Surface Soil Analytical Results (continued)

	Sample ID	ELSWH06-004-SS-001	ELSWH06-004-SS-901 (dup)
	Date Sampled	05/06/18	05/06/18
	Sample Depth (ft bgs)	0 - 0.5	0 - 0.5
Analyte	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.46 U	0.49 U
Perfluorooctanoic Acid (PFOA)	126[c]	**1.2 J**	**1.8 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**29 J**	**22**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
dup = duplicate
ft = foot or feet
ID = identification
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Subsurface Soil

Four subsurface soil samples were also collected at the B-1 crash site. PFBS and PFOA were not detected in any of the samples. PFOS was detected in two of the four samples, but at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 20 and shown on Figure 27 in Appendix A.

Table 20 B-1 Crash (AFFF Area 6) Subsurface Soil Analytical Results

	Sample ID	ELSWH06-001-SO-012	ELSWH06-002-SO-010	ELSWH06-003-SO-054	ELSWH06-004-SO-035
	Date Sampled	05/06/18	05/05/18	05/05/18	05/06/18
	Sample Depth (ft bgs)	12 - 13	10 - 11	54 - 55	35 - 36
Analyte	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.43 U	0.48 U	0.46 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.68 U	0.76 U	0.73 U	0.80 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**0.77 J**	**0.51 J**	0.73 U	0.80 U

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SO = subsurface soil
ID = identification
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 6 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH06-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the four borings completed at Area 6. Subsurface soil sample ELSWH06-005-SO-054 was composed of equal aliquots of soil collected from the same borings at depths ranging from 10 to 55 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Four groundwater samples (three primary and one duplicate) were collected from three new monitoring wells at the B-1 crash site. PFBS was detected in three of the four samples, but at concentrations below the screening level. PFOA and PFOS were also detected in one of the three groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 21 and shown on Figure 28 in Appendix A.

Table 21 B-1 Crash (AFFF Area 6) Groundwater Analytical Results

	Well Number	**MW18PFC0601**	**MW18PFC0602**	**MW18PFC0602**	**MW18PFC0603**
	Sample ID	**ELSWH06-001-GW-018**	**ELSWH06-002-GW-018**	**ELSWH06-002-GW-918 (dup)**	**ELSWH06-003-GW-055**
	Date Sampled	**05/09/18**	**05/09/18**	**05/09/18**	**05/07/18**
	Screened Interval (ft bgs)	**8.6 - 18.6**	**8.9 - 18.9**	**8.9 - 18.9**	**49.3 - 59.3**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40^{a}	**0.022**	**0.016 J**	**0.015 J**	0.015 U
Perfluorooctanoic Acid (PFOA)	0.07^{b}	**0.19**	0.010 U	0.010 U	0.010 U
Perfluorooctane Sulfonate (PFOS)	0.07^{b}	**0.40**	0.015 U	0.015 U	0.015 U
Combined PFOA+PFOS	0.07^{c}	**0.59**	ND	ND	ND

Bold values indicate analyte detected at concentration indicated.

Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
dup = duplicate
ID = identification
AFFF = aqueous film forming foam
ft = foot or feet
ND = not detected
bgs = below ground surface
GW = groundwater
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected at the reported value

3.10.5 Conclusions

Use of AFFF at the B-1 crash site has resulted in a release of PFAS to the environment. Groundwater is the only media impacted by PFAS (PFOS and PFOA) above screening levels at AFFF Area 6.

3.11 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

3.11.1 Sample Locations

To assess possible PFAS impacts from a 2000 AFFF spill on Delta Taxiway West (resulting from a vehicle crash), four surface soil samples, four subsurface soil samples, and three groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0701, MW18PFC0702, and MWPFC0703 and from soil boring SB18PFC0704. Groundwater samples were collected from each monitoring well. Sample locations for AFFF Area 7 are shown on Figure 11 in Appendix A.

3.11.2 Soil Descriptions

Four soil borings completed at the Delta Taxiway West crash site were terminated at depths ranging from 20.0 to 60.0 feet bgs. Soil types encountered were highly variable, consisting primarily of lean clay (CL) with occasional intervals of silty sand (SM), well graded sand (SW), silt (ML), clayey sand (SC), and clayey gravel (GC). Detailed boring logs are included in Appendix C.

3.11.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the Delta Taxiway West crash site on June 1, 2018. Groundwater was detected at depths ranging from 13.66 feet to 15.41 feet btoc and at elevations ranging from 3189.84 feet above NAVD 88 (at MW18PFC0702) to 3190.55 feet above NAVD 88 (at MW18PFC0703). Groundwater contours developed from these water level measurements indicate shallow groundwater flows southeast as shown on Figure 11 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.11.4 Analytical Results

Surface Soil

Four surface soil samples were collected at the Delta Taxiway West crash site. PFBS was not detected in any of the samples. PFOS was detected in all four samples and PFOA was detected in three of four samples, all at concentrations below the screening level. Surface soil analytical results are summarized in Table 22 and shown on Figure 29 in Appendix A.

Table 22 Delta Taxiway West Crash (AFFF Area 7) Surface Soil Analytical Results

	Sample ID	**ELSWH07-001-SS-001**	**ELSWH07-002-SS-001**	**ELSWH07-003-SS-001**	**ELSWH07-004-SS-001**
	Date Sampled	**05/08/18**	**05/09/18**	**05/15/18**	**05/08/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.55 U	0.45 U	0.43 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	**2.6**	**0.36 J**	0.69 U	**0.60 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**18**	**18**	**1.8**	**5.9**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Subsurface Soil

Four subsurface soil samples were also collected at the Delta Taxiway West crash site. PFBS and PFOA were not detected in any of the samples. PFOS was detected in two of four samples, both at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 23 and shown on Figure 29 in Appendix A.

Table 23 Delta Taxiway West Crash (AFFF Area 7) Subsurface Soil Analytical Results

	Sample ID	**ELSWH07-001-SO-029**	**ELSWH07-002-SO-013**	**ELSWH07-003-SO-016**	**ELSWH07-004-SO-013**
	Date Sampled	**05/08/18**	**05/09/18**	**05/15/18**	**05/08/18**
	Sample Depth (ft bgs)	**29 - 30**	**13 - 14**	**16 - 17**	**13 - 14**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.50 U	0.41 U	0.40 U	0.41 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.80 U	0.66 U	0.64 U	0.65 U
Perfluorooctane Sulfonate (PFOS)	126[c]	0.80 U	**1.1**	**0.34 J**	0.65 U

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 7 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH07-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the four borings completed at Area 7. Subsurface soil sample ELSWH07-005-SO-001 was composed of equal aliquots of soil collected from the same borings at depths ranging from 13 to 30 feet bgs. Table E-1, summarizing the physiochemical data, and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells at the Delta Taxiway West crash site. PFBS was detected in two of the three samples, but at concentrations below the screening level. PFOA and PFOS were also detected in two of the three groundwater samples; however, both the individual and combined concentrations of PFOA and PFOS were below the screening level. Groundwater analytical results are summarized in Table 24 and shown on Figure 30 in Appendix A.

Table 24 Delta Taxiway West Crash (AFFF Area 7) Groundwater Analytical Results

	Well Number	**MW18PFC0701**	**MW18PFC0702**	**MW18PFC0703**
	Sample ID	**ELSWH07-001-GW-035**	**ELSWH07-002-GW-021**	**ELSWH07-003-GW-021**
	Date Sampled	**05/15/18**	**05/21/18**	**05/21/18**
	Screened Interval (ft bgs)	**29.1 - 39.1**	**14.3 - 24.3**	**14.1 - 24.1**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	0.015 U	**0.018 J**	**0.016 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	0.010 U	**0.010 J**	**0.0094 J**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	0.015 U	**0.017 J**	**0.017 J**
Combined PFOA+PFOS	0.07[b]	ND	**0.027 J**	**0.0264 J**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ID = identification
GW = groundwater
ND = not detected

3.11.5 Conclusions

Although an AFFF spill occurred at the Delta Taxiway West crash site, soil and groundwater were not impacted by PFBS, PFOA, or PFOS above screening levels.

3.12 MARTEN CRASH (2006) – AFFF AREA 8

3.12.1 Sample Locations

To assess possible PFAS impacts from use of AFFF at a 2006 truck crash, four surface soil samples, five subsurface soil samples (four primary and one duplicate), and three groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC0801, MW18PFC0802, and MWPFC0803 and from soil boring SB18PFC0804. Groundwater samples were collected from each monitoring well. Sample locations for AFFF Area 8 are shown on Figure 12 in Appendix A.

3.12.2 Soil Descriptions

Four soil borings completed at the Marten crash site were terminated at depths ranging from 50.0 to 60.0 feet bgs. Soils encountered at Area 8 were very consistent; lean clay (CL) was the only soil type encountered in each of the four borings. Detailed boring logs are included in Appendix C.

3.12.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the Marten crash site on June 1, 2018. Groundwater was detected at depths ranging from 14.36 feet to 15.07 feet btoc and at elevations ranging from 3058.49 feet above NAVD 88 (at MW18PFC0802) to 3059.65 feet above NAVD 88 (at MW18PFC0801). Groundwater contours developed from these water level measurements indicate shallow groundwater flows south-southeast as shown on Figure 12 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.12.4 Analytical Results

Surface Soil

Four surface soil samples were collected at the Marten crash site. PFBS was not detected in any of the samples. PFOS and PFOA were detected in all four samples, but at concentrations below the screening level. Surface soil analytical results are summarized in Table 25 and shown on Figure 31 in Appendix A.

Table 25 Marten Crash (2006) (AFFF Area 8) Surface Soil Analytical Results

	Sample ID	**ELSWH08-001-SS-001**	**ELSWH08-002-SS-001**	**ELSWH08-003-SS-001**	**ELSWH08-004-SS-001**
	Date Sampled	**04/23/18**	**04/22/18**	**04/21/18**	**04/21/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.60 U	0.45 U	0.45 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.64 J**	**0.57 J**	**0.75 J**	**1.1**
Perfluorooctane Sulfonate (PFOS)	126[c]	**13**	**5.2**	**12**	**12**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification
J = reported concentration is an estimated value

Subsurface Soil

Five subsurface soil samples (four primary and one duplicate) were collected at the Marten crash site. PFBS, PFOS, and PFOA were not detected in any of the samples. Subsurface soil analytical results are summarized in Table 26 and shown on Figure 31 in Appendix A.

Table 26 Marten Crash (2006) (AFFF Area 8) Subsurface Soil Analytical Results

	Sample ID	**ELSWH08-001-SO-030**	**ELSWH08-002-SO-040**	**ELSWH08-002-SO-940 (dup)**
	Date Sampled	**04/23/18**	**04/23/18**	**04/23/18**
	Sample Depth (ft bgs)	**30 - 31**	**40 - 41**	**40 - 41**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.60 U	0.55 U	0.60 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.96 U	0.88 U	0.96 U
Perfluorooctane Sulfonate (PFOS)	126[c]	0.96 U	0.88 U	0.96 U

	Sample ID	**ELSWH08-003-SO-046**	**ELSWH08-004-SO-051**
	Date Sampled	**04/22/18**	**04/22/18**
	Sample Depth (ft bgs)	**46 - 47**	**51 - 52**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.55 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.88 U	0.80 U
Perfluorooctane Sulfonate (PFOS)	126[c]	0.88 U	0.80 U

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 8 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH08-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the four borings completed at Area 8. Subsurface soil sample ELSWH08-005-SO-046 was composed of equal aliquots of soil collected from the same borings at depths ranging from 30 to 52 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells at the Marten crash site. PFBS, PFOS, and PFOA were not detected in any of the samples. Groundwater analytical results are summarized in Table 27 and shown on Figure 32 in Appendix A.

Table 27 Marten Crash (2006) (AFFF Area 8) Groundwater Analytical Results

	Well Number	**MW18PFC0801**	**MW18PFC0802**	**MW18PFC0803**
	Sample ID	**ELSWH08-001-GW-044**	**ELSWH08-002-GW-045**	**ELSWH08-003-GW-045**
	Date Sampled	**05/01/18**	**04/26/18**	**04/26/18**
	Screened Interval (ft bgs)	**35.9 - 50.9**	**39.3 - 49.3**	**40.1 - 50.1**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	0.015 U	0.015 U	0.015 U
Perfluorooctanoic Acid (PFOA)	0.07[b]	0.010 U	0.010 U	0.010 U
Perfluorooctane Sulfonate (PFOS)	0.07[b]	0.015 U	0.015 U	0.015 U
Combined PFOA+PFOS	0.07[c]	ND	ND	ND

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b]EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c]The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ID = identification
GW = groundwater
ND = not detected

3.12.5 Conclusions

Although AFFF was used at the Marten crash site, soil and groundwater have not been impacted by PFBS, PFOS, or PFOA above screening levels.

3.13 CRASH 4 (2001) – AFFF AREA 9

3.13.1 Sample Locations

To assess possible PFAS impacts from an AFFF spill from emergency response vehicle “Crash 4,” four surface soil samples (three primary and one duplicate), three subsurface soil samples, and two groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings SB18PFC0901, MW18PFC0902, and SB18PFC0903. Monitoring wells installed in soil borings SB18PFC0901 and SB18PFC0902 did not produce water and were determined to be too shallow. These wells were abandoned and deeper replacement wells MW18PFC0901A and MW18PFC0902A were installed near the original well locations and sampled. Sample locations for AFFF Area 9 are shown on Figure 13 in Appendix A.

3.13.2 Soil Descriptions

Five soil borings completed at the Crash 4 spill site were terminated at depths ranging from 18.0 to 35.0 feet bgs. Soil types encountered were highly variable, consisting primarily of lean clay (CL) with occasional intervals of silty sand (SM), well graded sand (SW), fat clay (CH), silt (ML), and clayey sand (SC). Detailed boring logs are included in Appendix C.

3.13.3 Groundwater Flow

Groundwater levels were gauged at two new monitoring wells at the Crash 4 spill site on June 1, 2018. Groundwater was detected at depths of 25.70 feet and 31.72 feet btoc and at elevations of 3215.09 feet above NAVD 88 (at MW18PFC0901A) and 3222.52 feet above NAVD 88 (at MW18PFC0902A). Groundwater contours developed from these water level measurements and from adjacent AFFF Area 2 (70, 80, 90 Rows) indicate shallow groundwater flows southeast as shown on Figure 13 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.13.4 Analytical Results

Surface Soil

Four surface soil samples (three primary and one duplicate) were collected at the Crash 4 spill site. PFBS was not detected in any of the samples. PFOS was detected in all four samples and PFOA was detected in two of the three primary samples and in the duplicate sample, all at concentrations below the screening level. Surface soil analytical results are summarized in Table 28 and shown on Figure 33 in Appendix A.

Table 28 Crash 4 (AFFF Area 9) Surface Soil Analytical Results

	Sample ID	**ELSWH09-001-SS-001**	**ELSWH09-002-SS-001**	**ELSWH09-002-SS-901 (dup)**	**ELSWH09-003-SS-001**
	Date Sampled	**05/21/18**	**05/21/18**	**05/21/18**	**05/04/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.49 U	0.55 U	0.55 U	0.60 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.62 J**	0.88 U	**0.64 J**	**1.1 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**32**	**4.0 J**	**31 J**	**3.0**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
dup = duplicate
ft = foot or feet
ID = identification
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Subsurface Soil

Three subsurface soil samples were collected at the Crash 4 spill site. PFBS was not detected in any of the samples. PFOS was detected in two of three samples and PFOA was detected in one of three samples, all at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 29 and shown on Figure 33 in Appendix A.

Table 29 Crash 4 (AFFF Area 9) Subsurface Soil Analytical Results

	Sample ID	**ELSWH09-001-SO-005**	**ELSWH09-002-SO-005**	**ELSWH09-003-SO-028**
	Date Sampled	**05/21/18**	**05/21/18**	**05/04/18**
	Sample Depth (ft bgs)	**5 - 6**	**5 - 6**	**28 - 29**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.49 U	0.50 U	0.42 U
Perfluorooctanoic Acid (PFOA)	126[c]	**4.5**	0.80 U	0.67 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**1.0**	**2.1**	0.67 U

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SO = subsurface soil
ID = identification
ELSWH = ERPIMS designation for Ellsworth Air Force Base
U = analyte was not detected above the reported value

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 9 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH09-004-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the three borings completed at Area 9. Subsurface soil sample ELSWH09-004-SO-028 was composed of equal aliquots of soil collected from the same borings at depths ranging from 5 to 29 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from two new monitoring wells at the Crash 4 spill site. PFBS was detected in one sample at a concentration below the screening level. PFOS and PFOA were detected in both samples. PFOS exceeded the screening level in one groundwater sample and the combined PFOS and PFOA concentrations exceeded the screening level in both samples. Groundwater analytical results are summarized in Table 30 and shown on Figure 34 in Appendix A.

Table 30 Crash 4 (AFFF Area 9) Groundwater Analytical Results

Analyte	Well Number	MW18PFC0901A	MW18PFC0902A
	Sample ID	ELSWH09-001-GW-033A	ELSWH09-002-GW-030A
	Date Sampled	05/31/18	05/31/18
	Screened Interval (ft bgs)	23.9 - 33.9	24.1 - 34.1
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	0.016 U	**0.017 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.013 J**	**0.065**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.16**	**0.0076 J**
Combined PFOA+PFOS	0.07[c]	**0.173 J**	**0.0726 J**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b]EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[c]The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ID = identification
GW = groundwater

3.13.5 Conclusions

An AFFF spill at the Crash 4 site has resulted in a release of PFAS to the environment. Groundwater is the only media impacted by PFAS (PFOS and PFOA) above screening levels at AFFF Area 9.

3.14 WASTEWATER TREATMENT PLANT – AFFF AREA 10

3.14.1 Sample Locations

To further assess PFAS impacts from releases of AFFF from the WWTP, three surface soil samples, three subsurface soil samples, and four groundwater samples (three primary and one duplicate) were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC1001 and MW18PFC1002 at the former unlined sludge drying beds and MW18PFC1003 on the golf course. Groundwater samples were also collected from each monitoring well. In addition, paired surface water and sediment samples were collected at location SW18PFC1004 downstream from the former WWTP effluent discharge in an unnamed drainage that flows to a lake on the golf course. Sample locations for AFFF Area 10 are shown on Figure 14 in Appendix A.

3.14.2 Soil Descriptions

Three soil borings completed at the WWTP were terminated at depths ranging from 40.0 to 60.0 feet bgs. Gravel fill (GP and GW) was encountered at borings MW18PFC1001 and MW18PFC1002 installed in the former sludge drying beds. Subsurface soil encountered below the gravel fill at the sludge bed borings and encountered at the ground surface at MW18PFC1003 was very uniform, consisting entirely of lean clay (CL). Detailed boring logs are included in Appendix C.

3.14.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the WWTP on June 4, 2018. Groundwater was detected at depths ranging from 7.99 feet to 9.80 feet btoc and at elevations ranging from 3105.17 feet above NAVD 88 (at MW18PFC1003) to 3113.58 feet above NAVD 88 (at MW18PFC1001). Groundwater contours developed from these water level measurements indicate shallow groundwater flows southeast as shown on Figure 14 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.14.4 Analytical Results

Surface Soil

Three surface soil samples were collected at the WWTP. PFBS was not detected in any of the samples. PFOS was detected in all three samples and exceeded the screening level in one sample. PFOA was also detected in all three samples, but at concentrations below the screening level. Surface soil analytical results are summarized in Table 31 and shown on Figure 35 in Appendix A.

Table 31 Wastewater Treatment Plant (AFFF Area 10) Surface Soil Analytical Results

	Sample ID	**ELSWH10-001-SS-001**	**ELSWH10-002-SS-001**	**ELSWH10-003-SS-001**
	Date Sampled	**04/24/18**	**05/04/18**	**05/24/18**
	Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.55 U	0.60 U	0.60 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.97 J**	**1.5**	**1.9**
Perfluorooctane Sulfonate (PFOS)	126[c]	**5.4**	**5.2**	**140**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Subsurface Soil

Three subsurface soil samples were collected at the WWTP. PFBS, PFOS, and PFOA were not detected in any of the samples. Subsurface soil analytical results are summarized in Table 32 and shown on Figure 35 in Appendix A.

Table 32 Wastewater Treatment Plant (AFFF Area 10) Subsurface Soil Analytical Results

	Sample ID	**ELSWH10-001-SO-040**	**ELSWH10-002-SO-029**	**ELSWH10-003-SO-050**
	Date Sampled	**04/24/18**	**05/04/18**	**05/31/18**
	Sample Depth (ft bgs)	**40 - 41**	**29 - 30**	**50 - 51**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.49 U	0.55 U	0.55 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.78 U	0.88 U	0.88 U
Perfluorooctane Sulfonate (PFOS)	126[c]	0.78 U	0.88 U	0.88 U

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification
U = analyte was not detected above the reported value

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 10 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH10-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the three borings completed at Area 10. Subsurface soil sample ELSWH10-005-SO-040 was composed of equal aliquots of soil collected from the same borings at depths ranging from 29 to 51 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Four groundwater samples (three primary and one duplicate) were collected from three new monitoring wells at the WWTP. PFBS was not detected in any of the samples. PFOS and PFOA were detected in one primary sample; however, both individual and combined concentrations were below the screening level. Groundwater analytical results are summarized in Table 33 and shown on Figure 36 in Appendix A.

Table 33 Wastewater Treatment Plant (AFFF Area 10) Groundwater Analytical Results

	Well Number	**MW18PFC1001**	**MW18PFC1002**	**MW18PFC1002**	**MW18PFC1003**
	Sample ID	**ELSWH10-001-GW-045**	**ELSWH10-002-GW-035**	**ELSWH10-002-GW-935 (dup)**	**ELSWH10-003-GW-059**
	Date Sampled	**05/19/18**	**05/19/18**	**05/19/18**	**06/03/18**
	Screened Interval (ft bgs)	**38.8 - 48.8**	**29.3 - 39.3**	**29.3 - 39.3**	**49.4 - 59.4**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	0.015 U	0.015 U	0.015 U	0.017 U
Perfluorooctanoic Acid (PFOA)	0.07[b]	0.010 U	0.010 U	0.010 U	**0.0065 J**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	0.015 U	0.015 U	0.015 U	**0.014 J**
Combined PFOA+PFOS	0.07[b]	ND	ND	ND	**0.0205 J**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
AFFF = aqueous film forming foam
bgs = below ground surface
dup = duplicate
ID = identification
ft = foot or feet
GW = groundwater
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Sediment

One sediment sample was collected downstream from the WWTP. PFBS and PFOA were detected at concentrations below their respective screening levels and PFOS was detected at a concentration above the screening level. Sediment analytical results are summarized in Table 34 and shown on Figure 35 in Appendix A.

Table 34 Wastewater Treatment Plant (AFFF Area 10) Sediment Analytical Results

	Sample ID	ELSWH10-004-SD-001
	Date Sampled	05/16/18
	Sample Depth (ft bgs)	0 - 0.5
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**1.9 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**8.8**
Perfluorooctane Sulfonate (PFOS)	126[c]	**710**

Bold values indicate analyte detected at concentration indicated. Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram AFFF = aqueous film forming foam bgs = below ground surface ft = foot or feet
SD = sediment ID = identification ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value

Surface Water

One surface water sample was also collected downstream from the WWTP. PFBS was detected at a concentration below the screening level. PFOS and PFOA were detected at individual and combined concentrations above the screening level. Surface water analytical results are summarized in Table 35 and shown on Figure 36 in Appendix A.

Table 35 Wastewater Treatment Plant (AFFF Area 10) Surface Water Analytical Results

	Sample ID	ELSWH10-004-SW-001
	Date Sampled	05/16/18
	Screening Level (µg/L)	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.12**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.22**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.96**
Combined PFOA+PFOS	0.07[b]	**1.18**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter AFFF = aqueous film forming foam
ID = identification SW = surface water
ELSWH = ERPIMS designation for Ellsworth Air Force Base ID = identification

3.14.5 Conclusions

Past releases of AFFF-impacted effluent from the WWTP have resulted in releases of PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 10 include surface soil (PFOS), sediment (PFOS), and surface water (PFOS and PFOA).

3.15 SPRAY NOZZLE TEST AREA – AFFF AREA 11

3.15.1 Sample Locations

To assess possible PFAS impacts from releases of AFFF at the spray nozzle test area, five surface soil samples, six subsurface soil samples (five primary and one duplicate), and three groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC1101, MW18PFC1102, and MW18PFC1103 and from soil borings SB18PFC1104 and SB18PFC1105. Groundwater samples were also collected from each monitoring well. In addition, paired sediment and surface water samples were collected at location SW18PFC1106 at a storm drain outfall downgradient from the spray test area and southwest of Pumphouse #2. Sample locations for AFFF Area 11 are shown on Figure 15 in Appendix A.

3.15.2 Soil Descriptions

Five soil borings completed at the spray nozzle test area were terminated at depths ranging from 15.0 to 25.0 feet bgs. Soil types encountered were highly variable and included lean clay (CL), fat clay (CH), silt, (ML), silty sand (SM), poorly graded sand (SP), well graded sand (SW), clayey sand (SC), clayey gravel (GC), and well graded gravel (GW). Detailed boring logs are included in Appendix C.

3.15.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at the spray nozzle test area on June 1, 2018. Groundwater was detected at depths ranging from 9.32 feet to 13.76 feet btoc and at elevations ranging from 3181.15 feet above NAVD 88 (at MW18PFC1103) to 3187.80 feet above NAVD 88 (at MW18PFC1101). Groundwater contours developed from these water level measurements (and from wells in adjacent AFFF Areas 4 and 7) indicate shallow groundwater flows southeast as shown on Figure 15 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.15.4 Analytical Results

Surface Soil

Five surface soil samples were collected at the spray nozzle test area. PFBS was not detected in any of the samples. PFOS was detected in all five samples and PFOA was detected in four of five samples, all at concentrations below the screening level. Surface soil analytical results are summarized in Table 36 and shown on Figure 37 in Appendix A.

Table 36 Spray Nozzle Test Area (AFFF Area 11) Surface Soil Analytical Results

Analyte	Sample ID	ELSWH11-001-SS-001	ELSWH11-002-SS-001	ELSWH11-003-SS-001
	Date Sampled	05/09/18	05/09/18	05/04/18
	Sample Depth (ft bgs)	0 - 0.5	0 - 0.5	0 - 0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.43 U	0.42 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	**1.1**	**0.34 J**	0.80 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**5.9**	**6.7**	**0.46 J**

Analyte	Sample ID	ELSWH11-004-SS-001	ELSWH11-005-SS-001
	Date Sampled	05/09/18	05/04/18
	Sample Depth (ft bgs)	0 - 0.5	0 - 0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.48 U	0.48 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.59 J**	**0.59 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**15**	**9.6**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
bgs = below ground surface
SS = surface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Subsurface Soil

Six subsurface soil samples (five primary and one duplicate) were also collected at the spray nozzle test area. PFBS was not detected in any of the samples. PFOS was detected in three of five primary samples and PFOA was detected in one of five primary samples, all at concentrations below the screening level. Subsurface soil analytical results are summarized in Table 37 and shown on Figure 37 in Appendix A.

Table 37 Spray Nozzle Test Area (AFFF Area 11) Subsurface Soil Analytical Results

Analyte	Sample ID	ELSWH11-001-SO-012	ELSWH11-002-SO-010	ELSWH11H-002-SO-910 (dup)
	Date Sampled	**05/09/18**	**05/09/18**	**05/09/18**
	Sample Depth (ft bgs)	**12 - 13**	**10 - 11**	**10 - 11**
	Screening Level (µg/kg)	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.41 U	0.50 U	0.50 U
Perfluorooctanoic Acid (PFOA)	126[c]	0.65 U	0.79 U	0.80 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**0.51 J**	0.79 U	0.80 U

Analyte	Sample ID	ELSWH11-003-SO-015	ELSWH11-004-SO-012	ELSWH11-005-SO-013
	Date Sampled	**05/04/18**	**05/09/18**	**05/09/18**
	Sample Depth (ft bgs)	**15 - 16**	**12 - 13**	**13 - 14**
	Screening Level (µg/kg)	**Result (µg/kg)**	**Result (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.46 U	0.55 U	0.48 U
Perfluorooctanoic Acid (PFOA)	126[c]	**0.42 J**	0.88 U	0.77 U
Perfluorooctane Sulfonate (PFOS)	126[c]	**1.0**	0.88 U	**0.31 J**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SO = subsurface soil
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

AFFF = aqueous film forming foam
ft = foot or feet
dup = duplicate
ID = identification

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 11 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH11-007-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the five borings completed at Area 11. Subsurface soil sample ELSWH11-007-SO-015 was composed of equal aliquots of soil collected from the same borings at depths ranging from 10 to 16 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells at the spray nozzle test area. PFBS was detected in all three of the samples at concentrations below the screening level. PFOS and PFOA were also detected in all three groundwater samples at individual and combined concentrations above the screening level. Groundwater analytical results are summarized in Table 38 and shown on Figure 38 in Appendix A.

Table 38 Spray Nozzle Test Area (AFFF Area 11) Groundwater Analytical Results

	Well Number	**MW18PFC1101**	**MW18PFC1102**	**MW18PFC1103**
	Sample ID	**ELSWH11-001-GW-015**	**ELSWH11-002-GW-015**	**ELSWH11-003-GW-020**
	Date Sampled	**05/20/18**	**05/20/18**	**05/20/18**
	Screened Interval (ft bgs)	**9.2 - 19.2**	**9.1 - 19.1**	**13.5 - 23.5**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.061**	**0.044**	**0.077**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.25**	**0.16**	**0.13**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.25**	**0.25**	**0.34**
Combined PFOA+PFOS	0.07[c]	**0.50**	**0.41**	**0.47**

Bold values indicate analyte detected at concentration indicated.

Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ID = identification
GW = groundwater

Sediment

One sediment sample was collected at a storm drain downgradient from the spray test area. PFBS was not detected in the sample and PFOS and PFOA were detected at concentrations below the screening level. Sediment analytical results are summarized in Table 39 and shown on Figure 37 in Appendix A.

Table 39 Spray Nozzle Test Area (AFFF Area 11) Sediment Analytical Results

	Sample ID	ELSWH11-006-SD-001
	Date Sampled	05/16/18
	Sample Depth (ft bgs)	0 - 0.5
Analyte	Screening Level (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	1.3 U
Perfluorooctanoic Acid (PFOA)	126[c]	**1.9 J**
Perfluorooctane Sulfonate (PFOS)	126[c]	**81**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SD = sediment
ID = identification
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Surface Water

One surface sample was also collected at the storm drain downgradient from the spray test area. PFBS, PFOS, and PFOA were all detected in the sample. PFBS and PFOA concentrations were below the screening level, but the PFOS concentration and the combined PFOS and PFOA concentration were above the screening level. Surface water analytical results are summarized in Table 40 and shown on Figure 38 in Appendix A.

Table 40 Spray Nozzle Test Area (AFFF Area 11) Surface Water Analytical Results

	Sample ID	ELSWH11-006-SW-001
	Date Sampled	05/16/18
Analyte	Screening Level (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.011 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.057**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.43**
Combined PFOA+PFOS	0.07[c]	**0.487**

Bold values indicate analyte detected at concentration indicated.

Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
AFFF = aqueous film forming foam
bgs = below ground surface
ID = identification
ft = foot or feet
SW = surface water
ELSWH = ERPIMS designation for Ellsworth Air Force Base
J = reported concentration is an estimated value

3.15.5 Conclusions

Past releases of AFFF at the spray nozzle test area have resulted in releases of PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 11 include groundwater (PFOS and PFOA) and surface water (PFOS and PFOA).

3.16 BUILDING 88240 – AFFF AREA 12

3.16.1 Sample Locations

To further assess PFAS impacts from apparent AFFF releases at Building 88240, four surface soil samples (three primary and one duplicate), three subsurface soil samples, and three groundwater samples were collected. Surface and subsurface soil samples were collected from soil borings completed for installation of monitoring wells MW18PFC1201, MW18PFC1202, and MW18PFC1203 and groundwater samples were collected from each monitoring well. In addition, paired sediment and surface water samples were collected at location SW18PFC1204 at a culvert south of, and downstream from, the pond. Sample locations for AFFF Area 12 are shown on Figure 16 in Appendix A.

3.16.2 Soil Descriptions

Three soil borings completed at Building 88240 were terminated at depths ranging from 35.0 to 55.0 feet bgs. Lean clay (CL) was encountered in each of the three borings. Detailed boring logs are included in Appendix C.

3.16.3 Groundwater Flow

Groundwater levels were gauged at three new monitoring wells at Building 88240 area on June 1, 2018. Groundwater was detected at depths ranging from 12.49 feet to 30.50 feet btoc and at elevations ranging from 3291.66 feet above NAVD 88 (at MW18PFC1203) to 3318.02 feet above NAVD 88 (at MW18PFC1201). Groundwater contours developed from these water level measurements indicate shallow groundwater flows south as shown on Figure 16 in Appendix A. Groundwater level measurements and elevations are summarized in Table F-1 in Appendix F.

3.16.4 Analytical Results

Surface Soil
Four surface soil samples (three primary and one duplicate) were collected south of Building 88240. PFBS was detected in two of three primary samples at concentrations below the screening level. PFOA was detected in all four samples at concentrations below the screening level. PFOS was detected in all four samples at concentrations above the screening level. Surface soil analytical results are summarized in Table 41 and shown on Figure 39 in Appendix A.

Table 41 Building 88240 (AFFF Area 12) Surface Soil Analytical Results

Analyte	Sample ID	ELSWH12-001-SS-001	ELSWH12-001-SS-901 (dup)	ELSWH12-002-SS-001	ELSWH12-003-SS-001
	Date Sampled	04/19/18	04/19/18	04/19/18	04/20/18
	Sample Depth (ft bgs)	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**1.1 J**	5.5 U	0.65 U	**0.55 J**
Perfluorooctanoic Acid (PFOA)	126[c]	**5.2**	**9.7 J**	**1.1 J**	**2.4**
Perfluorooctane Sulfonate (PFOS)	126[c]	**260 J**	**390 J**	**250**	**160**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
SS = subsurface soil
dup = duplicate
ELSWH = ERPIMS designation for Ellsworth Air Force Base
ID = identification
J = reported concentration is an estimated value
U = analyte was not detected above the reported value

Subsurface Soil

Three subsurface soil samples were also collected south of Building 88240. PFBS, PFOS, and PFOA were detected in one of three samples, all at concentrations below their respective screening levels. Subsurface soil analytical results are summarized in Table 42 and shown on Figure 39 in Appendix A.

Table 42 Building 88240 (AFFF Area 12) Subsurface Soil Analytical Results

Analyte	Sample ID	ELSWH12-001-SO-023	ELSWH12-002-SO-036	ELSWH12-003-SO-006
	Date Sampled	04/19/18	04/19/18	04/20/18
	Sample Depth (ft bgs)	23 - 24	36 - 37	6 - 7
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	0.50 U	0.60 U	**1.1 J**
Perfluorooctanoic Acid (PFOA)	126[c]	0.80 U	0.96 U	**1.7**
Perfluorooctane Sulfonate (PFOS)	126[c]	0.80 U	0.96 U	**88**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
AFFF = aqueous film forming foam
bgs = below ground surface
ft = foot or feet
ID = identification
J = reported concentration is an estimated value
SO = subsurface soil
U = analyte was not detected above the reported value
ELSWH = ERPIMS designation for Ellsworth Air Force Base

Soil Physiochemical Analyses

To provide basic soil parameter information, composite surface and subsurface soil samples were collected from AFFF Area 12 soil borings for pH, TOC, percent solids, and grain size analysis. Surface soil sample ELSWH12-005-SS-001 was composed of equal aliquots of soil collected from 0 to 6 inches bgs at the three borings completed at Area 12. Subsurface soil sample ELSWH12-005-SO-036 was composed of equal aliquots of soil collected from the same borings at depths ranging from 6 to 37 feet bgs. Table E-1 summarizing the physiochemical data and supporting laboratory data sheets are included in Appendix E.

Groundwater

Groundwater samples were collected from three new monitoring wells south of Building 88240. PFBS was detected in two of three samples at concentrations below the screening level. PFOS was detected in all three samples and exceeded the screening level in two samples. PFOA was detected in two of three samples and exceeded the screening level in one sample. Combined PFOS and PFOA concentrations also exceeded the screening level in two of three samples. Groundwater analytical results are summarized in Table 43 and shown on Figure 40 in Appendix A.

Table 43 Building 88240 (AFFF Area 12) Groundwater Analytical Results

	Well Number	**MW18PFC1201**	**MW18PFC1202**	**MW18PFC1203**
	Sample ID	**ELSWH12-001-GW-032**	**ELSWH12-002-GW-045**	**ELSWH12-003-GW-016**
	Date Sampled	**04/25/18**	**04/22/18**	**04/22/18**
	Screened Interval (ft bgs)	**24.6 - 34.6**	**37.9 - 47.9**	**5.1 - 15.1**
Analyte	**Screening Level (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.31**	0.015 U	**2.8**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.035**	0.010 U	**0.11**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.096**	**0.056**	**1.1**
Combined PFOA+PFOS	0.07[c]	**0.131**	**0.056**	**1.21**

Bold values indicate analyte detected at concentration indicated.

Shaded results indicate value exceeds screening criteria.

[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).

[c] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
U = analyte was not detected above the reported value
AFFF = aqueous film forming foam
ID = identification
GW = groundwater

Sediment

One sediment sample was collected at a culvert downstream from Building 88240. PFBS, PFOS, and PFOA were detected in the sample, but at concentrations below the screening level. Sediment analytical results are summarized in Table 44 and shown on Figure 39 in Appendix A.

Table 44 Building 88240 (AFFF Area 12) Sediment Analytical Results

	Sample ID	**ELSWH12-004-SD-001**
	Date Sampled	**04/22/18**
	Sample Depth (ft bgs)	**0 - 0.5**
Analyte	**Screening Level (µg/kg)**	**Result (µg/kg)**
Perfluorobutane Sulfonate (PFBS)	130,000[a] 13[b]	**1.9**
Perfluorooctanoic Acid (PFOA)	126[c]	**1.5**
Perfluorooctane Sulfonate (PFOS)	126[c]	**59**

Bold values indicate analyte detected at concentration indicated.

[a] EPA Regional Screening Level for Residential Soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[b] EPA Regional Screening Level for Protection of Groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).

[c] Screening level calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

µg/kg = micrograms per kilogram
bgs = below ground surface
SD = sediment
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ft = foot or feet
ID = identification

Surface Water

One surface water sample was also collected at the culvert downstream from Building 88240. PFBS was detected but at a concentration below the screening level. PFOS and PFOA were detected at both individual and combined concentrations above the screening level. Surface water analytical results are summarized in Table 45 and shown on Figure 40 in Appendix A.

Table 45 Building 88240 (AFFF Area 12) Surface Water Analytical Results

	Sample ID	ELSWH12-004-SW-001
	Date Sampled	04/22/18
Analyte	Screening Level (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**2.9**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.82**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**3.8**
Combined PFOA+PFOS	0.07[b]	**4.62**

Bold values indicate analyte detected at concentration indicated.
Shaded results indicate value exceeds screening criteria.
[a] EPA Regional Screening Level for Tap Water (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf).
[b]EPA, May 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and EPA, May 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).
[c]The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA.

µg/L = micrograms per liter
bgs = below ground surface
ft = foot or feet
ELSWH = ERPIMS designation for Ellsworth Air Force Base
AFFF = aqueous film forming foam
ID = identification
SW = surface water

3.16.5 Conclusions

Past releases of AFFF at Building 88240 have resulted in releases PFAS to the environment. Media impacted by PFAS above screening levels at AFFF Area 12 include surface soil (PFOS), groundwater (PFOS and PFOA), and surface water (PFOS and PFOA).

3.17 INVESTIGATION-DERIVED WASTE

The USAF has awarded a separate contract to others for the removal and disposal of soil and water investigation-derived waste (IDW) generated during this SI. All waste soil and water were placed in Department of Transportation (DOT)-approved steel drums (53 drums of soil and 19 drums of water) and staged on pallets in Building 6905, pending disposal. Note that the readiness review forms (Appendix C) indicate some IDW would not be containerized; however, all IDW was drummed for offsite disposal based on regulator input. A representative sample was collected from each media, submitted to CT Laboratories, and analyzed for total petroleum hydrocarbons, toxicity (using the Toxicity Characteristic Leaching Procedure [TCLP] for the full TCLP list of analytes), flashpoint, pH, cyanide, and sulfide. A representative sample of each media was also submitted to Maxxam and analyzed for PFAS. These analytical results have been submitted to the USAF electronically and are also included in Appendix G. All IDW was removed from the Base by Heritage Transport LLC (EPA ID IND058484114) in two shipments on July 23, 2018, and July 25, 2018, and transported to Heritage Environmental Services of Kansas City, Missouri (EPA ID MOD981505555), for disposal. Note that these waste shipments and manifests included additional IDW drums generated during an ongoing RI at the former FTA (by others). A copy of the waste manifests are in Appendix G.

4.0 GROUNDWATER PATHWAY

The objectives of groundwater sampling during the SI were to

- determine if a confirmed release of PFAS has occurred at sites selected for SI;
- determine if PFAS are present in groundwater at the site in concentrations exceeding the EPA lifetime Has, tap water RSLs, or a state standard; and
- identify potential receptor pathways with immediate impacts to human health.

4.1 HYDROGEOLOGY

One shallow unconfined aquifer and three confined aquifers (the Inyan Kara, the Minnelusa, and the Madison) have been identified at Ellsworth AFB (EA, May 1995). These aquifers (from shallowest to deepest) are discussed below.

Shallow Unconfined Aquifer
The upper shallow aquifer consists of both alluvial and colluvial deposits and weathered/fractured Pierre Shale. The shallow aquifer is absent in some areas and extends in depth from only a few feet below the surface to 60 feet or less in depth in other areas. The thickness and yield of the shallow aquifer depend upon the extent of alluvial material and the thickness of water-yielding fractures in the Pierre Shale. In several areas toward the northern end of Ellsworth AFB, no groundwater-bearing zones were found, while in the southern area of the Base, alluvial sand and gravel beds and shallow fracture zones typically produce less than 2 gallons per minute to monitoring wells. The shallow, unconfined aquifer at Ellsworth AFB is present within the fractured shale horizon near the top of the Pierre Shale and the contiguous overlying deposits of unconsolidated material. The shallow unconfined aquifer is considered a federal Class IIB aquifer (potential drinking water source). In addition, according to ARSD 74:54:01:03, any groundwater in South Dakota that has an ambient concentration of 10,000 milligrams per liter (mg/L) or less of total dissolved solids is classified as having the beneficial use of drinking water supplies suitable for human consumption. Groundwater within the shallow aquifer generally flows southeast in the northern portion of the Base and to the south-southeast within the southern portion of the Base. None of the confined aquifers discussed below are in hydraulic communication with the shallow unconfined aquifer. Further, shallow groundwater from the Base likely discharges to Box Elder Creek, south of the Base precluding migration of impacted groundwater further south.

Inyan Kara Aquifer
The Inyan Kara Aquifer is a confined aquifer bounded by confining beds of the Pierre Shale and other relatively impermeable Upper Cretaceous strata above and Permian-Jurassic strata below. The aquifer lies about 1,900 feet beneath Ellsworth AFB and consists of 350 to 500 feet of permeable sandstone belonging to the Fall River and Lakota Formations. Groundwater flow direction is assumed based on published data; west of Ellsworth AFB, it is assumed to be toward the east-northeast based on the direction of dip.

Minnelusa Aquifer
The Minnelusa Aquifer is a confined aquifer that lies beneath approximately 1,000 feet of Permian-Jurassic confining beds and above Pennsylvanian confining beds. The aquifer is a limestone unit approximately 600 feet thick and lies 3,460 feet beneath Ellsworth AFB. Groundwater flow direction is assumed to be toward the east-northeast based on the direction of dip.

Madison Aquifer
The Madison Aquifer (also known as Pahasapa Aquifer) is the deepest aquifer used as a drinking water source in the region. This limestone aquifer averages 350 feet in thickness, lies 4,150 feet bgs, and is

below a 240- to 450-foot-thick Lower Pennsylvanian confining unit. Groundwater flow direction is assumed to be toward the east-northeast in the direction of dip.

4.1.1 Drinking Water Sources

Base Drinking Water

Five public water supply wells installed in deep bedrock aquifers previously provided drinking water for the Base, but these wells have been abandoned/decommissioned. Base drinking water is now supplied by the Rapid City Municipal Distribution System. Sources of water for this system come from two infiltration galleries installed in the Rapid Creek alluvium: Jackson Springs Gallery and Girl Scout Gallery. These galleries are on Rapid Creek, approximately 11 miles southwest of and upstream from the mid-point of the Base airfield. Water is also drawn from eight wells that tap the Minnelusa and Madison aquifers (Rapid City Water Division, 2017).

Off-Base Public and Community Drinking Water Sources from Groundwater

The City of Box Elder, approximately 1 mile south of the Base, uses groundwater as a drinking water source. Groundwater is extracted from six wells with total depths ranging from 2,000 feet to 4,574 feet and tap the Inyan Kara and Madison aquifers (see Map ID locations 89 through 94 on Figure 41 in Appendix A).

The city of New Underwood, approximately 12 miles east-southeast and downstream from the Base (on Box Elder Creek), also uses groundwater as a drinking water source. Groundwater is extracted from the Inyan Kara aquifer from two wells (Wells #1 and #2) with total depths of 2,762 feet and 2,960 feet, respectively.

Sunset Ranch, a private housing development approximately 7.5 miles east-southeast, also uses groundwater as a drinking water source. The Sunset Ranch well was drilled to a depth of 2,954 feet deep and plugged back to a depth of 2,631 feet. The well report indicates multiple sections of well screen were installed from 2,398 to a depth of 2,486 within the Dakota Sandstone slightly above the Inyan Kara aquifer (SD DENR, July 2018).

4.1.2 Off-Base Drinking Water Wells within Four Miles of Ellsworth AFB

SD DENR Well Database Wells

Based on information in the SD DENR well database and as shown on Figure 41 in Appendix A, there are 72 wells within four miles of the Base including 59 domestic wells, seven municipal wells, five stock wells, and one irrigation well. Six of the municipal wells are deep wells owned by the City of Box Elder and one (Well 68 on Figure 41) is a shallow private community well (30 feet deep) which provides water for the Plainsview Mobile Manor Public Water System (map location 95 on Figure 41). Well 68 is 1.1 miles southwest of the current FTA and 1.8 miles south of Outfall #3. A second private community system (Whispering Willows) included in the SD DENR water supply system database was indicated immediately north of location 95; however, this system purchases water from the City of Box Elder (SD DENR, August 2018b).

Of the 72 wells within 4 miles of the base, 11 wells (including the six municipal wells for the City of Box Elder) are deep—ranging from 1,624 feet to 4,574 feet—and are less vulnerable to surface contaminants.

The remaining 61 wells (within four miles) are 100 feet deep or less and would be vulnerable to contaminants released to the ground surface. Most of the shallow wells are either upgradient or side gradient from the Base and are unlikely to be impacted by AFFF releases. Downgradient wells, however, are at risk of PFAS impacts. The extent of PFAS impacts to groundwater south of the Base are unclear at this time. Stage 3 of an ongoing RI being conducted by others will further assess the southern extent of impacted groundwater and determine the extent to which Box Elder Creek may act as a hydraulic barrier.

Wells Not Listed in the SD DENR Database
A recent (2018) off-Base door-to-door survey and sampling effort conducted for the Air Force by others has determined that there are several water wells classified as household use or non-household use south of (and potentially downgradient from) the Base which were not listed in the SD DENR database. Preliminary results of this sampling effort indicated a number of these wells have been impacted by PFOS and PFOA at concentrations above the EPA HA of 0.07 μg/L.

4.1.3 Groundwater Use Restrictions

Groundwater-use restrictions have been established in several areas surrounding the Base, as shown on Figure 41 (Krebs, August 2018). Most of the areas of restricted groundwater use were established due to trichloroethene (TCE)-impacted groundwater (Ellsworth, February 2012). One groundwater-use restriction area south of the Base was established due to PFAS-impacted groundwater. A PFAS groundwater plume originating from the former FTA (AOC PFC-1) is migrating off-Base to the south (CB&I, August 2017; Ayuda, November 2017). Note that there are numerous domestic wells that are not shown on Figure 41 because they are located within these areas of groundwater use restrictions. Groundwater use restrictions have not been established in areas where the door-to-door survey and sampling (discussed above) identified impacted drinking water wells.

4.2 CURRENT FIRE TRAINING AREA – AFFF AREA 1

Both individual and combined PFOA and PFOS concentrations in shallow groundwater at the current FTA (AFFF Area 1) exceeded the screening level. Groundwater at the site flows east-southeast toward an unnamed tributary of Box Elder Creek. Groundwater at AOC PFC-1 (immediately south of the current FTA) flows south-southeast (Ayuda, August 2017). Based on south-southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.3 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at 70, 80, 90 Rows and at Outfall #3 (AFFF Area 2). Groundwater at the outfall flows southwest towards an unnamed tributary of Box Elder Creek. Based on the SD DENR database and the door-to-door survey, there are several shallow domestic wells south of and potentially downgradient from Outfall #3, as shown on Figure 41. The domestic wells represent a potentially complete human ingestion exposure pathway via consumption of impacted drinking water.

Groundwater at the 70, 80, 90 Rows flows southeast toward Box Elder Creek. Based on southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.4 BUILDING 618 – AFFF AREA 3

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at Building 618 (AFFF Area 3). Groundwater at Building 618 flows southeast toward Box

Elder Creek. Based on southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.5 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at the former fire station (AFFF Area 4). Groundwater flows south-southeast toward Box Elder Creek. Based on south-southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.6 B-52 CRASH (1972) – AFFF AREA 5

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at the B-52 crash site (AFFF Area 5). Groundwater flows southeast toward Box Elder Creek. Based on southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.7 B-1 CRASH (1988) – AFFF AREA 6

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level in one of three monitoring wells installed at the B-1 crash site (AFFF Area 6). Although the extent appears to be limited, PFAS impacts to groundwater have not been fully delineated. Groundwater at the site flows south toward Box Elder Creek. Based on groundwater flow to the south and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.8 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

Combined PFOA and PFOS concentrations in shallow groundwater at the Delta Taxiway West vehicle crash site (AFFF Area 7) did not exceed the screening level. Since PFAS concentrations in groundwater are below the screening level at the crash site, the human exposure pathway through the ingestion of impacted drinking water is incomplete.

4.9 MARTEN CRASH (2006) – AFFF AREA 8

Combined PFOA and PFOS concentrations in shallow groundwater at the Marten truck crash site (AFFF Area 8) did not exceed the screening level. Since PFAS concentrations in groundwater are below the screening level at the crash site, the human exposure pathway through the ingestion of impacted drinking water is incomplete.

4.10 CRASH 4 (2001) – AFFF AREA 9

Individual and/or combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at the Crash 4 spill site (AFFF Area 9). Groundwater at the site flows southeast toward AFFF Area 2 and ultimately toward Box Elder Creek. Based on southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.11 WASTEWATER TREATMENT PLANT – AFFF AREA 10

Combined PFOA and PFOS concentrations in shallow groundwater at the WWTP (AFFF Area 10) did not exceed the screening level. Since PFAS concentrations in groundwater are below the screening level at the WWTP, the human exposure pathway through the ingestion of impacted groundwater migrating from the WWTP is incomplete. Note, however, that the surface water pathway (as discussed in Section 5.11) is potentially complete based on possible surface water to groundwater impacts downstream from the WWTP.

4.12 SPRAY NOZZLE TEST AREA – AFFF AREA 11

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at the spray nozzle test area (AFFF Area 11). Groundwater flows southeast toward Box Elder Creek. Based on southeast groundwater flow and the presence of downgradient off-Base wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

4.13 BUILDING 88240 – AFFF AREA 12

Both individual and combined PFOA and PFOS concentrations in shallow groundwater exceeded the screening level at Building 88240 (AFFF Area 12). Groundwater at Area 12 flows south toward AFFF Areas 2 and 9. From Areas 2 and 9, groundwater flows southeast toward Box Elder Creek. Based on south to southeast groundwater flow and the presence of downgradient off-Base use wells that have been impacted above the EPA HA, the human exposure pathway for ingestion of impacted groundwater is potentially complete.

5.0 SURFACE WATER PATHWAY

The objectives of surface water sampling during the SI were to

- determine if a confirmed release of PFAS has occurred at sites selected for SI;
- determine if PFAS are present in surface water at the site in concentrations exceeding the EPA lifetime HAs, tap water RSLs, or a state standard; and
- identify potential receptor pathways with immediate impacts to human health.

5.1 BASE HYDROLOGIC SETTING

Ellsworth AFB is located within the Missouri River Basin. The north border of Ellsworth AFB is a steep northward-facing escarpment drained by seven unnamed ephemeral drainages which flow into Elk Creek approximately 5 miles to the northeast. Surface drainage on the plateau itself (and most of the Base) follows a topographic slope primarily flowing south-southeast via retention ponds, ditches, storm sewers, and ephemeral streams with eventual discharge into Box Elder Creek one mile to the south; although, some surface flow in the western and southwestern portions of Ellsworth AFB is southwest toward an unnamed drainage west of the installation that ultimately discharges to Box Elder Creek. Elk Creek is a perennial stream while Box Elder is considered ephemeral. Ephemeral streams contain water only when sufficient runoff is available to support flow, typically during or immediately following precipitation events (EA, May 1994). Floodplains occur along the main Base drainage, as well as along several of the creek drainages on the northern and southern portion of the Base. The northern limit of the Box Elder Creek floodplain is approximately 50 feet south of the southern Base boundary (Ellsworth AFB, 2017).

Drinking Water Sources from Surface Water

Although groundwater provides the bulk of drinking water in the region, the Rapid City Municipal Distribution System also uses surface water from Rapid Creek. This surface water originates from drainage areas west of Rapid City and upstream from the Base. This drainage area also includes Deerfield Reservoir on Castle Creek and Pactola Reservoir on Rapid Creek. The distribution system drinking water intakes are also upstream from the Base (Rapid City Water Division, 2017).

There are no drinking water intakes within 15 miles downstream of the Base. Sunset Ranch, a private housing development approximately 7.5 miles east-southeast of the Base, uses groundwater as a drinking water source. The city of New Underwood, approximately 12 miles east-southeast and downstream from Ellsworth (on Box Elder Creek), also obtains drinking water from groundwater (SD DENR, June 2018).

Potential Migration of Surface Water to Groundwater

Although there are no drinking water intakes within 15 miles downstream of the Base, surface water in Box Elder Creek and its tributaries may migrate to groundwater seasonally or at least during periods of low precipitation and lower groundwater levels. Known as “losing stream” conditions, the possible migration of surface water to groundwater could result in PFAS impacts to shallow drinking water wells near Box Elder Creek and downstream from the Base.

5.2 CURRENT FIRE TRAINING AREA – AFFF AREA 1

Surface water was not identified as media of concern at AFFF Area 1 and no surface water samples were collected. Surface water south of the current FTA is being investigated by others as part of an RI at the former fire training area.

5.3 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

Surface water from the 70, 80, 90 Rows drains to the southwest to Pond #3 and flows off-Base at Outfall #3 and ultimately to Box Elder Creek (Figure 2, Appendix A). PFOS and PFOA were detected above screening levels in surface water in Pond #3 (in 2014 and 2018), in a low-lying area west of Pond #3 (in 2018), and at Outfall #3 (in 2014). As discussed in Section 5.1, although there are no drinking water intakes within 15 miles downstream of the Base, there is the potential of surface water impacts to groundwater. Shallow drinking water wells downstream from Outfall #3 represent a potentially complete human exposure pathway for ingestion of impacted drinking water.

5.4 BUILDING 618 – AFFF AREA 3

There are no surface water bodies near Building 618. Surface water was not identified as media of concern and no surface water samples were collected.

5.5 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

There are no surface water bodies near Building 7506. Surface water was not identified as media of concern and no surface water samples were collected.

5.6 B-52 CRASH (1972) – AFFF AREA 5

There are no surface water bodies near the B-52 crash site. Surface water was not identified as media of concern and no surface water samples were collected.

5.7 B-1 CRASH (1988) – AFFF AREA 6

There are no surface water bodies near the B-1 crash site. Surface water was not identified as media of concern and no surface water samples were collected.

5.8 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

There are no surface water bodies near the Delta Taxiway West crash site. Surface water was not identified as media of concern and no surface water samples were collected.

5.9 MARTEN CRASH (2006) – AFFF AREA 8

There are no surface water bodies near the Marten crash site. Surface water was not identified as media of concern and no surface water samples were collected.

5.10 CRASH 4 (2001) – AFFF AREA 9

There are no surface water bodies near the Crash 4 site. Surface water was not identified as media of concern and no surface water samples were collected.

5.11 WASTEWATER TREATMENT PLANT – AFFF AREA 10

Until it ceased operation in July 2014, the WWTP received discharge from several locations on Base where AFFF releases have occurred and discharged effluent potentially impacted by PFAS at Outfall #5 (Figure 2, Appendix A). This effluent then flowed via an unnamed drainage feature to Golf Course Lake, off-Base to Outfall #6, and ultimately to Box Elder Creek. PFOS and PFOA were detected above screening levels in surface water samples collected from the drainage downstream from Outfall #5 (in 2014 and in 2018) and from Golf Course Lake (in 2014). As discussed in Section 5.1, although there are no drinking water intakes within 15 miles downstream of the Base, there is the potential of surface water impacts to groundwater. The possible presence of shallow drinking water wells downstream from Outfall #6 represents a potentially complete human exposure pathway for ingestion of impacted drinking water.

5.12 SPRAY NOZZLE TEST AREA – AFFF AREA 11

Surface water from the spray nozzle test area drains to the southeast to an unnamed tributary of Box Elder Creek and flows off-Base at Outfall #1 (Figure 2, Appendix A). PFOS (and combined PFOS and PFOA) were detected above the screening level in a surface water sample collected at a storm drain outfall southwest of the test area and upstream from Outfall #1. As discussed in Section 5.1, although there are no drinking water intakes within 15 miles downstream of the Base, there is the potential of surface water impacts to groundwater. The presence of shallow drinking water wells downstream from Outfall #1 represents a potentially complete human exposure pathway for ingestion of impacted drinking water.

5.13 BUILDING 88240 – AFFF AREA 12

When the AFFF system was activated in Building 88240, the water/foam mixture was routed into a retention pond south of Building 88240. During heavy rainfall, surface water flows from the pond to a culvert south of the pond. From the culvert, surface water flows south toward the live ordnance loading area and Row 100. Any surface water that does not infiltrate the subsurface would likely flow to Outfall #3. PFOS and PFOA were detected above the screening level in a surface water sample collected from the retention pond (in 2014) and at the culvert south of the retention pond (in 2018). Surface water at Outfall #3 (Figure 2, Appendix A) ultimately flows to Box Elder Creek. As discussed in Section 5.1, although there are no drinking water intakes within 15 miles downstream of the Base, there is the potential of surface water impacts to groundwater. The presence of shallow drinking water wells downstream from Outfall #3 represents a potentially complete human exposure pathway for ingestion of impacted drinking water.

6.0 SOIL AND SEDIMENT EXPOSURE AND AIR PATHWAYS

The objectives of soil and sediment sampling during the SI were to

- determine if a confirmed release of PFAS has occurred at sites selected for SI;
- determine if PFAS are present in soil and sediment at the site in concentrations exceeding residential soil screening levels, or a state standard; and
- identify potential receptor pathways with immediate impacts to human health.

The approved QAPP and site-specific QAPP addendum indicated PFOS and PFOA concentrations in soil would be compared to calculated residential RSLs. RSLs protective of groundwater for PFOS and PFOA are typically several orders of magnitude lower than residential RSLs. Soil pathways discussed below do not include possible exposure to surface soil from use of PFAS-impacted groundwater for irrigation.

6.1 CURRENT FIRE TRAINING AREA – AFFF AREA 1

PFOS was detected in surface and subsurface soil at concentrations above the residential screening level at the current FTA. The FTA surface is covered with concrete pavement and the surrounding area is vegetated, inhibiting fugitive dust emissions. Human ingestion through exposure to the soil is also unlikely. Although a complete human ingestion pathway is unlikely, PFOS-impacted surface soil could represent an ongoing source of groundwater impacts. Sediment was not identified as media of concern at AFFF Area 1.

6.2 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

Where detected, PFAS concentrations in surface soil, subsurface soil, and sediment samples collected at the 70, 80, 90 Rows and Outfall #3 were below residential screening levels. PFOS was, however, detected in a sediment sample collected from Pond #3 in 2014 at a concentration above the residential screening level. Although human ingestion of PFAS through exposure to the sediment is unlikely, PFOS-impacted sediment at Pond #3 could represent an ongoing source of surface water and/or groundwater impacts.

6.3 BUILDING 618 – AFFF AREA 3

Where detected, PFAS concentrations in subsurface soil at Building 618 were below residential screening levels (both in samples collected during this SI in 2018 and in samples collected in 2014). Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 3. Surface soil and sediment were not identified as media of concern at Area 3.

6.4 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

PFOS was detected in one surface soil sample at Area 4 at a concentration above the residential screening level. The area is well vegetated and the surrounding area paved inhibiting fugitive dust emissions. Human ingestion through exposure to the soil is also unlikely. Although a complete human ingestion pathway is unlikely, PFOS-impacted surface soil could represent an ongoing source of groundwater impacts. Sediment was not identified as media of concern at AFFF Area 4.

6.5 B-52 CRASH (1972) – AFFF AREA 5

Where detected, PFAS concentrations in surface and subsurface soil samples collected at the B-52 crash site were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 5. Sediment was not identified as media of concern at Area 5.

6.6 B-1 CRASH (1988) – AFFF AREA 6

Where detected, PFAS concentrations in surface and subsurface soil samples collected at the B-1 crash site were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 6. Sediment was not identified as media of concern at Area 6.

6.7 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

Where detected, PFAS concentrations in surface and subsurface soil samples collected at the Delta Taxiway West crash site were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 7. Sediment was not identified as media of concern at Area 7.

6.8 MARTEN CRASH (2006) – AFFF AREA 8

Where detected, PFAS concentrations in surface and subsurface soil samples collected at the Marten crash site were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 8. Sediment was not identified as media of concern at Area 8.

6.9 CRASH 4 (2001) – AFFF AREA 9

Where detected, PFAS concentrations in surface and subsurface soil samples collected at the Crash 4 spill site were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 9. Sediment was not identified as media of concern at Area 9.

6.10 WASTEWATER TREATMENT PLANT – AFFF AREA 10

PFOS was detected at concentrations above the residential screening level in one surface soil sample (collected in 2018) and in two sediment samples (one collected in 2014 and one collected in 2018). Both sediment samples were collected downgradient and downstream from the WWTP on the adjacent golf course. The area is well vegetated, which would inhibit fugitive dust emissions. Human ingestion through exposure to the soil or sediment is also unlikely. Although a complete human ingestion pathway is unlikely, PFOS-impacted surface soil and sediment could represent an ongoing source of groundwater and/or surface water impacts.

6.11 SPRAY NOZZLE TEST AREA – AFFF AREA 11

Where detected, PFAS concentrations in surface soil, subsurface soil, and sediment samples collected at the spray nozzle test area were below residential screening levels. Lacking concentrations of PFAS above residential screening levels, the human ingestion pathway is incomplete at AFFF Area 11.

6.12 BUILDING 88240 – AFFF AREA 12

PFOS was detected in surface soil samples collected at Area 12 at concentrations above the residential screening level. The area is well vegetated, which would inhibit fugitive dust emissions, and human ingestion through exposure to the soil is also unlikely. PFAS concentrations in the one sediment sample collected during this SI were below residential screening levels. PFBS, PFOA, and PFOS concentrations in a sediment sample collected from the retention pond in 2014 all exceeded their respective screening values. Although a complete human ingestion pathway is unlikely, PFOS-impacted surface soil could represent an ongoing source of groundwater impacts at AFFF Area 12.

7.0 UPDATES TO CONCEPTUAL SITE MODELS

The following sections contain updates to the conceptual site models (CSMs) for AFFF Areas 1 through 12 as presented in the QAPP addendum (ASL, November 2017). The discussions address PFOA and PFOS in soil, groundwater, surface water, and sediment. Based on analytical results presented in Sections 3.0, PFOS and PFOA are the primary PFAS contaminants of concern. PFBS detections in all samples collected from all media for this SI were below screening levels. PFBS will not be discussed in the following sections with the exception of Section 7.12, Building 88240 (AFFF Area 12), where PFBS was detected above the current screening level in a surface water sample collected in 2014.

7.1 CURRENT FIRE TRAINING AREA – AFFF AREA 1

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by releases of AFFF at the current FTA (ASL, November 2017). PFOS was detected in surface and subsurface soil at concentrations above the residential screening level. However, as discussed in Section 6.1, human ingestion of impacted soil is unlikely. PFOS and PFOA were also detected in groundwater at concentrations above screening levels and, as discussed in Section 4.2, the human exposure pathway for ingestion of impacted groundwater is potentially complete. Surface soil, subsurface soil, and groundwater remain media of concern at AFFF Area 1.

7.2 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by releases of AFFF at the 70, 80, 90 Rows and identified subsurface soil, groundwater, sediment, and surface water as media potentially impacted by releases of AFFF to Outfall #3 (ASL, November 2017). PFOS and PFOA were not detected above residential screening levels in surface soil or subsurface soil at the 70, 80, 90 Rows or in subsurface soil or sediment at Outfall #3 during this SI. PFOS was detected in a 2014 sediment sample at a concentration above the current residential screening level.

PFOS and PFOA were detected in groundwater above screening levels at the 70, 80, 90 Rows. As discussed in Section 4.3, the human ingestion exposure pathway for impacted groundwater at the 70, 80, 90 Rows is potentially complete and groundwater remains media of concern.

PFOS and PFOA were also detected in surface water and groundwater above screening levels at Outfall #3. As discussed in Section 5.3, the human exposure pathway for ingestion of impacted surface water via drinking water is potentially complete based on possible surface water to groundwater impacts. In addition, as discussed in Section 4.3, due to the presence of shallow domestic wells potentially downgradient from Outfall #3, the human exposure pathway for the ingestion of impacted groundwater is potentially complete. Further, although a complete human ingestion exposure pathway from impacted sediment has not been identified (based on current receptors), sediment remains media of concern at AFFF Area 2 (in addition to groundwater and surface water).

7.3 BUILDING 618 – AFFF AREA 3

The QAPP addendum CSM identified subsurface soil and groundwater as media potentially impacted by releases of AFFF at Building 618 (ASL, November 2017). PFOS and PFOA were not detected above residential screening levels in subsurface soil. PFOS and PFOA were, however, detected in groundwater at concentrations above screening levels. As discussed in Section 4.4, the human exposure pathway for ingestion of impacted groundwater is potentially complete and groundwater remains media of concern at AFFF Area 3.

7.4 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by releases of AFFF at the former fire station (ASL, November 2017). PFOS was detected in surface soil at concentrations above the residential screening level. However, as discussed in Section 6.1, human ingestion of impacted surface soil is unlikely. PFOS and PFOA were not detected above residential screening levels in subsurface soil. PFOS and PFOA were, however, detected in groundwater at concentrations above screening levels. As discussed in Section 4.5, the human exposure pathway for ingestion of impacted groundwater is potentially complete. Surface soil and groundwater remain media of concern at AFFF Area 4.

7.5 B-52 CRASH (1972) – AFFF AREA 5

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by use of AFFF at the B-52 crash site (ASL, November 2017). PFOS and PFOA were not detected in surface soil or subsurface soil at concentrations above the residential screening level. PFOS and PFOA were, however, detected in groundwater at concentrations above screening levels. As discussed in Section 4.6, the human exposure pathway for ingestion of impacted groundwater is potentially complete and groundwater remains media of concern at AFFF Area 5.

7.6 B-1 CRASH (1988) – AFFF AREA 6

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by use of AFFF at the B-1 crash site (ASL, November 2017). PFOS and PFOA were not detected in surface soil or subsurface soil at concentrations above the residential screening level. PFOS and PFOA were, however, detected in groundwater at concentrations above screening levels. As discussed in Section 4.7, the human exposure pathway for ingestion of impacted groundwater is potentially complete and groundwater remains media of concern at AFFF Area 6.

7.7 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by use of AFFF at the Delta Taxiway West crash site. As discussed in Sections 6.7 and 4.8, PFOS and PFOA concentrations in surface soil, subsurface soil, and groundwater were all below their respective screening levels. Lacking contaminant levels above screening levels, human exposure pathways are incomplete at AFFF Area 7. Several other PFAS compounds were detected in soil and groundwater at AFFF Area 7 for which there are currently no HA or RSL values. Future characterization may be warranted at Area 7 if state or federal soil/groundwater standards are promulgated for any of these analytes.

7.8 MARTEN CRASH (2006) – AFFF AREA 8

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by use of AFFF at the Marten crash site. As discussed in Sections 6.8 and 4.9, PFOS and PFOA concentrations in surface soil, subsurface soil, and groundwater were all below screening levels. Lacking contaminant levels above screening levels, human exposure pathways are incomplete and no media remain a concern at AFFF Area 8. Several other PFAS compound were detected in soil and groundwater at AFFF Area 8 for which there are currently no HA or RSL values. Future characterization may be warranted at Area 8 if state or federal soil/groundwater standards are promulgated for any of these analytes.

7.9 CRASH 4 (2001) – AFFF AREA 9

The QAPP addendum CSM identified surface soil, subsurface soil, and groundwater as media potentially impacted by use of AFFF at the Crash 4 spill site (ASL, November 2017). PFOS and PFOA were not detected in surface soil or subsurface soil at concentrations above the residential screening level. PFOS and combined PFOS and PFOA were, however, detected in groundwater at concentrations above screening levels. As discussed in Section 4.10, the human exposure pathway for ingestion of impacted groundwater is potentially complete and groundwater remains media of concern at AFFF Area 9.

7.10 WASTEWATER TREATMENT PLANT (WWTP) – AFFF AREA 10

The QAPP addendum CSM identified surface soil, subsurface soil, groundwater, sediment, and surface water as media potentially impacted by releases of AFFF in effluent from the WWTP (ASL, November 2017). PFOS was detected in surface soil and sediment at concentrations above the residential screening level. However, as discussed in Section 6.10, human ingestion of impacted soil or sediment is unlikely. PFOS and PFOA were also detected in surface water at concentrations above the screening level. As discussed in Section 5.11, the human ingestion exposure pathway for impacted surface water is potentially complete based on possible surface water to groundwater impacts. PFOS and PFOA were not detected in subsurface soil or groundwater at concentrations above screening levels. Surface soil, sediment, and surface water remain media of concern at AFFF Area 10.

7.11 SPRAY NOZZLE TEST AREA – AFFF AREA 11

The QAPP addendum CSM identified surface soil, subsurface soil, groundwater, sediment, and surface water as media potentially impacted by releases of AFFF at the spray nozzle test area (ASL, November 2017). PFOS and PFOA were not detected in surface soil, subsurface soil, or sediment at concentrations above the residential screening level. PFOS and PFOA were, however, detected in groundwater and surface water at concentrations above screening levels. As discussed in Sections 4.12 and 5.12, the human ingestion exposure pathways for impacted surface water and groundwater are potentially complete and remain media of concern at AFFF Area 11.

7.12 BUILDING 88240 – AFFF AREA 12

The QAPP addendum CSM identified surface soil, subsurface soil, groundwater, sediment, and surface water as media potentially impacted by releases of AFFF at Building 88240 (ASL, November 2017). PFOS was detected in surface soil at concentrations above the residential screening level. PFBS, PFOA, and PFOS were also detected in a 2014 sediment sample collected from the retention pond, all at concentrations exceeding their respective screening values. However, as indicated in Section 6.12, human ingestion of impacted soil or sediment is unlikely. PFOS and PFOA were not detected in subsurface soil at concentrations above residential screening levels.

PFOS and PFOA were also detected in groundwater and surface water at concentrations above screening levels. As discussed in Sections 4.13 and 5.13, the human ingestion exposure pathways for impacted surface water and groundwater are potentially complete. Surface soil, groundwater, sediment, and surface water remain media of concern at AFFF Area 12.

8.0 CONCLUSIONS AND RECOMMENDATIONS

ASL completed SIs at 12 known or suspected areas of AFFF releases at Ellsworth AFB, as detailed in the site-specific QAPP addendum (ASL, November 2017). The areas inspected included

Current Fire Training Area	AFFF Area 1
70, 80, 90 Rows and Outfall #3	AFFF Area 2
Building 618	AFFF Area 3
Former Fire Station (Building 7506)	AFFF Area 4
B-52 Crash (1972)	AFFF Area 5
B-1 Crash (1988)	AFFF Area 6
Delta Taxiway West Crash (2000)	AFFF Area 7
Marten Crash (2006)	AFFF Area 8
Crash 4 (2001)	AFFF Area 9
Wastewater Treatment Plant	AFFF Area 10
Spray Nozzle Test Area	AFFF Area 11
Building 88240	AFFF Area 12

The objectives of the SIs were to

- determine if a confirmed release of PFAS has occurred at sites selected for SI;
- determine if PFAS are present in soil, groundwater, surface water, or sediment at the site in concentrations exceeding the EPA lifetime HAs or tap water RSLs, residential soil screening levels, or a state standard;
- identify potential receptor pathways with immediate impacts to human health; and
- provide recommendations for follow-on investigations if detected concentrations of PFAS equal or exceed project action levels (PALs). For PFAS without a specific numerical screening value, results will be discussed in terms of whether the chemical was detected.

Surface soil and/or subsurface soil and groundwater were sampled at each of the 12 AFFF areas. Sediment and surface water were also sampled at

- Outfall #3 (AFFF Area 2),
- the WWTP (AFFF Area 10),
- the spray nozzle test area (AFFF Area 11), and
- Building 88240 (AFFF Area 12).

Sampling was primarily limited to the immediate areas of known or suspected AFFF releases and biased toward locations most likely to have been impacted by the releases.

A 2014 screening-level site investigation conducted at Ellsworth AFB determined the presence of combined PFOS and PFOA above screening levels in groundwater at the 70, 80, 90 Rows and Outfall #3, Building 618, and Building 88240 (now designated AFFF Areas 2, 3, and 12). The 2014 investigation also determined the presence of combined PFOS and PFOA at concentrations above screening levels in surface water at Outfall #3 (AFFF Area 2) and the WWTP (AFFF Area 10). The 2014 investigation also determined the presence of combined PFOS, PFOA, and PFBS above screening levels in surface water and sediment at the Building 88240 retention pond (AFFF Area 12). PFOS was also detected above screening levels in sediment samples collected at Outfall #3 and the WWTP.

All samples were analyzed for 18 PFAS compounds, including PFBS, PFOA, and PFOS, using modified EPA Method 537. Analytical results for PFBS in soil, sediment, groundwater, and surface water were compared to published EPA RSLs (HQ=0.1). Analytical results for PFOA and PFOS in soil and sediment were compared to calculated residential RSLs (126 µg/kg for both PFOA and PFOS; HQ=0.1). Analytical results for PFOA and PFOS in groundwater and surface water were compared to the EPA HA of 0.07 µg/L (for the individual and combined concentrations of PFOA and PFOS) for drinking water.

AFFF releases at Ellsworth AFB have resulted in PFOA and PFOS concentrations above screening levels in groundwater at AFFF Areas 1, 2, 3, 4, 5, 6, 9, 11, and 12 (nine of 12 areas investigated). Human ingestion exposure pathways for impacted groundwater are potentially complete at AFFF Areas 1, 2, 3, 4, 5, 6, 9, 11, and 12. Impacted groundwater at from these areas may be migrating off-Base and may have impacted downgradient domestic wells. The presence of PFOA and PFOS in groundwater represents a potentially complete human ingestion exposure pathway, and may pose immediate risk to human health. Sampling of private domestic wells downgradient of the base (conducted by others) indicated the presence of PFOS and PFOA at concentrations above the EPA HA in several wells. The groundwater ingestion exposure pathway for groundwater is incomplete for AFFF Areas 7, 8, and 10 where PFOA and PFOS concentrations were below screening levels.

PFOA and PFOS were also detected at concentrations above screening levels in surface water at AFFF Areas 2, 10, 11, and 12. Impacted surface water discharging from Outfall #3 (AFFF Area 2) and from Outfall #5 (at the former WWTP at AFFF Area 10) may be impacting groundwater downstream from the outfalls. There is also the potential for discharge of impacted groundwater from the base to surface water (i.e., Box Elder Creek and its tributaries) based on groundwater flow to the southeast. The human ingestion exposure pathway for impacted surface water is, therefore, potentially complete via surface water to groundwater interactions.

PFOS was also detected above residential screening levels in surface soil at AFFF Areas 1, 4, 10 and 12; in subsurface soil at Area 1; and in sediment at AFFF Area 10. Complete human ingestion exposure pathways for PFOS-impacted soil or sediment are unlikely, but impacted soil or sediment could represent a continuing source for groundwater and/or surface water impacts.

Table 46 (at the end of this section) summarizes detected concentrations of PFBS, PFOA, and PFOS for media sampled at each area. Brief summaries of key findings, conclusions, and recommendations for each area (focusing on PFOA and PFOS screening level exceedances) are included in Sections 8.1 through 8.12.

8.1 CURRENT FIRE TRAINING AREA – AFFF AREA 1

Use of AFFF during training activities at the current FTA has resulted in PFAS impacts to surface soil, subsurface soil, and groundwater at concentrations above screening levels. PFOS was detected in surface soil at a maximum concentration of 3,300 µg/kg and in subsurface soil at a maximum concentration of 630 µg/kg. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 91 µg/L.

PFOS concentrations above residential screening levels in soil do not represent an immediate risk to human health. As indicated in Section 6.1, human ingestion of PFOS-impacted surface soil is unlikely. However, as indicated in Section 4.2, the human ingestion exposure pathway for impacted groundwater is potentially complete. Surface soil, subsurface soil, and groundwater remain media of concern at the current FTA and an RI is recommended.

8.2 70, 80, 90 ROWS AND OUTFALL #3 – AFFF AREA 2

Releases of AFFF at the 70, 80, 90 Rows and Outfall #3 have resulted in PFAS impacts to groundwater at concentrations above screening levels (at both the 70, 80, 90 Rows and Outfall #3) and to surface water (at Outfall #3). PFOS and PFOA were detected in groundwater at a maximum combined concentration of 2.62 µg/L at the 70, 80, 90 Rows and 1.22 µg/L at Outfall #3. PFOS and PFOA were detected in surface water at a maximum combined concentration of 0.80 µg/L at Outfall #3.

PFOS/PFOA concentrations above screening levels in groundwater at the 70, 80, 90 Rows represent an immediate risk to human health. As indicated in Section 4.3, the human ingestion exposure pathway for impacted groundwater at the 70, 80, 90 Rows is potentially complete. Groundwater remains media of concern at the 70, 80, 90 Rows and an RI is recommended.

PFOS/PFOA concentrations above screening levels in surface water at Outfall #3 also represents an immediate threat to human health. As indicated in Section 5.2, the human ingestion exposure pathway is potentially complete for impacted surface water (based on possible surface water to groundwater impacts). PFOS/PFOA concentrations above screening levels in groundwater at Outfall #3 also represent an immediate risk to human health. As indicated in Section 4.3, the human ingestion exposure pathway for impacted groundwater is potentially complete at Outfall #3. Based on the presence of domestic wells potentially downgradient from Outfall #3 and the possible, immediate threat to human health, an expanded SI is recommended. Subsequent to this SI, sampling of private domestic wells downgradient of Outfall #3 was conducted and an additional groundwater investigation is in progress. This work is being performed under a separate contract by others.

8.3 BUILDING 618 – AFFF AREA 3

Releases of AFFF at Building 618 have resulted in PFAS impacts to groundwater at concentrations above screening levels. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 1.673 µg/L. PFOS/PFOA concentrations above screening levels in groundwater represent an immediate risk to human health. As indicated in Section 4.4, the human ingestion exposure pathway for impacted groundwater is potentially complete. Groundwater remains media of concern at Building 618 and an RI is recommended.

8.4 FORMER FIRE STATION (BUILDING 7506) – AFFF AREA 4

Releases of AFFF at the former fire station have resulted in PFAS impacts to surface soil and groundwater above screening levels. PFOS was detected in surface soil above the residential screening level at a concentration of 3,000 µg/kg. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 1.55 µg/L.

PFOS concentrations above the residential screening level in surface soil do not represent an immediate risk to human health. As indicated in Section 6.4, human ingestion of PFOS-impacted soil is unlikely. PFOS/PFOA concentrations above screening levels in groundwater do represent an immediate risk to human health. As indicated in Section 4.5, the human ingestion exposure pathway for impacted groundwater is potentially complete. Surface soil and groundwater remain media of concern at Building 618 and an RI is recommended.

8.5 B-52 CRASH (1972) – AFFF AREA 5

Use of AFFF at the B-52 crash site has resulted in PFAS impacts to groundwater at concentrations above screening levels. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 0.435 µg/L. PFOS/PFOA concentrations above screening levels in groundwater represent an immediate risk to human health. As indicated in Section 4.6, the human ingestion exposure pathway for impacted groundwater is potentially complete. Groundwater remains media of concern at the B-52 crash site, and an RI is recommended.

8.6 B-1 CRASH (1988) – AFFF AREA 6

Use of AFFF at the B-1 crash site has resulted in PFAS impacts to groundwater at concentrations above screening levels. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 0.59 µg/L. PFOS/PFOA concentrations above screening levels in groundwater represent an immediate risk to human health. As indicated in Section 4.7, the human ingestion exposure pathway for impacted groundwater is potentially complete. Groundwater remains media of concern at the B-1 crash site and an RI is recommended.

8.7 DELTA TAXIWAY WEST CRASH (2000) – AFFF AREA 7

As discussed in Sections 6.7 and 4.8, release of AFFF at the Delta Taxiway West crash site has not resulted in PFAS impacts to surface soil, subsurface soil, or groundwater above screening levels. Lacking concentrations of PFAS above screening levels, there are no complete exposure pathways, and a determination of NFRAP is recommended for AFFF Area 7.

8.8 MARTEN CRASH (2006) – AFFF AREA 8

As discussed in Sections 6.8 and 4.9, use of AFFF at the Marten crash site has not resulted in PFAS impacts to surface soil, subsurface soil, or groundwater above screening levels. Lacking concentrations of PFAS above screening levels, there are no complete exposure pathways, and a determination of NFRAP is recommended for AFFF Area 8.

8.9 CRASH 4 (2001) – AFFF AREA 9

A release of AFFF at the Crash 4 spill site has resulted in PFAS impacts to groundwater at concentrations above screening levels. PFOS and PFOA were detected in groundwater at a maximum combined concentration of 0.173 µg/L (estimated value). PFOS/PFOA concentrations above screening levels in groundwater represent an immediate risk to human health. As indicated in Section 4.10, the human ingestion exposure pathway for impacted groundwater is potentially complete. Groundwater remains media of concern at the Crash 4 spill site and an RI is recommended.

8.10 WASTEWATER TREATMENT PLANT – AFFF AREA 10

Releases of AFFF impacted effluent at the WWTP have resulted in PFAS impacts to surface soil, sediment, and surface water at concentrations above screening levels. PFOS was detected in surface soil and sediment at maximum concentrations of 140 µg/kg and 710 µg/kg, respectively. PFOS and PFOA were detected in surface water at a maximum combined concentration of 1.18 µg/L.

PFOS/PFOA concentrations above screening levels in surface soil and sediment do not represent an immediate risk to human health. As indicated in Section 6.10, human ingestion of impacted soil or sediment is unlikely. As indicated in Section 5.11, the human ingestion exposure pathway for impacted surface water is potentially complete (based on possible surface water to groundwater impacts). Surface soil, groundwater, sediment, and surface water remain media of concern at the WWTP, and an RI is recommended.

8.11 SPRAY NOZZLE TEST AREA – AFFF AREA 11

Releases of AFFF at the spray nozzle test area have resulted in PFAS impacts to groundwater and surface water at concentrations above screening levels. PFOS and PFOA were detected in groundwater and surface water at maximum combined concentrations of 0.50 µg/L and 0.487 µg/L, respectively.

PFOS/PFOA concentrations above screening levels in groundwater and surface water do not represent an immediate risk to human health. As indicated in Sections 4.12 and 5.12, the human ingestion exposure pathway for impacted groundwater and surface water are potentially complete. Groundwater and surface water remain media of concern at the spray nozzle test area and an RI is recommended.

8.12 BUILDING 88240 – AFFF AREA 12

Releases of AFFF at Building 88240 have resulted in PFAS impacts to surface soil, groundwater, and surface water at concentrations above screening levels. PFOS was detected in surface soil at a maximum concentration of 390 µg/kg (estimated). PFOS and PFOA were detected in groundwater and surface water at maximum combined concentrations of 1.21 µg/L and 4.62 µg/L, respectively.

As indicated in Section 6.12, human ingestion through exposure to impacted soil is unlikely. PFOS/PFOA concentrations above screening levels in groundwater and surface water represent an immediate risk to human health. As indicated in Sections 4.13 and 5.13, the human ingestion exposure pathway for impacted groundwater and surface water are potentially complete. Groundwater and surface water remain media of concern at the spray nozzle test area and an RI is recommended.

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 1 Current FTA	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	4.9 J	130,000[b] 13[c]	4/0	No	No	Advance area to RI
		PFOA	21	126[d]	4/0	No		
		PFOS	**3,300 J**[i]	126[d]	4/4	Yes		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	2.5 J	130,000 13	4/0	No	No	
		PFOA	4.1 J	126	4/0	No		
		PFOS	**630**	126	4/2	Yes		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	28	40[e]	4/0	No	Yes[1]	
		PFOA	**15**	0.07[f]	4/4	Yes		
		PFOS	**82**	0.07[f]	4/4	Yes		
		PFOA + PFOS	**91**[h]	0.07[g]	4/4	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 2 70, 80, 90 Rows and Outfall #3	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	3/0	No	No	Expanded SI (Outfall #3) Advance area to RI (70, 80, 90 Rows)
		PFOA	1.4	126	3/0	No		
		PFOS	47	126	3/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	5/0	No	No	
		PFOA	ND	126	5/0	No		
		PFOS	27 J	126	5/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.69	40	7/0	No	Yes[1]	
		PFOA	**0.78**	0.07	7/4	Yes		
		PFOS	**2.5 J**	0.07	7/7	Yes		
		PFOA + PFOS	**2.62 J[h]**	0.07	7/7	Yes		
		Sediment	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	1/0	No	No	
		PFOA	9.2 J[i]	126	1/0	No		
		PFOS	90 J[i]	126	1/0	No		
		Surface Water	**(µg/L)**	**(µg/L)**				
		PFBS	0.015 J	40	1/0	No	Yes[1]	
		PFOA	**0.38[i]**	0.07	1/1	Yes		
		PFOS	**0.44**	0.07	1/1	Yes		
		PFOA + PFOS	**0.80[i]**	0.07	1/1	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 3 Building 618	Not an existing site	**Subsurface Soil**	**(µg/kg)**	**(µg/kg)**				Advance area to RI
		PFBS	ND	130,000 13	4/0	No	No	
		PFOA	0.69 J	126	4/0	No		
		PFOS	110 J	126	4/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.086	40	3/0	No	Yes[1]	
		PFOA	**0.12**	0.07	3/3	Yes		
		PFOS	**1.6**	0.07	3/3	Yes		
		PFOA + PFOS	**1.673**[h]	0.07	3/3	Yes		
AFFF Area 4 Former Fire Station (Building 7506)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				Advance area to RI
		PFBS	8.2 J	130,000 13	3/0	No	No	
		PFOA	62	126	3/0	No		
		PFOS	**3,000**	126	3/1	Yes		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	0.62 J	130,000 13	5/0	No	No	
		PFOA	2.1	126	5/0	No		
		PFOS	11	126	5/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.40	40	3/0	No	Yes[1]	
		PFOA	**0.76**	0.07	3/3	Yes		
		PFOS	**0.79**	0.07	3/3	Yes		
		PFOA + PFOS	**1.55**	0.07	3/3	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 5 B-52 Crash (1972)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	3/0	No	No	Advance area to RI
		PFOA	3.1	126	3/0	No		
		PFOS	75	126	3/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	3/0	No	No	
		PFOA	0.37 J[i]	126	3/0	No		
		PFOS	1.4[i]	126	3/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.015 J	40	2/0	No	Yes[1]	
		PFOA	**0.095**	0.07	2/2	Yes		
		PFOS	**0.34**	0.07	2/2	Yes		
		PFOA + PFOS	**0.435**	0.07	2/2	Yes		
AFFF Area 6 B-1 Crash (1988)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	Advance area to RI
		PFOA	1.8 J	126	4/0	No		
		PFOS	61	126	4/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	
		PFOA	ND	126	4/0	No		
		PFOS	0.77 J	126	4/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.022	40	3/0	No	Yes[1]	
		PFOA	**0.19**	0.07	3/1	Yes		
		PFOS	**0.40**	0.07	3/1	Yes		
		PFOA + PFOS	**0.59**	0.07	3/1	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 7 Delta Taxiway West Crash (2000)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	No further response action planned.
		PFOA	2.6	126	4/0	No		
		PFOS	18	126	4/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	
		PFOA	ND	126	4/0	No		
		PFOS	1.1	126	4/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.018 J	40	3/0	No	No	
		PFOA	0.010 J	0.07	3/0	No		
		PFOS	0.017 J	0.07	3/0	No		
		PFOA + PFOS	0.027 J	0.07	3/0	No		
AFFF Area 8 Marten Crash (2006)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	No further response action planned.
		PFOA	1.1	126	4/0	No		
		PFOS	13	126	4/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	4/0	No	No	
		PFOA	ND	126	4/0	No		
		PFOS	ND	126	4/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	ND	40	3/0	No	No	
		PFOA	ND	0.07	3/0	No		
		PFOS	ND	0.07	3/0	No		
		PFOA + PFOS	ND	0.07	3/0	No		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 9 Crash 4 (2001)	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				Advance area to RI.
		PFBS	ND	130,000 13	3/0	No	No	
		PFOA	1.1 J	126	3/0	No		
		PFOS	32	126	3/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	3/0	No	No	
		PFOA	4.5	126	3/0	No		
		PFOS	2.1	126	3/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.017 J	40	2/0	No	Yes[1]	
		PFOA	0.065	0.07	2/0	No		
		PFOS	**0.16**	0.07	2/1	Yes		
		PFOA + PFOS	**0.173 J[h]**	0.07	2/2	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 10 WWTP	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				Advance area to RI.
		PFBS	ND	130,000 13	3/0	No	No	
		PFOA	1.9	126	3/0	No		
		PFOS	**140**	126	3/1	Yes		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	3/0	No	No	
		PFOA	ND	126	3/0	No		
		PFOS	ND	126	3/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	ND	40	3/0	No	No	
		PFOA	0.0065 J	0.07	3/0	No		
		PFOS	0.014 J	0.07	3/0	No		
		PFOA + PFOS	0.0205 J	0.07	3/0	No		
		Sediment	**(µg/kg)**	**(µg/kg)**				
		PFBS	1.9 J	130,000 13	1/0	No	No	
		PFOA	8.8	126	1/0	No		
		PFOS	**710**	126	1/1	Yes		
		Surface Water	**(µg/L)**	**(µg/L)**				
		PFBS	0.12	40	1/0	No	Yes[1]	
		PFOA	**0.22**	0.07	1/1	Yes		
		PFOS	**0.96**	0.07	1/1	Yes		
		PFOA + PFOS	**1.18**	0.07	1/1	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 11 Spray Nozzle Test Area	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	5/0	No	No	Advance area to RI.
		PFOA	1.1	126	5/0	No		
		PFOS	15	126	5/0	No		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	5/0	No	No	
		PFOA	0.42 J	126	5/0	No		
		PFOS	1.0	126	5/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	0.077	40	3/0	No	Yes[1]	
		PFOA	**0.25**	0.07	3/3	Yes		
		PFOS	**0.34**	0.07	3/3	Yes		
		PFOA + PFOS	**0.50**[h]	0.07	3/3	Yes		
		Sediment	**(µg/kg)**	**(µg/kg)**				
		PFBS	ND	130,000 13	1/0	No	No	
		PFOA	1.9 J	126	1/0	No		
		PFOS	81	126	1/0	No		
		Surface Water	**(µg/L)**	**(µg/L)**				
		PFBS	0.011 J	40	1/0	No	Yes[1]	
		PFOA	0.057	0.07	1/0	No		
		PFOS	**0.43**	0.07	1/1	Yes		
		PFOA + PFOS	**0.487**	0.07	1/1	Yes		

Table 46 Summary of PFBS, PFOA, and PFOS Detections and Screening Level Exceedances (continued)

AFFF Area	Associated Existing IRP ID	Parameter	Maximum Detected Concentration	Screening Level	Number of Samples / Number of Exceedances[a]	Exceeds Screening Level	Potentially Complete Exposure Pathway	Recommendation
AFFF Area 12 Building 88240	Not an existing site	**Surface Soil**	**(µg/kg)**	**(µg/kg)**				Advance area to RI.
		PFBS	1.1 J	130,000 13	3/0	No	No	
		PFOA	9.7 J	126	3/0	No		
		PFOS	**390 J**	126	3/3	Yes		
		Subsurface Soil	**(µg/kg)**	**(µg/kg)**				
		PFBS	1.1 J	130,000 13	3/0	No	No	
		PFOA	1.7	126	3/0	No		
		PFOS	88	126	3/0	No		
		Groundwater	**(µg/L)**	**(µg/L)**				
		PFBS	2.8	40	3/0	No	Yes[1]	
		PFOA	**0.11**	0.07	3/1	Yes		
		PFOS	**1.1**	0.07	3/2	Yes		
		PFOA + PFOS	**1.21**	0.07	3/2	Yes		
		Sediment	**(µg/kg)**	**(µg/kg)**				
		PFBS	1.9	130,000 13	1/0	No	No	
		PFOA	1.5	126	1/0	No		
		PFOS	59	126	1/0	No		
		Surface Water	**(µg/L)**	**(µg/L)**				
		PFBS	2.9	40	1/0	No	Yes[1]	
		PFOA	**0.82**	0.07	1/1	Yes		
		PFOS	**3.8**	0.07	1/1	Yes		
		PFOA + PFOS	**4.62**	0.07	1/1	Yes		

[a] Includes only primary samples unless an exceedance only occurred in a duplicate sample. In those instances, only the duplicate is included. [b] EPA Regional Screening Levels for soil protective of groundwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf). [c] EPA Regional Screening Levels for residential soil (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf). [d] Screening levels were calculated using the EPA Regional Screening Level Calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search). [e] EPA Regional Screening Levels for tapwater (November 2018) (https://semspub.epa.gov/work/HQ/197416.pdfhttps://semspub.epa.gov/work/HQ/197416.pdf). [f] Screening Level listed in *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* (EPA, May 2016b) and *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)* (EPA, May 2016a). [g] The EPA Health Advisory value for drinking water of 0.07 µg/L applies to the combined detected concentrations of PFOS and PFOA. [h] Maximum PFOA + PFOS concentration shown is the highest combined PFOA and PFOS concentration detected in a specific groundwater or surface water sample and in this instance is not the sum of the individual maximum PFOA and PFOS concentrations listed as they occurred in two separate samples. [i] Duplicate result.

[1] Sampling of private domestic wells and investigation of groundwater downgradient of the Base has been completed by others.

Bold values exceed screening levels.

µg/kg = micrograms per kilogram
ID = identification
PFOA = perfluorooctanoic acid
µg/L = micrograms per liter
IRP = Installation Restoration Program
PFOS = perfluorooctane sulfonate
AFFF = aqueous film forming foam
J = the reported concentration is an estimated value.
RI = remedial investigation
ND = not detected
SI = site inspection
FTA = fire training area
PFBS = perfluorobutane sulfonate
WWTP = wastewater treatment plant

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Appendix A

Figures

Appendix B

RSL Calculation

Default
Resident Equation Inputs for Soil

Variable	Value
THQ (target hazard quotient) unitless	0.1
TR (target risk) unitless	1E-06
LT (lifetime) years	70
ET_{res} (exposure time) hours/day	24
ET_{res-c} (child exposure time) hours/day	24
ET_{res-a} (adult exposure time) hours/day	24
ET_{0-2} (mutagenic exposure time) hours/day	24
ET_{2-6} (mutagenic exposure time) hours/day	24
ET_{6-16} (mutagenic exposure time) hours/day	24
ET_{16-26} (mutagenic exposure time) hours/day	24
ED_{res} (exposure duration) years	26
ED_{res-c} (exposure duration - child) years	6
ED_{res-a} (exposure duration - adult) years	20
ED_{0-2} (mutagenic exposure duration) years	2
ED_{2-6} (mutagenic exposure duration) years	4
ED_{6-16} (mutagenic exposure duration) years	10
ED_{16-26} (mutagenic exposure duration) years	10
BW_{res-c} (body weight - child) kg	15
BW_{res-a} (body weight - adult) kg	80
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-26} (mutagenic body weight) kg	80
SA_{res-c} (skin surface area - child) cm^2/day	2373
SA_{res-a} (skin surface area - adult) cm^2/day	6032
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032
EF_{res} (exposure frequency) days/year	350
EF_{res-c} (exposure frequency - child) days/year	350
EF_{res-a} (exposure frequency - adult) days/year	350

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Default
Resident Equation Inputs for Soil

Variable	Value
EF_{0-2} (mutagenic exposure frequency) days/year	350
EF_{2-6} (mutagenic exposure frequency) days/year	350
EF_{6-16} (mutagenic exposure frequency) days/year	350
EF_{16-26} (mutagenic exposure frequency) days/year	350
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3
IRS_{res-c} (soil intake rate - child) mg/day	200
IRS_{res-a} (soil intake rate - adult) mg/day	100
IRS_{0-2} (mutagenic soil intake rate) mg/day	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200
IRS_{6-16} (mutagenic soil intake rate) mg/day	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100
AF_{res-a} (skin adherence factor - adult) mg/cm^2	0.07
AF_{res-c} (skin adherence factor - child) mg/cm^2	0.2
AF_{0-2} (mutagenic skin adherence factor) mg/cm^2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm^2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm^2	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm^2	0.07
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260
AT_{res} (averaging time - resident carcinogenic)	365
$City_{PEF}$ (Climate Zone) Selection	Default
A_s (PEF acres)	0.5
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77
PEF (particulate emission factor) m^3/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194

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Default

Resident Equation Inputs for Soil

Variable	Value
City$_{VF}$ (Climate Zone) Selection	Default
A$_s$ (VF acres)	0.5
Q/C$_{vol}$ (g/m^2-s per kg/m^3)	68.18
foc (fraction organic carbon in soil) g/g	0.006
p$_b$ (dry soil bulk density) g/cm ^{3}	1.5
p$_s$ (soil particle density) g/cm ^{3}	2.65
n (total soil porosity) L$_{pore}$/L$_{soil}$	0.43396
Theta$_a$ (air-filled soil porosity) L$_{air}$/L$_{soil}$	0.28396
Theta$_w$ (water-filled soil porosity) L$_{water}$/L$_{soil}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
City$_{VF mass-loading}$ (Climate Zone) Selection	Default
VF$_{ml}$ (volitization factor - mass-limit) m ^{3}/kg	.
Q/C$_{vol}$ (g/m^2-s per kg/m^3)	68.18
A$_s$ (VF mass-limit acres)	0.5
T (exposure interval) yr	26
d$_s$ (depth of source) m	.
p$_b$ (dry soil bulk density) g/cm ^{3}	1.5
A (VF Dispersion Constant - Mass Limit)	11.911
B (VF Dispersion Constant - Mass Limit)	18.4385
C (VF Dispersion Constant - Mass Limit)	209.7845
T$_w$ (groundwater temperature) Celsius	25

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Default
Resident Risk-Based Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; D = DWSHA; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #29); H = HEAST; F = See FAQ; E = see user guide Section 2.3.5; W = see user guide Section 2.3.6; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); U = User-provided

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF (mg/kg-day)$^{-1}$	SFO Ref	Inhalation Unit Risk (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA	Soil Saturation Concentration (mg/kg)	S (mg/L)
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	No	No	-		-		2.00E-05	D	-		1	0.1	1	-	6.80E+02
Perfluorooctanoic acid (PFOA)	335-67-1	No	No	7.00E-02	D	-		2.00E-05	D	-		1	0.1	1	-	9.50E+03

K_{oc} (cm3/g)	K_d (cm³/g)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Normal Boiling Point T_{boil} (K)	BP Ref	Critical Temperature T_{crit} (K)	T_{crit} Ref	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor (m^3/kg)
3.72E+02	-	-	-		532.15	PHYSPROP	-		2.07E-02	5.25E-06	-	1.36E+09	-
1.15E+02	-	-	-		465.55	PHYSPROP	-		2.26E-02	5.79E-06	-	1.36E+09	-

Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=0.1 (mg/kg)	Dermal SL Child THQ=0.1 (mg/kg)	Inhalation SL Child THQ=0.1 (mg/kg)	Noncarcinogenic SL Child THI=0.1 (mg/kg)	Ingestion SL Adult THQ=0.1 (mg/kg)	Dermal SL Adult THQ=0.1 (mg/kg)	Inhalation SL Adult THQ=0.1 (mg/kg)	Noncarcinogenic SL Adult THI=0.1 (mg/kg)	Screening Level (mg/kg)
-	-	-	-	1.56E-01	6.59E-01	-	1.26E-01	1.67E+00	3.95E+00	-	1.17E+00	1.26E-01 nc
9.93E+00	3.53E+01	-	7.75E+00	1.56E-01	6.59E-01	-	1.26E-01	1.67E+00	3.95E+00	-	1.17E+00	1.26E-01 nc

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Inhalation Unit Risk Toxicity Metadata

Chemical	CASNUM	Inhalation Unit Risk (µg/m ^{3})$^{-1}$	Toxicity Source	EPA Cancer Classification	Inhalation Unit Risk Tumor Type	Inhalation Unit Risk Target Organ	Inhalation Unit Risk Species	Inhalation Unit Risk Method	Inhalation Unit Risk Route	Inhalation Unit Risk Treatment Duration	Inhalation Unit Risk Study Reference	Inhalation Unit Risk Notes
Perfluorooctane sulfonic acid (PFOS)	1763-23-1											
Perfluorooctanoic acid (PFOA)	335-67-1											

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Oral Slope Factor Toxicity Metadata

Chemical	CASNUM	Oral Slope Factor (mg/kg-day) $^{-1}$	Toxicity Source	EPA Cancer Classification	Oral Slope Factor Tumor Type	Oral Slope Factor Target Organ	Oral Slope Factor Species	Oral Slope Factor Method	Oral Slope Factor Route	Oral Slope Factor Treatment Duration	Oral Slope Factor Study Reference	Oral Slope Factor Notes
Perfluorooctane sulfonic acid (PFOS)	1763-23-1											
Perfluorooctanoic acid (PFOA)	335-67-1	7.00E-02	DWSHA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Oral Chronic Toxicity Metadata

Chemical	CASNUM	Chronic Oral Reference Dose (mg/kg-day)	Toxicity Source	Oral Chronic Reference Dose Basis	Oral Chronic Reference Dose Confidence Level	Oral Chronic Reference Dose Critical Effect
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	2.00E-05	DWSHA	NA	NA	NA
Perfluorooctanoic acid (PFOA)	335-67-1	2.00E-05	DWSHA	NA	NA	NA

Oral Chronic Reference Dose Target Organ	Oral Chronic Reference Dose Modifying Factor	Oral Chronic Reference Dose Uncertainty Factor	Oral Chronic Reference Dose Species	Oral Chronic Reference Dose Route	Oral Chronic Reference Dose Study Duration	Oral Chronic Reference Dose Study Reference	Oral Chronic Reference Dose Notes
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

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Inhalation Chronic Toxicity Metadata

Chemical	CASNUM	Chronic Inhalation Reference Concentration (mg/m^3)	Toxicity Source	Inhalation Chronic Reference Concentration Basis	Inhalation Chronic Reference Concentration Confidence Level	Inhalation Chronic Reference Concentration Critical Effect	Inhalation Chronic Reference Concentration Target Organ	Inhalation Chronic Reference Concentration Modifying Factor	Inhalation Chronic Reference Concentration Uncertainty Factor	Inhalation Chronic Reference Concentration Species	Inhalation Chronic Reference Concentration Route	Inhalation Chronic Reference Concentration Study Duration	Inhalation Chronic Reference Concentration Study Reference	Inhalation Chronic Reference Concentration Notes
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	-												
Perfluorooctanoic acid (PFOA)	335-67-1	-												

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Appendix C

Readiness Review Forms, Field Forms, and Boring Logs

SES FIELD READINESS REVIEW FORM

Employee Name: Arek Turolski

Job Number: M2027.0003

Job Location: Ellsworth AFB

Job Tasks:

Surface water sampling, groundwater sampling, soil sampling – surface soil and subsurface soil, soil boring logging, surface water and sediment sampling, mob/demob tasks

Equipment Needed:

Soil boring: Munsell Charts, tape measure, pens, soil boring forms, USCS table

GW Sampling: YSI, peristaltic pump, multiRAE, sample containers etc.

Sediment Sampling: Sample containers, spoons

SW Sampling: Sample containers, SW collection device

Proper PPE for all above tasks is a minimum Level D, plus nitrile gloves

Documents Needed:

Field forms: Boring log, GW sampling log, sample log, log book, calibration sheets

Meeting Notes:

We'll have one mini sonic rig working this installation with Justin as the geologist and Arek serving as back up. The rotation schedule is

April 17–26 – Travel out on April 16, return on April 27 – Ash, Justin, Miles, Arek
May 1–May 10 – Travel out on April 30, return on May 11 – Ash, Justin, Matt B., Arek
May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

If a fourth shift is required, it will start after Memorial Day by traveling out on the 29th.

Justin has PTO scheduled for Friday May 4 through Sunday May 6 and Arek will be on the rig these days.

There are 12 different areas at this installation (called sites in the QAPP as this is one of the early work plans) and we have 38 wells to install. Groundwater is estimated to be 60 feet or less below surface throughout the installation. During our first rotation there is a major exercise scheduled so we will not be working on the airfield. Areas available for work off of the airfield during the first rotation are: Site 1, Outfall #3 wells (part of site 2 which has wells on the airfield as well), Site 3, Site 8, Site 10, and Site 17. This gives you 18 wells available for installation during the first rotation which should be more than enough to keep you guys busy.

We have only one existing well to be redeveloped/sampled at Site 1 and four SW/SD samples (three of which are off airfield).

Airfield work

During work on the airfield we will be getting escorted. No airfield drivers training will be conducted for this job but our movement on the airfield will be restricted because we'll have only one escort.

Drilling

Dig permits have been subcontracted and work will be started on April 5th for those. The subcontractor will have all non-airfield locations cleared by April 16th and all airfield locations cleared by May 1. We also have several locations that are soil borings only in which wells will not be installed.

Hotels/Storage Unit/Vehicles

The hotel for this work will be the Residence Inn at 581 Watiki Way, Box Elder South Dakota 57719. MAKE SURE YOU DO NOT USE GOVERNMENT RATE. Once you've read through this go ahead and book your rooms so you have them. Government rate is nearly twice as expensive as the standard rate for the first rotation. That may change during following rotations but ensure you're getting the cheapest rate available. Jenny – Please have the sample bottles shipped to this location for delivery no later than Monday the 16th. We'll need 20 gallons of PFC-free water to start with. They should be addressed to Ash Willis.

For vehicles – Justin is driving an Aerostar vehicle in from Hill AFB and I have arranged for two commercial truck pickups to be waiting for us at the airport on Monday the 16th. They'll be delivered there on Friday the 13th and have Ash and Arek's name attached to them. You guys will rent as normal from the airport counter but will be on the same monthly rate that was negotiated for Hill AFB which was 1050/month plus tax with 2500 miles of driving. Make sure your rental agreements have the rate/mileage listed before you sign for the trucks. Miles and Matt, get with Arek and Ash to coordinate your flights as you guys will be riding.

Ash will be organizing the storage unit and equipment the week of April 9th and he'll be coordinating with Justin on the storage unit, etc. If/when you guys have questions regarding equipment or a storage unit just let me know.

IDW

We will be following the new IDW guidance at Ellsworth as we have at Hill AFB and I've attached a spreadsheet showing which areas will be containerized and which will not. Note that areas may be containerized because of known plumes, not their surficial conditions.

Equipment Packed for travel on: April 14

Travel Dates:

April 17–26 – Travel out on April 16, return on April 27 – Ash, Justin, Miles, Arek
May 1–May 10 – Travel out on April 30, return on May 11 – Ash, Justin, Matt B., Arek
May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

Site Supervisor Signature

SES FIELD READINESS REVIEW FORM

Employee Name: Ash Willis

Job Number: M2027.0003

Job Location: Ellsworth AFB

Job Tasks:

Surface water sampling, groundwater sampling, soil sampling – surface soil and subsurface soil, soil boring logging, surface water and sediment sampling, mob/demob tasks

Equipment Needed:

Soil boring: Munsell Charts, tape measure, pens, soil boring forms, USCS table

GW Sampling: YSI, peristaltic pump, multiRAE, sample containers etc.

Sediment Sampling: Sample containers, spoons

SW Sampling: Sample containers, SW collection device

Proper PPE for all above tasks is a minimum Level D, plus nitrile gloves

Documents Needed:

Field forms: Boring log, GW sampling log, sample log, log book, calibration sheets

Meeting Notes:

We'll have one mini sonic rig working this installation with Justin as the geologist and Arek serving as back up. The rotation schedule is

April 17–26 – Travel out on April 16, return on April 27 – Ash, Justin, Miles, Arek
May 1–May 10 – Travel out on April 30, return on May 11 – Ash, Justin, Matt B., Arek
May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

If a fourth shift is required, it will start after Memorial Day by traveling out on the 29th.

Justin has PTO scheduled for Friday May 4 through Sunday May 6 and Arek will be on the rig these days.

There are 12 different areas at this installation (called sites in the QAPP as this is one of the early work plans) and we have 38 wells to install. Groundwater is estimated to be 60 feet or less below surface throughout the installation. During our first rotation there is a major exercise scheduled so we will not be working on the airfield. Areas available for work off of the airfield during the first rotation are: Site 1, Outfall #3 wells (part of site 2 which has wells on the airfield as well), Site 3, Site 8, Site 10, and Site 17. This gives you 18 wells available for installation during the first rotation which should be more than enough to keep you guys busy.

We have only one existing well to be redeveloped/sampled at Site 1 and four SW/SD samples (three of which are off airfield).

Airfield work

During work on the airfield we will be getting escorted. No airfield drivers training will be conducted for this job but our movement on the airfield will be restricted because we'll have only one escort.

Drilling

Dig permits have been subcontracted and work will be started on April 5th for those. The subcontractor will have all non-airfield locations cleared by April 16th and all airfield locations cleared by May 1. We also have several locations that are soil borings only in which wells will not be installed.

Hotels/Storage Unit/Vehicles

The hotel for this work will be the Residence Inn at 581 Watiki Way, Box Elder South Dakota 57719. MAKE SURE YOU DO NOT USE GOVERNMENT RATE. Once you've read through this go ahead and book your rooms so you have them. Government rate is nearly twice as expensive as the standard rate for the first rotation. That may change during following rotations but ensure you're getting the cheapest rate available. Jenny – Please have the sample bottles shipped to this location for delivery no later than Monday the 16th. We'll need 20 gallons of PFC-free water to start with. They should be addressed to Ash Willis.

For vehicles – Justin is driving an Aerostar vehicle in from Hill AFB and I have arranged for two commercial truck pickups to be waiting for us at the airport on Monday the 16th. They'll be delivered there on Friday the 13th and have Ash and Arek's name attached to them. You guys will rent as normal from the airport counter but will be on the same monthly rate that was negotiated for Hill AFB which was 1050/month plus tax with 2500 miles of driving. Make sure your rental agreements have the rate/mileage listed before you sign for the trucks. Miles and Matt, get with Arek and Ash to coordinate your flights as you guys will be riding.

Ash will be organizing the storage unit and equipment the week of April 9th and he'll be coordinating with Justin on the storage unit, etc. If/when you guys have questions regarding equipment or a storage unit just let me know.

IDW

We will be following the new IDW guidance at Ellsworth as we have at Hill AFB and I've attached a spreadsheet showing which areas will be containerized and which will not. Note that areas may be containerized because of known plumes, not their surficial conditions.

Equipment Packed for travel on: April 14

Travel Dates:

April 17–26 – Travel out on April 16, return on April 27 – Ash, Justin, Miles, Arek
May 1–May 10 – Travel out on April 30, return on May 11 – Ash, Justin, Matt B., Arek
May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

Site Supervisor Signature

SES FIELD READINESS REVIEW FORM

Employee Name: Justin Vojak

Job Number: M2027.0003

Job Location: Ellsworth AFB

Job Tasks:

Surface water sampling, groundwater sampling, soil sampling – surface soil and subsurface soil, soil boring logging, surface water and sediment sampling, mob/demob tasks

Equipment Needed:

Soil boring: Munsell Charts, tape measure, pens, soil boring forms, USCS table

GW Sampling: YSI, peristaltic pump, multiRAE, sample containers etc.

Sediment Sampling: Sample containers, spoons

SW Sampling: Sample containers, SW collection device

Proper PPE for all above tasks is a minimum Level D, plus nitrile gloves

Documents Needed:

Field forms: Boring log, GW sampling log, sample log, log book, calibration sheets

Meeting Notes:

We'll have one mini sonic rig working this installation with Justin as the geologist and Arek serving as back up. The rotation schedule is

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Drilling

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May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

Site Supervisor Signature

SES FIELD READINESS REVIEW FORM

Employee Name: Matthew Butterworth

Job Number: M2027.0003

Job Location: Ellsworth AFB

Job Tasks:

Surface water sampling, groundwater sampling, soil sampling – surface soil and subsurface soil, soil boring logging, surface water and sediment sampling, mob/demob tasks

Equipment Needed:

Soil boring: Munsell Charts, tape measure, pens, soil boring forms, USCS table

GW Sampling: YSI, peristaltic pump, multiRAE, sample containers etc.

Sediment Sampling: Sample containers, spoons

SW Sampling: Sample containers, SW collection device

Proper PPE for all above tasks is a minimum Level D, plus nitrile gloves

Documents Needed:

Field forms: Boring log, GW sampling log, sample log, log book, calibration sheets

Meeting Notes:

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Drilling

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Site Supervisor Signature

SES FIELD READINESS REVIEW FORM

Employee Name: Miles Nielson

Job Number: M2027.0003

Job Location: Ellsworth AFB

Job Tasks:

Surface water sampling, groundwater sampling, soil sampling – surface soil and subsurface soil, soil boring logging, surface water and sediment sampling, mob/demob tasks

Equipment Needed:

Soil boring: Munsell Charts, tape measure, pens, soil boring forms, USCS table

GW Sampling: YSI, peristaltic pump, multiRAE, sample containers etc.

Sediment Sampling: Sample containers, spoons

SW Sampling: Sample containers, SW collection device

Proper PPE for all above tasks is a minimum Level D, plus nitrile gloves

Documents Needed:

Field forms: Boring log, GW sampling log, sample log, log book, calibration sheets

Meeting Notes:

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May 15–24 – Travel out on May 14, return on May 25 – Ash, Justin, Miles, Arek

Site Supervisor Signature

BORING LOG - MW18PFC0101

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/17/18
End Date : 05/17/18
Northing : 667866.13
Easting : 124247.97
Surface Elev. (ft)* : 3190.27
Total Depth (ft)** : 20.0

Site Name : AFFF Area 1
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Arek Turolski
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well

Depth to Water (ft) : 14.5
Signature Arek Turolski

Water Levels

▼ During Drilling

Measurements

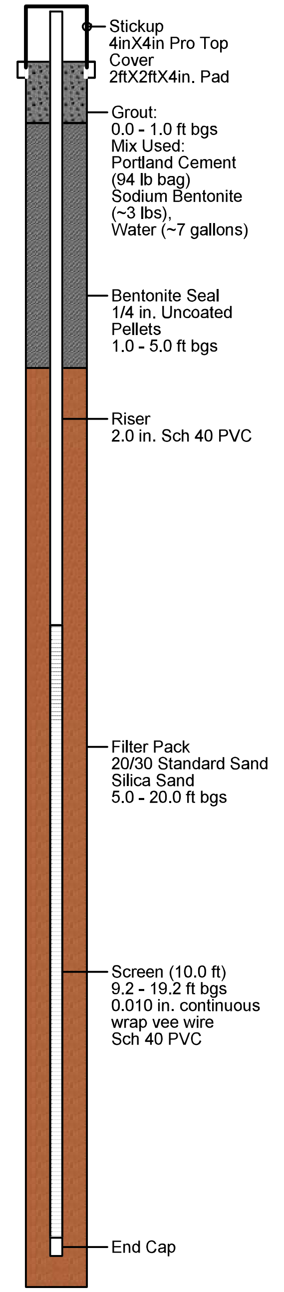
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Water Level	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 2.0) Lean Clay, low density, low plasticity, stiff, slightly moist, 10YR, 3/3, dark brown		CL			SS	ELSWH01-001-SS-001 Note: Interval 0.0 - 0.5 ft
	2		(2.0 - 5.0) Lean Clay, high density, low plasticity, very stiff, dry, 10YR 4/3, brown, trace mottling with 10YR 8/1, white		CL				
5	3	75	(5.0 - 10.0) Lean Clay, medium density, low plasticity, very stiff, dry, 10YR 5/3, brown	0	CL				
10	4	100	(10.0 - 14.5) Gravelly Sand, low density, fine to coarse, sub-rounded to round, well graded, dry, 10YR, 5/3, brown, Gravel: (40%), sub-round to round, fine to coarse	0 0	SW			SO	ELSWH01-001-SO-013 Note: Interval 13.0 - 14.0 FT
	5		(14.5 - 15.0) Gravelly Sand, low density, fine to coarse, sub-rounded to round, well graded, wet, 10YR 5/3, brown, Gravel: (40%), sub-round to round, fine to coarse		SW		▼		
15	6	100	(15.0 - 16.0) Gravel, low density, fine to coarse, sub-round, to round, well graded, wet, 10YR, 4/3, brown		GW				
	7		(16.0 - 17.0) Clay with Gravel, medium density, medium plasticity, stiff, wet, 10YR, 5/4, yelllowish brown, Gravel: (30%), fine to coarse, sub-round to round		CL				
	8		(17.0 - 20.0) Lean Clay, high density, low plasticity, very stiff, dry, 10YR, 4/1, dark gray, mottled with 10YR, 6/2, light brownish gray and 10YR, 6/6, brownish yellow		CL				
20			End of Borehole 20.0 ft bgs						

MW18PFC0101

Elev (TOC): 3192.60



BORING LOG - MW18PFC0102

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/15/18
End Date : 05/16/18
Northing : 668054.33
Easting : 1242946.64
Surface Elev. (ft)* : 3187.26
Total Depth (ft)** : 40.0

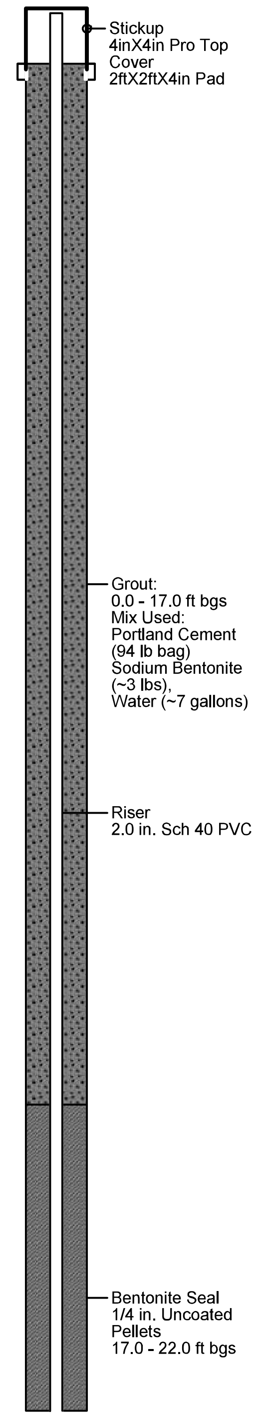
Site Name : AFFF Area 1
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Arek Turolski
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 26.0
Signature Arek Turolski

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Water Level	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 4.0) ORGANIC CLAY, high plasticity, 10YR 6/2, very dark brown, organic material (roots, etc.), moist	0 0	OH			SS	ELSWH01-003-SS-001 Note: Interval 0.0 - 0.5 ft
	2		(4.0 - 5.0) CLAY, brittle, low plasticity, dry, 10YR 4/1, dark gray, dry		CL				
5	3	60	(5.0 - 7.0) CLAYEY SILT, brittle, 10YR 4/2, dark grayish brown, dry		ML				
	4		(7.0 - 10.0) SAND, poorly graded, fine to medium grained, subanglular, 10YR 3/3 dark brown. (10%) GRAVEL, poorly graded, dry	0	SP				
10	5	80	(10.0 - 13.0) GRAVEL, well graded with trace clay, medium, sub-rounded to sub-angular, 10YR 4/3, brown, dry		GW				
	6		(13.0 - 15.0) CLAY, low plasticity, hard, mottled, 10YR 5/3, brown, moist	0	CL				
15	7	80	(15.0 - 16.0) CLAY, medium plasticity, 10YR 3/2, very dary grayish brown, mottled with CLAY, 10YR 6/8 brownish yellow, moist		CL				
	8		(16.0 - 18.0) CLAY, low plasticity, hard, 10YR 4/1, dark gray, slightly moist	0	CL				
	9		(18.0 - 20.0) CLAY, very hard, low plasticity, 10YR 3/2, very dary grayish brown, damp		CL				
20	10		(20.0 - 22.0) CLAY, low plasticity, hard, 10YR 3/1, very dark gray, dry		CL				

MW18PFC0102
Elev (TOC): 3189.50



BORING LOG - MW18PFC0102

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/15/18
End Date	: 05/16/18
Northing	: 668054.33
Easting	: 1242946.64
Surface Elev. (ft)*	: 3187.26
Total Depth (ft)**	: 40.0

Site Name	: AFFF Area 1
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Logged By	: Arek Turolski
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 26.0
Signature	Arek Turolski

Water Levels

▼ During Drilling

Measurements

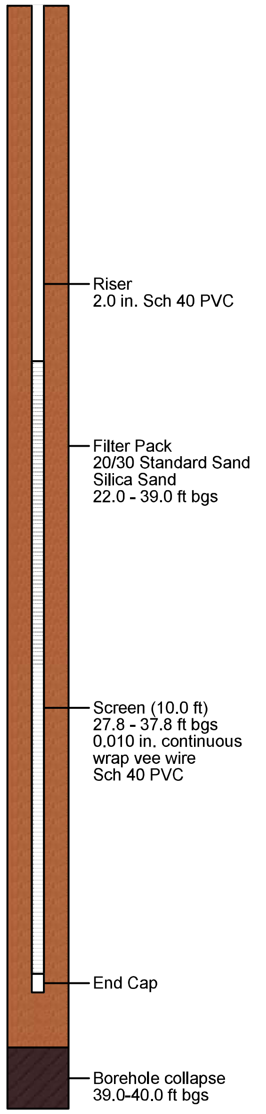
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Water Level	SAMPLE TYPE	SAMPLE ID
22	11	100	(22.0 - 25.0) CLAY, low plasticity, hard, brittle 10YR 3/1, very dark gray, mottled with CLAY, 10YR 4/6, dark yellowish brown, damp	0	CL				
	12			0				SO	ELSWH01-003-SO-025 Note: Interval 25.0-26.0 FT
			(25.8 - 26.0) CLAY, with trace gravel, high plasticity, 10YR 4/1, dark gray, moist		CH		▼		
27	13	100	(26.0 - 30.0) CLAY, low plasticity, hard, 10YR 3/1, very dark gray, mottled with CLAY, 10YR 4/6, dark yellowish brown, moist	0	CL				
	14	100	(30.0 - 32.0) CLAY, low plasticity, hard, 10YR 3/2, very dark grayish brown, dry		CL				
32	15		(32.0 - 34.0) CLAY, low plasticity, hard, 10YR 3/1, very dark gray, mottled with CLAY, 10YR 3/3, dark brown, dry	0	CL				
	16		(34.0 - 35.0) CLAY, low plasticity, hard, brittle, 10YR 3/1, very dark gray, dry		CL				
	17	100	(35.0 - 36.5) CLAYwith trace gravel, low plasticity, hard, 10YR 3/1, very dark gray, dry		CL				
			(36.5 - 36.8) SHALE, weathered, dry		SH				
37			(36.8 - 40.0) CLAY with tracel gravel, low plasticity, hard, 10YR 3/1, very dark gray, dry	0	CL				
			End of Borehole 40 ft bgs						
42									

MW18PFC0102

Elev (TOC): 3189.50



BORING LOG - SB18PFC0102

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/16/18
End Date : 5/16/18
Northing : 667908.88
Easting : 1242849.93
Surface Elev. (ft)* : 3186.60
Total Depth (ft)** : 15.0

Site Name : AFFF Area 1
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/16/18
DTW During Drilling (ft) 13.0
Logged by: Arek Turolski
Signature: Arek Turolski

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 4.0) FAT CLAY, high plasticity, soft, moist, heavy organics (roots, grass, seeds),10 YR, 3/1, very dark gray,	2	CH			SS	ELSWH-01-002-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
			(4.0-5.0) LEAN CLAY, medium plasticity, medium stiff, moist, organic matter, 10 YR, 4/4, dark yellowish brown		CL					
5	2	60	(5.0-8.0) LEAN CLAY, low plasticity, very stiff, moist, 10 YR, 4/2, dark grayish brown	1	CL					
10	3	80	(8.0-13.0) SANDY GRAVEL, fine to coarse, sub-angular to round, moist, 10 YR, 3/3, dark brown, Sand: (30%), angular-sub-round, medium grained	0	GW		▼	SO	ELSWH-01-002-SO-012 Note: Interval 12.0 - 13.0 ft	
			(13.0-14.0) SAND, medium grained, angular to sub-round, wet, 10 YR, 3/3, dark brown, (10%), fine, sub-angular to round Gravels		SP					
15			(14.0-15.0) CLAY with GRAVEL, medium plasticity, hard, moist, 10 YR, 3/3, dark brown, Gravel: (30%), coarse, sub-round to round		CL					

Total Depth of Boring 15.0 ft BGS

Aerostar SES LLC

BORING LOG - MW18PFC0103

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/16/18
End Date : 05/16/18
Northing : 667839.65
Easting : 1242661.54
Surface Elev. (ft)* : 3187.29
Total Depth (ft)** : 20.0

Site Name : AFFF Area 1
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Arek Turolski
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 13.0
Signature Arek Turolski

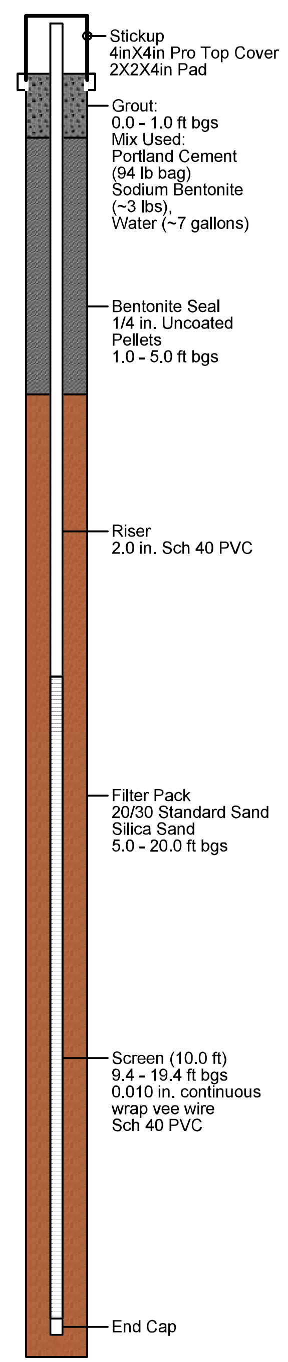
Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Water Level	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 2.0) ORGANIC CLAY, medium plasticity, 10YR 3/1, very dark gray, organic material (roots, etc.), moist	0	OH			SS	ELSWH01-004-SS-001 Note: Interval 0.0 - 0.5 ft
	2	100	(2.0 - 5.0) CLAY, low plasticity, dry, 10YR 5/3, brown, dry	0	CL				
5	3		(5.0 - 7.0) CLAY, low plasticity, brittle, 10YR 5/3, brown, dry		CL				
10	4	80	(7.0 - 12.0) GRAVEL, well Graded, fine to coarse grained, 10YR 4/2, brown with SAND, medium to coarse grained, angular to sub rounded, dry	0	GW				
	5	100	(12.0 - 13.0) GRAVEL, well graded, fine to coarse grained, subangular to round, 10YR 4/4, brown with SAND, medium to coarse grained, angular to sub-rounded, moist	0	GW		▼	SO	ELSWH01-004-SO-012 Note: Interval 11.0-12.0 ft
15	6		(13.0 - 16.0) GRAVEL, well graded, fine to coarse grained, subangular to round, 10YR 4/4, brown, with SAND, medium to coarse grained, angular so sub-angular, wet	0	GW				
20	7	100	(16.0 - 20.0) CLAY, low plasticity, 10YR 5/3, brown, mottled with 10YR 4/1, dark gray, moist	0	CL				

End of Borehole 20.0 ft bgs

MW18PFC0103
Elev (TOC) 3189.71



Aerostar SES LLC

BORING LOG - MW18PFC0201

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/25/18
End Date : 04/25/18
Northing : 673468.17
Easting : 1238430.83
Surface Elev. (ft)* : 3212.87
Total Depth (ft)** : 50.0

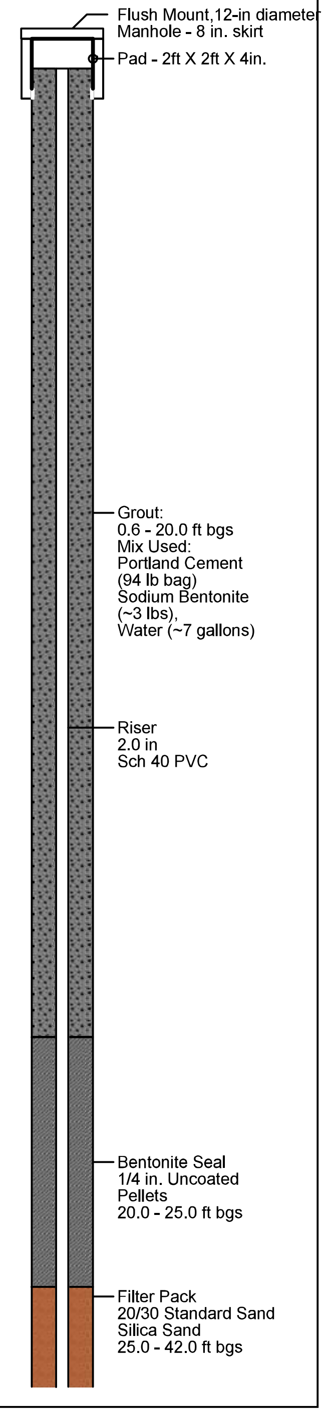
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 31.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	40	(0.0 - 5.0) CLAY, low plasticity, very stiff, 10YR 4/3, brown, with GRAVEL (30%), slightly moist	0	CL				
5	2	90	(5.0 - 10.0) CLAY, medium plasticity, stiff, 10YR 5/2 grayish brown, trace mottling 10YR 4/1, dark gray, dry	0	CL				
10	3	30	(10.0 - 15.0) CLAY, medium plasticity, stiff, 10YR 5/2, grayish brown, dry	0	CL				
15	4	70	(15.0 - 18.0) FAT CLAY, high plasticity, medium stiff, 10YR 5/2 grayish brown, dry	0	CH				
	5		(18.0 - 18.5) FAT CLAY, high plasticity, medium stiff, 10YR 5/2, grayish brown with GRAVEL (40%), dry		CH				
	6		(18.5 - 20.0) CLAY, low plasticity, very stiff, 10YR 6/2, light grayish brown, trace mottling 10YR 6/6, brownish yellow, dry		CL				
20	7	80	(20.0 - 24.0) CLAY, hard, 10YR 6/2, light grayish brown, trace mottling, 10YR 4/1, dark gray, 10YR 6/6, brownish yellow, dry	0	CL				
	8		(24.0 - 31.2) CLAY, hard, 10YR 3/1, very dark gray, dry 0.2' SILTSTONE lesne from 31.0 - 31.2		CL				
25	9								

Well: MW18PFC0201
Elev (TOC): 3212.29



BORING LOG - MW18PFC0201

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/25/18
End Date : 04/25/18
Northing : 673468.17
Easting : 1238430.83
Surface Elev. (ft)* : 3212.87
Total Depth (ft)** : 50.0

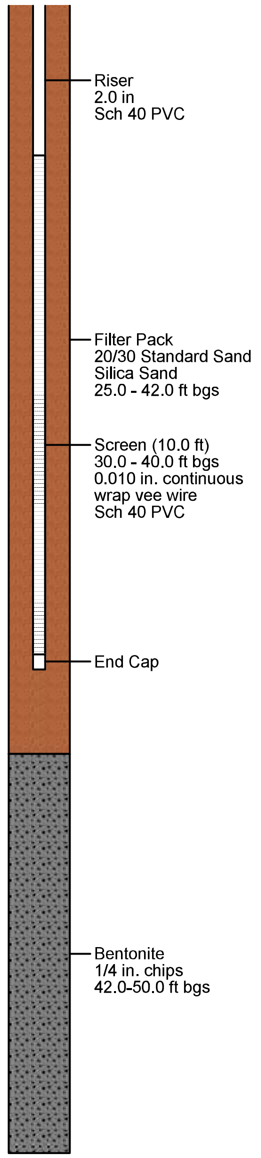
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 31.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
27	9	100		0	CL				
							▼	SO	ELSWH02-001-SO-030 Note: Interval 30.0-31.0 ft
32	10	100	(31.2 - 36.7) CLAY, hard, 10YR 3/1, very dark gray, dry 0.2' SILTSTONE Lense from 36.5 - 36.7	0	CL				
37	11	100	(36.7 - 50.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0					
42	12	100		0	CH				
47	13	100		0					
			End of Borehole 50.0 ft bgs						
52									

Well: MW18PFC0201
Elev (TOC): 3212.29



BORING LOG - MW18PFC0202

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/25/18
End Date : 04/25/18
Northing : 673302.35
Easting : 1238543.34
Surface Elev. (ft)* : 3211.88
Total Depth (ft)** : 40.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 32.0
Signature :

Water Levels

▼ During Drilling

Measurements

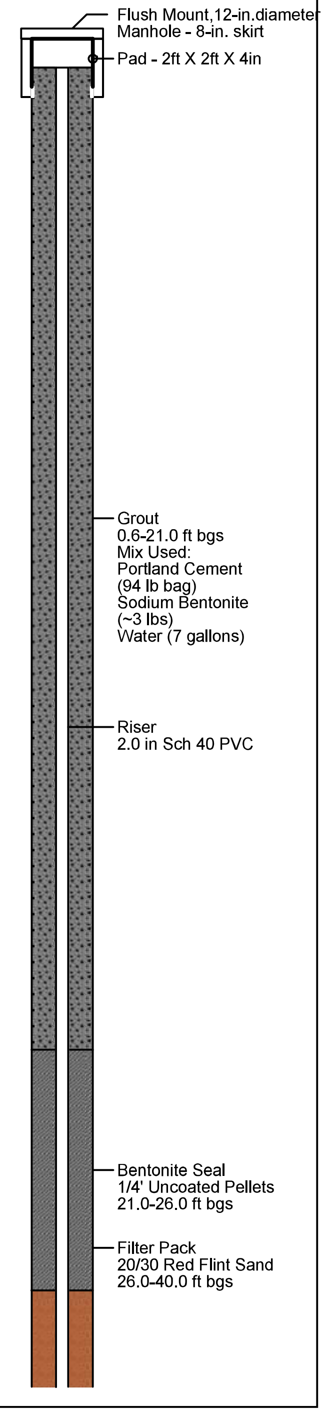
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 5.0) CLAY, medium plasticity, stiff, 10YR 4/3, brown, with GRAVEL (35%), moist	0	CL				
5	2	80	(5.0 - 10.0) CLAY, low plasticity, very stiff, 10YR 6/2 light brownish yellow, mottled with 10YR 6/6, brownish yellow, dry	0	CL				
10	3	80	(10.0 - 15.0) CLAY, hard, 10YR 6/2, light brownish gray, mottled with 10YR 6/6, brownish, yellow, dry	0	CL				
15	4	100	(15.0 - 19.0) CLAY, low plasticity, hard, 10YR 6/2, light brownish gray, mottled with 10YR 6/6, brownish yellow, and 10YR 4/1, dark gray, dry	0	CL				
20	5		(19.0 - 21.0) CLAY, hard, 10YR 3/1, very dark gray, mottled with 10YR 6/6, brownish yellow, dry		CL				
25	6	95	(21.0 - 32.3) CLAY, hard, 10YR 3/1, very dark gray, dry 0.3' SILTSTONE Lense from 32.0 - 32.3	0 0	CL				

Well: MW18PFC0202

Elev (TOC): 3211.33



BORING LOG - MW18PFC0202

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/25/18
End Date : 04/25/18
Northing : 673302.35
Easting : 1238543.34
Surface Elev. (ft)* : 3211.88
Total Depth (ft)** : 40.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 32.0
Signature :

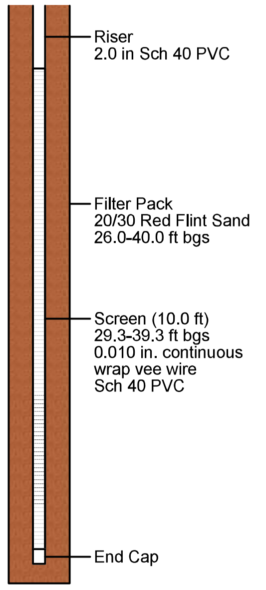
Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
28	6	100			CL				
	7	100					▼	SO	ELSWH02-002-SO-031 Note: Interval 31.0-32.0 ft
33			(32.3 - 40) CLAY, hard, 10YR 3/1, very dark gray, dry	0	CL				
38	8	100		0					
43									
48									
53									

End of Borehole 40.0 ft bgs

Well: MW18PFC0202
Elev (TOC): 3211.33



BORING LOG - MW18PFC0203

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/25/18
End Date : 04/25/18
Northing : 673232.77
Easting : 1238356.55
Surface Elev. (ft)* : 3197.44
Total Depth (ft)** : 20.0

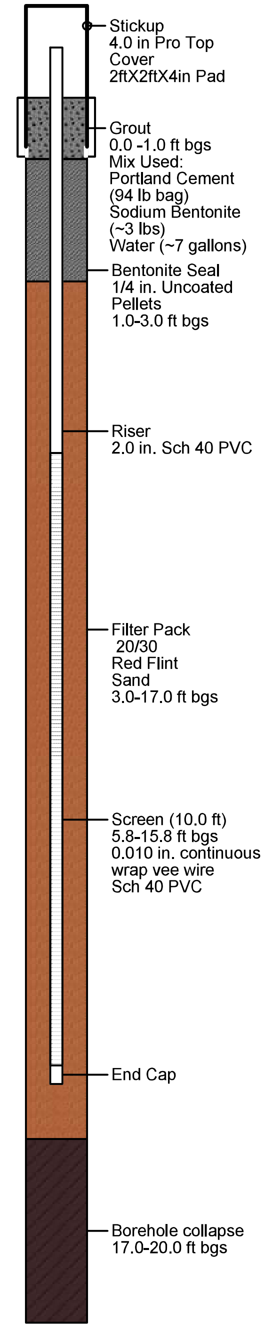
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 5.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Water Level	SAMPLE TYPE	SAMPLE ID
0	1	80	(0.0 - 3.0) FAT CLAY, high plasticity, soft, 10YR 4/3, brown, with GRAVEL (35%), moist		CH				
	2		(3.0 - 5.0) GRAVEL, well graded, fine to coarse, subangular to sub-rounded, 10YR 4/3, borwn, with CLAY (20%),slightly moist	0				SO	ELSWH02-003-SO-004 Note: Interval 4.0 - 5.0 FT
5	3		(5.0 - 7.0) SAME AS ABOVE, wet		GW		▼		
	4	60	(7.0 - 10.0) CLAY, medium plasticity, very stiff, 10YR 3/1, very dark gray, with GRAVEL (30%), dry	0	CL				
10	5	90	(10.0 - 20.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0					
15		100		0	CL				
20			End of Borehole 20.0 ft bgs						

Well: MW18PFC0203
Elev (TOC): Elev (TOC): 3199.20



BORING LOG - MW18PFC0204

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/07/18
End Date : 05/07/18
Northing : 676420.28
Easting : 1241833.69
Surface Elev. (ft)* : 3246.39
Total Depth (ft)** : 45.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 35.0
Signature :

Water Levels

▼ During Drilling

Measurements

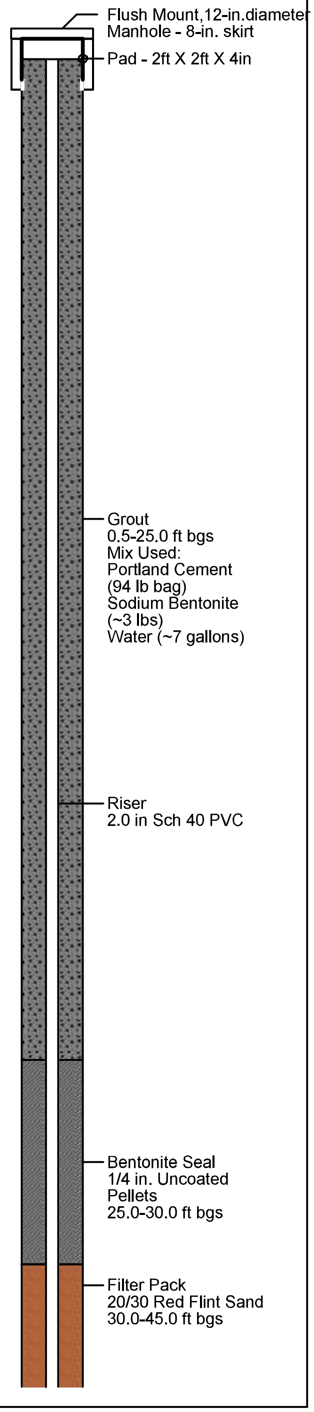
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 2.0) CLAY, low plasticity, soft, 10 YR 3/3, dark brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, slightly moist		CL				
	2		(2.0 - 5.0) FAT CLAY, high plasticity, stiff, 10YR 3/3, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	CH				
5	3	80	(5.0 - 8.5) CLAY, low plasticity, medium to stiff, 10YR 3/3, dark brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	CL				
	4		(8.5 - 10) CLAY, medium plasticity, very stiff, 10YR 4/3, brown, mottled with 10YR 6/2, light brownish gray, dry		CL				
10 15 20 25	5	100 75 75 80	(10.0 - 29.0) FAT CLAY, high plasticity, stiff, 10YR 6/3, pale brown, slightly moist	0 0 0 0 0	CH				
30	6	100	(29.0 - 30.3) CLAY, medium plasticity, very stiff, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry	0	CL				
	7		(30.3 - 31.0) SILT, loose, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry		ML				
	8			0	CL				

Well: MW18PFC0204

Elev (TOC): 3245.90



BORING LOG - MW18PFC0204

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/07/18
End Date : 05/07/18
Northing : 676420.28
Easting : 1241833.69
Surface Elev. (ft)* : 3246.39
Total Depth (ft)** : 45.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 35.0
Signature :

Water Levels

▼ During Drilling

Measurements

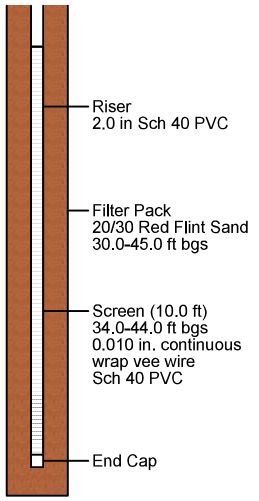
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
33	8	100		0	CL				
	9		(33.5 - 35.0) SILT, loose, 10YR 6/3, pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry		ML		▼	SO	ELSWH02-005-SO-034 Note: Interval 33.0 - 34.0 ft
	10	80	(35.0 - 38.5) CLAY, medium plasticity, stiff, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	CL				
38	11		(38.5 - 40.0) CLAY, low plasticity, very stiff, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry		CL				
	12	100	(40.0 - 41.0) CLAYEY GRAVEL, well graded, fine to coarse, sub-rounded to round, 10YR 5/3, brown, wet		GC				
	13		(41.0 - 42.0) CLAYEY SAND, well graded, fine to coarse, sub-rounded to round, 10YR 5/3, brown, with GRAVEL (10%), well graded, fine to medium, sub-rounded to round, wet		SC				
43	14		(42.0 - 45.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 6/6 brownish yellow, dry	0	CL				
48			End of Borehole 45.0 ft bgs						
53									
58									
63									

Well: MW18PFC0204

Elev (TOC): 3245.90



BORING LOG - MW18PFC0205

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/01/18
End Date : 05/01/18
Northing : 674249.12
Easting : 1241547.02
Surface Elev. (ft)* : 3227.10
Total Depth (ft)** : 35.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 24.5
Signature :

Water Levels

▼ During Drilling

Measurements

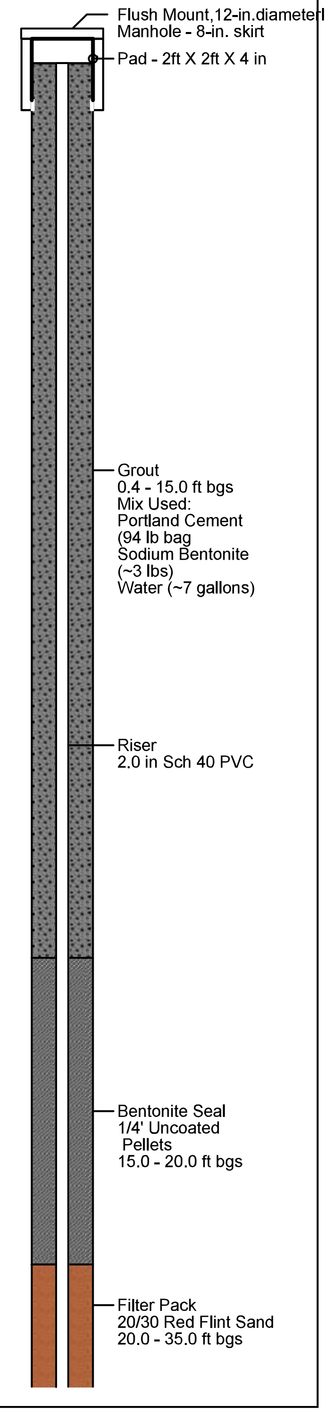
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 1.0) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, slightly moist		CL			SS	ELSWH02-006-SS-001 Note: Interval 0.0 - 0.5 ft
	2	100	(1.0 - 5.0) FAT CLAY, high plasticity, stiff, 10YR 6/3, pale brown, dry	0	CH				
5	3	80	(5.0 - 10.0) CLAY, low plasticity, very stiff, 10YR 5/3, brown, with GRAVEL (10%), dry	0	CL				
10	4		(10.0 - 10.5) CLAY, low plasticity, soft, 10YR 5/3 brown, with trace sand, moist		CL				
	5	100 100	(10.5 - 15.0) SILTY SAND, well graded, fine to coarse, round, loose, 10YR 6/2, light brownish gray, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	0 0	SM				
15	6	80	(15.0 - 20.0) SILTY SAND, well graded, fine to coarse, loose, 10YR 6/3, pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	SM				
20	7		(20.0 - 24.5) FAT CLAY, high plasticity, soft, 10YR 5/4, yellowish brown, moist		CH				

Well: MW18PFC0205

Elev (TOC): 3226.71



Aerostar SES LLC

BORING LOG - MW18PFC0205

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/01/18
End Date : 05/01/18
Northing : 674249.12
Easting : 1241547.02
Surface Elev. (ft)* : 3227.10
Total Depth (ft)** : 35.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 24.5
Signature :

Water Levels

▼ During Drilling

Measurements

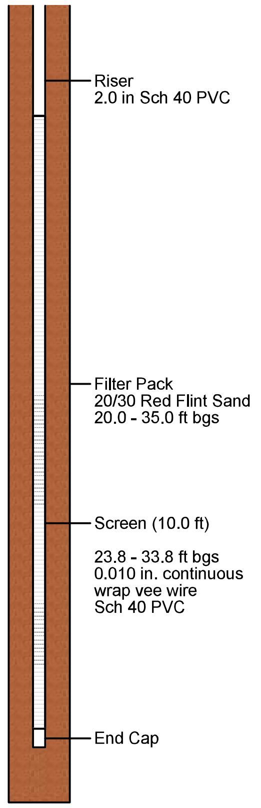
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
22	7	60		0	CH		▼	SO	ELSWH02-006-SO-024 Note: Interval 23.0 - 24.0 ft
	8		(24.5 - 25.0) CLAYEY SAND, poorly graded, fine, round, loose, 10YR 5/4, yellowish brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, wet		SC				
	9	80	(25.0 - 26.0) CLAY, medium plasticity, stiff, 10YR 5/4 yellowish brown, with GRAVEL (30%), slightly moist		CL				
27	10		(26.0 - 27.5) SANDY CLAY, hard, 10YR 7/4, very pale brown, with GRAVEL (40%), well graded, fine to coarse, subangular to sub-rounded, dry	0	CL				
	11 12		(27.5 - 29.4) CLAYEY GRAVEL, well graded, fine to coarse, subangular to round, 10YR 5/4 yellowish brown, wet 0.4' SILTSTONE Lense from 29.0 - 29.4		GC				
	13	100	(29.4 - 31.0) CLAYEY GRAVEL, well graded, fine to coarse, subangular to round, 10YR 5/4, yellowish brown, wet		GC				
32	14		(31.0 - 35.0) SANDY CLAY, low plasticity, stiff, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, wet	0	CL				
			End of Borehole 35.0 ft bgs						
37									
42									

Well: MW18PFC0205

Elev (TOC): 3226.71



BORING- MW18PFC0206

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/03/18
End Date : 05/03/18
Northing : 675723.12
Easting : 1241866.27
Surface Elev. (ft)* : 3234.85
Total Depth (ft)** : 35.0

Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 15.0
Signature :

Water Levels

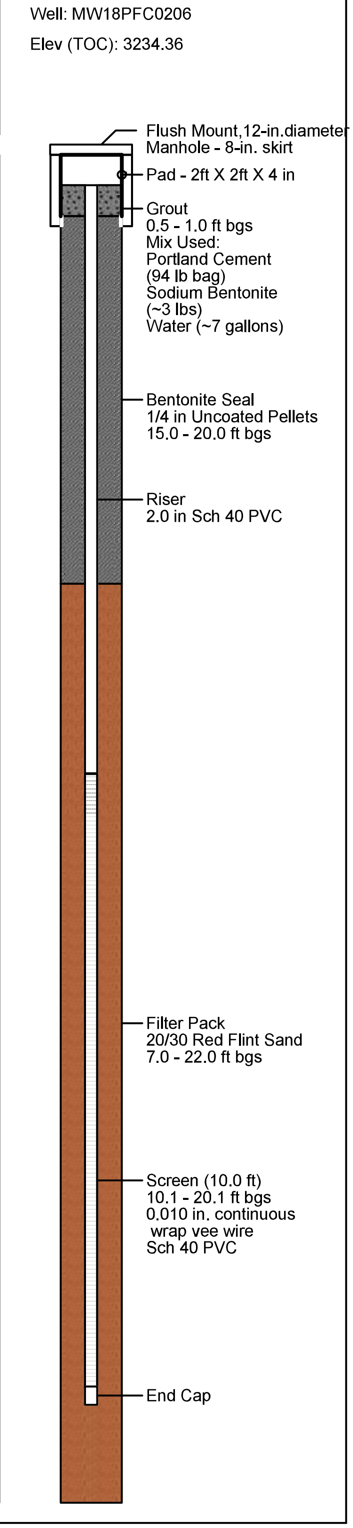
▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 5.0) CLAY, medium plasticity, stiff, 10YR 3/3, dark brown, with GRAVEL (15%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	CL			SS	ELSWH02-007-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	25 20	(5.0 - 14.0) FAT CLAY, high plasticity, soft, 10YR 3/3 dark brown, with GRAVEL (5%), poorly graded, fine, sub-rounded to round, slightly moist	0 0	CH				
	3		(14.0 - 15.0) SAND, poorly graded, fine, round, loose, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, moist		SP				
15	4		(15.0 -16.0) SAND, poorly graded, fine, round, loose, 10YR 5/3 brown, moist		SP		▼		
	5	100	(16.0 - 19.0) SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded, to round, slightly moist	0	SW				
20	6	100	(19.0 - 23.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, 10YR 5/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	0	SM				



BORING- MW18PFC0206

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/03/18
End Date : 05/03/18
Northing : 675723.12
Easting : 1241866.27
Surface Elev. (ft)* : 3234.85
Total Depth (ft)** : 35.0

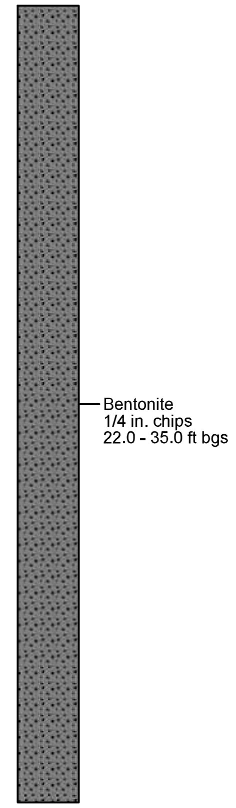
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 15.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
22	6	100			SM				
	7		(23.0 - 25.0) SILT, loose, 10YR 7/4 very pale brown, with GRAVEL (25%), subangular to round, dry		ML				
27	8		(25.0 - 28.5) SILTY SAND, well graded, fine to coarse, sub-rounded, to round, 10YR 5/3 brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	0	SM				
	9		(28.5 - 30.0) CLAY, low plasticity, stiff, 10YR 6/2 light brownish gray, mottled with 10YR 5/1, gray and 10YR 6/6, brownish yellow, dry		CL				
	10	80	(30.0 - 32.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, with GRAVEL (25%), well graded, fine to coarse, sub-rounded to round, dry		CL				
32	11		(32.0 - 35.0) CLAY, hard, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, dry	0	CL				
			End of Borehole 35.0 ft bgs						
37									
42									

Well: MW18PFC0206
Elev (TOC): 3234.36



Aerostar SES LLC

BORING LOG - MW18PFC0207

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/02/18
End Date : 05/02/18
Northing : 674400.87
Easting : 1242462.51
Surface Elev. (ft)* : 3222.41
Total Depth (ft)** : 35.0

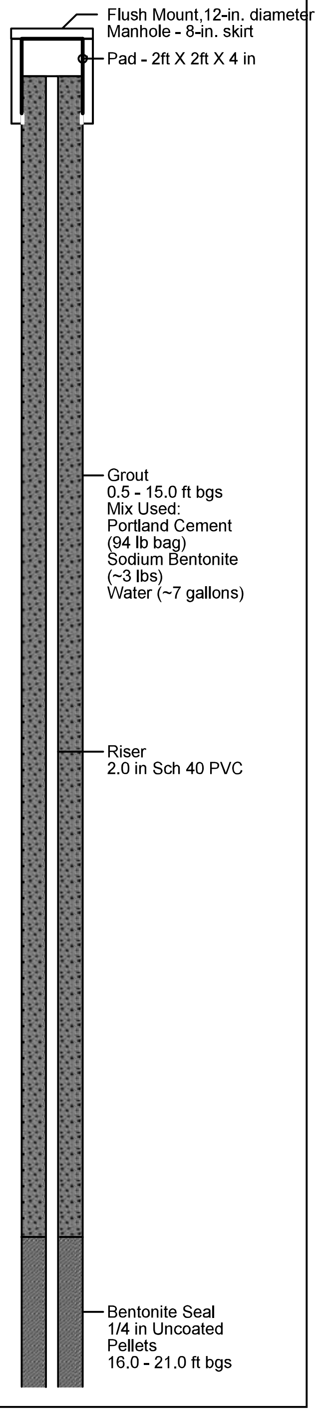
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 26.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 3.0) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded, round, slightly moist		CL			SS	ELSWH02-008-SS-001 Note: Interval 0.0 - 0.5 ft
	2		(3.0 - 9.0) CLAY, medium plasticity, stiff, 10YR 5/3, brown, dry	0	CL				
5		80		0					
10	3		(9.0 - 11.0) SAND, poorly graded, fine, round, loose, 10YR 4/3, brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, slightly moist		SP				
	4	100	(11.0 - 14.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (40%) well graded, fine to coarse, sub-rounded to round, dry	0	SM				
	5	100	(14.0 - 15.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 8/3, very pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded, to round, dry	0	SM				
15	6		(15.0 - 20.0) SILTY SAND, well graded, fine to coarse, loose, 10YR 5/3, brown, with GRAVEL (45%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	SM				

Well: MW18PFC0207
Elev (TOC): 3221.96



BORING LOG - MW18PFC0207

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/02/18
End Date : 05/02/18
Northing : 674400.87
Easting : 1242462.51
Surface Elev. (ft)* : 3222.41
Total Depth (ft)** : 35.0

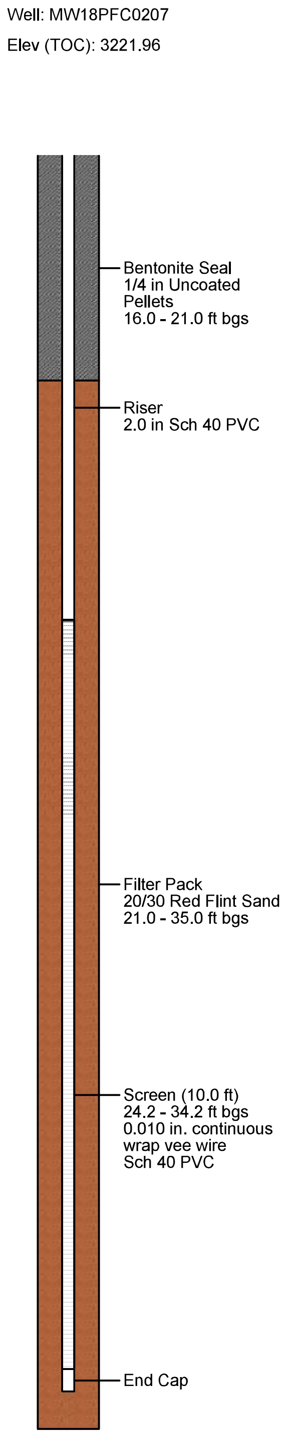
Site Name : AFFF Area 2
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 26.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
18	6	80			SM				
	7	100	(20.0 - 21.0) SILT, loose, 10YR 8/3, very pale brown, dry		ML				
23	8		(21.0 - 24.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (45%), well graded, fine to coarse, sub-rounded to round, hydrocarbon odor, dry	475	SM				
	9		(24.0 - 25.0) SILTY GRAVEL, well graded, fine to coarse, subangular to round, loose, 10YR 8/3 very pale brown, dry		GM		▼		
	10	100	(25.0 - 26.0) SILTY SAND, well graded, fine to coarse, sub-round to round, loose, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry		SM				
28	11		(26.0 - 31.5) CLAYEY GRAVEL, well graded, fine to coarse, sub-rounded to round, 10YR 3/2, very dark brown, hydrocarbon odor, wet	1823	GC				
33	12	100	(31.5 - 34.5) CLAY, very stiff, 10YR 6/2 light brownish gray, mottled with 10YR 4/1, gray and 10YR 6/6, brownish yellow, dry	10	CL				
	13		(34.5 - 35.0) CLAY, hard, 10YR 7/1, very dark gray, dry		CL				

End of Borehole 35.0 ft bgs



BORING LOG - MW18PFC0301

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/17/18
End Date	: 05/17/18
Northing	: 668683.38
Easting	: 1246302.67
Surface Elev. (ft)*	: 3179.59
Total Depth (ft)**	: 20.0

Site Name	: AFFF Area 3
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 10.0
Signature	:

Water Levels

▼ During Drilling

Measurements

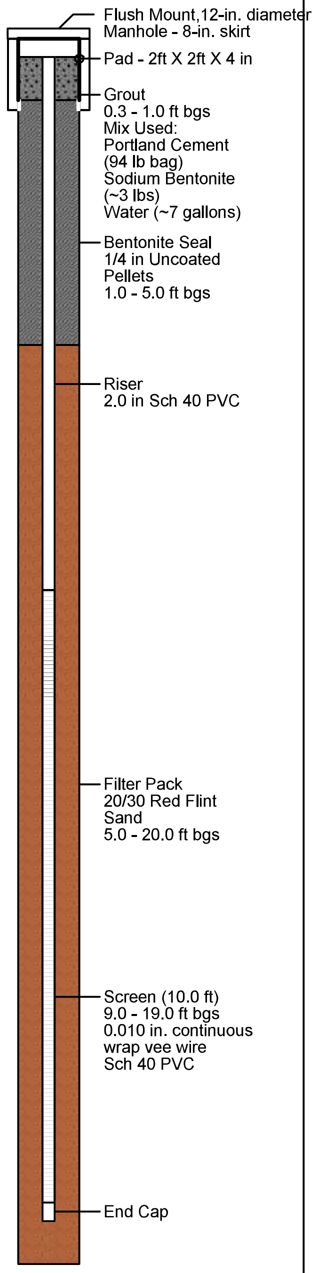
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 10.0) FAT CLAY, high plasticity, stiff, 10YR 3/3, dark brown, with GRAVEL (30%), well graded, fine to medium, sub-rounded to round, moist	0	CH	▨			
5		40		0				SO	ELSWH03-001-SO-009 Note: Interval 9.0 - 10.0 ft
10	2	80	(10.0 - 12.0) FAT CLAY, high plasticity, soft, 10YR 5/4, yellowish brown, with GRAVEL (10%), well graded, fine to medium, sub-rounded to round, wet		CH	▨	▼		
	3		(12.0 - 13.0) CLAYEY GRAVEL, well graded, fine to coarse, sub-rounded to round, 10YR 5/3, brown, wet		GC	▨			
	4		(13.0 - 20.0) CLAY, low plasticity, very stiff, 10YR 4/1, darkgray, mottled with 10YR 6/2, light brownish gray and trace 10YR 6/6, brownished yellow, dry	2	CL	▨			
15		65		0					
20			End of borehole 20.0 ft bgs						

Well: MW18PFC0301

Elev (TOC): 3179.30



Aerostar SES LLC

BORING LOG - MW18PFC0302

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/06/18
End Date : 05/06/18
Northing : 668607.27
Easting : 1246345.85
Surface Elev. (ft)* : 3179.66
Total Depth (ft)** : 20.0

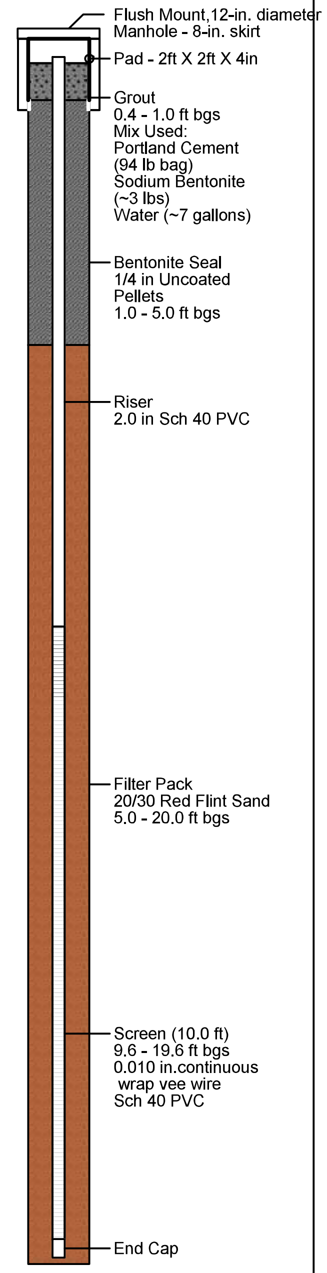
Site Name : AFFF Area 3
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 12.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 5.0) GRAVEL FILL, loose, fine to coarse, sub-angular to round, well graded, dry, 10 YR, 5/2, grayish brown	0	GP				
5	2	90	(5.0 - 12.0) FAT CLAY, high plasticity, stiff, 10YR 7/4, very pale brown, slightly moist	0	CH		▼	SO	ELSWH03-002-SO-012 Note: Interval 11.0 - 12.0 ft
10	3	100	(12.0 - 13.0) CLAY, low plasticity, soft, 10YR 4/3, brown, with GRAVEL (20%), well graded, fine to coarse, su -round to round, slighlty moist		CL				
	4		(13.0 - 15.0) CLAYEY SAND, well graded, fine, loose, 10YR 4/3 brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, wet	41	SC				
15	5		(15.0 - 17.0) SAND, well graded, fine, loose, 10YR4/3, brown, wet		SP				
	6		(17.0 - 17.5) CLAY, medium plasticity, stiff, strong odor, 10YR 4/3, brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, wet	0	CL				
	7		(17.5 - 17.8) GRAVEL, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, wet		GW				
	8		(17.8 - 20.0) CLAY, stiff, 10YR 6/2, light brownish gray, mottled with 10YR 4/1, dark gray, dry		CL				
20			End of borehole 20.0 ft bgs						

Well: MW18PFC0302
Elev (TOC): 3179.32



BORING LOG - MW18PFC0303

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/06/18
End Date : 05/06/18
Northing : 668631.055
Easting : 1246273.021
Surface Elev. (ft)* : 3180.137
Total Depth (ft)** : 20.0

Site Name : AFFF Area 3
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 12.0
Signature :

Water Levels

▼ During Drilling

Measurements

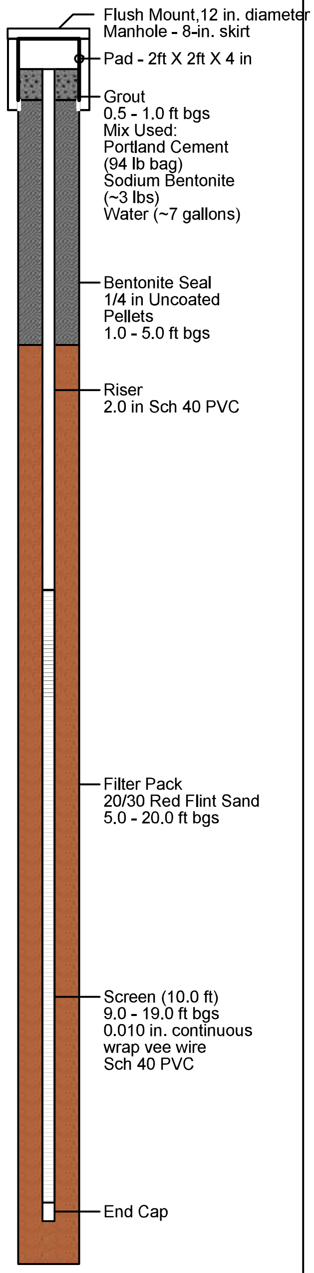
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 2.0) SILT, loose, 10YR 4/3, brown, slightly moist	13	ML				
	2		(2.0 - 3.5) CLAY, medium plasticity, very stiff, 10YR 4/3 brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry		CL				
	3		(3.5 - 5.0) CLAY, hard, 10YR 5/3 brown, mottled with 10YR 8/1 white, dry		CL				
5	4	55	(5.0 - 9.0) CLAYEY SAND, poorly graded, fine, round loose, 10YR 4/3, brown, dry	10	SC				
	5		(9.0 - 10.0) CLAY, low plasticity, very stiff, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry		CL				
10	6	65	(10.0 - 12.0) SILT, loose, 10YR 6/3, pale brown, dry	75	ML		▼	SO	ELSWH03-003-SO-012 Note: Interval 11.0 - 12.0 ft
	7		(12.0 - 14.0) GRAVEL, well graded, fine to coarse, sub-rounded to round, loose, 10YR 4/3, brown, wet		GW				
15	8	95	(14.0 - 20.0) CLAY, low plasticity, hard, 10YR 6/2, light brownish gray, with mottling 10YR 4/1, dark gray, trace 10YR 6/6 brownish yellow, dry	10	CL				
20			End of Borehole 20.0 ft bgs						

Well: MW18PFC0303

Elev (TOC): 3179.65



Aerostar SES LLC

BORING LOG - SB18PFC0304

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/07/18
End Date : 5/07/18
Northing : 668696.14
Easting : 1246237.63
Surface Elev. (ft)* : 3182.68
Total Depth (ft)** : 15.0

Site Name : AFFF Area 3
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/07/18
DTW During Drilling (ft) 12.0
Logged by: Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet)
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 1.0) SILT, soft, non-plastic, dry, 10 YR, 4/3, brown,	0	ML			SS	ELSWH-03-004-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
			(1.0-5.0) GRAVEL FILL		GW					
5	2	50	(5.0-6.0) LEAN CLAY, low plasticity, soft, slightly moist, 10 YR, 3/3, dark brown	0	CL					
			(6.0-8.0) LEAN CLAY, medium plasticity, stiff, dry, 10 YR, 4/2, dark grayish brown		CL					
			(8.0-10.0) LEAN CLAY, medium plasticity, stiff, dry, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white		CL					
10	3	90	(10.0-11.0) SILT with GRAVEL, soft, non-plastic, dry, Gravel: (15%), fine to coarse, sub-round to round	0	ML					
			(11.0-12.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 5/3, brown, Gravel: (15%), fine to coarse, sub-round to round		CL		▼	SO	ELSWH-03-004-SO-011 Note: Interval 11.0 - 12.0 ft	
			(12.0-14.0) CLAYEY GRAVEL, loose, fine to coarse, sub-round to round, well graded, dampt to wet, 10 Yr, 4/3, brown		GC					
			(14.0-15.0) CLAY with GRAVEL, medium plasticity, medium stiff, moist, 10 YR, 5/3, brown, Gravel: (35%), fine to coarse, sub-round to round		CL					
15										

Total Depth of Boring 15.0 ft BGS

Aerostar SES LLC

BORING LOG - MW18PFC0401

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/22/18
End Date	: 05/22/18
Northing	: 672572.76
Easting	: 1243823.58
Surface Elev. (ft)*	: 3212.00
Total Depth (ft)**	: 35.0

Site Name	: AFFF Area 4
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 30.0
Signature	:

Water Levels

▼ During Drilling

Measurements

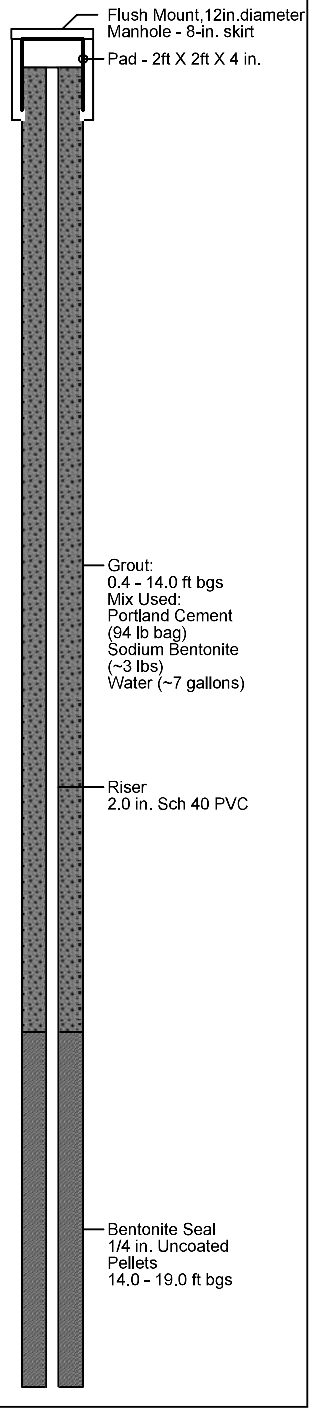
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 10) CLAY, medium plasticity, stiff, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to coarse, subangular to round, slightly moist	0	CL	▨		SS	ELSWH04-001-SS-001 Note: Interval 0.0 - 0.5 ft
5		80		0					
10	2	80	(10.0 - 15.0) SILTY SAND, well graded, fine to coarse, sub-round to round, loose, 10YR 5/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-round to round, slightly moist	0	SM	▨			
15	3		(15.0 - 15.5) CLAY, low plasticity, stiff, 10YR 5/3, brown, trace mottling with 10YR 4/1, dark gray, with GRAVEL (30%), well graded, fine to medium, sub-rounded to round, dry		CL	▨			
	4		(15.5 - 17.0) SILT, loose, 10YR 6/3, pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry		ML	▨			
	5		(17.0 - 17.5) CLAY, low plasticity, stiff, 10YR 5/3, brown, trace mottling with 10YR 4/1, dark gray, with GRAVEL (35%), well graded, fine to medium, sub-rounded to round, slightly moist	0	CL	▨			
	6				SM	▨			

Well: MW18PFC0401

Elev (TOC): 3211.63



BORING LOG - MW18PFC0401

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/22/18
End Date : 05/22/18
Northing : 672572.76
Easting : 1243823.58
Surface Elev. (ft)* : 3212.00
Total Depth (ft)** : 35.0

Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 30.0
Signature :

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

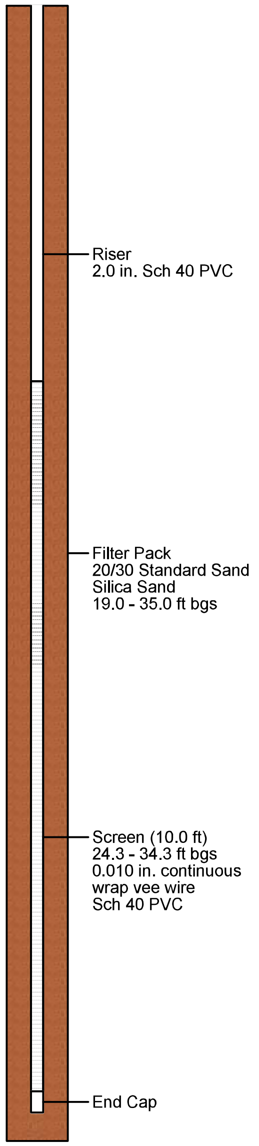
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
19	6	80			SM				
	7	90	(20.0 - 24.0) CLAY, low plasticity, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 6/6, brownish yellow, slightly moist	0	CL				
24	8		(24.0 - 24.2) GRAVEL, 10YR5/1, gray, slightly moist		GC				
	9		(24.2 - 25.5) CLAY, low plasticity, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 6/6, brownish yellow, slightly moist		CL				
	10	100	(25.5 - 26.5) CLAYEY GRAVEL well graded, fine to medium, sub-rounded to rounded, loose, 10YR 5/3, brown, with trace sand, dry		GC				
29	11		(26.5 - 30.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray with trace 10YR 6/6, brownish yellow, dry	0	CL		▼	SO	ELSWH04-001-SO-029 Note: Interval 29.0 - 30.0 ft
	12	100	(30.0 - 31.0) CLAYEY GRAVEL, well graded, fine to medium, sub-rounded to round, 10YR 5/3 brown, mottled with 10YR 4/1, dark gray, wet		GC				
34	13		(31.0 - 35.0) CLAY, low plasticity, very stiff, 10YR 4/1 dark gray, with trace mottling 10YR 6/2, light brownish gray and 10YR 6/6, brownish yellow, dry	0	CL				

End of borehole 35.0 ft bgs

Well: MW18PFC0401

Elev (TOC): 3211.63



BORING LOG - MW18PFC0402

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/18/18
End Date : 05/18/18
Northing : 672406.53
Easting : 1243939.64
Surface Elev. (ft)* : 3213.35
Total Depth (ft)** : 45.0

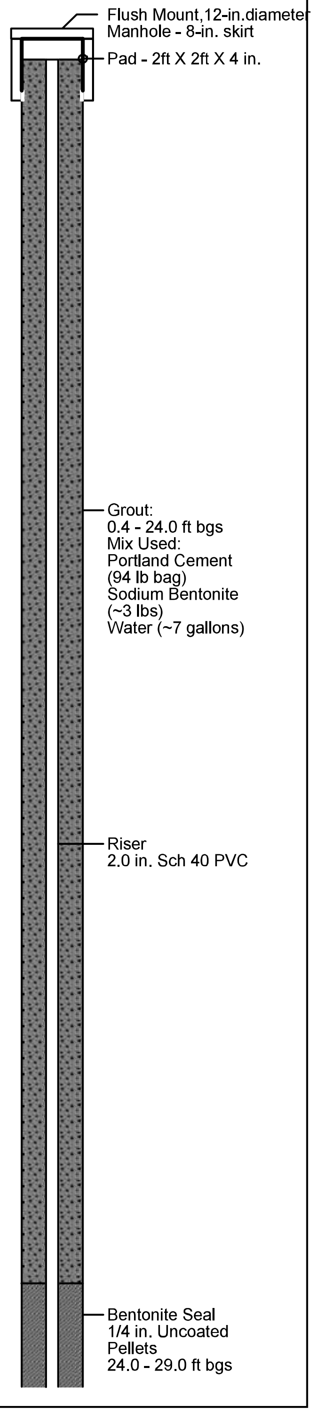
Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 36.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 5.0) CLAY, medium plasticity, stiff, 10YR 3/3, dark brown, with GRAVEL (20%), well graded, fine to medium, sub-rounded to round, slightly moist	0	CL			SS	ELSWH04-002-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	0	(5.0 - 10.0) NO RECOVERY - rock in drill bit	0					
10	3	100	(10.0 - 13.0) CLAY, low plasticity, stiff, 10YR 4/3, brown, dry		CL				
	4	70	(13.0 - 18.0) SILT SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry	0 0	SM				
	5		(18.0 - 19.0) SILT, loose, 10YR 2/2, with GRAVEL, well graded, fine to coarse, subangular to sub-rounde, dry		ML				
	6		(19.0 - 20.0) CLAY, low plasticity, stiff, 10YR 4/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry		CL				
20	7	70	(20.0 - 22.5) CLAYEY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, dry		SC				
25	8		(22.5 - 36.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 6/6, brownish yellow, dry	0	CL				

Well: MW18PFC0402
Elev (TOC): 3212.98



BORING LOG - MW18PFC0402

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/18/18
End Date : 05/18/18
Northing : 672406.53
Easting : 1243939.64
Surface Elev. (ft)* : 3213.35
Total Depth (ft)** : 45.0

Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 36.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

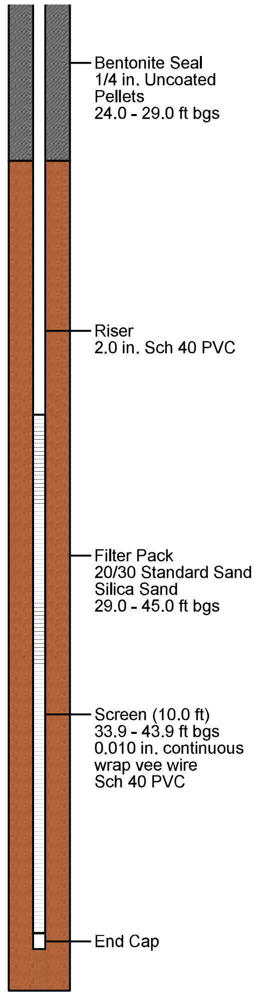
DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
26	8	100		0	CL				
31		100		0					
								SO	ELSWH04-002-SO-036 Note: Interval 35.0 - 36.0 ft
36	9	100	(36.0 - 36.5) CLAYEY GRAVEL, well graded, fine to coarse, subangular to round, 10YR 4/3, brown, wet	0	GC		▼		
	10		(36.5 - 37.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and trace 10YR 6/6, brownish yellow, dry		CL				
	11		(37.0 - 37.2) GRAVEL, well graded, fine to coarse, subangular to round, 10YR 4/1, dark gray, wet		GW				
	12		(37.2 - 40.0) CLAY, hard, 10YR 3/1, very dark gray, dry		CL				
41	13	100	(40.0 - 45.0) CLAY, hard, 10YR 3/1, very dark gray, with trace mottling, 10YR 6/6, brownish yellow, dry	0	CL				

End of Borehole 45.0 ft bgs

46

51

Well: MW18PFC0402
Elev (TOC): 3212.98



BORING LOG - MW18PFC0403

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/18/18
End Date	: 05/22/18
Northing	: 672345.02
Easting	: 1243863.37
Surface Elev. (ft)*	: 3210.94
Total Depth (ft)**	: 50.0

Site Name	: AFFF Area 4
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 28.0
Signature	:

Water Levels

▼ During Drilling

Measurements

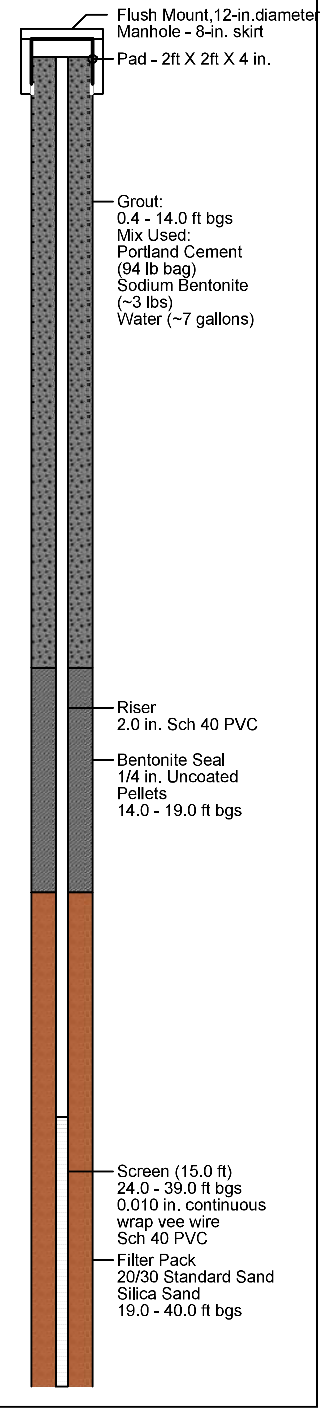
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 4.0) CLAY, medium plasticity, stiff, 10YR 4/3, brown, with GRAVEL (15%), well graded, fine to coarse, sub-rounded to round, slightly moist	0	CL			SS	ELSWH04-003-SS-001 Note: Interval 0.0 - 0.5 ft
	2		(4.0 - 5.0) CLAY, low plasticity, very stiff, 10YR 5/3 brown, mottled with 10YR 8/1, white, dry		CL				
5	3	90	(5.0 - 7.0) CLAY, low plasticity, stiff, 10YR 4/3, brown, dry		CL				
	4		(7.0 - 8.5) CLAY, low plasticity, medium stiff, 10YR 5/3, brown, dry	0	CL				
	5		(8.5 - 10.0) CLAY, medium plasticity, very stiff, 10YR 4/3, brown, dry		CL				
10	6	100	(10.0 - 14.0) CLAY, medium plasticity, sitff, 10YR 5/3, brown, mottled with 10YR 8/1, white, with GRAVEL (15%), well graded, fine to medium, sub-rounded to round, dry	0	CL				
	7		(14.0 - 15.0) CLAY, medium plasticity, stiff, 10YR 6/3, pale brown, dry		CL				
15	8	60	(15.0 - 23.5) FAT CLAY, high plasticity, medium stiff, 10YR 6/3, pale brown, slightly moist		CH				
20		100							
	9		(23.5 - 24.0) FAT CLAY, high plasticity, medium stiff, 10YR 6/3, pale brown, with trace gravels, slighlty moist	0	CH				
	10		(24.0 - 25.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and trace 10YR 6/6, brownish yellow, dry		CL				
25			(25.0 - 26.0) CLAY, medium plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 5/3, brown, with GRAVEL (15%), well graded, fine to coarse, sub-rounded to round, dry		CL				
	11			0	CL		▼	SO	ELSWH04-003-SO-028 Note: Interval 27.0 - 28.0 ft
	12				CL				
30									

Well: MW18PFC0403

Elev (TOC): 3210.55



BORING LOG - MW18PFC0403

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/18/18
End Date : 05/22/18
Northing : 672345.02
Easting : 1243863.37
Surface Elev. (ft)* : 3210.94
Total Depth (ft)** : 50.0

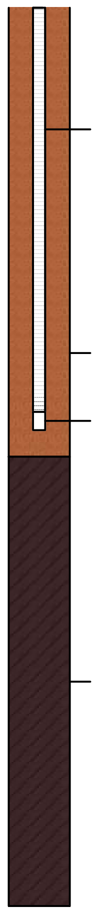
Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 28.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
30	12				CL				
	13		(30.5 - 31.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark brown, mottled with 10YR 5/3, brown, wet		CL				
	14	100	(31.0-35.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray with trace 10YR 6/6, brownish yellow, wet	0	CL				
35	15		(35.0 - 38.0) CLAY, low plasticity, very stiff, 10YR 3/1, bery dark gray, dry	0	CL				
	16	100	(38.0 - 40.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and trace 10YR 6/6, brownish yellow, dry		CL				
40	17	100	(40.0 - 45.0) CLAY, low plasticity, hard, 10YR 3/1, very dark gray, dry	0	CL				
45	18		(45.0 - 50.0) CLAY, low plasticity, hard, 10YR 3/1, very dark gray, with trace mottling 10YR 6/2, light brownish gray, dry	0	CL				
50			End of Borehole 50.0 ft bgs						
55									
60									

Well: MW18PFC0403
Elev (TOC): 3210.55



Screen (15.0 ft)
24.0 - 39.0 ft bgs
0.010 in. continuous
wrap vee wire
Sch 40 PVC

Filter Pack
20/30 Standard Sand
Silica Sand
19.0 - 40.0 ft bgs
End Cap

Borehole collapse
40.0 - 50.0 ft bgs

Aerostar SES LLC

BORING LOG - SB18PFC0404

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Dat : 5/18/18
End Date : 5/18/18
Northing : 672431.41
Easting : 1243884.08
Surface Elev. (ft)* : 3212.50
Total Depth (ft)** : 35.0

Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/18/18
DTW During Drilling (ft) 32.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 5.0) CLAY with GRAVEL, low plasticity, stiff, very slightly moist, 10 YR, 4/3, brown, Gravel: (15%), fine to medium, sub-round to round	0	CL					Borehole
5	2	80	(5.0-7.5) LEAN CLAY, low plasticity, stiff, dry, 10 YR, 5/3, brown	0	CL					
			(7.5-10.0) LEAN CLAY, medium plasticity, very stiff, very slightly moist, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white		CL					
10	3	60	(10.0-12.0) FAT CLAY, high plasticity, medium stiff, very slightly moist, 10 YR, 6/3, pale brown	0	CH					
			(12.0-16.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SM					
15	4	80		0						
			(16.0-17.0) CLAY with GRAVEL, medium plasticity, medium stiff, very slightly moist, 10 YR, 6/3, pale brown, Gravel: (15%), fine to medium, sub-round to round		CL					
			(17.0-22.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SM					
20	5			0						

BORING LOG - SB18PFC0404

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Dat : 5/18/18
End Date : 5/18/18
Northing : 672431.41
Easting : 1243884.08
Surface Elev. (ft)* : 3212.50
Total Depth (ft)** : 35.0

Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/18/18
DTW During Drilling (ft) 32.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
22	5	80	(22.0-24.0) CLAY with GRAVEL, medium plasticity, medium stiff, dry, 10 YR, 5/3, brown, 10 YR, 5/3, brown, Gravel: (35%), fine to coarse, sub-round to round		CL	▨				
			(24.0-32.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, and trace 10 YR, 6/6, brownish yellow	0	CL	▨				
27	6	80								
				0						
								SO	ELSWH-04-004-SO-031 Note: Interval 31.0 - 32.0 ft	
32	7	100	(32.0-32.5) GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 5/3, brown,		GW	▨	▼			
			(32.5- 35.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, 10 YR, 6/6, brownish yellow		CL	▨				

Total Depth of Boring 35.0 ft BGS

37

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Aerostar SES LLC

BORING LOG - SB18PFC0405

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/18/18
End Date : 5/18/18
Northing : 672528.09
Easting : 1243722.05
Surface Elev. (ft)* : 3212.06
Total Depth (ft)** : 25.0

Site Name : AFFF Area 4
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/22/18
DTW During Drilling (ft) 21.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	PID (ppm)
0 - 5	1	100	0
5 - 10	2	80	0
10 - 15	3	75	0
15 - 20	4	80	0
20 - 25	5	95	0

DESCRIPTION	USCS	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
(0.0 - 2.0) LEAN CLAY, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown	CL				Borehole
(2.0 - 10.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white	CL				
(7.5 - 10.0) LEAN CLAY, medium plasticity, very stiff, very slightly moist, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white	CL				
(10.0 - 11.5) CLAYEY SAND, loose, fine grained, round, poorly graded, dry, 10 YR, 5/4, yellowish brown	SC				
(11.5 - 19.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 6/2, light brownish gray, Gravel: (40%), fine to coarse, sub-round to round	SM				
(19.0 - 19.5) SAND, fine grained, round, poorly graded, dry, 10 YR, 7/8, yellow	SM				
(19.5 - 20.0) SANDY GRAVEL, loose, fine to coarse, sub-angular to sub-round, well graded, dry, 10 YR, 7/1, light gray	GW				
(20.0 - 21.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 7/3, very pale brown, Gravel: (20%), fine to medium, sub-round to round	ML	▼	SO	ELSWH-04-005-SO-020 Note: Interval 20.0 - 21.0 ft	
(21.0 - 23.0) CLAYEY GRAVEL, loose, fine to coarse, sub-round to round, well graded, damp to wet, 10 YR, 5/3, brown	GC				
(23.0 - 25.0) CLAY with GRAVEL, medium plasticity, stiff, slightly moist,, 10 YR, 5/3, brown, Gravel: (25%), fine to coarse, sub-round to round	CL				

Total Depth of Boring 25.0 ft BGS

BORING LOG - MW18PFC0501

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/02/18
End Date : 05/02/18
Northing : 673715.84
Easting : 1241664.63
Surface Elev. (ft)* : 3222.61
Total Depth (ft)** : 35.0

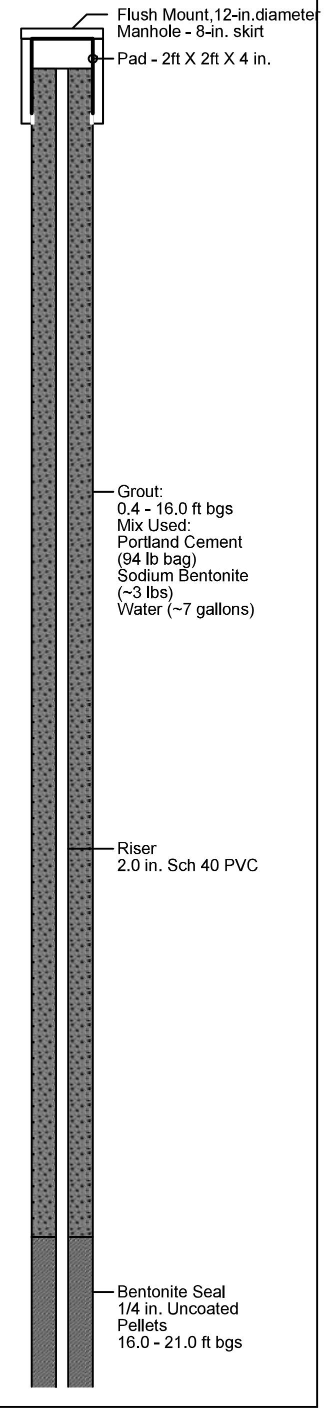
Site Name : AFFF Area 5
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 29.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 2.0) CLAY, medium plasticity, stiff, 10YR 3/3, dark brown, slightly moist		CL			SS	ELSWH05-001-SS-001 Note: Interval 0.0 - 0.5 ft
	2		(2.0 - 5.0) CLAY, medium plasticity, stiff, 10YR 5/3, brown, dry	0	CL				
5	3	100	(5.0 - 10.0) CLAY, low plasticity, very stiff, 10YR 6/3, pale brown, dry	0	CL				
10	4		(10.0 - 12.0) CLAY, low plasticity, very stiff, 10YR 4/3, brown, dry		CL				
	5	100	(12.0 - 14.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 6/2, light brownish gray, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	0	SM				
	6		(14.0 - 14.5) CLAY, medium plasticity, stiff, 10YR 5/4, yellowish brown, dry		CL				
15	7		(14.5 - 18.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 6/2, light brownish gray, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	0	SM				

Well: MW18PFC0501
Elev (TOC): 3222.23



BORING LOG - MW18PFC0501

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/02/18
End Date : 05/02/18
Northing : 673715.84
Easting : 1241664.63
Surface Elev. (ft)* : 3222.61
Total Depth (ft)** : 35.0

Site Name : AFFF Area 5
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 29.0
Signature :

Water Levels

▼ During Drilling

Measurements

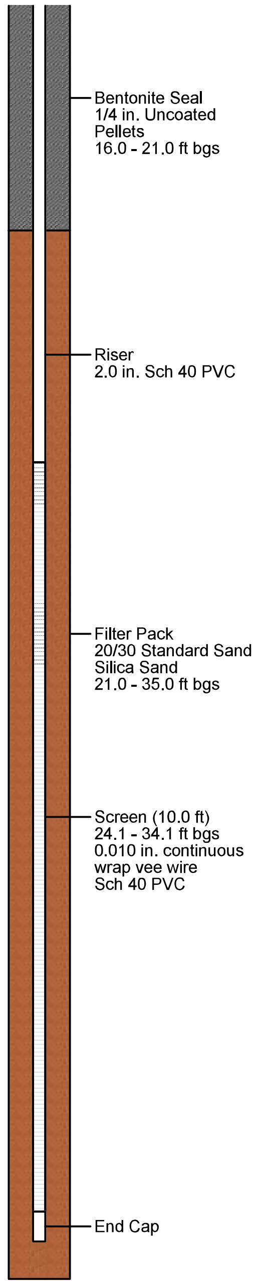
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

Well: MW18PFC0501

Elev (TOC): 3222.23

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
18	8	65	(18.0 - 18.5) FAT CLAY, hight plasticity, soft, 10YR 5/1, gray, mottled with 10YR 6/6, brownish yellow, dry		CH				
	9		(18.5 - 20.0) SILTY SAND, well graded, fine to coarse, sub-round to round, loose, 10YR 6/2, light brown, with GRAVEL (40%), well graded, fine to coarse, dry		SM				
	10		(20.0 - 22.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3 brown, with GRAVEL (40%), well graded, fine to coarse, subangular to sub-round, dry		SM				
	11	60	(22.0 - 23.0) FAT CLAY, high plasticity, soft, 10YR 5/1, gray, mottled with 10YR 6/6, brownish yellow, moist		CH				
23	12		(23.0 - 25.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (40%), well graded, well graded, fine to coarse, sub-rounded to round, dry	0	SM				
28	13	60	(25.0 - 29.0) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, with GRAVEL (25%), well graded, fine to coarse, sub-rounded to round, dry	0	CL		▼	SO	ELSWH05-001-SO-028 Note: Interval 28.0 - 29.0 ft
	14		(29.0 - 29.5) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, with GRAVEL (25%), well graded, fine to coarse, sub-rounded to round, wet		CL				
	15		(29.5 - 30.0) CLAYEY SAND, poorly graded, fine, round, 10YR 5/4, yellowish brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, moist		SC				
33	16	100	(30.0 - 35.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0	CL				



End of Borehole 35.0 ft bgs

BORING LOG - MW18PFC0502

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/11/18
End Date : 05/11/18
Northing : 673652.26
Easting : 1241543.83
Surface Elev. (ft)* : 3220.85
Total Depth (ft)** : 30.0

Site Name : AFFF Area 5
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 20.5
Signature :

Water Levels

▼ During Drilling

Measurements

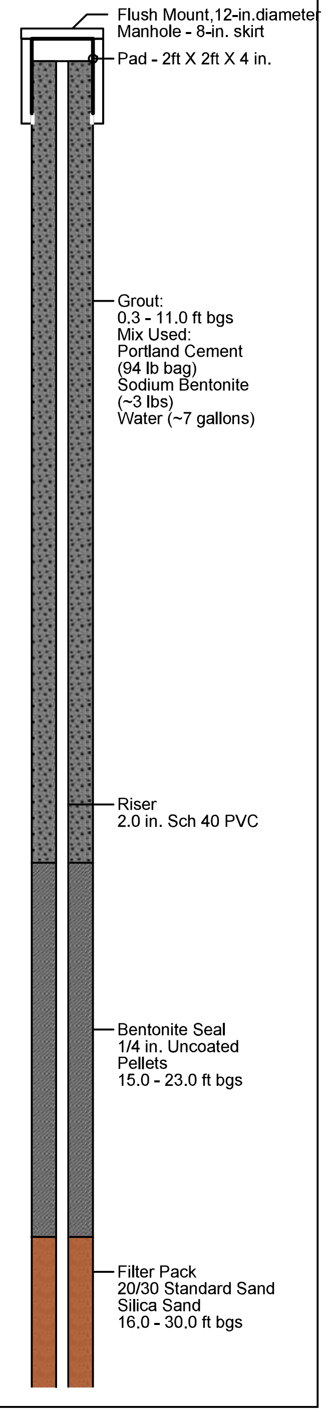
*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 1.0) CLAY, medium plasticity, stiff, 10YR 4/3, brown, slightly moist		CL			SS	ELSWH05-002-SS-001 Note: Interval 0.0 - 0.5 ft
	2		SANDY SILT, (1.0 - 5.0) CLAY, medium plasticity, stiff, 10YR 4/2, dark grayish brown, dry	0	CL				
5	3	60	(5.0 - 10.0) CLAY, hard, 10YR 5/2, grayish brown, dry	0	CL				
10	4	60	(10.0 - 11.0) CLAY, low plasticity, stiff, 10YR 4/2, dark grayish brown, slightly moist		CL				
	5		(11.0 - 13.0) CLAY, medium plasticity, medium stiff, 10YR 6/2, light brownish gray, mottled with 10YR 6/6, brownish yellow, dry	0	CL				
	6		(13.0 - 14.0) SILTY SAND, well graded, fine to coarse, loose, 10YR 4/3, brown, with GRAVEL, well graded, fine to coarse, sub-rounded to round, dry		SM				
15	7	100	(14.0 - 16.0) SILT, loose, 10YR 7/3, very pale brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, dry	0	ML				
	8		(16.0 - 20.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 6/2, light brownish gray, with GRAVEL (45%), well graded, fine to coarse, subangular to round, dry	0	SM				

Well: MW18PFC0502

Elev (TOC): 3220.51



BORING LOG - MW18PFC0502

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/11/18
End Date : 05/11/18
Northing : 673652.26
Easting : 1241543.83
Surface Elev. (ft)* : 3220.85
Total Depth (ft)** : 30.0

Site Name : AFFF Area 5
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 20.5
Signature :

Water Levels
▼ During Drilling

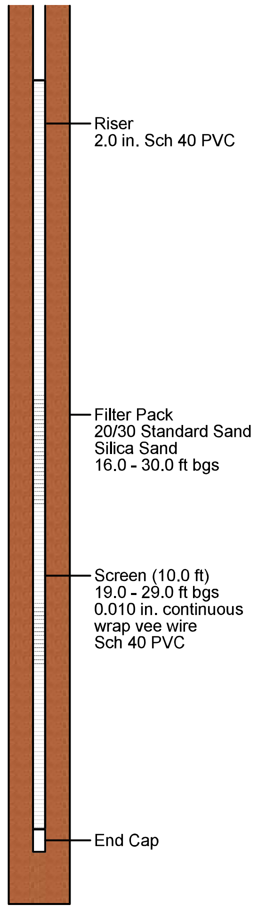
Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS \ LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
18	8	60			SM				
	9	90	(20.0 - 20.5) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, dry		CL		▼	SO	ELSWH05-002-SO-020 Note: Interval 19.0 - 20.0 ft
	10		(20.5 - 21.0) CLAY, medium plasticity, medium stiff, 10YR 4/3, brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, moist		CL				
	11		(21.0 - 22.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 4/3, brown, with GRAVEL, well graded, fine to coarse, subangular to sub-rounded, dry		SM				
23	12		(22.0 - 25.0) SILTY SAND, poorly graded, fine, loose, 10YR 7/4, very pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry	2600	SM				
	13	60	(25.0 - 27.5) CLAY, low plasticity, stiff, 10YR 4/3, brown, with GRAVEL (35%), well graded, fine to coarse, sub-rounded to round, wet		CL				
28	14		(27.5 - 30.0) SANDY CLAY, low plasticity, very stiff, 10YR 5/4, yellowish brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, dry	365	CL				

End of Borehole 30.0 ft bgs

33

Well: MW18PFC0502
Elev (TOC): 3220.51



BORING LOG - SB18PFC0503

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05-02-18
End Date : 05-02-18
Northing : 673787.51
Easting : 1241572.50
Surface Elev. (ft)* : 32223.32
Total Depth (ft)** : 15.0

Site Name : AFFF Site 5
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05-02-18
DTW During Drilling (ft) 10.0
Logged by: : Justin Vojak
Signature: :

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 5.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, plastic debris seen throughout, 10 YR, 4/3, brown, Gravel: fine to coarse, sub-round to round	0	CL			SS	ELSWH-05-003-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
5	2	40	(5.0 - 10.0) GRAVEL FILL, Pieces of Cement, and plastic debris	0	GW		▼	SO	ELSWH-05-003-SO-009 Note: Interval 9.0 - 10.0 ft	
10	3	100	(10.0 - 12.0) CLAY with GRAVEL, medium plasticity, soft, saturated, plastic debris seen throughout, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-angular to sub-round	0	CL					
			(12.0 - 14.0) CLAY with GRAVEL, low plasticity, stiff, moist, 10 YR, 5/4, yellowish brown, Gravel: (45%), fine to coarse, sub-round to round		CL					
			(14.0 - 15.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 6/2, light brownish gray, Gravel: (40%), fine to coarse, sub-round to round		ML					
15			End of Borehole 15.0 ft BGS							

Aerostar SES LLC

BORING LOG - MW18PFC0601

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/06/18
End Date : 05/06/18
Northing : 666532.62
Easting : 1246551.30
Surface Elev (ft)* : 3174.45
Total Depth (ft)** : 20.0

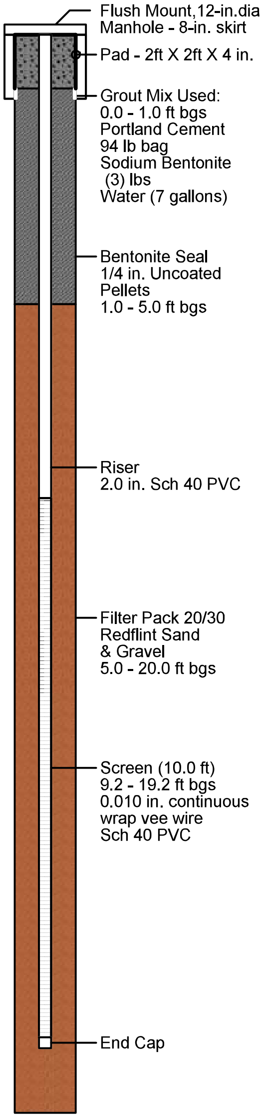
Site Name : AFFF Area 6
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 13.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) Silt, low density, non-plastic, dry, 10 YR, 6/3, dark brown	0	ML			SS	ELSWH 06-001-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-5.0) LEAN CLAY, low plasticity, stiff, slightly moist, 10 YR, 5/3, brown, mottled with 10 YR 8/1, white		CL				
5	2	100	(5.0-8.0) Lean Clay, high density, very stiff, dry, 10 YR, 3/3, dark brown	0	CL				
			(8.0-10.0) Clayey Sand with Gravel, high density, fine to coarse, sub-round to round, well graged, dry, 10 YR, 3/3, dark brown, Gravel: (10%), fine to medium, sub-round to round		SC				
10	3	80	(10.0-13.0) Silty Sand with Gravel, low density, fine to coarse, sub-round to round, well graded, dry, 10 YR, 6/3, pale brown, Gravel: (40%), fine tocoarse, sub-round to round	0	SM		▼	SO	ELSWH 06-001-SO-012 Note: Interval 12.0 to13.0 ft
			(13.0-14.0) Clayey Sand with Gravel, low density, fine to coarse, sub-round to round, well graded, damp, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		SC				
			(14.0-15.0) Lean Clay, medium density, high plasticity, medium stiff, moist, 10 YR, 6/3, pale brown, mottled, 10 YR, 6/6, brownish yellow		CL				
15	4	100	(15.0-17.5) Clay with Gravel, medium density, medium plasticity, stiff, damp to wet, 10 YR, 5/3, Brown, Gravel: (30%), fine to coarse, sub-round to round	0	CL				
			(17.5-20.0) Lean Clay, high density, low plasticity, very stiff, dry, 10 YR, 6/2, light brownish gray, mottled, 10 YR, 4/1, dark gray		CL				
20			Total depth of boring 20.0 ft BGS						
25									

Well: MW18PFC0601
Elev (TOC): 3174.16



BORING LOG - MW18PFC0602

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/05/18
End Date : 05/05/18
Northing : 666273.45
Easting : 1246989.27
Surface Elev (ft)* : 3168.62
Total Depth (ft)** : 20.0

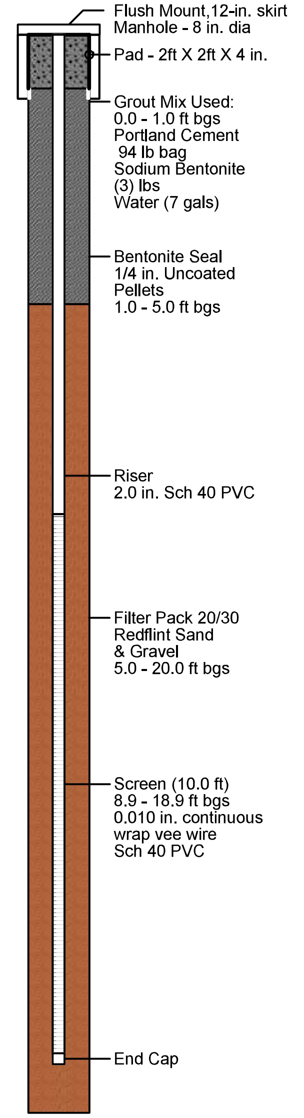
Site Name : AFFF Area 6
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 11.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) LEAN CLAY, medium density, medium plasticity,stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 06-002-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-4.0) LEAN CLAY with Gravel, medium density, medium plasticity, stiff, very slightly moist, 10 YR, 3/3, Gravel: (30%), fine to coarse, sub-round to round		CL				
			(4.0-5.0) GRAVELLY SAND, fine to coarse, sub-round to round, well graded, low density, dry, 10 YR, 5/3, Gravel: (45%), fine to coarse, sub-round to round		SW				
5	2	70	(5.0-10.0) SILTY SAND with Gravel, low density, fine to coarse, sub-round to round, well graded dry, 10 YR, 5/3, brown, Gravel: (45%), fine to coarse, sub-round to round	0	SM				
10	3	100	(10.0-11.0) SILT, low density, non-plastic, dry, 10 YR, 6/3, pale brown	0	ML		▼	SO	ELSWH 06-002-SO-010 Note: Interval 10.0 to11.0 ft
			(11.0-11.75) Clay with GRAVEL, low density, high plasticity, soft, wet, 10 YR, 5/3, Gravel: (40%), fine to coarse, sub-round to round		CL				
			(11.75-15.0) LEAN CLAY, high density, low plasticity, very stiff, dry, 10 YR, 6/2, light brownish gray, trace mottling with, 10 YR, 4/1, dark gray and 10 YR, 6/6, brownish yellow		CL				
15	4	80	(15.0-20.0) LEAN CLAY, medium density, low plasticity, stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, 10 YR, 6/6, brownish yellow	0	CL				
20			Total depth of boring 20.0 ft BGS						
25									

Well: MW18PFC0602
Elev (TOC): 3168.37



BORING LOG - MW18PFC0603

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/05/18
End Date : 05/05/18
Northing : 666039.96
Easting : 1246623.02
Surface Elev (ft)* : 3166.19
Total Depth (ft)** : 60.0

Site Name : AFFF Area 6
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 55.0
Signature :

Water Levels

▼ During Drilling

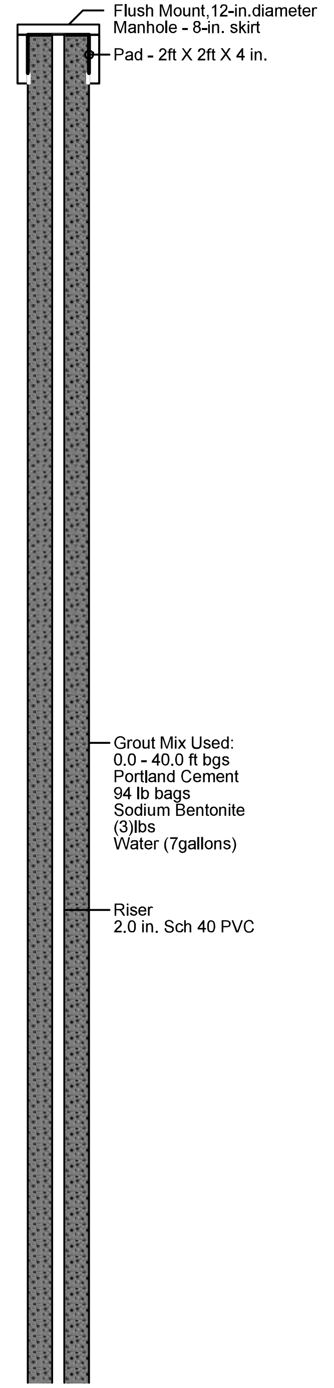
Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.5) LEAN CLAY, medium density, low plasticity, stiff, slighty moist, 10 YR, 4/3, brown	0	CL			SS	ELSWH 06-003-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.5-5.0) LEAN CLAY, high density, hard, dry, 10 YR, 5/2, grayish brown, mottled with 10 YR 8/1, white		CL				
5	2	100	(5.0-7.0) SILT, medium density, non-plastic, dry, 10 YR, 4/3, brown	0	ML				
			(7.0-10.0) SANDY CLAY, high density, medium plasticity, very stiff, dry, 10 YR, 5/3, brown		CL				
10	3	100	(10.0-14.0) LEAN CLAY, low density, low plasticity, soft, very slightly moist, 10 YR, 6/2, light brownish gray	0	CL				
15	4	100	(14.0-24.0) LEAN CLAY, medium density, low plasticity, stiff, dry, 10 YR, 6/2, light brownish gray, mottled, 10 YR, 4/1, dark gray, and trace, 10 YR, 6/6, brownish yellow	0	CL				
20		100		0					
25		80	(24.0-40.0) LEAN CLAY, medium density, low plasticity, stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, and trace, 10 YR, 6/6, brownish yellow	0	CL				
30		80		0					
35				0					

Well: MW18PFC0603
Elev (TOC): 3165.91



BORING LOG - MW18PFC0603

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/05/18
End Date	: 05/05/18
Northing	: 666039.96
Easting	: 1246623.02
Surface Elev (ft)*	: 3166.19
Total Depth (ft)**	: 60.0

Site Name	: AFFF Area 6
Drilling Company	: Cascade Drilling
Drilling Method	: Mini-Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 55.0
Signature	:

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet

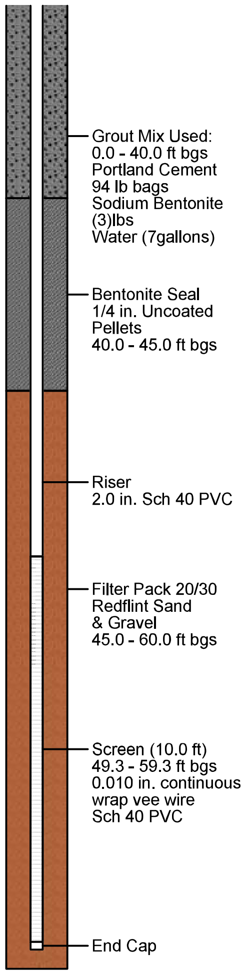
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
35		80		0	CL				
40		100	(40.0-47.0) LEAN CLAY, high density, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled,10 YR, 6/2, light brownish gray, and trace, 10 YR, 6/6, brownish yellow	0	CL				
45		75	(47.0-52.0) LEAN CLAY, high density, hard, dry, 10 YR, 4/1, dark gray, trace mottling with, 10 YR, 6/2, light brownish gray, and, 10 YR, 6/6, brownish yellow	0	CL				
50		75	(52.0-55.0) LEAN CLAY, high density, hard, dry, 10 YR, 3/1, very dark gray, trace mottling with, 10 YR, 6/6, brownish yellow,	0	CL			SO	ELSWH 06-003-SO-054 Note: Interval 54.0 to 55.0 ft
55		75	(55.0-59.5) LEAN CLAY, medium density, medium plasticity, stiff, wet, 10 YR, 3/1, very dark gray	0	CL		▼		
59.5			(59.5-60) LEAN CLAY, high density, very stiff, dry, 10 YR, 3/1, very dark gray		CL				

Total Depth of Boring 60.0 ft BGS

Well: MW18PFC0603

Elev (TOC): 3165.91



Aerostar SES LLC

BORING LOG - SB18PFC0604

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/6/18
End Date : 5/6/18
Northing : 666296.20
Easting : 1246720.93
Surface Elev. (ft)* : 3169.25
Total Depth (ft)** : 40.0

Site Name : AFFF Site 6
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/2/18
DTW During Drilling (ft) 36.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0.0 - 2.0	1	100	(0.0 - 2.0) CLAY, medium plasticity, stiff, 10YR 3/3, dark brown, slightly moist	0	CL			SS	ELSWH-06-004-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
2.0 - 5.0			(2.0 - 5.0) CLAY, very stiff, 10YR 4/3, brown, mottled with 10YR 8/1, white, dry	0	CL					
5.0 - 6.0	2	75	(5.0 - 6.0) SILT, loose, 10YR 7/4, very pale brown, dry		ML					
6.0 - 7.0			(6.0 - 7.0) SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 4/3, brown, with GRAVEL (30%), well graded, fine to medium, sub-rounded to round, slightly moist	0	SW					
7.0 - 10.0			(7.0 - 10.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 6/3, pale brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry		SM					
10.0 - 11.0	3	100	(10.0 - 11.0) CLAY, low plasticity, soft, 10YR 5/3, brown, with GRAVEL (20%), well graded, fine to coarse, sub-rounded to round, slightly moist		CL					
11.0 - 15.0			(11.0 - 15.0) CLAY, low plasticity, stiff, 10YR 6/2, light brownish gray, mottled with 10YR 4/1, dark gray, dry	0	CL					
15.0 - 25.0	4 5	100 85	(15.0 - 25.0) CLAY, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray, dry	0 0	CL					
25.0 - 36.0	6 7	85 100	(25.0 - 36.0) CLAY, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray with trace 10YR 6/6, brownish yellow, dry	0 0	CL			SO	ELSWH-06-004-SO-035 Note: Interval 35.0 - 36.0 ft	
36.0 - 37.0	8	85	(36.0 - 37.0) CLAY, low plasticity, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and trace 10YR 6/6, brownish yellow, with GRAVEL (25%), well graded, fine to coarse, subangular to round, wet		CL		▼			
37.0 - 40.0			(37.0 - 40.0) CLAY, very stiff, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray, dry	0	CL					

End of Borehole 40.0 ft BGS

BORING LOG - MW18PFC0701

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

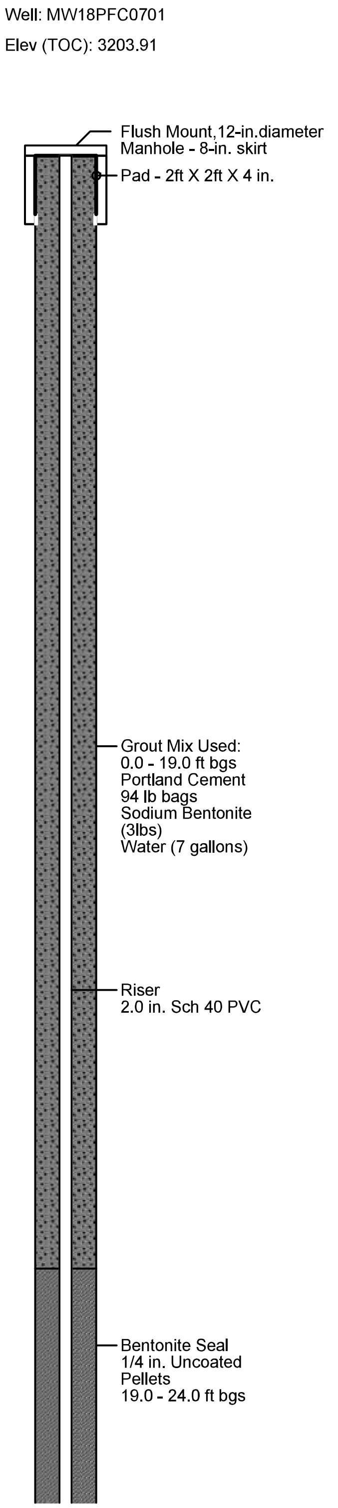
Start Date : 05/08/18
End Date : 05/08/18
Northing : 670650.17
Easting : 1241295.38
Surface Elev (ft)* : 3204.18
Total Depth (ft)** : 40.0

Site Name : AFFF Area 7
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 30.5
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) LEAN CLAY, medium plasticity, medium stiff, slighty moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 07-001-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-3.0) LEAN CLAY, medium plasticity, stiff, slightly moist, 10 YR, 4/3, brown		CL				
			(3.0-5.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 5/3, brown		CL				
5	2	75	(5.0-10.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (35%), fine to coarse, sub-round to round	0	SM				
10	3	55	(10.0-12.0) SILT, soft, non-plastic, dry, 10 YR, 6/3, pale brown	0	ML				
			(12.0-14.0) CLAY with GRAVEL, high plasticity, soft, very slightly moist, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		CH				
			(14.0-15.0) GRAVELLY SAND, loose, fine to coarse, sub-round to round, well graded, very slightly moist, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		SW				
15	4	40	(15.0-16.5) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round	0	SM				
			(16.5-20.0) LEAN CLAY, low plasticity, stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6 brownish yellow		CL				
20	5		(20.0-26.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6 brownish yellow	0	CL				



Aerostar SES LLC

BORING LOG - MW18PFC0701

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/08/18
End Date : 05/08/18
Northing : 670650.17
Easting : 1241295.38
Surface Elev (ft)* : 3204.18
Total Depth (ft)** : 40.0

Site Name : AFFF Area 7
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 30.5
Signature :

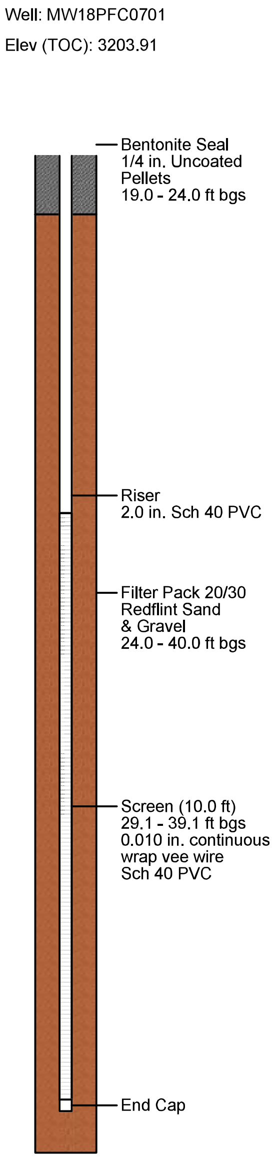
Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
23	5	80		0	CL				
	6	80	(26.0-27.0) CLAY with GRAVEL, medium plasticity, soft, slightly moist, 10 YR, 4/3, brown, Gravel: (30%), fine to coarse, sub-round to round		CL				
28			(27.0-30.5) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray	0	CL			SO	ELSWH 07-001-SO-029 Note: Interval 29.5 to 30.5. ft
	7	80	(30.5-31.0) GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 5/3, brown		GW		▼		
33			(31.0-35.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, mottled with trace, 10 YR, 6/6, brownish yellow,	0	CL				
	8	90	(35.0-36.0) CLAY with GRAVEL, low plasticity, very stiff, moist, 10 YR, 3/1, very dark gray, mottled, 10 YR, 5/3, brown, Gravel: (35%), fine to coarse, sub-angular to sub-round		CL				
38			(36.0-40.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, mottled with trace, 10 YR, 6/6, brownish yellow		CL				

Total Depth of Boring 40.0 ft BGS

43



Aerostar SES LLC

BORING LOG - MW18PFC0702

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/09/18
End Date : 05/010/18
Northing : 670458.10
Easting : 1241253.48
Surface Elev (ft)* : 3204.21
Total Depth (ft)** : 60.0

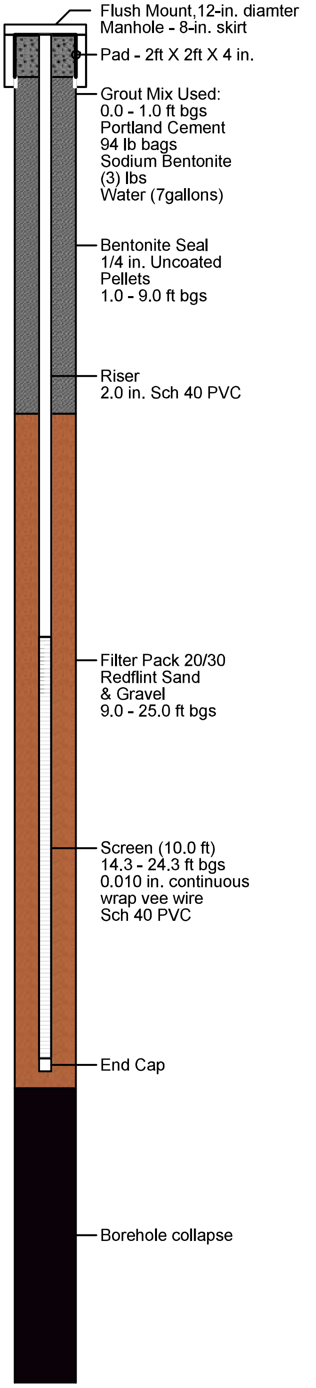
Site Name : AFFF Area 7
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 14.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) SILT with GRAVEL, soft, non-plastic, very slightly moist, 10 YR, 5/3, brown, Gravel: (20%), fine to coarse, sub-round to round	0	ML			SS	ELSWH 07-002-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-4.0) LEAN CLAY, medium plasticity, stiff, dry, 10 YR, 4/3, brown		CL				
			(4.0-5.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 5/3, brown, mottled, 10 YR, 8/1, white		CL				
5	2	60	(5.0-9.0) SILT, soft, non-plastic, dry, 10 YR, 5/3, brown,	0	ML				
			(9.0-10.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 7/3, very pale brown, Gravel: (25%) fine to coarse, sub-round to round		ML				
10	3	100	(10.0-11.0) SILT, soft, non-plastic, dry, 10 YR, 6/3, pale brown	0	ML				
			(11.0-14.0) GRAVELLY SAND, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SW		▼	SO	ELSWH 07-002-SO-013 Note: Interval 13.0 to 14.0 ft
			(14.0-15.0) CLAYEY SAND with GRAVEL, medium dense, fine to coarse, sub-round to round, well graded, slightly moist, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC				
15	4	80	(15.0-25.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
20	5	80		0					
25	6	100	(25.0-26.0) CLAY with GRAVEL, medium plasticity, stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 5/3, brown, Gravel: (30%), fine to medium, sub-round to round	0	CL				
			(26.0-30.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray		CL				
30	7		(30.0-32.0) LEAN CLAY, very stiff, dry, 10 YR, 4/1, dark gray, trace mottling with, 10 YR, 6/6 brownish yellow	0	CL				

Well: MW18PFC0702
Elev (TOC): 3203.80



BORING LOG - MW18PFC0702

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/09/18
End Date : 05/010/18
Northing : 670458.10
Easting : 1241253.48
Surface Elev (ft)* : 3204.21
Total Depth (ft)** : 60.0

Site Name : AFFF Area 7
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 14.0
Signature :

Water Levels

▼ During Drilling

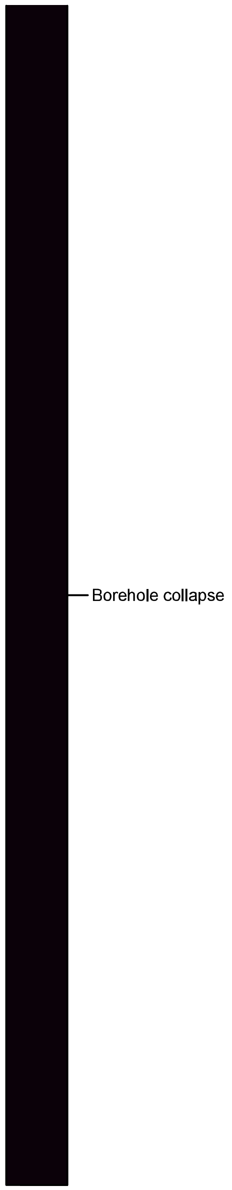
Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
32	7	100	(32.0-60.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, anhydrite lense 44.9' to 45.0'	0		▨			
37	8	100		0		▨			
42	9	100		0		▨			
47	10	100		0	CL	▨			
52	11	100		0		▨			
57	12	100				▨			
62			Total Depth of Boring 60.0 ft BGS						

Well: MW18PFC0702
Elev (TOC): 3203.80



Aerostar SES LLC

BORING LOG - MW18PFC0703

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/15/18
End Date : 05/15/18
Northing : 670582.56
Easting : 1241150.37
Surface Elev (ft)* : 3206.26
Total Depth (ft)** : 25.0

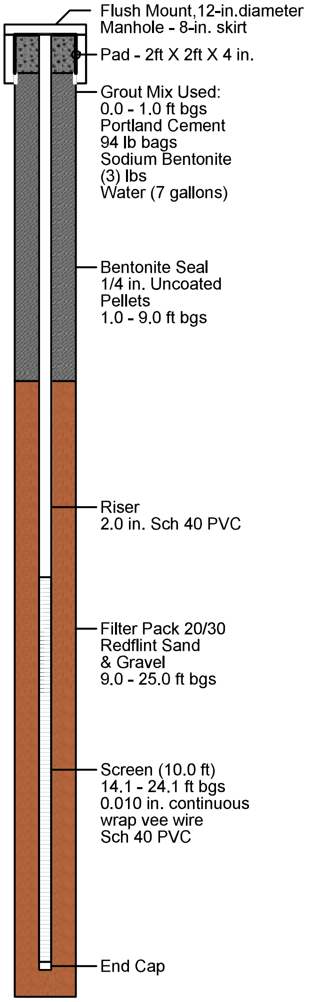
Site Name : AFFF Area 7
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Arek Turolski
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 17.0
Signature : Arek Turolski

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-1.0) CLAY with ORGANICS, soft, high plasticity, moist, organics present (grass, roots), 10 YR, 2/2, very dark brown, 10% gravel	0	CL			SS	ELSWH 07-003-SS-001 Note: Interval 0.0 - 0.5 ft
			(1.0-3.0) CLAY with GRAVEL, stiff, medium plasticity, moist, 10 YR, 4/3, brown, Gravel: (20%), coarse		CL				
			(3.0-5.0) CLAY with SAND and Gravel, low plasticity, stiff, dry, brittle, 10 YR, 7/2, light gray, (20%) sand and gravel		CL				
5 10	2 3	80 100	(5.0-12.0) GRAVELLY SAND, medium grained, angular to sub round, well graded, dry, 10 YR, 5/3, Gravel: (40%), coarse	0 0	SW				
			(12.0-14.0) GRAVELLY SAND, medium grained, angular to sub-round sand, well graded, moist, 10 YR, 3/3, dark brown, Gravel: (40%), coarse, sub-angular to round,		SW				
			(14.0-15.0) GRAVELLY SAND, coarse grained, angular to sub-round, well graded, moist, 10 YR, 4/4, dark yellowish brown, Gravel: (10%), fine, sub-angular, to round,		SW				
15	4	80	(15.0-17.0) CLAYEY GRAVEL, fine to coarse, dry, 10 YR, 5/4, yellowish brown	0	GC		▼	SO	ELSWH 07-003-SO-016 Note: Interval 16.0 to 17.0 ft
20	5	100	(17.0-20.5) CLAYEY GRAVEL, fine to coarse, wet, 10 YR, 4/3, brown	0	GC				
			(20.5-22.0) CLAY with GRAVEL, high plasticity, stiff, wet, 10 YR, 5/4, yellowish brown, Gravel: (20%), fine to coarse		CH				
			(22.0-23.5) LEAN CLAY, low plasticity, hard, brittle, moist, 10 YR, 3/3, dark brown		CL				
			(23.5-25.0) LEAN CLAY, low plasticity, hard, dry, 10 YR, 4/1, dark gray		CL				
25			Total Depth of Boring 25.0 ft BGS						
30									
35									

Well: MW18PFC0703
Elev (TOC): 3205.96



Aerostar SES LLC

BORING LOG - SB18PFC0704

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/08/18
End Date : 05/08/18
Northing : 670541.55
Easting : 1241262.06
Surface Elev. (ft)* : 3204.11
Total Depth (ft)** : 20.0

Site Name : AFFF Site 7
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/07/18
DTW During Drilling (ft) 14.5
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 4.0) CLAY, medium plasticity, stiff, 10YR 4/3, brown, slightly moist	0 0	CL	▨		SS	ELSWH-07-004-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
5	2	90	(4.0 - 7.0) CLAY, low plasticity, very stiff, 10YR 5/3, brown, mottled with 10YR 8/1, white, dry		CL	▨				
			(7.0 - 9.0) SILTY SAND, poorly graded, fine, round, loose, 10YR 6/3, pale brown, dry		SM	▨				
10			(9.0 - 10.0) SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 4/3, brown, with GRAVEL (20%), well graded, fine to medium, sub-rounded to round, dry	0	SW	▨				
			(10.0 - 12.0) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, dry		SM	▨				
			(12.0 - 14.5) SILTY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL (40%), well graded, fine to coarse, sub-rounded to round, moist		SM	▨	▼	SO	ELSWH-07-004-SO-013 Note: Interval 13.0 - 14.5 ft	
15	3	100	(14.5 - 15.0) CLAYEY SAND, well graded, fine to coarse, sub-rounded to round, loose, 10YR 5/3, brown, with GRAVEL, well graded, fine to coarse, sub-rounded to round, wet		SC	▨				
			(15.0 - 16.5) CLAY, low plasticity, soft, 10YR 5/3, brown, with GRAVEL (30%), well graded, fine to coarse, sub-rounded to round, wet	0	CL	▨				
			(16.5 - 20.0) CLAY, low plasticity, stiff, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, dry		CL	▨				
20			End of borehole 20.0 ft bgs							
25										

BORING LOG - MW18PFC0801

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

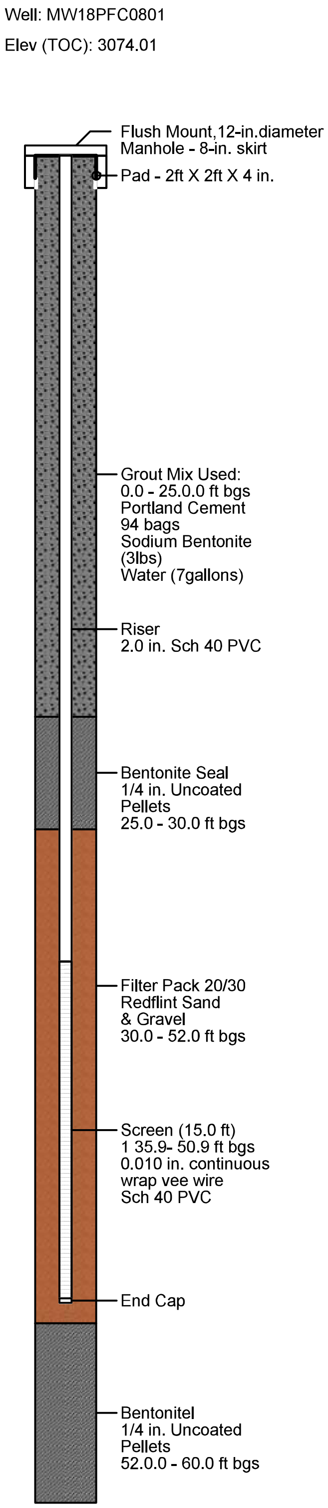
Start Date : 04/23/18
End Date : 04/23/18
Northing : 662383.10
Easting : 1247502.97
Surface Elev (ft)* : 3074.56
Total Depth (ft)** : 60.0

Site Name : AFFF Area 8
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 31.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 08-001-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-8.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow		CL				
5	2	90		0					
			(8.0-14.5) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light grayish brown, and 10 YR, 6/6, brownish yellow		CL				
10	3	80		0					
			(14.5-15.0) LEAN CLAY, medium plasticity, stiff, dry, 10 YR, 5/2, grayish brown		CL				
15	4	100	(15.0-20.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light grayish brown, mottled, 10 YR, 6/6, brownish yellow	0	CL				
20	5	100	(20.0-25.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
25	6	100	(25.0-60.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, 0.1' gravel lense at 31.0'	0					
30	7	90		0			▼	SO	ELSWH 08-001-SO-030 Note: Interval 30.0 to 31.0 ft
35	8	90		0					
40	9	100		0	CL				
45	10	100		0					
50	11	100		0					
55	12	100		0					
60									



BORING LOG - MW18PFC0802

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 04/22/18
End Date	: 04/23/18
Northing	: 662298.26
Easting	: 1247544.84
Surface Elev (ft)*	: 3073.58
Total Depth (ft)**	: 50.0

Site Name	: AFFF Area 8
Drilling Company	: Cascade Drilling
Drilling Method	: Mini-Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 40.5
Signature	:

Water Levels

▼ During Drilling

Measurements

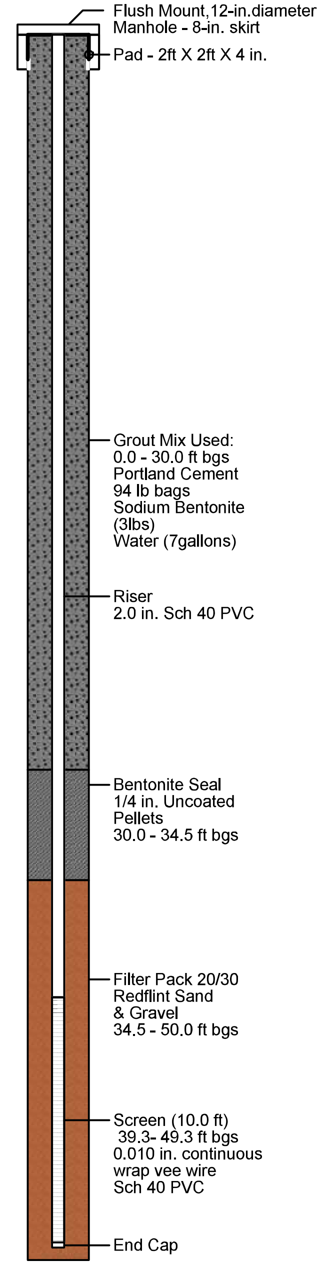
*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-1.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown (1.0-4.0) LEAN CLAY, low plasticity, stiff, dry, 10 YR, 6/2, light brownish gray, mottled, 10 YR, 6/6, brownish yellow	0	CL CL CL			SS	ELSWH 08-002-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	100	(4.0-5.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
10	3	100	(5.0-5.4) CLAY with GRAVEL, high plasticity, medium stiff, slightly moist, 10 YR, 5/2, grayish brown, (20%) gravel (5.4-20.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
15	4	100		0					
20	5	100	(20.0-21.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light grayish brown, mottled, 10 YR, 6/6, brownish yellow (21.0-50.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, 0.2' siltstone lense at 31.0', and 0.3' siltstone lense at 40.5', lense is wet	0	CL				
25	6	100		0					
30	7	100		0					
35	8	100		0	CL				
40	9	100		0			▼	SO	ELSWH 08-002-SO-040 Note: Interval 40.0 to 40.5 ft
45	10	100		0					
50			Total Depth of Boring 50.0 ft BGS						
55									

Well: MW18PFC0802

Elev (TOC): 3073.20



BORING LOG - MW18PFC0803

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/21/18
End Date : 04/22/18
Northing : 662294.31
Easting : 1247520.46
Surface Elev (ft)* : 3073..87
Total Depth (ft)** : 50.0

Site Name : AFFF Area 8
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 47.0
Signature :

Water Levels

▼ During Drilling

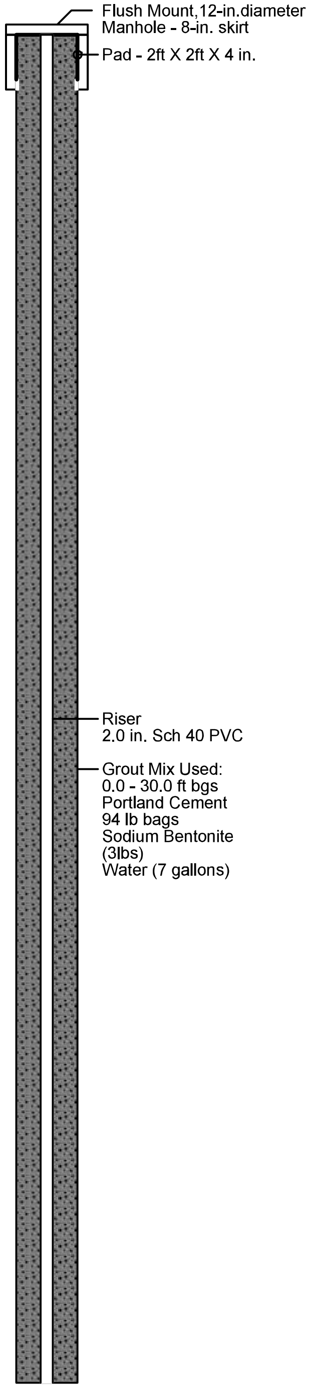
Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSW H08-003-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-5.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light brownish gray, mottled, 10 YR, 4/1, dark gray, 10 YR, 6/6, brownish yellow		CL				
5	2	100	(5.0-20.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow,	0	CL				
10	3	100		0					
15	4	100		0					
20	5	100	(20.0-25.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light grayish brown, mottled, 10 YR, 6/6, brownish yellow, and 10 YR, 4/1, dark gray,	0	CL				
25	6	100	(25.0-25.5) LEAN CLAY, medium plasticity, very stiff, slightly moist, 10 YR, 6/2, light grayish brown, mottled, 10 YR, 6/6, brownish yellow, and 10 YR, 4/1, dark gray	0	CL				
			(25.5-32.5) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray		CL				
30				0					

Well: MW18PFC0803
Elev (TOC): 3073.57



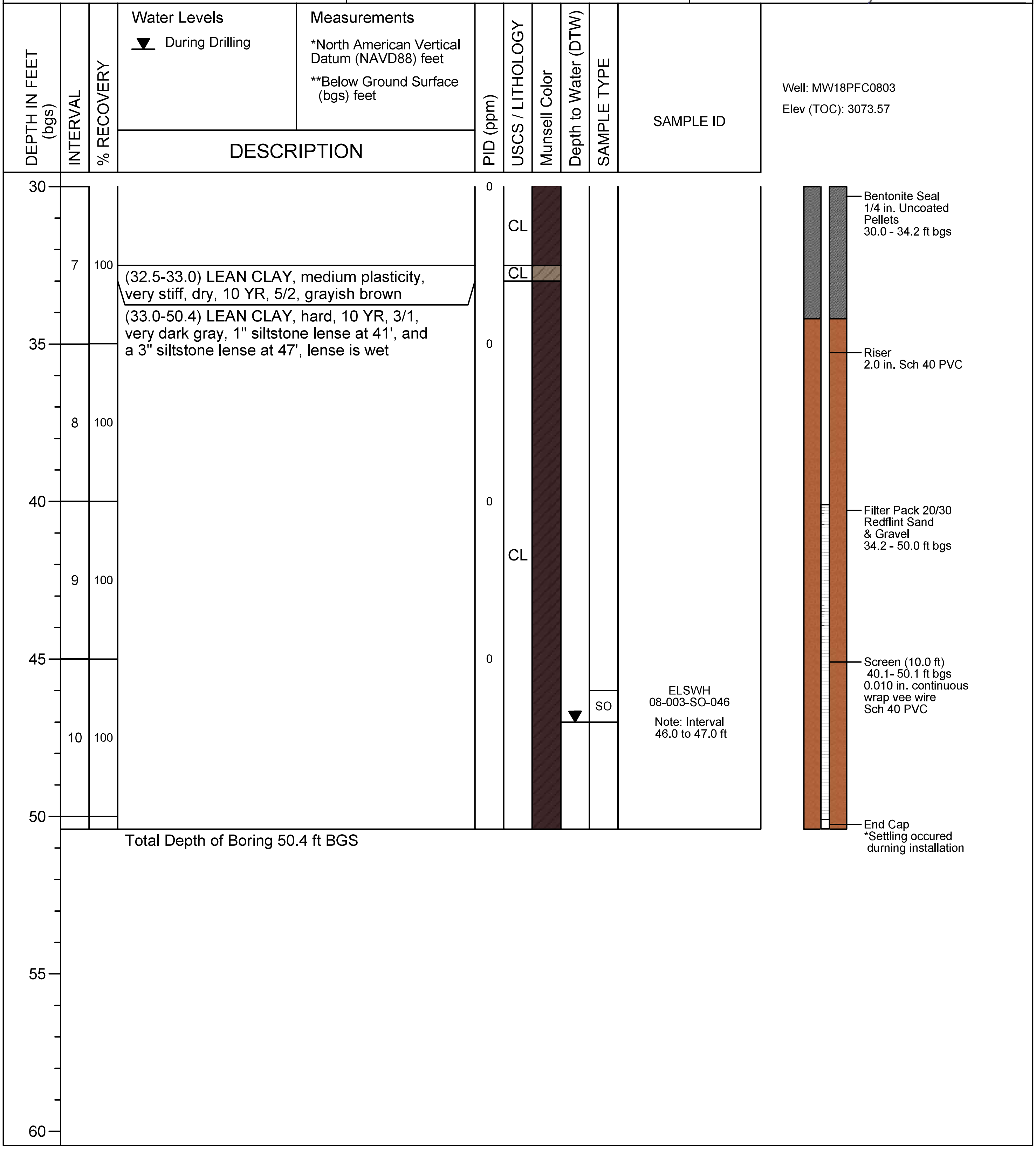
BORING LOG - MW18PFC0803

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/21/18
End Date : 04/22/18
Northing : 662294.31
Easting : 1247520.46
Surface Elev (ft)* : 3073..87
Total Depth (ft)** : 50.0

Site Name : AFFF Area 8
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 47.0
Signature :



*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

(32.5-33.0) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 5/2, grayish brown

(33.0-50.4) LEAN CLAY, hard, 10 YR, 3/1, very dark gray, 1" siltstone lense at 41', and a 3" siltstone lense at 47', lense is wet

ELSWH
08-003-SO-046
Note: Interval
46.0 to 47.0 ft

Total Depth of Boring 50.4 ft BGS

BORING LOG - SB18PFC0804

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/22/18
End Date : 04/22/18
Northing : 662378.08
Easting : 1247474.96
Surface Elev. (ft)* : 3075.08
Total Depth (ft)** : 55.0

Site Name : AFFF Site 8
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 04/23/18
DTW During Drilling (ft) 52.0
Logged by: : Justin Vojak
Signature: :

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 1.0) CLAY, medium plasticity, medium stiff, 10YR 3/3, dark brown, slightly moist	0	CL	▨		SS	ELSWH-08-004-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
			(1.0 - 3.0) CLAY, medium plasticity, stiff, 10YR 4/2, dark grayish brown, with GRAVEL (20%), dry		CL	▨				
			(3.0 - 5.0) CLAY, low plasticity, very stiff, 10YR 6/2, light brownish gray, mottled with 10YR 4/1, dark gray and 10YR, 6/6, brownish yellow, dry	0	CL	▨				
5	2	100	(5.0 - 10.0) CLAY, hard, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, dry	0	CL	▨				
10		90	(10.0 - 10.5) CLAY, medium plasticity, medium stiff, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, with GRAVEL, moist		CL	▨				
			(10.5 - 15.0) CLAY, hard, 10YR 4/1, dark gray, mottled with 10YR 6/6, brownish yellow, dry	0	CL	▨				
15	3	80	(15.0 - 25.0) CLAY, hard, 10YR 4/1, dark gray, mottled with 10YR 6/2, light brownish gray and 10YR 6/6, brownish yellow, dry	0	CL	▨				
20	4	100		0						
25	5	100	(25.0 - 26.0) CLAY, medium plasticity, very stiff, 10YR 5/2, grayish brown, slightly moist		CL	▨				
			(26.0 - 30.0) CLAY, hard, 10YR 3/1, very dark gray, mottled with 10YR 6/6, brownish yellow, dry	0	CL	▨				
30										

BORING LOG - SB18PFC0804

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/22/18
End Date : 04/22/18
Northing : 662378.08
Easting : 1247474.96
Surface Elev. (ft)* : 3075.08
Total Depth (ft)** : 55.0

Site Name : AFFF Site 8
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 04/23/18
DTW During Drilling (ft) 52.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
30	6	80	(30.0 - 35.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0	CL	▨				
35	7	100	(35.0 - 36.0) CLAY, medium plasticity, stiff, 10YR 5/2, grayish brown, dry		CL	▨				
			(36.0 - 52.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0	CL	▨				
40	8	80		0						
45	9	100		0						
50	10	90					▼	SO	ELSWH-08-004-SO-051 Note: Interval 51.0 - 52.0 ft	
			(52.0 - 52.3) CLAY, stiff, 10YR 3/1, very dark gray, with GRAVEL (40%), wet		CL	▨				
			(52.3 - 55.0) CLAY, hard, 10YR 3/1, very dark gray, dry	0	CL	▨				
55			End of borehole 55.0 ft bgs							
60										

BORING LOG - MW18PFC0901A

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/24/18
End Date	: 05/24/18
Northing	: 676352.29
Easting	: 1240360.43
Surface Elev (ft)*	: 3247.07
Total Depth (ft)**	: 35.0

Site Name	: AFFF Area 9
Drilling Company	: Cascade Drilling
Drilling Method	: Mini-Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 29.5
Signature	:

Water Levels

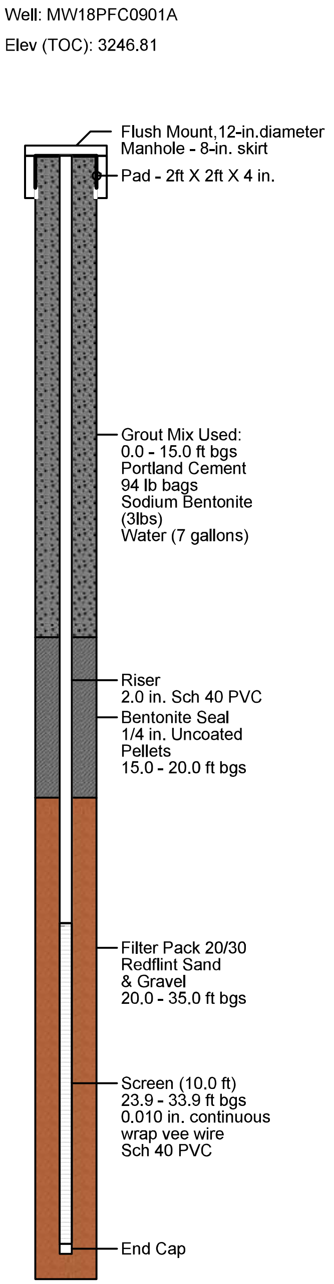
▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) LEAN CLAY, medium plasticity, very stiff, very slightly moist, 10 YR, 6/3, pale brown	0	CL				
			(2.0-5.0) CLAY with GRAVEL, low plasticity, stiff, moist, 10 YR, 5/3, brown, Gravel: (45%), fine to coarse, sub-round to round		CL				
5	2	80	(5.0-17.25) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 6/3, pale brown	0	CL				
10	3	100		0					
15	4	80	(17.25-20.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, very slightly moist, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round	0	SM				
20	5	60	(20.0-21.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 6/3, pale brown, Gravel: (25%), fine to coarse, sub-round to round	0	ML				
			(21.0-25.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (35%), fine to coarse, sub-round to round		SM				
25	6	75	(25.0-28.0) SILT with GRAVEL, loose, non-plastic, dry, 10 YR, 6/3, pale brown, Gravel: fine to coarse, sub-round to round	0	ML				
			(28.0-29.5) SAND, loose, fine to coarse, sub-round to round, well graded, moist, 10 YR, 5/3, brown,		SW		▼		
			(29.5-30.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 5/3, brown, Gravel: fine to medium, sub-round to round		SC				
30	7	80	(30.0-35.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, brownish yellow	0	CL				
35			Total Depth of Boring 35.0 ft BGS						
40									



BORING LOG - MW18PFC0902A

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/23/18
End Date : 05/23/18
Northing : 676165.17
Easting : 1240136.36
Surface Elev (ft)* : 3248.57
Total Depth (ft)** : 35.0

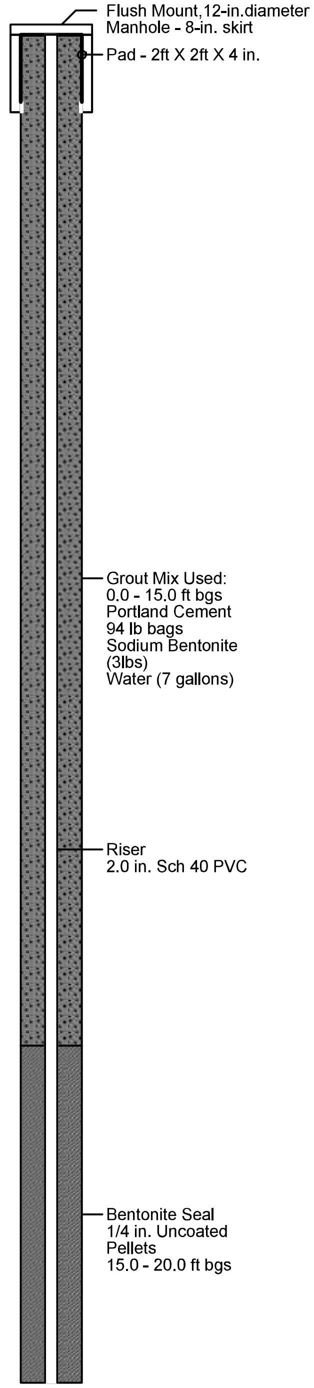
Site Name : AFFF Area 9
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 28
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-5.0) CLAY with GRAVEL, medium plasticity, very stiff, very slightly moist, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round	0	CL	▨			
5	2	80	(5.0-15.0) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 6/3, pale brown	0		▨			
10	3	80		0	CL				
15	4	70	(15.0-20.0) LEAN CLAY, medium plasticity, very stiff, very slighlt moist, 10 YR, 6/3, pale brown	0	CL	▨			
20				0					

Well: MW18PFC0902A
Elev (TOC): 3248.22



BORING LOG - MW18PFC0902A

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

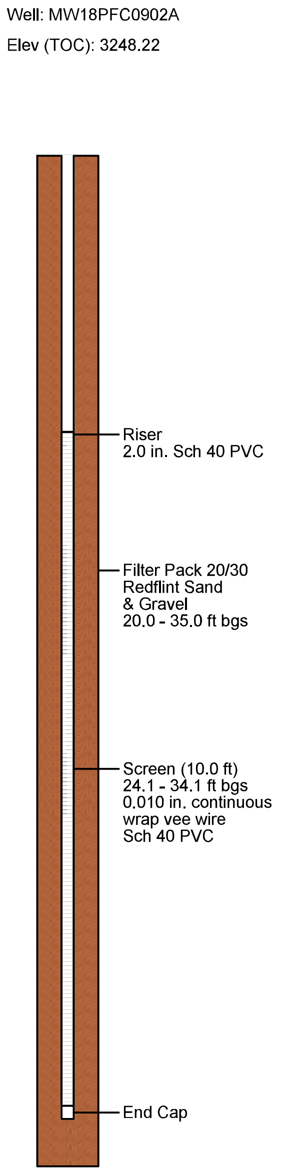
Start Date : 05/23/18
End Date : 05/23/18
Northing : 676165.17
Easting : 1240136.36
Surface Elev (ft)* : 3248.57
Total Depth (ft)** : 35.0

Site Name : AFFF Area 9
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 28
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
20	5	70 100	(20.0-21.0) FAT CLAY, high plasticity, soft, very slighlt moist, 10 YR, 6/3, pale brown	0	CH				
			(21.0-22.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SM				
25	6	58	(22.0-27.5) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 6/3, pale brown, Gravel: (30%) fine to coarse, sub-round to round	0	ML				
	7	70	(27.5-28.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, damp, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		SM		▼		
30			(28.0-30.0) CLAY with GRAVEL, medium plasticity, very stiff, very slightly moist, wet along gravels from 28.0' to 28.25', 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round	0	CL				
			(30.0-31.0) FAT CLAY, high plasticity, stiff, dry, 10 YR, 5/3, brown		CH				
	8	80	(31.0-34.5) CLAY with GRAVEL, medium plasticity, very stiff, dry, 10 YR, 5/3, brown, Gravel: (20%), fine to coarse, sub-round to round		CL				
35			(34.5-35.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow,		CL				
40			Total Depth of Boring 35.0 ft BGS						



BORING LOG - SB18PFC0901

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/21/18
End Date : 5/21/18
Northing : 676358.85
Easting : 1240357.13
Surface Elev. (ft)* : 3246.25
Total Depth (ft)** : 18.0

Site Name : AFFF Area 9
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/24/18
DTW During Drilling (ft) 6.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	60	(0.0 - 5.0) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 6/3, pale brown	0	CL	▨		SS	ELSWH-09-001-SS-001 Note: Interval 0.0 - 1.0 ft.	Borehole
5	2	100	(5.0-17.0) LEAN CLAY, medium plasticity, very stiff, wet, 10 YR, 6/3, pale brown	0	CL	▨	▼	SO	ELSWH-09-001-SO-005 Note: Interval 5.0 - 6.0 ft	
10	3	100		0		▨				
15	4	100		0		▨				
			(17.0-18.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SM	▨				
20			End of Borehole 18.0 ft BGS							

BORING LOG - SB18PFC0902

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/21/18
End Date : 5/21/18
Northing : 676177.76
Easting : 1240125.83
Surface Elev. (ft)* : 3245.89
Total Depth (ft)** : 20.0

Site Name : AFFF Area 9
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/24/18
DTW During Drilling (ft) 6.0
Logged by: : Justin Vojak
Signature: :

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 2.0) CLAY with GRAVEL, medium plasticity, very stiff, moist, 10 YR, 6/3, pale brown, Gravel: (20%), fine to medium, sub-round to round	0	CL			SS	ELSWH-09-002-SS-001 Note: Interval 0.0 - 1.0 ft.	Borehole
			(2.0-5.0) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 6/3, pale brown		CL					
5	2	80	(5.0-15.0) LEAN CLAY, medium plasticity, very stiff, wet, 10 YR, 6/3, pale brown	0	CL		▼	SO	ELSWH-09-002-SO-005 Note: Interval 5.0 - 6.0 ft	
10	3	80		0						
15	4	90	(15.0-19.0) FAT CLAY, high plasticity, medium stiff, moist, 10 YR, 6/3, pale brown,	0	CH					
			(19.0-20.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 6/3, pale brown, Gravel: (40%), fine to coarse, sub-round to round		SM					
20										

Total Depth of Boring 20.0 ft BGS

Aerostar SES LLC

BORING LOG - SB18PFC0903

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 5/04/18
End Date	: 5/04/18
Northing	: 676213.00
Easting	: 1239882.39
Surface Elev. (ft)*	: 3248.44
Total Depth (ft)**	: 35.0

Site Name	: AFFF Site 9
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Borehole Diameter	: 6.0
Boring Completion	: Abandoned w/ Grout
Abandonment Date	: 05/04/18
DTW During Drilling (ft)	29.0
Logged by:	: Justin Vojak
Signature:	:

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 1.0) CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown, Gravel: fine to coarse, sub-round to round	0	CL			SS	ELSWH09-003-SS-001 Note: Interval 0.0-0.5 ft	Borehole
			(1.0-4.5) CLAYEY GRAVEL, loose, fine to coarse, sub-round to round, well graded, slightly moist, 10 YR, 4/3, brown		GC					
5	2	100	(4.5-10.0) LEAN CLAY, medium plasticity, very stiff, dry, 10 YR, 6/3, pale brown	0	CL					
10	3	100	(10.0-15.0) FAT CLAY, medium to high plasticity, stiff, dry, 10 YR, 6/3, pale brown	0	CH					
15	4	70	(15.0-16.0) FAT CLAY, high plasticity, stiff, moist, 10 YR, 6/3, pale brown	0	CH					
			(16.0-20.0) GRAVELLY SAND, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SW					
20	5	100	(20.0-23.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 7/3, very pale brown, Gravel: (40%), fine to coarse, sub-round to round	0	SM					

BORING LOG - SB18PFC0903

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 5/04/18
End Date	: 5/04/18
Northing	: 676213.00
Easting	: 1239882.39
Surface Elev. (ft)*	: 3248.44
Total Depth (ft)**	: 35.0

Site Name	: AFFF Site 9
Drilling Company	: Cascade Drilling
Drilling Method	: Mini Sonic
Driller	: Dennis Schweisthal
Borehole Diameter	: 6.0
Boring Completion	: Abandoned w/ Grout
Abandonment Date	: 05/04/18
DTW During Drilling (ft)	29.0
Logged by:	: Justin Vojak
Signature:	:

Water Levels

▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet (ft)

**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
22	5	62.5			SM					
	6		(23.0-25.0) **SILT with GRAVEL**, soft, non-plastic, dry, 10 YR, 7/3, very pale brown, Gravel: (25%), fine to coarse, sub-angular to round		ML					
27	7	50	(25.0-29.0) **SILTY SAND with GRAVEL**, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 7/3, very pale brown, Gravel: (40%), fine to coarse, sub-round to round	0	SM			SO	ELSWH-09-003-SO-028 Note: Interval 28.0 - 29.0 ft	
			(29.0-30.0) **SILTY SAND with GRAVEL**, loose, fine to coarse, sub-round to round, well graded, damp, 10 YR, 7/3, very pale brown, Gravel: (40%), fine to coarse, sub-round to round		SM		▼			
32	8	40	(30.0- 33.0) **SILT with GRAVEL**, soft, non-plastic, dry, 10 YR, 7/3, very pale brown, Gravel: (25%), fine to medium, sub-round to round	0	ML					
			(33.0-35.0) **LEAN CLAY**, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow		CL					

Total Depth of Boring 35.0 ft BGS

37

42

BORING LOG - MW18PFC1001

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

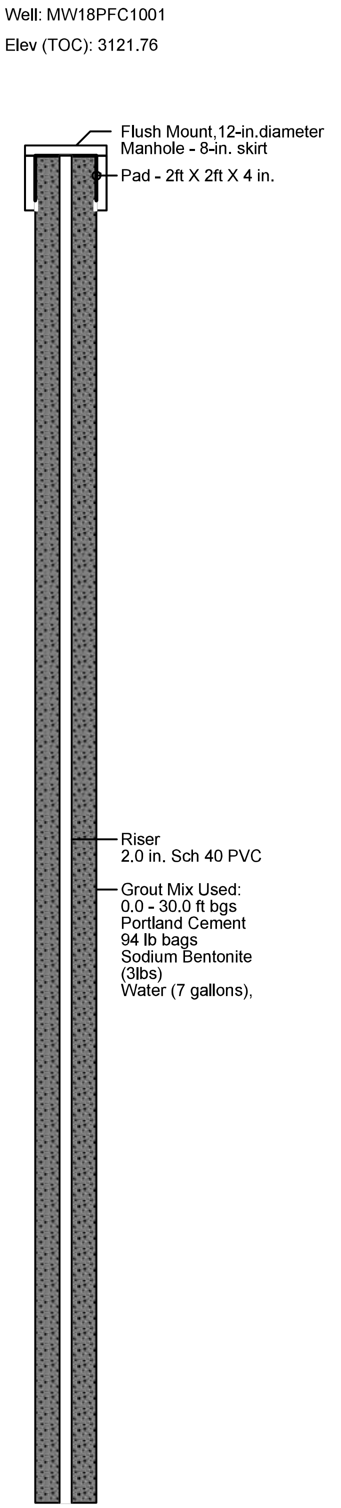
Start Date : 04/24/18
End Date : 04/24/18
Northing : 667545.64
Easting : 1247946.07
Surface Elev (ft)* : 3122.14
Total Depth (ft)** : 50.0

Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 41.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-0.5) CLAY with GRAVEL, medium plasticity,stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 10-001-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	30	(0.5-9.75) GRAVEL FILL	0	GP				
10			(9.75-10.0) CLAY with GRAVEL, high plasticity, medium stiff, slightly moist, 10 YR, 3/2, very dark grayish brown, (30%) gravel	0	CL				
15	3	80	(10.0-17.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 6/2, light brownish gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
	4	80	(17.0-20.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, 10 YR, 6/6, brownish yellow		CL				
20	5	100	(20.0-25.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
25	6	100	(25.0-30.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray	0	CL				
30	7	90		0					



Aerostar SES LLC

BORING LOG - MW18PFC1001

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

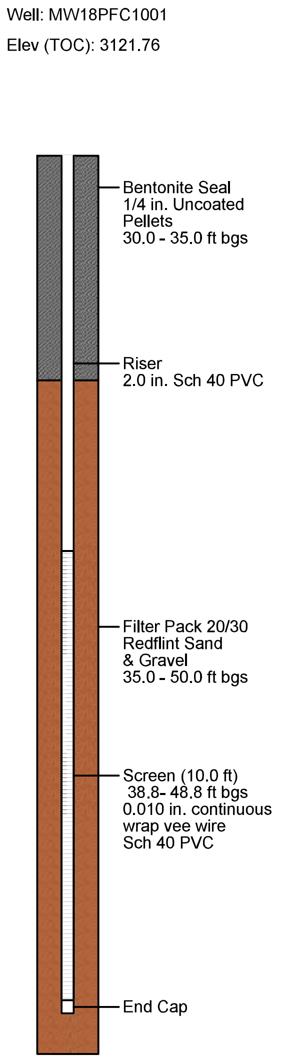
Start Date : 04/24/18
End Date : 04/24/18
Northing : 667545.64
Easting : 1247946.07
Surface Elev (ft)* : 3122.14
Total Depth (ft)** : 50.0

Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 41.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
30	8	100	(30.0-33.0) LEAN CLAY, low plasticity, very stiff, slightly moist, 10 YR, 3/1, very dark gray	0	CL	■			
35	9	100		0					
40	10	100		0				SO	ELSWH 10-001-SO-040 Note: Interval 40.0 to 41.0 ft
			(41.0-46.0) LEAN CLAY, low to medium plasticity, medium stiff, wet, 10 YR, 3/1, very dark gray		CL	■	▼		
45	11	100		0					
			(46.0-50.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray		CL	■			
50			Total Depth of Boring 50.0 ft BGS						
55									
60									



Aerostar SES LLC

BORING LOG - MW18PFC1002

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/04/18
End Date : 05/04/18
Northing : 667609.77
Easting : 1248036.86
Surface Elev (ft)* : 3122.26
Total Depth (ft)** : 40.0

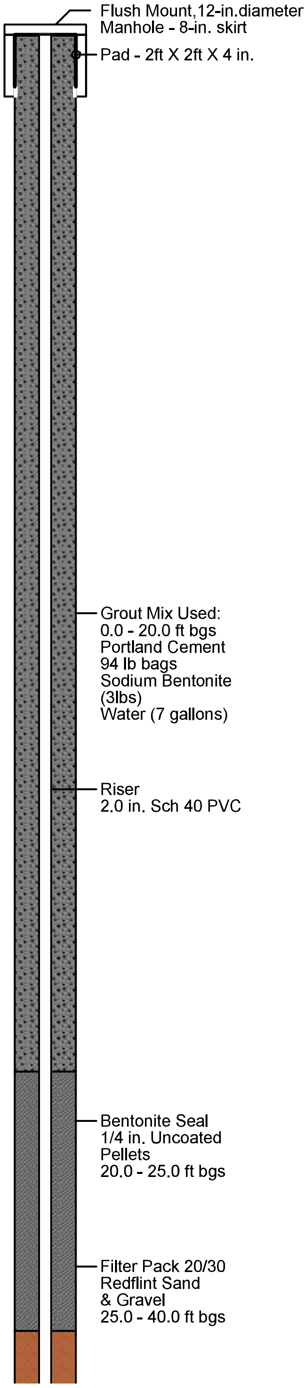
Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 30.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) LEAN CLAY, low plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 10-002-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-5.0) CLAY with GRAVEL, low plasticity, stiff, slightly moist, 10 YR, 4/3, brown, Gravel: (30%), fine to medium, sub-round to round		CL				
5	2	60	(5.0-9.0) GRAVEL, medium dense, fine to coarse, sub-angular to round, well graded, dry, (fill), 10 YR, 7/3, very pale brown	0	GW				
			(9.0-10.0) CLAY with GRAVEL, high plasticity, stiff, dry, 10 YR, 3/2, very dark grayish brown, Gravel: (20%), fine to coarse, sub-round to round		CH				
10	3	55	(10.0-12.0) CLAY with GRAVEL, medium plasticity, soft, slightly moist, 10 YR, 4/2, dark grayish brown, Gravel: (30%), fine to medium, sub-round to round	0	CL				
			(12.0-15.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 6/3, pale brown, mottled, 10 YR, 6/6, brownish yellow,		CL				
15	4	50	(15.0-20.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 6/3, pale brown, mottled, 10 YR, 5/1, Gray, 10 YR, 6/6, yellowish brown	0	CL				
20	5	70	(20.0-23.5) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
			(23.5-27.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray,		CL				
25	6			0					

Well: MW18PFC1002
Elev (TOC): 3121.75



BORING LOG - MW18PFC1002

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/04/18
End Date : 05/04/18
Northing : 667609.77
Easting : 1248036.86
Surface Elev (ft)* : 3122.26
Total Depth (ft)** : 40.0

Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 30.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
26	6	100			CL				
	7	100	(27.0-30.0) LEAN CLAY, stiff, dry, 10 YR, 3/1, very dark gray	0	CL		▼	SO	ELSWH 10-002-SO-029 Note: Interval 29.0 to 30.0 ft
31	8	100	(30.0-36.0) LEAN CLAY, low plasticity, medium stiff, wet, 10 YR, 3/1, very dark gray	0	CL				
36	9	100	(36.0-40.0) LEAN CLAY, hard, dry, 10 YR, 3/1, very dark gray		CL				

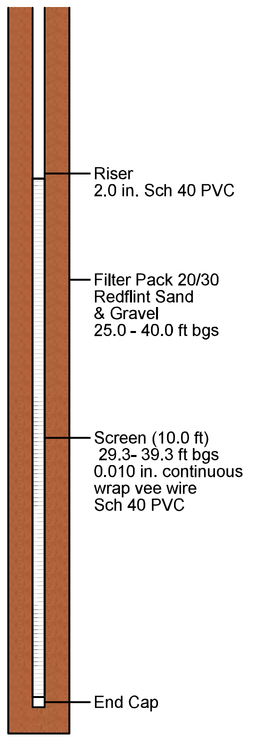
Total Depth of Boring 40.0 ft BGS

41

46

51

Well: MW18PFC1002
Elev (TOC): 3121.75



BORING LOG - MW18PFC1003

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/24/18
End Date : 05/31/18
Northing : 667353.43
Easting : 1248209.19
Surface Elev (ft)* : 3113.30
Total Depth (ft)** : 60

Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 51.0
Signature :

Water Levels

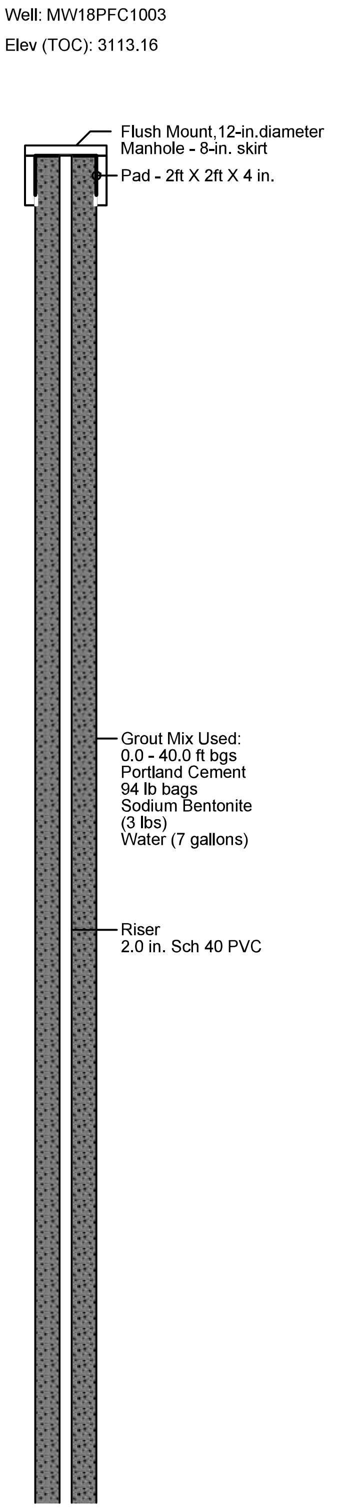
▼ During Drilling

Measurements

*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-5.0) CLAY with GRAVEL, low plasticity, stiff, very slightly moist, 10 YR, 3/3, dark brown, Gravel: (20%), fine to coarse, sub-round to round	0	CL			SS	ELSWH 10-003-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	75	(5.0-10.0) LEAN CLAY, low plasticity, stiff, very slightly moist, 10 YR, 6/2, light brownish gray, mottled with trace 10 YR, 5/1, gray, and 10 YR, 6/6, brownish yellow	0	CL				
10	3	100	(10.0-15.0) LEAN CLAY, low plasticity, stiff, dry, 10 YR, 5/2, grayish brown	0	CL				
15	4	90	(15.0-50.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, siltstone lense 49.9'-50.0'	0	CL				
20	5	95		0					
25	6	100		0					
	7	100							
30	8			0					



BORING LOG - MW18PFC1003

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/24/18
End Date : 05/31/18
Northing : 667353.43
Easting : 1248209.19
Surface Elev (ft)* : 3113.30
Total Depth (ft)** : 60

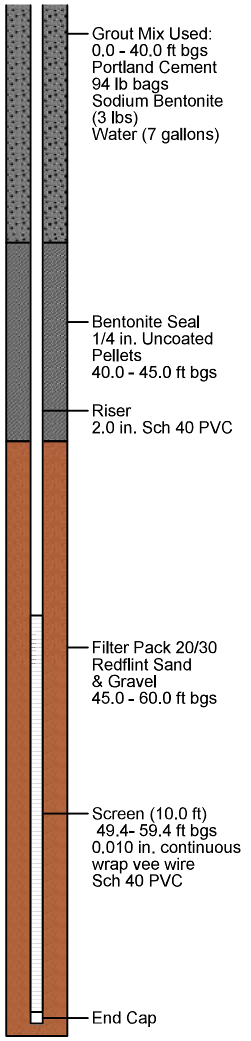
Site Name : AFFF Area 10
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 51.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
34	8	100		0					
39	9	100		0					
	10	100		0	CL				
44	11	100		0					
49	12	100		0					
	13	100	(50.0-52.0) CLAY with GRAVEL, medium plasticity, stiff, wet in places, siltstone lense at 51.5', 10 YR, 4/1, dark gray,		CL		▼	SO	ELSWH 10-003-SO-050 Note: Interval 50.0 to 51.0 ft
54	14	100	(52.0-54.0) LEAN CLAY, low plasticity, very stiff, wet in places, 10 YR, 4/1, dark gray		CL				
			(54.0-55.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray	0	CL				
	15	90	(55.0-59.0) LEAN CLAY, low plasticity, very stiff, wet, 10 YR, 4/1, dark gray		CL				
59			(59.0-60.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray		CL				
64			Total Depth of Boring 60.0 ft BGS						

Well: MW18PFC1003
Elev (TOC): 3113.16



BORING LOG - MW18PFC01101

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/09/18
End Date : 05/09/18
Northing : 671714.97
Easting : 1243088.99
Surface Elev (ft)* : 3200.69
Total Depth (ft)** : 20.0

Site Name : AFFF Area 11
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 13.0
Signature :

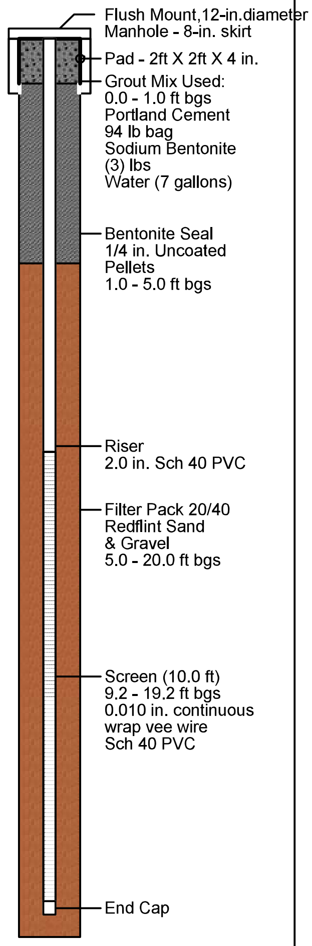
Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	40	(0.0-2.0) LEAN CLAY, low plasticity, stiff, very slightly moist, 10 YR, 3/3, dark brown	0	CL			SS	ELSWH 011-001-SS-001 Note: Interval 0.0 - 0.5 ft
			(2.0-5.0) GRAVEL FILL		GW				
5	2	60	(5.0-9.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white,	0	CL				
			(9.0-10.0) CLAY with GRAVEL, medium plasticity, stiff, dry, 10 YR, 5/3, brown, Gravel: (15%), fine to coarse, sub-round to round		CL				
10	3	100	(10.0-13.0) CLAYEY SAND Sand with Gravel, loose, fine to coarse, sub-round to round, well graded, moist, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round	0	SC		▼	SO	ELSWH 11-001-SO-012 Note: Interval 12.0 to13.0 ft
			(13.0-13.5) CLAYEY SAND with Gravel, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC				
			(13.5-14.5) SAND, loose, fine grained, round, poorly graded, wet, 10 YR, 4/3, brown		SP				
			(14.5-15.0) CLAYEY SAND with Gravel, loose, fine to coarse, sub-round to round, well graded, damp, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC				
15	4	40	(15.0-19.0) SAND, loose, fine grained, round, poorly graded, saturated, 10 YR, 4/3, brown	240	SP				
			(19.0-19.5) CLAY with GRAVEL, medium plasticity, stiff, damp, staining petroleum odor, 10 YR, 5/3, brown, Gravel: fine to coarse, sub-round to round		CL				
20			(19.5-20.0) FAT CLAY, high plasticity, very stiff, dry, 10 YR, 4/2, dark grayish brown		CH				
25									
30									

Total depth of boring 20.0 ft BGS

Well: MW18PFC01101
Elev (TOC): 3200.37



BORING LOG - MW18PFC01102

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 05/09/18
End Date : 05/09/18
Northing : 670932.52
Easting : 1243679.81
Surface Elev (ft)* : 3193.41
Total Depth (ft)** : 20.0

Site Name : AFFF Area 11
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 11.0
Signature :

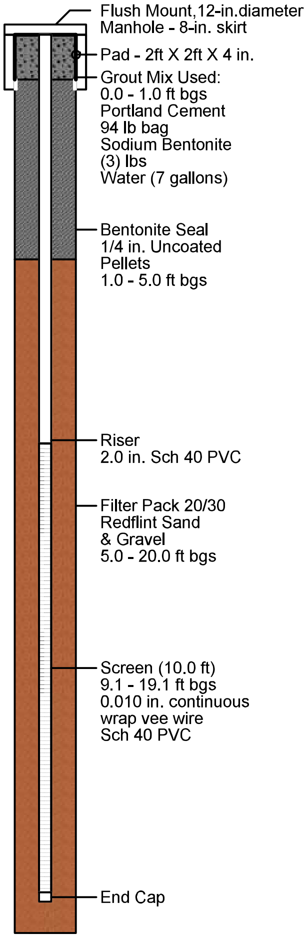
Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-2.0) CLAY with GRAVEL, low plasticity, medium stiff, slightly moist, 10 YR, 4/3, brown, Gravel: (15%), fine to coarse, sub-round to round	0	CL			SS	ELSWH 011-002-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	0	(2.0-6.0) GRAVEL FILL	0	GW				
	3	60	(6.0-10.0) GRAVELLY SAND, loose, fine to coarse, sub-round to round, well graded, moist, 10 YR, 4/3, brown, Gravel: (25%), fine to coarse, sub-round to round		SW				
10	4	80	(10.0-11.0) CLAY with GRAVEL, high plasticity, soft, moist, 10 YR, 5/3, brown, Gravel: (15%), fine to coarse, sub-round to round	0	CH		▼	SO	ELSWH 11-002-SO-010 Note: Interval 10.0 to11.0 ft
			(11.0-12.0) CLAYEY GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown		GC				
15			(12.0-15.5) LEAN CLAY, low plasticity, medium stiff, wet, 10 YR, 4/3, brown, Gravel: (35%), fine to coarse, sub-round	0	CL				
	5	95	(15.5-20.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light grayish brown, 10 YR, 6/6, brownish yellow		CL				

20 Total depth of boring 20.0 ft BGS

Well: MW18PFC01102
Elev (TOC): 3193.12



BORING LOG - MW18PFC01103

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date	: 05/04/18
End Date	: 05/04/18
Northing	: 670191.48
Easting	: 1244393.71
Surface Elev (ft)*	: 3195.21
Total Depth (ft)**	: 25.0

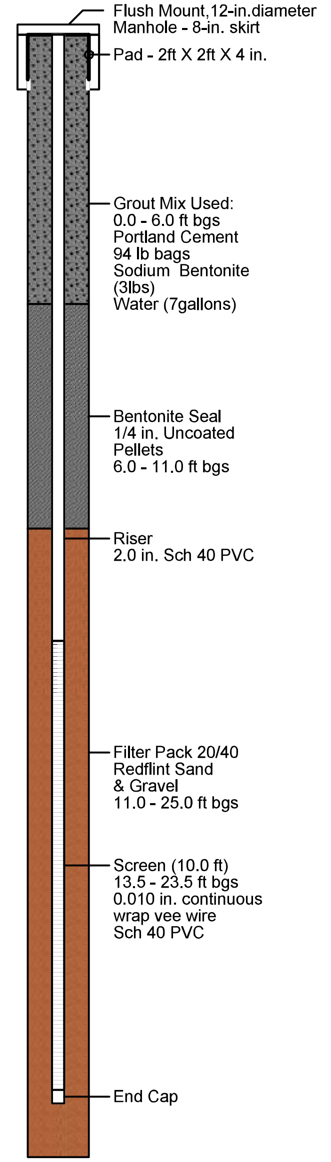
Site Name	: AFFF Area 11
Drilling Company	: Cascade Drilling
Drilling Method	: Mini-Sonic
Driller	: Dennis Schweisthal
Logged By	: Justin Vojak
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 16.0
Signature	:

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-5.0) LEAN CLAY, medium plasticity, medium stiff, slightly moist, 10 YR, 3/3, dark brown	0	CL		SS	ELSWH 011-003-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	40	(5.0-9.5) SAND, loose, fine to coarse, sub-round to round, well graded, very slightly moist, 10 YR, 5/3, brown	0	SW			
			(9.5-10.0) CLAY with GRAVEL, low plasticity very stiff, dry, 10 YR, 5/3, brown, Gravel: fine to medium, sub-angular to round		CL			
10	3	80	(10.0-13.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 6/3, pale brown	0	SM			
			(13.0-15.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 7/3, very pale brown, Gravel: (40%), fine to coarse, sub-round to round		ML			
15	4	80	(15.0-16.0) SILT, soft, non-plastic, dry, 10 YR, 5/3, brown,	0	ML	▼	SO	ELSWH 11-003-SO-015 Note: Interval 15.0 to16.0 ft
			(16.0-18.5) SANDY GRAVEL, (85%) Gravel, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown		GW			
			(18.5-19.5) SAND, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown		SW			
			(19.5-20.0) CLAY with GRAVEL, low plasticity, very stiff, moist, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		CL			
20	5	80	(20.0-24.0) SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 5/3, brown, Gravel: (30%), fine to medium, sub-round to round	0	SW			
			(24.0-25.0) LEAN CLAY, very stiff, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light grayish brown, and 10 YR, 6/6, brownish yellow		CL			
25			Total depth of boring 25.0 ft BGS					
30								

Well: MW18PFC01103
Elev (TOC): 3194.91



BORING LOG - SB18PFC1104

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/09/18
End Date : 5/09/18
Northing : 671243.77
Easting : 1243481.25
Surface Elev. (ft)* : 3196.88
Total Depth (ft)** : 15.0

Site Name : AFFF Site 11
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/09/18
DTW During Drilling (ft) 13.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 4.0) LEAN CLAY, medium plasticity, stiff, slightly moist, 10 YR, 3/3, dark brown,	0	CL			SS	ELSWH-11-004-SS-001 Note: Interval 0.0 - 1.0 ft	Borehole
			(4.0-5.0) LEAN CLAY, low plasticity, very stiff, dry, 10 YR, 4/3, brown, mottled, 10 YR, 8/1, white		CL					
5	2	100	(5.0-7.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round	0	SC					
			(7.0-10.0) SAND, loose, fine grained, round, poorly graded, slightly moist, 10 YR, 5/3, brown		SP					
10	3	80	(10.0-13.0) FAT CLAY, high plasticity, medium stiff, moist, 10 YR, 5/3, brown	0	CH			SO	ELSWH-11-004-SO-012 Note: Interval 12.0 - 13.0 ft	
			(13.0-14.0) CLAY with GRAVEL, medium density, medium stiff, wet, 10 YR, 5/3, brown, Gravel: (40%), fine to coarse, sub-round to round		CL		▼			
15			(14.0-15.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC					

Total Depth of Boring 15.0 ft BGS

BORING LOG - SB18PFC1105

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 5/09/18
End Date : 5/09/18
Northing : 670706.37
Easting : 1243946.96
Surface Elev. (ft)* : 3194.94
Total Depth (ft)** : 15.0

Site Name : AFFF Site 11
Drilling Company : Cascade Drilling
Drilling Method : Mini Sonic
Driller : Dennis Schweisthal
Borehole Diameter : 6.0
Boring Completion : Abandoned w/ Grout
Abandonment Date : 05/09/18
DTW During Drilling (ft) 14.0
Logged by: : Justin Vojak
Signature: :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (bgs) feet (ft)

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	100	(0.0 - 2.0) LEAN CLAY, medium plasticity, stiff, slightly moist, 10 YR, 5/3, brown,	0	CL			SS	ELSWH-11-005-SS-001 Note: Interval 0.0 - 1.0 ft.	Borehole
			(2.0-4.5) SANDY CLAY with GRAVEL, medium plasticity, medium stiff, slightly moist, 10 YR, 5/3, brown, Gravel: (30%), fine to coarse, sub-round to round		CL					
5	2	80	(4.5-6.0) SILTY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, dry, 10 YR, 6/3, pale brown, Gravel: (40%), fine to coarse, sub-round to round	0	SM					
			(6.0-9.0) GRAVELLY SAND, loose, fine to coarse, sub-round to round, well graded, slightly moist, 10 YR, 4/3, brown, Gravel: (30%), fine to coarse, sub-round to round		SW					
			(9.0-10.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, slightly moist, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sun-round to round		SC					
10	3	80	(10.0-11.0) SILT with GRAVEL, soft, non-plastic, dry, 10 YR, 6/3, pale brown, Gravel: (15%), fine to medium, sub-angular to round	0	ML					
			(11.0-14.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, moist, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC		▼	SO	ELSWH-11-005-SO-013 Note: Interval 13.0 - 14.0 ft	
			(14.0-15.0) CLAYEY SAND with GRAVEL, loose, fine to coarse, sub-round to round, well graded, wet, 10 YR, 4/3, brown, Gravel: (40%), fine to coarse, sub-round to round		SC					
15			Total Depth of Boring 15.0 ft BGS							

Aerostar SES LLC

BORING LOG - MW18PFC1201

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/19/18
End Date : 04/19/18
Northing : 679135.35
Easting : 1241007.40
Surface Elev (ft)* : 3327.79
Total Depth (ft)** : 35

Site Name : AFFF Area 12
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 24.0
Signature :

Water Levels

▼ During Drilling

Measurements

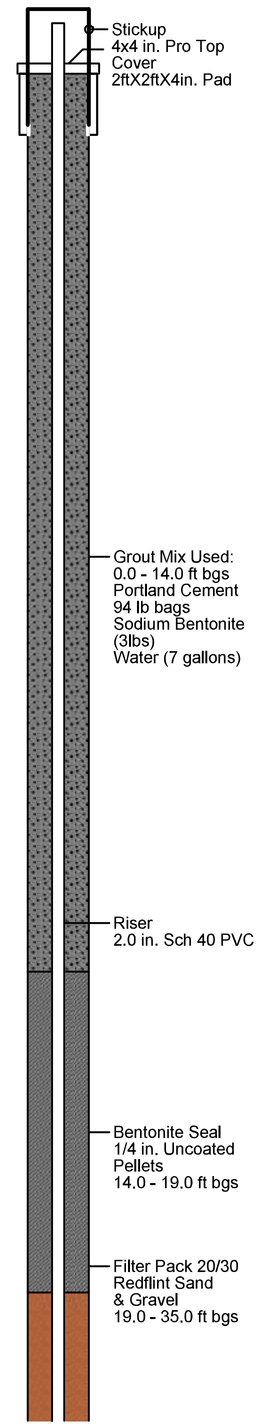
*North American Vertical Datum (NAVD88) feet

**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-4.0) FAT CLAY, high plasticity, very soft, moist, 10 YR, 2/2, very dark brown	0	CL			SS	ELSWH 12-001-SS-001 Note: Interval 0.0 - 0.5 ft
			(4.0-5.0) LEAN CLAY, hard, dry, 10 YR, 4/3, brown		CL				
5	2	70	(5.0-8.0) LEAN CLAY, stiff, dry, 10 YR, 6/2, light brownish gray, mottled with trace 10 YR, 1/1, white	0	CL				
			(8.0-10.0) LEAN CLAY, medium plasticity, hard, dry, 10 YR, 5/2, grayish brown, trace mottling with 10 YR, 6/6, brownish yellow,		CL				
10	3	80	(10.0-15.0) LEAN CLAY, medium stiff, dry, 10 YR, 5/2, grayish brown, trace mottling, 10 YR, 6/6, brownish yellow	0	CL				
15	4	100	(15.0-20.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow	0	CL				
20	5		(20.0-24.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, trace mottling, 10 YR, 6/6, brownish yellow	0	CL				

Well: MW18PFC1201

Elev (TOC): 3330.51



BORING LOG - MW18PFC1201

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/19/18
End Date : 04/19/18
Northing : 679135.35
Easting : 1241007.40
Surface Elev (ft)* : 3327.79
Total Depth (ft)** : 35

Site Name : AFFF Area 12
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 24.0
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

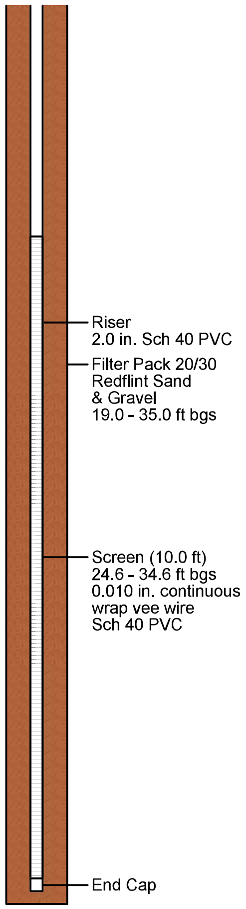
DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
21	5	80			CL				
			(24.0-24.5) CLAY with GRAVEL, hard, damp to wet, 10 YR, 4/1, dark gray, mottled, 10 YR, 4/3, brown, and 10 YR, 6/6, brownish yellow	0	CL		▼	SO	ELSWH 12-001-SO-023 Note: Interval 23.0 to 24.0 ft
			(24.5-25.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/6, brownish yellow		CL				
26 31	6	90	(25.0-32.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray,	0	CL				
	7	80	(32.0-33.0) LEAN CLAY, hard, dry, 10 YR, 7/3, pale brown		CL				
			(33.0-35.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, trace mottling with, 10 YR, 6/6, brownish yellow		CL				

Total Depth of Boring 35.0 ft BGS

36

41

Well: MW18PFC1201
Elev (TOC): 3330.51



Aerostar SES LLC

BORING LOG - MW18PFC1202

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

Start Date : 04/19/18
End Date : 04/19/18
Northing : 679172.02
Easting : 1241177.08
Surface Elev (ft)* : 3345.49
Total Depth (ft)** : 50

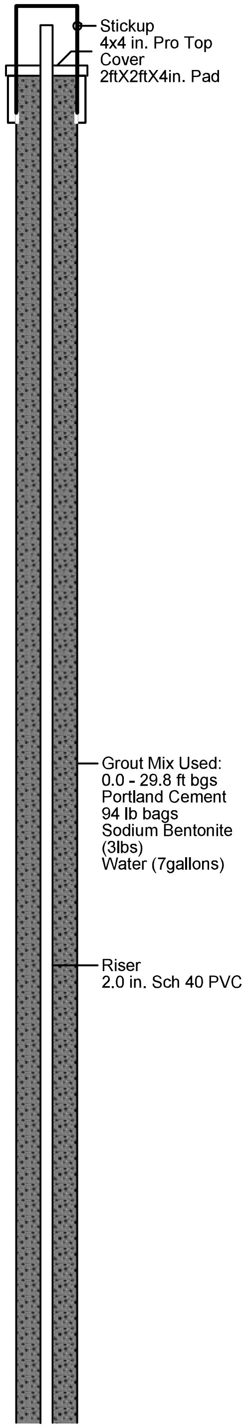
Site Name : AFFF Area 12
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 37
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-7.0) CLAY with GRAVEL, medium plasticity, stiff, slightly moist, 10 YR, 4/3, brown, (25%) Gravel	0	CL			SS	ELSWH 12-002-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	60		0					
7			(7.0-15.0) LEAN CLAY, hard, dry, 10 YR, 5/1, gray, mottled, 10 YR, 6/6, brownish yellow		CL				
10	3	60		0					
15	4	100	(15.0-22.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/1, gray, and 10 YR, 6/6, brownish yellow	0	CL				
20	5	90		0					
22			(22.0-25.0) LEAN CLAY, low plasticity, hard, dry, 10 YR, 4/1, dark gray, mottling in places, 10 YR, 6/6, brownish yellow,		CL				
25	6		(25.0-37.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, trace mottling, 10 YR, 4/1, dark gray	0	CL				

Well: MW18PFC1202
Elev (TOC): 3347.93



Aerostar SES LLC

BORING LOG - MW18PFC1202

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

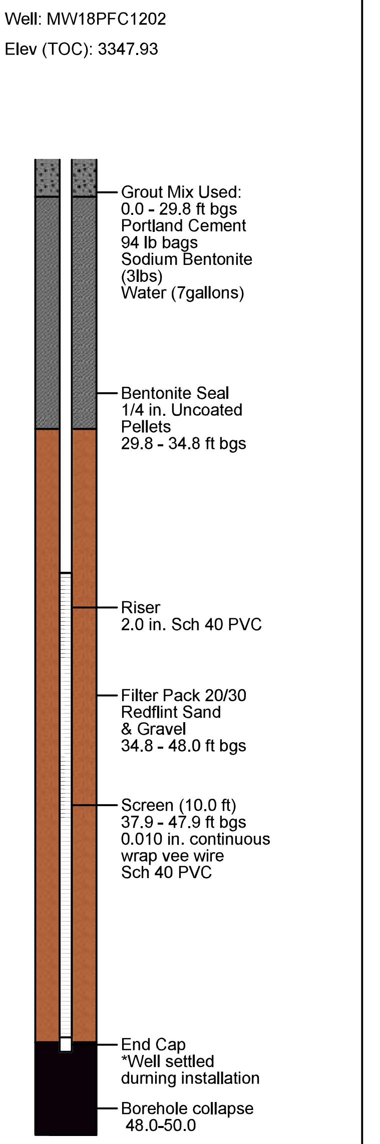
Start Date : 04/19/18
End Date : 04/19/18
Northing : 679172.02
Easting : 1241177.08
Surface Elev (ft)* : 3345.49
Total Depth (ft)** : 50

Site Name : AFFF Area 12
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 37
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
29	6	100		0					
34	7	80		0	CL				
	8	90	(37.0-37.5) CLAY with GRAVEL, hard, wet, 10 YR, 4/1, dark gray, trace mottling with 10 YR, 6/6, brownish yellow, (15%) Gravel		CL		▼	SO	ELSWH 12-002-SO-036 Note: Interval 36.0 to 37.0 ft
39			(37.5-50.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, trace mottling, 10 YR, 6/6, brownish yellow	0					
44	9	80		0	CL				
49	10	90							
54			Total Depth of Boring 50.0 ft BGS						



BORING LOG - MW18PFC1203

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Ellsworth Air Force Base

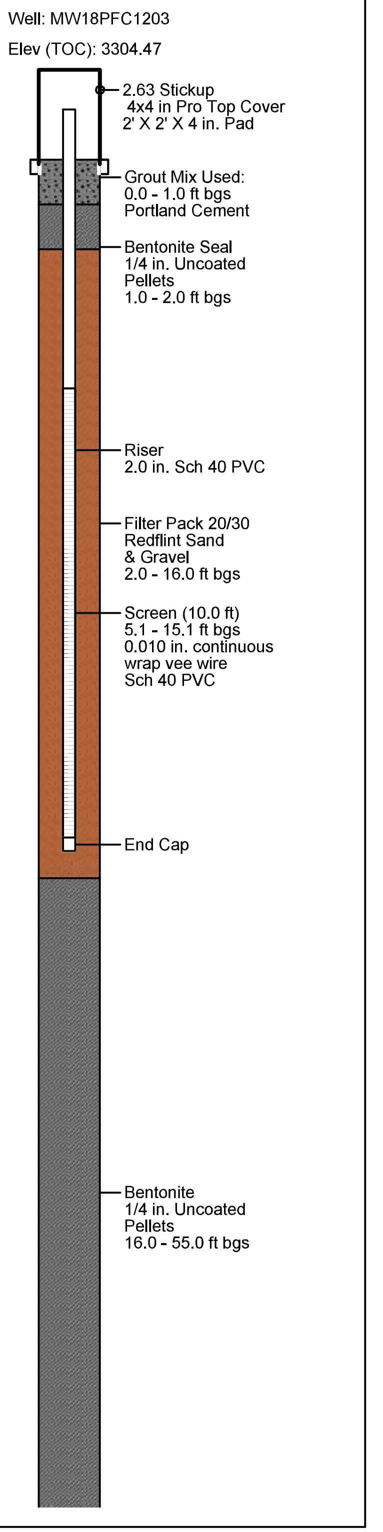
Start Date : 04/20/18
End Date : 04/20/18
Northing : 678627.65
Easting : 1241104.85
Surface Elev (ft)* : 3302.36
Total Depth (ft)** : 55

Site Name : AFFF Area 12
Drilling Company : Cascade Drilling
Drilling Method : Mini-Sonic
Driller : Dennis Schweisthal
Logged By : Justin Vojak
Borehole Diameter : 6.0 in.
Boring Completion : 2.0 in. PVC Monitoring Well
Depth to Water (ft) : 7
Signature :

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet
**Below Ground Surface (bgs) feet

DEPTH IN FEET (bgs)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS / LITHOLOGY	Munsell Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0-5.0) FAT CLAY, high plasticity, medium stiff, slightly moist, 10 YR, 2/2, very dark brown	0	CH			SS	ELSWH 12-003-SS-001 Note: Interval 0.0 - 0.5 ft
5	2	70	(5.0-7.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light brownish gray	0	CL			SO	ELSWH 12-003-SO-006 Note: Interval 6.0 to 7.0 ft
			(7.0-7.5) CLAY with GRAVEL, hard, moist, 10 YR, 6/2, light brownish gray, (15%) Gravel		CL		▼		
			(7.5-10.0) LEAN CLAY, hard, dry, 10 YR, 6/2, light brownish gray		CL				
10	3	90	(10.0-20.0) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brownish gray, and 10 YR, 6/6, brownish yellow	0					
15	4	90		0	CL				
20	5	90	(20.0-25.0) LEAN CLAY, low plasticity, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 4/1, dark gray	0	CL				
25	6	100	(25.0-36.5) LEAN CLAY, hard, dry, 10 YR, 4/1, dark gray, mottled, 10 YR, 6/2, light brown gray, and trace 10 YR, 6/6, brownish yellow	0	CL				
30				0					



AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 1 (current FTA)
Date: 5/17/18-5/18/18 MAN
Sample Technician: Arek Turolski/Miles Neilson
Well ID No.: MW18PFC0101

Initial Measurements

Well Total Depth: 20.35 ft BTOC		Water Level: 15.55 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.35 Ft -15.55 Ft) x 0.163 gal/ft = 0.8 Gal			
Calculated Well Volume: 0.8 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 378 mL/min

5/18/18

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. MAN ~~(mS/Cm)~~ us/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1530	MAN —	—	—	—	—	15.55	—	—	0.0	Begin Development
1535	~~568~~ 1,100	OR	12.5	828	7.30	—*	7.13	-1.0	1.5	
1540	378	OR	12.1	1168	7.31	—*	6.67	-0.7	2.0	
1545	378	OR	11.9	1357	7.36	—*	6.06	-1.4	2.5	MAN
1550	378	OR	11.8	1461	7.36	—*	5.96	-0.3	3.0	~~End~~ Pause for Lightning
1430	—	—	—	—	—	15.50	—	—	3.0	Resume Development
1435	378	OR	11.5	841	7.17	—*	5.98	-14.1	3.5	
1440	378	OR	11.0	840	7.13	—*	5.82	-28.6	4.0	
1445	378	OR	11.0	845	7.15	—*	5.94	-33.5	4.5	End Development
Results At End Of Purging:		OR	11.0	845	7.15	—	5.94	-335	4.5	

No Data

MAN 5/18/18

COMMENTS: well pad not complete, Stickup: 0.88'

Begin purging @ 1530
3785 mL = 1 gal
OR = out of range
5 well volumes = 4 gal

* Water Level Meter on top of Pump
End Development @ 1445 on 5/18/18
Turbidity unable to stabilize due to geology
See Bore Log

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: ~~MW18PFC0102~~ AT 5/18/18 1 (current FTA)
Date: 5/18/18
Sample Technician: Arell Turolski / Miles Neilson
Well ID No.: MW18PFC0102 (ELSWH01-003)

Initial Measurements

Well Total Depth: 40.39 ft BTOC		Water Level: 22.92 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (40.39 Ft - 22.92Ft) x 0.163 gal/ft = 2.85 Gal			
Calculated Well Volume: 2.85 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 845 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1530	570	OR	12.5	922	7.02	24.63	1.04	-53.4	1.5	
1540	380	OR	12.4	1641	6.07	25.15	1.22	-81.7	2.5	
1550	570	OR	12.5	2473	5.50	25.15	0.87	-100.3	4.0	
1600	945	OR	12.2	2613	5.61	26.05	1.03	-97.5	6.5	
1610	1135	OR	12.3	2779	5.27	27.15	1.17	-97.1	9.5	
1620	1325	OR	12.2	2898	5.16	26.70	1.11	-90.9	13.0	
1625	1135	OR	12.2	3002	5.02	26.75	0.83	-86.9	14.5	
		AT 5/18/18								
		Results At End Of Purging:								
		OR	12.2	3002	5.02	26.75	0.83	-86.9	14.5	

COMMENTS: well pad not complete, Stickup: 2.33' ags
Begin purging @ 1520
OR = out of range
3785 mL = 1 gal
5 well volumes = 14.25 gal

6 5/19

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 1 (current FTA)
Date: 5/17/18
Sample Technician: Arek Turolski /Miles Neilson
Well ID No.: MW18PFC0103

Initial Measurements

Well Total Depth: 20.36 ft BTOC		Water Level: 13.02 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.36 Ft - 13.02 Ft) x 0.163 gal/ft = 1.2 Gal			
Calculated Well Volume: 1.2 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 757 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	MAV Cond. ~~(mS/Cm)~~ uS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1410	—	–	—	—	—	13.62	—	—	0.0	Begin Development
1420	757 mL/min	OR	10.0	681	7.27	16.27	4.92	-33.6	2.0	
1430	757	OR	10.5	923	7.27	17.15	6.07	-41.4	4.0	
1435	757	OR	10.9	995	7.38	17.15	7.88	-34.4	5.0	Well Pumped Dry at 1435
1500 ~~1440~~ MAN	—	—	—	—	—	13.62	—	—	5.0	Resume Development
1505	757	OR	8.8	1027	7.52	17.15	10.53	-4.9	7.0	
1510	757	OR	8.9	1014	7.55	17.15	10.57	-3.9	9.0	End Development @ 1510, Pumped Dry

MAN 5/17/18

Results At End Of Purging:							
OR	8.9	1014	7.55	17.15	10.57	-3.9	9.0

COMMENTS: well pad not complete. Stickup: 0.75'
Begin purging @ 1410
3785 mL = 1 gal
OR: out of range
5 well volumes = 6 gal
End Development @ 1510
9.0 gallons Purged

05/19

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: Current Fire Training Area (Site 1) (AFFF AREA 1)

Date: 4-18-18

Sample Technician: A.Willis, M.Nilson

Well ID No.: MW930107

Initial Measurements

Well Total Depth: 37.28 ft BTOC		Water Level: 31.79 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (37.28 Ft - 31.79 Ft) x 0.163 gal/ft = 0.89 Gal			
Calculated Well Volume: 0.89 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): 1500 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	~~Cond.~~ (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1056	1500	—	—	—	—	31.95	—	—	—	Development initiated
1100	1500	472	11.4	3.34	7.24	31.90	2.46	360.7	1.60	
1105	1500	563	11.4	3.30	7.21	31.90	1.60	334.1	~~4.98~~ 3.58	Surged @ 1104
1110	1500	509	11.4	3.29	7.23	31.91	1.34	284.7	5.56	surged @ 1114 – 5 < well volumes
1117	1500	725	11.4	3.29	7.26	31.90	1.35	271.5	8.37	
1126	1500	over range	11.5	3.31	7.28	31.90	1.07	266.1	11.9	surged @ 1129, 1130
1133	1500	417	11.5	3.29	7.28	31.90	0.89	260.4	14.67	Surged @ 1137
11.40	1500	992	11.4	3.29	7.28	31.90	0.82	255.8	17.44	
1143	1500	107	11.4	3.28	7.29	31.90	0.85	255.8	18.62	
1146	1500	59.4	11.3	3.27	7.29	31.90	0.88	255.1	19.8	
1150	1500	29.4	11.5	3.28	7.29	31.90	0.82	253.8	21.38	
1153	1500	11.2	11.5	3.29	7.30	31.90	0.81	253.9	22.56	
1155	1500	6.13	11.5	3.29	7.31	31.90	0.81	253.7	23.35	Developed
Results At End Of Purging:		6.13	11.5	3.29	7.31	31.90	0.81	253.7	23.35	

COMMENTS: * Teflon dedicated pump in well

4.45 ≈ 5 well volumes

4/22/18

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: Area 2 (pond 3)

Date: 5/3/18

Sample Technician: Arek Turnbull / Matthew Buttersworth.

Well ID No.: MW18PFC0201

Initial Measurements

Well Total Depth: 40.38 ft BTOC		Water Level: 15.43 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (40.38 Ft - 15.43 Ft) x 0.163 gal/ft = 4.1 Gal			
Calculated Well Volume: 4.1 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 568 mL/min.

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
0855	379	OR	12.2	1498	7.60	17.81	4.01	157.0	0.5	
0900	757	OR	12.0	1622	7.27	18.76	2.38	158.4	1.5	
0910	379	OR	12.1	2836	7.35	21.55	1.02	156.6	2.5	
0920	568	OR	12.3	3404	7.46	22.02	0.85	147.8	4.0	
0930	379	OR	11.6	3450	7.55	24.24	2.70	137.9	5.0	
0940	568	OR	11.7	3740	7.57	25.81	1.26	131.3	6.5	
0950	757	OR	11.7	4106	7.62	25.96	1.00	111.2	8.5	
1000	757	OR	11.8	4248	7.66	26.05	1.42	96.0	10.5	
1010	379	OR	12.0	4109	7.62	25.75	0.99	81.3	11.5	
1020	568	372	12.0	4300	7.64	25.56	0.97	66.6	13.0	
1030	379	946	12.1	4276	7.63	25.85	0.94	54.2	14.0	
1040	568	OR	12.1	4326	7.63	24.45	0.87	40.4	15.5	
1050	568	408	12.0	4326	7.62	24.75	0.93	29.8	17.0	
1100	568	164	11.9	4357	7.63	25.19	1.01	17.5	18.5	
1110	379	196	12.5	4447	7.64	22.80	0.91	4.1	19.5	
1120	190	OR	13.9	8603	7.84	22.30	6.97	7.2	20.0	equipment malfunction
1130	1514	OR	11.1	3493	7.60	31.21	5.63	15.7	24.0	
Results At End Of Purging:		OR	11.1	3493	7.60	31.21	5.63	15.7	24.0	

COMMENTS: well pad not complete, TOC is 0.4' ags

5 well volumes = 20.5 gal

OR = out of range

3785 mL = 1 gal

Begin purging @ 0850

05/07

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 2 (pond #3)
Date: 5/1/18 - 5/2/18
Sample Technician: Arek Turolski
Well ID No.: MW18PFC0202

Initial Measurements

Well Total Depth: 41.88 ft BTOC		Water Level: 16.4 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (41.88 Ft - 16.4 Ft) x 0.163 gal/ft = 4.15 Gal			
Calculated Well Volume: 4.15 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 666 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1555	1514	OR	11.1	5906	7.77	26.75	1.87	24.6	2.0	
1600	1135	OR	11.1	6271	7.66	29.81	1.77	19.2	3.5	
1610	757	OR	11.1	6383	7.60	32.30	0.83	2.6	5.5	
1620	568	OR	11.2	7527	7.52	34.40	1.43	6.4	7.0	
1630	946	OR	11.4	8401	7.47	35.85	1.94	11.0	9.5	
1640	378	OR	11.5	7207	7.44	—*	2.36	25.4	10.5	DTW water on top of pump
1650	568	OR	11.8	7950	7.45	—	3.37	28.4	12.0	Well dry @ 1651 on 5/1/18
1510	757	OR	12.3	11009	7.25	18.92	5.11	14.1	13.0	5/2/18
1520	378	OR	11.4	11516	7.10	21.93	4.11	25.0	14.0	
1530	378	OR	11.3	10540	7.08	25.16	3.55	24.2	15.0	
1540	378	OR	11.2	10581	7.08	26.75	3.05	21.2	16.0	
1550	378	416	11.2	10616	7.08	27.46	2.93	8.2	17.0	
1600	378	234	11.1	10557	7.10	29.46	2.71	-6.1	18.0	
1610	1514	OR	11.1	10738	7.05	39.24	4.49	-3.1	22.0	
AT	5/2/18									
Results At End Of Purging:		OR	11.1	10738	7.05	39.24	4.49	-3.1	22.0	

COMMENTS: Begin purging @ 1550 on 5/1/18 well pad not completed. TOC = 2.4' ags
OR = out of range
5 well volumes = 20.75 gal.
3785 mL = 1 gal.
5/2/18 - DTW = 17.42
Begin purging @ 1505 on 5/2/18

05/07

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: Ellsworth AFB

Site: Area (site) 2

Date: 4/25/18

Sample Technician: Arek Twolski

Well ID No.: MW18PFC0203

Initial Measurements

Well Total Depth: ft BTOC		Water Level: ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) =	(18.2 Ft - 4.65Ft) x 0.163 gal/ft = 2.20 Gal		
Calculated Well Volume: 2.20 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon

Flow rate (incl. units): 1385 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1345	1514	OR	7.7	4.64	7.15	4.87	1.34	-67.3	2.0	
1350	1136	326	7.2	4.78	7.13	4.81	1.49	-79.1	3.5	
1355	757	OR	7.4	4.85	7.16	4.60	1.43	-73.9	4.5	AT 4/25/18
1400	1136	OR	7.0	4.63	7.18	4.92	1.40	-79.4	6.0	
1405	1893	OR	7.0	4.63	7.16	4.98	0.41	-88.7	8.5	
1410	1893	OR	6.9	4.74	7.17	4.95	1.57	-80.2	11.0	
1415	1136	59	6.5	4.70	7.22	4.99	0.39	-96.7	12.5	Stopped surging well
1418	757	24.8	6.5	4.70	7.21	5.03	0.41	-100.3	13.5	
1421	1136	9.61	6.3	4.69	7.23	5.08	0.44	-104.9	15.0	
										AT
										4/25/18
		AT 4/25/18								
Results At End Of Purging:		9.61	6.3	4.69	7.23	5.08	0.44	-104.9	15.0	

COMMENTS: well not grouted. TOC is 2.15' ~~abs~~ AT 4/25/18 ags

5 well volumes = 11 gal

OR = out of range

3785 mL = 1 gal

Begin purging @ 1340

05/10

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFF Multiple sites
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 2 (rows 70, 80, 90)
Date: 5/18/18, 5/22/18
Sample Technician: Arek Turobski, Miles Neilson
Well ID No.: MW18PFC0204 (ELSWH02-005)

Initial Measurements

Well Total Depth: 45.26 ft BTOC		Water Level: 34.62 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (45.26 Ft -34.62Ft) x 0.163 gal/ft = 1.74 Gal			
Calculated Well Volume: 1.74 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 515 mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/18/18	1320	379	OR	13.5	581	7.29	37.66	1.80	-148.8	0.5	
	1325	758 AT 5/18/18	OR	13.3	409	7.16	38.70	1.47	-127.2	1.5	
	1330	758	OR	14.2	400.3	7.15	40.96	0.86	-156.0	2.5	
	1335	379	OR	15.1	404.8	7.16	–	0.64	-202.8	3.0	WLM on top of pump
	1340	379	OR	14.3	456.4	7.16	–	1.06	-222.5	3.5	
	1345	379	OR	14.3	578	7.16	–	4.60	-135.4	4.0	well dry @ 1345
5/22/18	0905	758	OR	13.4	444.7	7.22	37.38	5.14	92.6	5.0	resume dev. @ 0900
	0910	379	OR	13.3	434.5	7.31	39.03	5.57	84.5	5.5	
	0915	758	OR	13.2	386.4	7.38	41.02	5.60	90.6	6.5	
	0920	379	OR	13.5	407.3	7.36	–	5.46	91.6	7.0	WLM on top of pump
	0925	379	OR	14.0	461.8	7.34	–	6.20	89.9	7.5	well dry @ 0925.
			AT 5/22/18								
	Results At End Of Purging:		OR	14.0	461.8	7.34	–	6.20	89.9	7.5	

COMMENTS: Well pad not complete. Stickup: 1.0' ags

Begin purging @ 1315 on 5/18/18
3785 mL = 1 gal
OR = out of range
5 well volumes: 8.7 gal

Resume development on 5/22/18 @ 0900, DTW prior to dev. is 35.08' btoc.
well dry @ 0925 on 5/22/18.
well considered developed after purging 4.3 well volumes due to slow recharge & restricted access of well site.

5/24

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: Area 2
Date: 05/02/18
Sample Technician: Arek Turolski / Matthew Butters
Well ID No.: MW18PFC020~~6~~ 5 AT

Initial Measurements

Well Total Depth: 35.35 ft BTOC		Water Level: 25.55 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (35.35 Ft -25.55Ft) x 0.163 gal/ft = 1.6 Gal			
Calculated Well Volume: 1.6 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 805 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/Cm~~) µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1300	379	OR	13.1	8090	7.21	25.58	4.58	-31.8	0.5	
1310	568	OR	12.3	7994	7.17	25.60	4.84	-22.7	2.0	
1320	757	OR	12.2	7849	7.17	25.55	5.17	-20.4	4.0	
1325	1135	OR	11.9	7789	7.17	25.55	5.15	-19.0	5.5	
1330	1135	OR	11.8	7788	7.17	25.56	5.21	-17.7	7.0	
1335	1135	OR	11.7	7749	7.17	25.56	5.25	-17.7	8.5	

AT
5/2/18

Results At End Of Purging:	OR	11.7	7749	7.17	25.56	5.25	-17.7	8.5

COMMENTS: Well pad not complete. TOC = 1.29' ags.
5 well volumes = 8 gal
Begin purging @ 1255
3785 mL = 1 gal
OR = out of range

05/07

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: Site 2 - Rows 70,80,90

Date: 5·8·18

Sample Technician: Arek Turolski / Matthew Butterworth

Well ID No.: MW08PFC0206 (ELSWH02-007)

Initial Measurements

Well Total Depth: 20.34 ft BTOC		Water Level: 19.54 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.34 Ft - 19.54Ft) x 0.163 gal/ft = 0.13 Gal			
Calculated Well Volume: 0.13 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): N/A X

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
Results At End Of Purging:										

AT SEE COMMENTS AND GROUND WATER LOG

COMMENTS:

X NOT able to develop due to lack of water / slow recharge / lack of access to restricted area. This well was sampled w/ a peristaltic pump. See GW LOG Sheet.

05/19

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: Ellsworth AFB

Site: 2

Date: 5/8/18

Sample Technician: Arek Twrobki / Matthew Buttersworth

Well ID No.: MW18PFC0207 (ELSWH02-008)

Initial Measurements

Well Total Depth: ~~35.98~~ 33.93 GB ft BTOC		Water Level: 21.23 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = 33.93 GB (~~35.48~~ Ft -21.23 Ft) x 0.163 gal/ft = ~~2.4~~ GB 2.0701 Gal			
Calculated Well Volume: 2.4 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon

Flow rate (incl. units): ~~350~~ MB ml/min (0.34 gall/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/Cm~~) µS/cm	pH	Depth to water (BTOC 21.21 MB	DO (mg/l)	ORP	Total Gal Pumped	Comments
1043	378	OR	13.6	659	7.40	~~41.21~~	0.94	39.2	0.5	
1048	757	OR	13.3	652	7.45	21.21	0.41	-9.5	1.5	
1053	1514	OR	13.0	666	7.50	21.21	0.18	-44.9	3.5	
1058	1135	OR	13.4	675	7.53	21.21	0.21	-62.3	5.0	
1103	1514	OR	13.2	684	7.51	21.21	0.10	-70.6	7.0	AB
1108	1892	OR	12.9	691	7.51	21.21	0.12	-79.9	9.5	
1113	757	OR	13.4	695	7.53	21.21	0.65	-90.4	10.5	
1118	1135	OR	13.6	694	7.53	21.21	0.13	-92.8	12	
			MB							
Results At End Of Purging:		OR	13.6	694	7.53	21.21	0.13	-92.8	12	

COMMENTS: Surface well pad complete, TOC is 0.5' bgs

5 well volumes = 12 gal.

3785 mL = 1 gal

OR = out of range

Begin purging @ 1038

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 3 (building 618)
Date: 5/23/18
Sample Technician: Arek Turolski, Miles Neilson
Well ID No.: MW18PFC0301

Initial Measurements

Well Total Depth: 20.38 ft BTOC		Water Level: 9.02 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.38 Ft - 9.02 Ft) x 0.163 gal/ft = 1.85 Gal			
Calculated Well Volume: 1.85 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon
Flow rate (incl. units): 757 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1020	AT 5/23/18 ~~380~~ 757	OR	11.1	444.5	7.04	10.42	2.15	73.5	1.0	
1025	570	OR	11.3	463.2	7.19	10.65	1.38	32.1	1.75	
1030	570	OR	11.9	479.0	7.36	10.42	0.47	-16.7	2.50	
1035	757	OR	10.7	446.1	7.55	11.44	0.50	-44.6	3.50	
1040	757	OR	10.4	432.6	7.51	12.45	0.62	-47.9	4.50	
1045	1135	OR	10.4	432.5	7.51	13.95	2.17	-39.2	6.0	
1050	757	OR	10.7	434.8	7.49	14.60	2.77	-36.9	7.0	
1055	570	OR	11.0	440.1	7.46	15.05	3.43	-45.1	7.75	
1100	945	OR	11.0	442.5	7.50	15.55	4.67	-43.0	9.0	
1105	757	OR	10.8	440.8	7.55	16.16	5.31	-37.5	10.0	
		AT 5/23/18								
Results At End Of Purging:		OR	10.8	440.8	7.55	16.16	5.31	-37.5	10.0	

COMMENTS: well pad complete.

3785 mL = 1 gal
OR = out of range
5 well volumes = 9.25 gal

Begin purging @ 1015

5/24

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 3 (building 618)
Date: 5/6/18
Sample Technician: Arek Turolski/Matthew Buttersworth
Well ID No.: MW18PFC0302

Initial Measurements

Well Total Depth: 20.35 ft BTOC		Water Level: 8.85 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.35 Ft -8.85 Ft) x 0.163 gal/ft = 1.88 Gal			
Calculated Well Volume: 1.88 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon
Flow rate (incl. units): 720 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/Cm~~) µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1500	757	OR	17.2	429.6	7.56	10.65	6.63	19.4	1.0	
1505	757	OR	16.5	441.2	7.30	12.03	6.36	19.8	2.0	
1510	379	OR	16.1	508	7.28	13.25	4.46	14.3	2.5	
1515	757	OR	16.6	500	7.37	13.93	4.97	3.9	3.5	
1520	379	OR	16.5	480	7.38	14.52	5.05	-5.3	4.0	
1525	757	OR	15.3	509	7.41	15.05	4.85	-5.3	5.0	
1530	757	OR	14.0	553	7.28	15.67	2.62	-4.4	6.0	
1535	1136	OR	13.8	583	7.33	15.77	1.87	-7.4	7.5	
1540	757	OR	13.1	598	7.28	16.20	2.63	-9.8	8.5	
1545	757	OR	12.9	602	7.29	16.67	3.87	-11.4	9.5	
Results At End Of Purging:		OR	12.9	602	7.29	16.67	3.87	-11.4	9.5	

AT
5/6/18

COMMENTS: well pad not complete. TOC = 0.55' ags
5 well volumes = 9.4 gal Begin purging @ 1455
OR = out of range
3785 mL = 1 gal

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 3 (Building 618)
Date: 5/6/18
Sample Technician: Arek Turolski / Matthew Buttersworth
Well ID No.: MW18 PFC0303

Initial Measurements

Well Total Depth: 20.37 ft BTOC		Water Level: 10.86 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.37 Ft -10.86 Ft) x 0.163 gal/ft = 1.55 Gal			
Calculated Well Volume: 1.55 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon
Flow rate (incl. units): 757 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ μS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1615	757	OR	17.6	391.7	7.67	12.66	9.49	16.3	1.0	
1620	1136	OR	17.1	416.3	7.51	13.82	8.04	15.1	2.5	
1625	757	OR	15.5	445.4	7.42	15.21	6.81	7.5	3.5	
1630	379	OR	15.3	418.4	7.31	16.00	8.22	11.5	4.0	
1635	757	OR	16.0	449.3	7.38	16.24	8.43	13.6	5.0	
1640	757	OR	14.9	479.4	7.38	17.18	8.05	16.7	6.0	
1645	757	OR	15.4	448.6	7.35	18.75	8.19	10.9	7.0	
1650	757	OR	16.1	500.0	7.44	19.35	8.50	8.9	8.0	
Results At End Of Purging:		OR	16.1	500	7.44	19.35	8.5	8.9	8.0	

MB 5/6/18

COMMENTS: well pad not complete. Stickup: 1.15' ags
5 well volumes = 7.75 gal
Beginpurging @ 1610
3785 mL = 1 gal
OR = out of range

05/07

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: 4 (former fire station)

Date: 5/23/18

Sample Technician: Arek Turolski, Miles Neilson

Well ID No.: MWL8PFC0401

Initial Measurements

Well Total Depth: 35.9 ft BTOC		Water Level: 31.6 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (35.9 Ft -31.6 Ft) x 0.163 gal/ft = 0.7 Gal			
Calculated Well Volume: 0.7 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon Pro

Flow rate (incl. units): 400 mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/23/18	1658	630	OR	17.4	1323	7.26	33.39	3.06	28.9	0.5	
	1701	630	OR	15.4	1010	7.20	–	5.13	25.1	1.0	WLM on top of pump
	1702		well			Dry					
5/24/18	0948	315	OR	18.2	1295	7.45	33.3	3.53	127.5	1.25	
	0951	315	OR	16.4	1173	7.35	34.16	4.77	124.6	1.50	
	0954	315	OR	15.9	1104	7.50	34.90	5.06	118.9	1.75	
	0957	315	OR	16.1	1135	7.49	–	6.56	116.1	2.0	Pumped well dry
			AT 5/24/18								
	Results At End Of Purging:		OR	16.1	1135	7.49	–	6.56	116.1	2.0	

COMMENTS: well pad not complete. Stickup: 1.6' ags

5 well volumes = 3.5 gal

OR = out of range

WLM = water level meter

3785 mL = 1 gal

Begin purging @ 1655 on 5/23/18

Resume development @ 0945 on 5/24/18

DTW @ 32' prior to development on 5/24/18

well considered developed after ~3 well volumes due to slow recharge and restricted access to well site.

5/24

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 4 (former fire station)
Date: 5/23/18
Sample Technician: Arek Turolski, Miles Neilson
Well ID No.: MW18PFC0402

Initial Measurements

Well Total Depth: ft BTOC		Water Level: ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (45.08 Ft -34.56Ft) x 0.163 gal/ft = 1.71 Gal			
Calculated Well Volume: 1.71 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 345 mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/23/18	1535	380	OR	17.7	1018	7.59	36.5	0.67	-16.4	0.5	
	1540	380	OR	18.2	1065	7.30	37.65	0.87	-29.7	1.0	
	1545	380	OR	14.9	1018	7.22	39.21	2.67	-31.1	1.5	
	1550	380	OR	14.4	996	7.18	40.40	3.03	-30.6	2.0	
	1555	380	OR	14.3	938	7.14	–	4.78	-26.5	2.5	WLM on top of pump
	1600	380	OR	15.2	949	7.12	–	5.63	-20.2	3.0	
	1605	380	OR	15.4	974	7.15	–	6.56	-13.4	3.5	well pumped dry
5/24/18	0845	380	OR	13.9	954	7.37	41.47	3.98	169.1	4.0	
	0850	190	OR	13.7	931	7.52	–	4.93	154.3	4.25	
	0855	190	OR	14.3	927	7.48	–	5.86	146.4	4.5	
	0900	380	OR	14.9	928	7.36	–	7.38	136.4	5.0	well pumped dry
			AT 5/24/18								
	Results At End Of Purging:		OR	14.9	928	7.36	–	7.38	136.4	5.0	

COMMENTS: well pad not complete. stickup: 0.96' ags

5 well volumes = 8.55 gal.
OR = out of range
3785mL = 1gal

Begin purging @ 1530 on 5/23/18
Resume development @0840 on 5/24/18.
DTW @ 38.66' btoc prior to dev. on 5/24/18.

well considered developed after ~3 well volumes purged due to slow recharge and restricted access to well site.

AP 5/24

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: 4 (former fire station)

Date: 5/23/18

Sample Technician: Arell Turolski, Miles Neilson

Well ID No.: ~~MW18PFC0403~~ AT 5/24/18 MW18PFC0403

Initial Measurements

Well Total Depth: 40.69 ft BTOC		Water Level: 32.26 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (40.69 Ft -32.2 Ft) x 0.163 gal/ft = 1.40 Gal			
Calculated Well Volume: 1.4 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 460 mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/23/18	1620	380	OR	13.2	633	7.31	34.0	6.65	12.5	0.5	
	1625	755	OR	13.2	488.2	7.08	37.85	7.66	16.1	1.5	
	1630	380	OR	13.0	521	6.98	–	7.33	20.4	2.0	WLM on top of pump
	1635	755	OR	13.4	558	6.96	–	7.78	23.6	3.0	
	1640	380	OR	13.3	604	7.03	–	8.28	25.4	3.5	well dry
5/24/18	0920	380	OR	13.1	746	7.36	–	7.06	137.1	4.0	WLM on top of pump
	0925	190	OR	12.8	718	7.30	–	9.89	135.5	4.25	well pumped dry
			AT 5/24/18								
		Results At End Of Purging:	OR	12.8	718	7.30	–	9.89	135.5	4.25	

COMMENTS: well pad not complete. Stickup: 1.40' ags

5 well volumes: 7 gal

OR = Out of range

3785 mL = 1 gal

WLM = water level meter

Begin purging @ 1615 on 5/23/18

Resume development @ 0915 on 5/24/18

water level below top of pump prior to development on 5/24/18

Well considered developed after 3 well volumes due to slow recharge and restricted access to well site.

5/24

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: Site 5 (B-52 crash, 1970)
Date: 5/2/18
Sample Technician: Arek Turdski / Matt Bud
Well ID No.: MW18PFC0501

Initial Measurements

Well Total Depth: 35.47 ft BTOC		Water Level: 9.16 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (35.47 Ft - 9.16 Ft) x 0.163 gal/ft = 4.3 Gal			
Calculated Well Volume: 4.3 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Redeflow
Flow rate (incl. units): 666 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1115	710	OR	14.5	7998	8.55	17.51	0.59	-35.2	1.5	
1125	379	OR	14.1	5667	8.56	23.43	2.93	-36.0	2.5	
1135	568	OR	14.7	5736	8.50	24.84	3.02	-30.6	4.0	
1145	568	OR	14.3	5833	8.06	25.47	2.85	-25.3	5.5	
5/2/18 1155	946	OR	13.3	6967	7.55	26.75	1.58	-24.6	8.0	Stop development for well grouting
5/3/18 1340	379	OR	14.2	4022	7.61	23.72	0.85	-6.5	8.5	
1350	757	OR	12.4	3451	7.32	25.70	2.22	-29.9	10.5	
1400	757	OR	12.1	3267	7.23	28.09	2.61	-43.4	12.5	
1410	946	OR	12.4	3361	7.20	31.17	1.33	-63.1	15.0	
1420	568	OR	13.2	3675	7.34	—	3.99	-58.0	16.5	Water level meter on top of pump
1430	379	361	13.1	3731	7.34	30.7	6.06	-43.9	17.5	
1440	568	OR	12.9	4015	7.39	30.4	4.99	-43.0	19.0	
1450	379	135	12.8	3732	7.33	30.35	6.52	-31.9	20.0	
1500	757	269	12.4	3653	7.31	31.40	6.61	-28.5	22.0	
	AT	5/3/18								
Results At End Of Purging:		269	12.4	3653	7.31	31.4	6.61	-28.5	22.0	

COMMENTS: TOC = 1.14' ags (well pad not complete)

Begin purging @ 1107

5 well volumes = 21.5 gal.

3785 mL = 1 gal

stop purging @ 1155 on 5/2/18

Resume development @ 1335 on 5/3/18

05/07

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: Area 5 (B-52 crash, 1970)

Date: 05/02/18

Sample Technician: Arek Iwolski / Matthew Buttersworth

Well ID No.: MW18PFC0502

Initial Measurements

Well Total Depth: 30.05 ft BTOC		Water Level: 18.91 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (30.05 Ft - 18.91(Ft) x 0.163 gal/ft = 1.82 Gal			
Calculated Well Volume: 1.82 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 600 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
0850	190	OR	12.6	3461	7.66	19.41	5.03	172.4	0.5	
0900	568	OR	11.7	3721	7.56	20.86	2.73	111.0	2.0	
0910	568	OR	11.6	4712	7.34	20.90	3.26	66.8	3.5	
0920	568	OR	11.4	5611	7.28	21.55	2.77	7.1	5.0	
0930	946	OR	11.4	6007	7.27	22.15	2.33	-26.7	7.5	
0935	757	OR	11.4	6227	7.26	22.25	2.28	-33.9	8.5	
0940	757	OR	11.4	6477	7.26	22.30	2.17	-43.1	9.5	
Results At End Of Purging:		OR	11.4	6477	7.26	22.30	2.17	-43.1	9.5	

AI 5/2/18

COMMENTS: Well pad not complete. TOC = 0.9' ags

5 well volumes: 9.1 gal

3785 mL = 1 gal

Begin purging @ 0840

AI 05/07

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: 6 (1988 B-1 crash)

Date: 5/6/18

Sample Technician: A. Twolski /M. Buttersworth

Well ID No.: MW18PFC0601

Initial Measurements

Well Total Depth: 20.34 ft BTOC	Water Level: 15.50 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT		
(only fill out if applicable) = (20.34 Ft - 15.5 Ft) x 0.163 gal/ft = 0.8 Gal		
Calculated Well Volume: AT ~~4.0~~ 0.8 Gallons 5/6/18	Well Diameter: 2 inches	
Calculations: 1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon

Flow rate (incl. units): 1000 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/Cm~~) μS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1320	757	OR	14.4	374.6	7.53	16.24	9.46	28.7	1.0	
1325	757	OR	13.7	397.1	7.35	15.97	8.85	37.8	2.0	
1330	757	OR	13.4	406.7	7.36	16.55	9.08	40.0	3.0	
1335	757	OR	12.6	406.5	7.33	16.48	8.61	42.0	4.0	
1340	2271	OR	12.0	407.4	7.36	16.45	9.25	43.2	7.0	
	AT									
	5/6/18									
Results At End Of Purging:		OR	12.0	407.4	7.36	16.45	9.25	43.2	7.0	

COMMENTS: well pad not complete. TOC is 1.51' ags

5 well volumes = 4.0

Begin purging @ 1315

OR = out of range

3785 mL = 1 gal

05/07

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: Ellsworth AFB

Site: 6 (1988 B-1 crash)

Date: 5/6/18

Sample Technician: Arek Twolski / Matthew Butters

Well ID No.: MW18PFC0602

Initial Measurements

Well Total Depth: 20.36 ft BTOC		Water Level: 10.43 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.36 Ft -10.43Ft) x 0.163 gal/ft = 1.62 Gal			
Calculated Well Volume: 1.62 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 395 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1150	568	OR	11.5	346.5	7.41	13.45	9.73	34.0	1.5	
1200	568	OR	11.5	368.4	7.23	16.70	9.88	34.2	3.0	
1210 ~~1200~~ AT	379	OR	12.1	382.5	7.32	–	9.00	31.4	4.0	WLM on top of pump
5/6/18 1215	379	OR	13.6	402.7	7.29	–	9.16	28.6	4.5	well dry
5/7/18 1435	379	OR	12.1	624.7	7.10	–	6.67	2.9	5.0	WLM on top of pump.
1440	379	OR	12.4	449.1	7.06	–	8.71	14.0	5.5	
1450	189	OR	13.0	441.9	7.11	–	9.62	23.1	6.0	
1455	189	OR	13.3	444.2	7.17	–	9.72	27.3	6.25	well dry @ 1455

AT

Results At End Of Purging:	OR	13.3	444.2	7.17	–	9.72	27.3	6.25

COMMENTS: Well pad not complete. TOC = 1.23' ags

OR = Out of range

3785 mL = 1 gal

5 well volumes = 8.1 gal

Begin purging @ 1140

Stop purging @ 1215 on 5/6/18

Resume purging @ 1430 on 5/7/18

DTW before pumping @ 15.08'

Due to restricted access to area of well and time constraints, well is considered developed after 6.25 gallons

05/02

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: Ellsworth AFB

Site: 6 (1988 B-1 crash)

Date: 5/5/18

Sample Technician: Alek Turotski / Matthew Buttersworth

Well ID No.: MW18PFC0603

Initial Measurements

Well Total Depth: 60.40 ft BTOC		Water Level: 27.65 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (60.4 Ft - 27.65 Ft) x 0.163 gal/ft = 5.34 Gal			
Calculated Well Volume: 5.34 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 520 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1620	1893	OR	15.6	1192	7.23	32.82	7.78	2.1	5.0	5/5/18
1630	1514	OR	15.2	1037	7.91	50.97	8.00	5.8	9.0	
1640	1136	OR	14.7	2355	6.90	54.38	5.27	7.3	12.0	
1650	757	OR	14.8	2637	6.77	—	6.54	14.0	14.0	well dry @ 1650
0815	568	OR	12.4	3827	6.80	34.60	2.95	84.4	15.5	5/6/18
0830	505	OR	12.6	3811	6.83	44.50	2.78	40.7	17.5	
0845	379	551	12.6	3808	6.83	51.26	2.82	24.7	19.0	
0900	379	OR	12.8	3718	6.88	54.27	5.44	26.7	20.5	
0915	126	OR	13.5	3671	6.79	55.45	5.33	39.2	21.0	
0930	252	OR	13.0	3624	6.76	56.88	4.62	44.4	22.0	
0945	126	OR	13.3	3690	6.76	—	6.39	46.5	22.5	WLM on top of pump
1000	126	OR	13.3	3761	6.92	—	10.33	52.2	23.0	well dry
1100	252	OR	12.8	3768	7.15	—	11.46	62.8	24.0	well dry
	AT 5/6/18									
Results At End Of Purging:		OR	12.8	3768	7.15	—	11.46	62.8	24.0	

COMMENTS: well pad not complete. TOC is 0.88' ags

Begin purging @ 1610 on 5/5/18

OR = out of range

3785 mL = 1 gal.

5 well volumes = 26.7 gal.

Resume purging on 5/6/18 @ 0805

well ran dry @ 1000 on 5/6/18

Resume purging @ 1050 on 5/6/18

Due to time constraints, well considered developed after 24 gallons. Restricted area

5/07

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 7 (Taxiway Delta 2000 crash)
Date: 5/9/18
Sample Technician: Arek Turobki / Matthew Buttersworth
Well ID No.: MW18PFC0701

Initial Measurements

Well Total Depth: 40.38 ft BTOC		Water Level: 13.66 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (40.38 Ft -13.66Ft) x 0.163 gal/ft = 4.4 Gal			
Calculated Well Volume: 4.4 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 575 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1435	379	OR	12.7	1581	7.06	19.05	1.99	-4.9	1.0	
1445	757	OR	12.2	1564	7.03	28.00	2.62	-19.2	3.0	
1455	568	OR	12.4	1641	7.10	30.52	2.63	-20.7	4.5	
1505	757	OR	13.0	1397	7.08	31.41	2.93	-21.6	6.5	
1515	568	OR	12.7	1602	6.97	34.09	2.99	-29.5	8.0	
1525	568	OR	13.1	1888	6.85	36.27	1.52	-40.4	9.5	
1535	379	OR	13.7	2241	6.95	—	3.41	-30.3	10.5	WLM on top of pump
1545	568	OR	12.2	2155	7.04	—	7.46	-16.3	12.0	well dry @ 1545
0820	757	OR	10.8	2712	6.88	23.79	1.87	58.9	14.0	
0830	568	OR	10.8	2686	6.89	29.82	2.40	37.2	15.5	
0840	757	OR	10.8	2538	6.90	33.84	3.08	24.5	17.5	
0850	568	OR	10.9	2566	6.81	36.29	3.62	22.6	19.0	
0900	568	OR	10.9	2619	6.84	←	3.18	21.2	20.5	WLM on top of pump
0910	190	OR	11.0	2678	6.90	—	6.00	25.7	21.0	
0905	379	OR	10.9	2648	6.92	—	5.89	26.8	22.0	well dry @ 0905
		At 5/10/18								
Results At End Of Purging:		OR	10.9	2648	6.92	—	5.89	26.8	22.0	

COMMENTS:

well pad not completed. Stickup: 1.05' ags
5 well volumes = 22 gal.
OR = out of range
3785 mL = 1 gal
WLM = water level meter

Begin purging @ 1425 on 5/9/18
Resume purging @ 0810 on 5/10/18
DTW: 14.77 prior to purging on 5/10/18

05/10

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: 7 (delta taxiway west

Date: 5/17/18

Sample Technician: Arek Turolski / Miles Neilson

Well ID No.: MW18PFC0702

Initial Measurements

Well Total Depth: 25.9 ft BTOC		Water Level: 15.74 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (25.9 Ft -15.74 Ft) x 0.163 gal/ft = 1.66 Gal			
Calculated Well Volume: 1.66 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer

Flow rate (incl. units): 568 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. MAN ~~(mS/Cm)~~ uS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1125	—	—	—	—	—	15.74	—	—	0.0	Begin Development
1135	568	OR	10.7	2677	6.94	16.70	1.95	35.3	1.5 MAN	
1145	~~568~~ MAN 757	OR	10.3	2517	6.97	17.65	2.09	24.7	~~3.0~~ 3.5	
1155	568	OR	10.2	2223	7.12	18.62	3.80	19.4	5.0	
1205	568	OR	9.8	2280	7.00	19.52	3.99	18.3	6.5	
1215	568	OR	10.0	2222	7.03	20.60	3.75	16.3	8.0	
1220	568	OR	10.3	2305	7.04	20.95	3.51	15.1	8.75	
1225	568	OR	10.4	2243	7.04	21.45	3.75	14.8	9.50	End Development
Results At End Of Purging:		OR	10.4	2243	7.04	21.45	3.75	14.8	9.5	

MAN 5/17/18

COMMENTS: well pad not complete. Stickup: 1.31'

Begin purging @ 1125
3785 mL = 1 gal
OR = out of range
5 well volumes = 8.3 gal

End Purging @ 1225
9.5 gallons Purged
Turbidity Not in Range due to geology
See bore log.

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 7 (delta taxiway west)
Date: 5/17/18
Sample Technician: Arek Twrolski / Miles ~~Nelson~~ Neilson MAV
Well ID No.: MW18PFC0703

Initial Measurements

Well Total Depth: 25.91 ft BTOC		Water Level: 17.38 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (25.91 Ft - Ft) x 0.163 gal/ft = 1.40 Gal			
Calculated Well Volume: 1.40 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 380 mL - 757 mL

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	~~µ~~Cond. ~~(mS/Cm)~~ uS/cm MAV	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1015	380 MAV	OR	10.8	~~7.74~~ 774 MAV	7.18	17.93	4.07	124.7	1.0 MAV	Begin Development
1025	~~380~~ 567	OR	10.4	1029	7.25	17.93	3.15	51.1	~~2.0~~ 2.5	Increase Rate
1035	757	OR	9.8	1346	7.33	18.10	4.57	-26.4	4.5	
1045	757	OR	9.7	1474	7.35	18.14	5.83	-55.8	6.5	
1050	757	OR	9.7	1480	7.36	18.20	5.85	-58.2	7.5	
1055	757	OR	9.6	1480	7.38	18.30	5.89	-58.9	8.5	End Development 8.5 gallons
Results At End Of Purging:		OR	9.6	1480	7.38	18.30	5.89	-58.9	8.5	

AT 5/17/18

COMMENTS: well pad not complete, Stickup: 1.58'
Begin purging @ 1005
3785 mL = 1 gal
OR = out of range
5 well volumes = 7 gal
Turbidity did Not stabilize due to geology
See Bore Log
8.5 gallons Purged

05/19

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: Site 8 - Marker Crash
Date: 4-26-18
Sample Technician: A. Willis / A. Turolski
Well ID No.: MW18PFC0801

Bottom of Screen = 51.28

Initial Measurements

Well Total Depth: TD 51.53 ft BTOC		Water Level: 15.93 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (51.28 Ft - 15.93Ft) x 0.163 gal/ft = 5.76 Gal			
Calculated Well Volume: 5.76 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): ~~Bailer~~ Mega Monsoon
Flow rate (incl. units): 955 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1010	946	OR	12.3	8.52	7.02	22.25	0.64	-78.4	1.25	
1020	852	OR	12.4	12.81	6.91	29.95	0.22	-105.2	3.50	
1030	757	OR	12.8	19.90	6.89	31.03	0.86	-94.6	5.50	
1040	757	OR	12.9	25.46	6.94	31.15	0.28	-130.9	7.50	
1050	757	OR	12.7	26.47	6.98	32.57	0.21	-134.3	9.50	
1100	757	OR	12.7	27.40	7.01	33.21	0.32	-108.6	11.50	
1110	946	OR	12.5	27.84	7.04	34.78	0.19	-124.4	14.00	AT
1120	757	OR	12.5	27.64	7.06	36.33	0.67	-99.1	16.06	
1130	757	OR	12.5	27.90	7.07	38.35	0.17	-116.3	18.00	
1140	1135	OR	12.5	27.61	7.08	39.20	0.20	-103.9	21.00	
1150	1135	OR	13.0	23.95	7.13	37.19	0.19	-119.7	24.00	
1200	1892	OR	12.6	19.73	7.07	43.75	0.44	-82.9	29.00	
	AT									
Results At End Of Purging:		OR	12.6	19.73	7.07	43.75	0.44	-82.9	29.00	

COMMENTS: Begin purging @ 1005
OR = out of range
3785 mL = 1 gal
5 well vol. = 28.8 gal.

Well pad not complete. TOC is 0.43' ags.

05/10

415

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 8 - Martin Crash
Date: 4/23/2018
Sample Technician: M. Neilson / A. Tulwolski
Well ID No.: MW18PFC0802

Initial Measurements

Well Total Depth: 49.63 ft BTOC	Water Level: ~~20.30~~ MAN 18.85 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT		
(only fill out if applicable) = (49.63 Ft – ~~20.30~~ MAN 18.85 ft) x 0.163 gal/ft = ~~25.1~~ MAN Gal 5.02		
Calculated Well Volume: 5.02 Gallons	Well Diameter: 2 inches	
Calculations: 1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Mega Monsoon
Flow rate (incl. units): 700 - 3000 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1320	MAN ~~1000~~ 1400	—	—	—	—	18.85	—	—	—	Begin Development
1330	1400	OR	14.4	18.96	7.80	29.30	0.90	-68.6	3.70	
1340	1000	OR	14.8	18.94	7.77	37.00	0.93	-65.5	7.40	
1345	1000	OR	14.5	18.77	7.73	41.20	1.20	-60.9	~~1.3~~ MAN 8.7	
1350	1000	OR	14.3	17.88	7.70	42.95	2.15	-43.3	10.00	
1355	700	OR	14.6	17.75	7.67	44.13	2.22	-33.6	10.90	
1400	1000	OR	14.6	17.59	7.66	44.95	1.98	-33.6	12.20	
1405	700	OR	15.0	17.63	7.64	45.12	1.98	-32.1	13.12	
1410	1000	OR	14.4	18.91	7.65	45.52	1.05	-48.3	14.07	*Surged @ 1411
1415	1400	OR	13.9	17.44	7.67	46.70	0.72	-51.8	15.89	Pumped Dry @ 1416
4/24 1800 ~~1550~~	MAN ~~1400~~ 3,000	—	—	—	—	~~17.74~~ MAN 16.41		—	16.26	Resume development
1805	3,000	OR	12.6	27.64	7.47	38.7	2.97	-24.4	20.26	
1808	3,000	OR	12.7	27.74	7.45	38.7	2.97	-25.2	22.66	
1811	3,000	OR	12.7	28.10	7.44	43.33	2.75	-28.6	25.06	
1814	3,000	OR	12.4	26.64	7.42	41.11	3.26	-22.9	27.46	End Development
Results At End Of Purging:		OR	12.4	26.64	7.42	41.11	3.26	-22.9	27.46	

COMMENTS:
5 Well Volumes: 25.1 gallons
OR: Over Range
27.46 Gallons Purged

4/24/17

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name:	SI AFFF MULTIPLE SITES
ASL Project No:	M2027.0003
Installation:	**Ellsworth AFB**
Site:	SITE 8- MARTEN CRASH
Date:	4-22-18
Sample Technician:	A.Willis / M. Neilson /
Well ID No.:	MW18PFC0803

Screen: 50.13

Initial Measurements

Well Total Depth: 50.38 ft BTOC		Water Level: 15.98 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (50.13 Ft - 15.98 Ft) x 0.163 gal/ft = 5.57 Gal			
Calculated Well Volume: Gallons		Well Diameter: inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): 1400 – 2000mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
4/22	1751	1,400	—	—	—	—	15.93	—	—	—	Development initiated
	1801	1,400	OR	14.5	32.22	7.41	34.78	2.09	22.2	3.7	*Surge & Increase Rate @1806
	~~1806~~	7,570	OR	16.2	26.93	7.37	34.60	4.84	12.9	5.55	*Dry at 1809
4/23 MAN	~~1805~~ 0805	1,600	—	—	—	—	16.90	—	—	8.55	Resume Development
	0809	1,600 MAN	OR	12.3	16.78	7.27	25.5	2.49	224.6	9.96	
	0813	~~1,600~~ 900	OR	12.4	16.91	7.30	29.3	2.02	175.8	11.37	
	0817	1,400	OR	12.4	16.45	7.37	30.5	1.67	71.7	12.33	
	0821	2,000	921	12.7	17.07	7.44	34.0	1.75	-7.8	13.81	
	0825	2,000	253	12.7	16.74	7.46	40.8	2.18	-13.8	15.92	
	0835	2,400	OR	12.7	13.78	7.47	42.0	4.81	11.8	21.22	*Surged, Pumped Dry 0837
0930 MAN	~~0837~~	1,200	—	—	—	—	26.8	—	—	22.49	Resume Development
	0940	1,400	OR	12.9	18.10	7.54	31.0	1.53	-20.4	~~22.81~~	MAN 25.66
	0945	1,400	OR	12.9	18.40	7.60	37.9	1.48	-42.1	27.51	
	0950	2,000	OR	12.8	17.99	7.61	41.0	2.04	-38.5	29.36	
	0955	2,000	OR	12.8	16.37	7.60	45.0	4.99	-8.6	31.21	
	0958	2,000 MAN	OR	12.8	16.31	7.59	46.05	4.92	-1.0	33.06	
	1001	~~2,000~~ 1,200	OR	12.9	16.29	7.58	46.55	4.90	-0.5	33.84	End Development**
	Results At End Of Purging:		OR	12.9	16.29	7.58	46.55	4.90	-0.5	33.84	

COMMENTS: 27.83 ~ 5 well volumes

5 Well Volumes = 27.85 gallons

** End Development, Turbidity not able to reach range due to geology

4/24/18

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 9 (crash 4, 2006)
Date: 5/24/18
Sample Technician: ~~Art Tworotski, Miles Nettson~~ @ A.willis w/ Escort
Well ID No.: MW18PFC0901A

Initial Measurements

Well Total Depth: 35.38 ft BTOC		Water Level: 27.81 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (35.38 Ft - 27.81 Ft) x 0.163 gal/ft = 1.23 Gal			
Calculated Well Volume: 1.23 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): ~~Reclaimer~~ @ Monsoon
Flow rate (incl. units): 800-1200 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. @ ~~(mS/Cm)~~ uS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1510	800	—	—	—	—	27.62	—	—	—	Development initiated
1514	800	OR	13.2	3593	6.91	29.23	2.90	-24.7	0.85	
1520	800	OR	12.8	3275	6.92	30.2	3.26	-33.0	2.12	
1524	1200	OR	12.6	3348	6.89	*	3.19	-51.3	3.38	~~Devel~~ @ Ran well dry to 2" above TD.
~~15~~ @										
1550	DUE TO SLOW RECHARGE, FLIGHT LINE, AND ESCORT									
	RESTRICTION (ALSO TIME) WELL CONSIDERED DEVELOPED									
	AFTER purging ~ 3 well volumes @1550									
Results At End Of Purging:		OR	12.6	3348	6.89	*	3.19	-51.3	3.38	

COMMENTS: 5 well volumes
* WL meter hitting top of monsoon - unable to record WL reading.

@ 05/30

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 9 (Crash 4, 2006)
Date: 5/24/18
Sample Technician: Arek Twolski, Miles Neilson
Well ID No.: MW18PFC0902A

Initial Measurements

Well Total Depth: 35.61 ft BTOC		Water Level: 29.96 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (~~34.86~~ 35.61 AT 5/24/18 Ft - 29.96 ft) x 0.163 gal/ft = 0.84 Gal			
Calculated Well Volume: 0.84 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer / Monsoon
Flow rate (incl. units): 800-1200 mL/min @

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/Cm~~) µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/24/18 1515	* N/A	OR	14.4	860	7.38	—	7.50	25.3	0.5	WLM on top of pump
1520	* N/A	OR	14.2	721	7.32	—	9.03	23.6	1.5	
1525	* N/A	OR	15.4	787	7.33	—	8.34	25.3	1.75	well pumped dry
A.Willis 5/30/18 J.Ubjak 1138	800	OR	—	—	—	27.2	—	—	1.75	Well development resumed
1146	1200	OR	12.9	1034	6.95	29.5	8.08	129.5	4.27	
1153	1200	OR	12.7	1051	7.05	30.61	6.96	82.1	8.07	
1202	1200	OR	12.9	1055	7.04	32.27	7.02	74.5	9.34	Developed
Results At End Of Purging:		OR	12.9	1055	7.04	32.27	7.02	74.5	9.34	

COMMENTS: well pad not complete, Stickup: 0.79

OR = out of range
*3785 = 1 gal
5 well volumes = 4.2 gal
WLM = water level meter

Begin purging @ 1505 on 5/24/18

5/30

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: 10 (WWTP)
Date: 5/5/18, 5/8/18, 5/9/18
Sample Technician: Arek Turolski / Matthew Buttersworth
Well ID No.: MW18 PFC1001

Initial Measurements

Well Total Depth: 50.39 ft BTOC | Water Level: 13.97 ft BTOC
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT
(only fill out if applicable) = (50.39 Ft - 13.97 Ft) x 0.163 gal/ft = 5.93 Gal
Calculated Well Volume: 5.93 Gallons | Well Diameter: 2 inches

Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 414 mL/min

	Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
5/5/18	0930	946	OR	12.9	3884	7.20	27.22	0.66	103.4	2.5	
	0950	757	OR	13.7	3835	7.19	42.73	1.24	17.8	6.5	
	1010	284	OR	14.9	3793	7.04	46.12	0.54	2.8	8.0	
	1030	189	OR	17.9	4362	7.07	–	0.72	6.3	9.0	WLM on top of pump
	1050	95	OR	16.2	4308	7.18	–	5.76	15.7	9.5	well dry
5/8/18	1255	284	OR	15.6	4876	7.40	24.45	1.02	43.7	11	resume purging on 5/8/18
	1315	284	362	15.7	4855	7.41	31.40	1.16	40.0	12.5	
	1335	379	142	14.9	5832	7.42	40.47	2.70	35.4	14.5	
	1355	379	920	15.1	4581	7.32	44.27	1.71	30.9	16.5	
	1415	284	OR	15.4	4744	7.26	–	2.61	39.1	18.0	WLM on top of pump
	1430	379	OR	15.1	4640	7.35	–	6.50	43.3	19.5	well dry
5/9/18	0900	568	OR	12.9	4721	7.42	39.04	1.35	34.9	22.5	5/9/18, resume purging
	0910	757	OR	12.7	4660	7.43	44.88	2.99	27.2	24.5	
	0920	757	OR	12.9	4627	7.32	–	6.37	45.2	26.5	WLM on top of pump
	0922	946	OR	12.7	4563	7.33	–	7.65	47.4	27.0	well dry
		AT	5/9/18								
	Results At End Of Purging:		OR	12.7	4563	7.33	–	7.65	47.4	27.0	

COMMENTS:

well pad not complete, TOC ≈ 1.3' ags
5 well volumes = 29.7 gal
3785 mL = 1 gal
OR = out of range
WLM = water level meter

Begin purging @ 0920. Stop @ 1050 on 5/5/18
Resume development @ 1235. Stop @ 1430 on 5/8/18. Well dry.
Resume development @ 0840. Well ran dry @ 0922 on 5/9/18.

05/70

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: 10 (WWTP)

Date: 5/5/18 - 5/9/18

Sample Technician: Arek Trmolski / Matthew Buttersworth

Well ID No.: MW18PFC1002

Initial Measurements

Well Total Depth: 40.4 ft BTOC		Water Level: 6.45 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (40.4 Ft - 6.45 Ft) x 0.163 gal/ft = 5.54 Gal			
Calculated Well Volume: 5.54 Gallons		Well Diameter: 2 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): 635 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (~~mS/cm~~) µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1150	568	OR	17.4	3447	7.62	17.22	1.16	-47.3	1.5	
1200	568	OR	15.8	3351	7.19	22.80	0.79	-70.1	3.0	
1215	252	OR	17.1	3596	7.14	26.09	0.69	-86.4	4.0	
1230	1009	OR	15.1	3,950	7.10	33.80	1.52	-96.3	8.0	
1245	505	OR	15.2	3,037	6.88	36.30	0.52	-81.7	10.0	
1300	379	OR	15.8	3560	7.12	37.81	2.00	-76.3	11.5	well dry @ 1302, 5/5/18
5/8/18 1520	946	OR	13.1	4130	7.23	21.95	2.93	7.3	14.0	5/8/18
1530	757	OR	13.4	4033	7.24	30.61	2.05	-5.3	16.0	
1545	757	OR	13.9	4262	7.16	34.85	2.07	-7.1	19.0	
1600	253	OR	14.7	~~23~~ 4405	7.09	—	2.15	7.7	20.0	WLM on top of pump
1610	757	OR	15.1	3958	7.43	—	3.37	11.3	22.0	well dry @ 1610
5/9/18 1300	631	OR	13.2	4345	7.30	22.97	3.81	58.1	24.5	5/9/18
1315	757	412	13.6	4344	7.33	31.59	2.48	40.3	27.5	
1330	883	860	13.1	4797	7.19	38.75	3.90	32.2	31.0	
Results At End Of Purging:		860	13.1	4797	7.19	38.75	3.90	32.2	31.0	

COMMENTS: well pad not complete. TOC = 0.86' ags.

Begin purging @ 1140 on 5/5/18

5 well volumes = 27.7 gal.

OR = out of range

3785 mL = 1 gal

Resume purging @ 1510 on 5/8/18

DTW prior to purging: 10.85'

Resume purging @ 1245 on 5/9/18

DTW prior to purging: 11.05'

05/10

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES * Well completed
ASL Project No: M2027.0003
Installation: ~~HIII AFB~~ ELLWORTH AFB
Site: Site 10 - WWTP
Date: 6-2-18
Sample Technician: A.willis, Justin Vojak
Well ID No.: MW18PFC1003

Initial Measurements

← Drillers water (?)

Well Total Depth: 59.53 ft BTOC		Water Level: * 7.67 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (59.53 Ft - *7.67 Ft) x 0.163 gal/ft = 8.45 Gal			
Calculated Well Volume: 8.45 Gallons		Well Diameter: 2.0" inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

(suspect - drillers used water during installation)

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 750 - 1350 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond.@ ~~(mS/Cm)~~ µS/cm	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1605	750	—	—	—	–	04.93	—	–	–	Development initiated
1610	750	OR	12.7	984	7.64	9.30	0.43	-8.4	0.99	
1614	1000	OR	13.6	996	7.81	18.78	0.22	-80.4	2.04	
1622	1350	OR	11.6	502	8.16	38.0	1.86	-50.0	4.89	
1632	1350	OR	11.5	478.7	8.15	52.36	3.86	-1.4	8.46	
1634	1350	OR	11.6	784	8.01	54.15	1.27	-5.5	9.17	
1638	1350	OR	12.0	855	7.94	56.05	3.14	1.6	10.59	
1644	750	OR	12.9	859	7.93	**	2.21	5.4	11.77	
1648	750	OR	12.9	860	7.93	**	1.38	-8.1	12.49	Stopped development / Dry well
1724	750	OR	—	–	–	56.15	–	–	12.49	Started pump again
1728	750	OR	13.0	1006	8.00	**	1.61	-53.0	12.89	
1735	750	OR	13.1	1013	8.02	**	0.17	-49.4	14.28	Well DRY
						***				
Results At End Of Purging:		OR	13.1	1013	8.02	**	0.17	-49.4	14.24	

COMMENTS: * high WL may be due to water used during drilling/installation
** WLM on top of Reclaimer - no water level reading available
*** Due to slow recharge (1 Gal/35min) and time constraint - could not start developing until 1530 due to grout/pad timing. We had to return carts by 1800. Purged over 1½ well volumes.

6/63

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: 11- SPRAY NOZZLE TEST AREA
Date: 5-19-18
Sample Technician: A. Willis, M. Neilson
Well ID No.: MW17PFC1101

Initial Measurements

Well Total Depth: 20.2 ft BTOC		Water Level: 13.99 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (20.2 Ft - 13.99 Ft) x 0.163 gal/ft = 1.01 Gal			
Calculated Well Volume: 1.01 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 946 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1810	946mL/min	—	—	—	—	13.80	—	—	—	Development initiated
1815	946mL/min	Over Range	8.6	0.82	7.16	*	5.20	19.3	1.25	
1820	946mL/min	Overrange	8.8	0.85	7.20	*	3.92	19.2	2.5	Stopped to allow recharge
1826	946mL/min	Over range	—	—	—	16.4	—	—	2.80	Resumned / 0.25gal before running dry
1836	946mL/min	Overrange	—	—	—	16.4	—	—	2.80	Resummed
1838	946mL/min	Overrange	9.1	0.86	7.21	16.9	3.95	29.1	3.3	Developed **
Results At End Of Purging:		Overrang	9.1	0.86	7.21	16.9	3.95	29.1	33	

COMMENTS: * WL Meter is on top ~~meter~~ @ reclaimer - unable to gage WL.
** Developed after puring 3 well volumes due to Flight Line, time, and escort restrictions.

5/19

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: Site 11- SPRAY NOZZLE TEST AREA
Date: 5-19-18
Sample Technician: A. Willis / M. Nailson
Well ID No.: MW18PFC1102

Initial Measurements

Well Total Depth: * 20.3 ft BTOC		Water Level: * 15.95 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT (only fill out if applicable) = (20.3 Ft - 15.95 Ft) x 0.163 gal/ft = 0.71 Gal			
Calculated Well Volume: 0.71 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon
Flow rate (incl. units): 1400-1800ml/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1550	1400	—	—	—	—	15.99	–	—	—	Development initialed
1605	1400	OR	8.60	0.280	6.62	16.02	6.36	267.9	0.55	
1615	1400	482	8.33	0.380	6.94	16.03	1.67	160.4	~~0.87~~	4.25
1625	1800	494	8.34	0.401	7.00	16.04	1.65	129.5	9.0	
1630	1800	169	8.34	0.423	7.03	16.04	1.38	98.4	11.37	
1635	1800	65.1	8.34	0.422	7.02	16.04	1.32	97.0	13.74	
1645	1800	179	8.35	0.425	7.05	16.05	1.30	96.0	18.49	Developed
Results At End Of Purging:		179	8.35	0.42	@ 7.05	16.05	1.30	96.0	18.49	

COMMENTS: 5 well volume = 3.54

Developed after purging over 5 well volumes w/ stable parameter

* Well not completed.

5/19

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Site: SiteII - SPRAY NOZZLE TEST AREA
Date: 5/19/18
Sample Technician: Miles Neilson (ASL)
Well ID No.: MW18PFC1103

Initial Measurements

Well Total Depth: 25.4 ft BTOC		Water Level: 15.62 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (25.4 Ft - 15.62 Ft) x 0.163 gal/ft = 1.59 Gal			
Calculated Well Volume: 1.59 Gallons		Well Diameter: 2.0 inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Reclaimer
Flow rate (incl. units): 492 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1530	—	—	—	—	—	15.62	-	-	0.0	Begin Development
1545 ~~1540~~	492	OR	9.9	0.83	8.11	15.62	5.79	10.5	2.0	
1600	492	OR	10.0	0.82	7.95	15.80	5.67	8.7	4.0	
1615	492	OR	10.0	0.83	7.89	15.75	5.69	10.8	6.0	
1620	492	OR	10.0	0.83	7.86	15.75	5.86	11.3	6.67	
1625	492	OR	10.0	0.83	7.81	15.75	5.90	11.8	7.34	
1630	492	OR	10.0	0.82	7.82	15.85	5.99	11.5	8.00	End Development
Results At End Of Purging:		OR	10.0	0.82	7.82	15.85	5.99	11.5	8.00	

COMMENTS: Well Pad Not Complete
1 Well Volume: 1.59 gallons
5 Well Volumes: 7.95 gallons
Begin Development @ 1530
End Development @ 1630
Turbidity unable to reach <20 NTU due to geology, See bore log

8.0 gallons Purged

5/22

AerostarSESLLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES
ASL Project No: M2027.0003
Installation: Ellsworth AFB
Site: Building 88240 - Site 12 (AFFF Area 12)
Date: 4-20-18
Sample Technician: A. Willis / M. Neilson
Well ID No.: MW18 PFC1201

Initial Measurements

Ⓐ Ran dry to ~~allow for~~ natural well WL to recharge (12.3') after running dry and recharge (driller's water during install)

Well Total Depth: 37.30 ft BTOC		Water Level: * ~~3.89~~ ft BTOC		
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT				
(only fill out if applicable) = (37.30 Ft - ~~3.89~~ 12.3 Ft) x 0.163 gal/ft = 4.1 Gal				
Calculated Well Volume: 4.1 Gallons		Well Diameter: 2 inches		
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft	

Well Purging Activites

Purging Method (pump type): Monsoon / Bailer
Flow rate (incl. units): 380 - 3,400 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1100	1700	—	—	—	—	2.39	—	—	—	development initiated
1105	2800	over range	10.9	0.92	8.94	37.0	4.97	219.2	3.70	well dry
1120	3,400	over range	12.3	0.99	8.98	29.8	5.62	242.8	4.59	development initiated @ 1119
Bailing 4/23/18 1456	to get	sediment	out then	putting	monsoon	back in				Bailed 8 gal well dry @ 1124
Bailing 4/24/18 1110	—	—	—	—	—	13.4	—	—	12.59	Resume Development + w/ Bailer Monsoon burning
1115	380	198	8.3	5.70	8.41	18.2	8.32	120.5	13.0	
1130	380	169	9.3	6.11	7.60	23.45	8.34	118.7	15.0	
1140	380	OR	9.6	6.27	7.62	27.82	8.72	114.5	16.0	
1150	380	OR	9.5	6.53	7.60	30.38	8.79	114.7	17.0	
1200	380	OR	9.7	7.09	7.57	32.32	8.29	114.6	18.0	
1210	380	OR	9.5	7.37	7.58	34.48	8.29	115.3	19.0	
1220	380	OR	9.1	7.20	7.65	35.83	8.34	117.5	19.75	well dry
1310	380	OR	9.6	7.33	7.66	35.37	8.03	122.3	20.50	Resume bailing @ 1300, Dry @ 1312 End Development
Results At End Of Purging:		OR	9.6	7.33	7.66	35.37	8.03	122.3	20.50	

COMMENTS: * WL suspect driller's water added during drilling - Run dry and let recharge.

~~*~~ 20.4 ≈ 5 well volumes

End Development: 20.50 gallons Purged

5/10

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Site: Building 8824 - site 12 (AFFF AREA 12)

Date: 4-19-18 / 4-20-18

Sample Technician: A. Willis / M. Neilson

Well ID No.: MW18PFC1202

Initial Measurements

Well Total Depth: 50.37 ft BTOC		Water Level: 9.73 * ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (50.37 Ft - 9.73 Ft) x 0.163 gal/ft = 6.62 Gal			
Calculated Well Volume: Gallons		Well Diameter: inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): 600 - 3,400 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	Cond. (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
4/19 1534	3,400	—	—	—	—	9.75	—	—	—	Development initiated
1540	3,400	OR	13.2	0.348	7.94	39.1	8.91	196.9	4.50	
1550	3,400	OR	13.9	0.402	7.71	46.8	8.06	214.6	12.00	
1600	1,000	OR	14.7	0.458	7.72	49.04	6.64	194.3	14.20	
1610	1,000	OR	15.1	0.540	7.79	49.34	6.20	175.5	16.40	Stopped to clean pump @1615
1625	600	—	—	—	—	47.20	—	—	17.50	~~Stopped to clean~~ MAD Resume
1635	600	OR	15.1	0.640	7.88	49.40	5.31	162.8	19.10	
1645	600	OR	14.8	0.67	7.89	49.43	4.50	153.8	20.70	
1655	600	OR	14.7	0.68	7.91	49.6	4.16	150.0	22.30	Well Ran Dry @ 1710
1930	1,000	—	—	—	—	44.32	—	—	24.70	Resume, Pumped Dry 1735
1745	1,000	—	—	—	—	46.90	—	—	28.60	Resume, Pumped Dry 1746
4/20 0840	350	—	—	—	—	32.56	—	—	28.86	Resume
0900	1,300	831	11.4	1.47	8.12	41.02	5.24	233.5	30.71	Surged @ 0918
0920	700	overrange	11.8	1.46	8.23	44.0	3.94	201.9	34.93	
0936	800	OR	11.8	1.37	8.22	45.90	4.06	184.1	38.33	
0938	800	OR	11.6	1.37	8.22	46.10	4.08	183.2	38.75	
0940	800	OR	11.8	1.37	8.22	46.21	4.07	182.6	39.17	** End Development
Results At End Of Purging:		OR	11.8	1.37	8.22	46.21	4.07	182.6	39.17	

COMMENTS: * WL suspect - drillers used 150 gal H2O when installing well.
33.12 ≈ 5 well volumes

** End Development after Purging 6 Well Volumes
NTUs Remained Over Range, Suspected Cause is lean clay lithology, See boring log

4/22/17

AerostarSES LLC

WELL DEVELOPMENT LOG

Project Name: SI AFFF MULTIPLE SITES

ASL Project No: M2027.0003

Installation: Ellsworth AFB

Site: Building 88240 - Site 12 (AFFF Area 12)

Date: 4-21-17

Sample Technician: A. Willis / M. Neilson

Well ID No.: MW18 PFC 1203

Bottom of screen Initial Measurements

~~Well Total Depth~~: 17.80 ft BTOC		Water Level: 9.52 ft BTOC	
WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACIT			
(only fill out if applicable) = (17.80 Ft - 9.52 Ft) x 0.163 gal/ft = 1.35 Gal			
Calculated Well Volume: Gallons		Well Diameter: inches	
Calculations:	1" diameter = 0.041 gal/ft	2" diameter = 0.163 gal/ft	4" diameter = 0.653 gal/ft

Well Purging Activites

Purging Method (pump type): Monsoon

Flow rate (incl. units): 600 – 2400 mL/min

Time	Flow Rate (ml/min)	Turbidity (NTUs)	Temp (°C)	~~Cond~~ (mS/Cm)	pH	Depth to water (BTOC)	DO (mg/l)	ORP	Total Gal Pumped	Comments
1148	2000	—	—	—	—	9.52	—	—	—	Development initiated
~~1150~~	~~2000~~		~~17.4~~	~~0.006~~	~~6.64~~	~~11.76~~	~~12.35~~	~~711.2~~		YSI was not working
1152	2000	over range	7.2	0.52	7.79	14.2	11.87	235.8	2.08	
1202	1000	over range	10.01	0.79	7.59	17.3	9.65	243.5	4.67	DRY - waiting for recharge / surged
1355	600	—	—	—	—	14.52	—	—	4.68	Resume
1400	800	overrange	10.01	~~8.25~~ 1.11	7.70	16.8	8.25	267.1	5.48	Well Pumped Dry @ 1405
1436	2400	over range	10.08	1.15	7.72	17.0	8.30	265.0	11.78	resumed. Ran DRY 1437
1554	2400	over range	10.08	1.17	7.80	15.4	7.43	198.0	18.08	Resumed. Ran dry ~5 well volumes 1555
Lowered @176 → 1718	1400	overrange	10.02	1.37	8.00	15.19	7.90	194.8	18.88	Resumed. Ran dry at 1720 → Developed

Results At End Of Purging:	overrange	10.02	1.38	8.00	15.19	7.90	194.8	18.88

COMMENTS: 6.75 25 well volumes

1720 Developed after purging ~14 well volumes w/ stable parameters. Screen is in lean clean - NTUs high due to natural turbidity in well.

4/27/18

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: Site 1- Current Fire Training

WELL NO: MW17PFC0101	SAMPLE ID: ELSWH01-001-GW-015	DATE: 5-20-18

PURGING DATA

WELL DIAMETER (inches): 2.0"	TUBING DIAMETER (inches): 1/4 OD	WELL SCREEN INTERVAL DEPTH: 20.10 Ft - 10.10 Ft	STATIC DEPTH TO WATER (feet BTOC): 15.46	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.75 Ft - 15.46 Ft) x 0.163 gal/ft = 0.79 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA ~~= gal + (x Ft.) + gal gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15	PURGING INITIATED AT: 0900	PURGING ENDED AT: 0923	TOTAL VOLUME PURGED (gallons): ~~0.78~~ 0.79 MAN

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. MAN ~~µS/cm~~ MS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
0905	0.15	0.15	.03	15.80	7.40	10.9	1.12	3.28	148.9	35.5	C	None
0908	.09	MAN ~~0.24~~ .33	.03	15.85	7.43	10.8	1.11	3.09	141.4	29.5	C	None
0911	.09	MAN ~~0.39~~ .42	.03	15.85	7.48	10.5	1.10	3.00	131.9	29.3	C	None
0914	.09	MAN ~~0.54~~ .51	.03	15.90	7.50	10.5	1.10	2.95	130.1	29.4	C	None
0917	.09	0.6	.03	15.90	7.64	10.7	1.12	2.73	96.8	20.7	C	None
0920	.09	0.69 MAN	.03	15.90	7.68	10.8	1.12	2.69	89.8	20.8	C	None
0923	.09	~~0.78~~ 0.79	.03	15.91	7.75	10.8	1.12	2.76	88.7	19.2	C	None

MAN

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis M. Neilson	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 0925	SAMPLING ENDED AT: 0932

PUMP OR TUBING DEPTH IN WELL (feet): 15	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filter Size mm Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH01-001-GW-015	2	PE	125mL each				EPA 537M	APP	125
ELSWH01-001-GW-915	2	PE	125mL each				EPA537M	APP	125
MS/MSD	2	PE	125mL each				EPA537M	APP	125

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/20/18

AerostarSES

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: 1 (Current FTA)

WELL NO: MW18PFCG107

SAMPLE ID: ELSWH01-003-GW-035

DATE: 05/21/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 40.14 Ft - 30.14 Ft

STATIC DEPTH TO WATER (feet BTOC): 22.76

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (40.39 Ft - 22.76 Ft) x 0.163 gal/ft = 2.9 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) gal (x Ft) + gal = gal~~ AT 5/21/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 35

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 35

PURGING INITIATED AT: 0945

PURGING ENDED AT: 1101

TOTAL VOLUME PURGED (~~gallons~~) mL: 11400

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
0950	750	750	150	23.11	5.82	14.3	2808	0.89	152.5	41.2	clear	none
0955	750	1500	150	23.21	5.81	14.1	2834	0.51	117.4	64.7	|	|
1005	1500	3000	150	23.06	5.69	14.5	2933	0.32	56.8	33.8	|	|
1010	750	3750	150	23.04	5.60	14.5	2970	0.31	20.6	19.7	|	|
1015	750	4500	150	23.04	5.51	14.7	3014	0.30	-11.1	16.3	|	|
1020	750	5250	150	23.04	5.55	15.1	3055	0.27	-32.7	14.4	|	|
1025	750	6000	150	23.04	5.58	14.9	3074	0.30	-57.4	10.5	|	|
1030	750	6750	150	23.04	5.50	15.1	3107	0.28	-78.2	8.26	|	|
1035	750	7500	150	23.04	5.44	15.2	3119	0.29	-94.2	7.28	|	|
1045	1500	9000	150	23.04	5.46	15.3	3170	0.30	-118.3	6.82	|	|
1055	1500	10500	150	23.04	5.45	15.6	3216	0.29	-136.3	5.24	|	|
1058	450	10950	150	23.04	5.46	15.6	3224	0.30	-137.4	5.32	|	|
1101	450	11400	150	23.04	5.46	15.4	3220	0.31	-140.2	5.18	|	|
			AT	5/21/18								

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turoski

SAMPLER(S) SIGNATURE(S): Arek Turoski

SAMPLING INITIATED AT: 1102

SAMPLING ENDED AT: 1103

PUMP OR TUBING DEPTH IN WELL (feet): 35

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH01-003-GW-035	2	PE	125				EPA 537M	APP	150

REMARKS: Well pad complete,

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/24

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: 1 (Current FTA)

WELL NO: MW18PFC0103

SAMPLE ID: ~~ELWS~~ 5/21/18 ELSWH01-004-GW-018

DATE: 5/21/18

PURGING DATA

WELL DIAMETER (inches): 2 in

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 20.11 Ft - 10.11 Ft

STATIC DEPTH TO WATER (feet BTOC): 15.02

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.36 Ft - 15.02 Ft) x 0.163 gal/ft = 0.87 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/21/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18

PURGING INITIATED AT: 1450

PURGING ENDED AT: 1510

TOTAL VOLUME PURGED ~~(gallons)~~ mL: 4000

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1455	1000	1000	200	15.2	7.22	13.2	746	8.51	14.6	19.0	clear	none
1500	1000	2000	200	15.2	7.37	12.7	725	8.10	4.2	14.7	|	|
1505	1000	3000	200	15.2	7.39	12.4	718	8.89	-1.5	14.3	|	|
1510	1000	4000	200	15.2	7.42	12.4	717	8.45	-3.9	9.74	|	↓

AT 5/21/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Tumbler

SAMPLER(S) SIGNATURE(S): Arek Tumbler

SAMPLING INITIATED AT: 1511

SAMPLING ENDED AT: 1512

PUMP OR TUBING DEPTH IN WELL (feet): 18

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH01-004-GW-018	2	PE	125				EPA 537M	APP	200

REMARKS: well pad complete.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

5/24

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**		Site: Site 1- Current FTA	
WELL NO: MW930107	SAMPLE ID: ELSWH01-MW930107-GW-034	DATE: ~~5-15-18~~	

PURGING DATA

WELL DIAMETER (inches): 30	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 34.5 Ft - 24.5 Ft	STATIC DEPTH TO WATER (feet BTOC): 31.81	PURGE PUMP TYPE OR BAILER: monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (34.5 Ft - 31.81 Ft) x 0.16 gal/ft = 0.43 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) N/A = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 30	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 30	PURGING INITIATED AT: 1534	PURGING ENDED AT: 1554	TOTAL VOLUME PURGED (gallons): 1.44

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. [✓ µS/cm]	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1534	—	—	0.06	31.9	—	—	—	—	—	—	Turbid	—
1538	0.43	0.43	0.06	31.87	8.21	17.7	0.128	3.38	68.9	379		
1540	0.12	0.60	0.06	31.86	8.24	16.9	0.124	3.13	55.9	228		
1542	0.12	0.72	0.06	31.88	8.25	16.7	0.119	3.00	53.7	143		
1545	0.18	0.90	0.06	31.9	8.23	16.6	0.115	2.89	52.1	83.5		
1550	0.30	1.20	0.06	32.5	8.24	16.3	0.114	2.85	51.0	57.2	Cloudy	
1554	0.24	1.44	0.06	31.90	8.21	16.1	0.110	2.79	49.7	16.4	Clear	none

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.willis/M.neibon	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1554	SAMPLING ENDED AT: 1556
PUMP OR TUBING DEPTH IN WELL (feet): 30	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH01-MW930107-GW-034	2	PE	125ml each				EPA 537M	* O	0.06 gal ~ 250mL

REMARKS: * Monsoon due to depth of water

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/16

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: 2 (pond #3)

WELL NO: MW18PFC0201 | SAMPLE ID: ELSWH02-001-GW-035 | DATE: 5/4/18

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 in OD | WELL SCREEN INTERVAL DEPTH: 40.13 Ft - 30.13 Ft | STATIC DEPTH TO WATER (feet BTOC): 15.49 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (40.38 Ft - 15.49 Ft) x 0.163 gal/ft = 4.06 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x ft) + gal = gal~~ AT 5/4/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 35 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 35 | PURGING INITIATED AT: 1130 | PURGING ENDED AT: 1230 | TOTAL VOLUME PURGED ~~(gallons)~~ mL: 21,000

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1140	3500	3,500	350	18.18	7.38	13.3	2939	0.89	24.1	295	cloudy	none
1150	3500	7000	350	19.03	7.34	13.9	3128	0.42	20.9	144	clear	|
1200	3500	10,500	350	19.85	7.39	13.2	3170	0.36	18.7	73.4	|	|
1210	3500	14,000	350	20.41	7.49	13.0	3334	0.24	16.0	22.9	|	|
1215	1750	15,750	350	20.30	7.55	13.5	3468	0.28	14.0	31.4	|	|
1220	1750	17,500	350	20.21	7.57	13.8	3537	0.32	12.1	8.45	|	|
1225	1750	19,250	350	20.12	7.57	13.7	3578	0.26	10.0	10.4	|	|
1230	1750	21,000	350	20.07	7.58	13.5	3565	0.18	7.1	5.57	|	|

AT 5/4/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski | SAMPLER(S) SIGNATURE(S): Arek Turolski | SAMPLING INITIATED AT: 1231 | SAMPLING ENDED AT: 1232

PUMP OR TUBING DEPTH IN WELL (feet): 35 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] | TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH02-001-GW-035	2	PE	125				EPA 537M	APP	350

REMARKS: Well pad not complete. TOC is 0.4' ags.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/67

AerostarSESLLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: Area 2 (pond #3)

WELL NO: MW18PFC0202 | SAMPLE ID: ELSWH02-002-GW-035 | DATE: 05/04/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 in OD	WELL SCREEN INTERVAL DEPTH: 40.14 Ft - 30.14 Ft	STATIC DEPTH TO WATER (feet BTOC): 16.49	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (40.39 Ft - 16.49 Ft) x 0.163 gal/ft = 3.9 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~

AT 5/4/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 35	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 35	PURGING INITIATED AT: 0845	PURGING ENDED AT: 0930	TOTAL VOLUME PURGED ~~(gallons)~~ mL: 15,750	

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
0850	1750	1,750	350	18.61	7.09	12.9	4127	4.63	171.9	34.9	clear	none
0900	3500	5,250	350	19.95	7.04	12.9	3933	4.17	155.6	26.0	|	|
0910	3500	8,750	350	22.32	7.04	12.8	3869	4.10	142.1	19.4	|	|
0920	3500	12,250	350	23.42	7.08	12.7	3801	3.07	130.6	11.6	|	|
0930	3500	15,750	350	24.15	7.09	13.1	3836	2.90	108.1	13.0	|	|
AR 5/4/18												

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski	SAMPLER(S) SIGNATURE(S): Arek Turolski	SAMPLING INITIATED AT: 0931	SAMPLING ENDED AT: 0932
PUMP OR TUBING DEPTH IN WELL (feet): 35	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH02-002-GW-035	2	PE	125				EPA 537M	APP	350

REMARKS: well pad not complete. TOC = 2.4' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/07

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**

Site: 2

WELL NO: MW 18PFC0203

SAMPLE ID: ELSWH02-003-GW013

DATE: 4/26/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 17.95 Ft - 7.95 Ft

STATIC DEPTH TO WATER (feet BTOC): 4.70

PURGE PUMP TYPE OR BAILER: APP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (18.20 Ft - 4.70 Ft) x 0.163 gal/ft = 2.2 gal

EQUIPMENT VOLUME PURGE: ~~1 EQUIPMENT VOL. = PUMP VOLUME +~~ (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft.) + gal = gal~~

A.T. 4/26/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 13

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 13

PURGING INITIATED AT: 1515

PURGING ENDED AT: 1540

TOTAL VOLUME PURGED ~~(gallons)~~ mL: 8750

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1520	1750	1750	350	4.78	7.02	8.5	4478	1.60	-106	24.2	clear	none
1525	1750	3500	350	4.80	7.01	8.1	4417	0.91	-106.1	10.6	|	|
1530	1750	5250	350	4.80	7.06	7.8	4277	0.26	-109.8	10.7	|	|
1535	1750	7000	350	4.80	7.05	8.0	4301	0.20	-115.0	8.57	|	|
1540	1750	8750	350	4.80	7.07	7.80	4281	0.14	-119.2	11.0		

AT 4/26/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1541

SAMPLING ENDED AT: 1542

PUMP OR TUBING DEPTH IN WELL (feet): 13

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH02-003-GW-013	2	PE	125				EPA 537M	APP	350

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**
Site: 2 (row 70, 80, 90)
WELL NO: MW18PFC0204
SAMPLE ID: ELSWH02-005-GW-040
DATE: 5/23/18

PURGING DATA

WELL DIAMETER (inches): 2
TUBING DIAMETER (inches): 1/2 in OD
WELL SCREEN INTERVAL DEPTH: 45.01 Ft - 35.01 Ft
STATIC DEPTH TO WATER (feet BTOC): 35.14
PURGE PUMP TYPE OR BAILER: Mega Monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (45.26 Ft - 35.14 Ft) x 0.163 gal/ft = 1.65 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
~~(only fill out if applicable) = gal (x Ft) + gal gal~~
AT
5/23/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 40
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 40
PURGING INITIATED AT: 1400
PURGING ENDED AT: 1434
TOTAL VOLUME PURGED ~~(gallons)~~ mL: 5400

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1410	1500	1500	150	35.95	7.53	19.6	425.7	5.76	22.1	143	Clear	none
1415	750	2250	150	36.15	7.39	20.3	428.7	5.41	26.1	104	|	|
1420	750	3000	150	36.45	7.33	18.5	410.7	6.56	29.2	148	|	|
1425	750	3750	150	37.00	7.35	17.0	394.5	5.30	31.7	150	|	|
1428	750	4500	150	37.14	7.38	17.4	397.4	4.92	30.1	190	|	|
1431	450	4950	150	37.25	7.37	18.3	404.7	5.58	30.6	206	|	|
1434	450	5400	150	37.30	7.38	18.6	407.3	4.96	30.2	232	|	|

AT
5/23/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski
SAMPLER(S) SIGNATURE(S): Arek Turolski
SAMPLING INITIATED AT: 1435
SAMPLING ENDED AT: 1436
PUMP OR TUBING DEPTH IN WELL (feet): 40
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N] Filter Size mm
Filtration Equipment Type:
FIELD DECONTAMINATION: PUMP [✓ Y] N TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH02-005-GW-040	2	PE	125				EPA 537M	ESP	150

REMARKS: well pad not complete. stickup: 1.0' ags
Took sample due to increasing turbidity and dropping water level.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)
SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings
pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: 2 (row 70)
WELL NO: MW18PFC020~~6~~5	SAMPLE ID: ELSWH02-006-GW-030 DATE: 5/4/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 MOD	WELL SCREEN INTERVAL DEPTH: 35.1 Ft - 25.1 Ft	STATIC DEPTH TO WATER (feet BTOC): 25.54	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (35.35 Ft - 25.54 Ft) x 0.163 gal/ft = 1.6 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/4/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 30	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 30	PURGING INITIATED AT: 1325	PURGING ENDED AT: 1349	TOTAL VOLUME PURGED ~~(gallons)~~ mL: 8400

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1330	1750	1750	350	25.55	7.30	15.8	3113	5.14	9.2	146	clear	none
1340	3500	5250	350	25.54	7.20	14.9	2979	5.17	2.5	12.8	|	|
1343	1050	6300	350	25.55	7.20	14.9	2976	4.98	3.2	8.89	|	|
1346	1050	7350	350	25.55	7.19	14.6	2959	5.43	4.4	6.01	|	|
1349	1050	8400	350	25.53	7.19	14.6	2952	5.74	5.4	4.72	|	|

AT 5/4/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Tuobski	SAMPLER(S) SIGNATURE(S): Arek Tuobski	SAMPLING INITIATED AT: 1350	SAMPLING ENDED AT: 1351
PUMP OR TUBING DEPTH IN WELL (feet): 30	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH02-006-GW-030	2	PE	125				EPA 537M	APP	350

REMARKS: well pad not complete. TOC is 1.29' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/07

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: 2 (rows 60, 70, 80, 90)

WELL NO: MW18PFC0206

SAMPLE ID: ELSWH02-007-GW-018

DATE: 5/18/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD.

WELL SCREEN INTERVAL DEPTH: 19.24 Ft - 9.24 Ft

STATIC DEPTH TO WATER (feet BTOC): 16.20

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (19.49 Ft - 16.20 Ft) x 0.163 gal/ft = 0.54 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18

PURGING INITIATED AT: 1112

PURGING ENDED AT: 1126

TOTAL VOLUME PURGED ~~(gallons)~~ mL: 1400

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1117	500	500	100	17.0	8.27	14.0	208.1	8.75	-8.6	5.84	clear	none
1120	300	800	100	17.3	8.00	13.5	200.7	8.46	1.8	10.1	|	|
1123	300	1100	100	17.5	7.85	13.2	189.0	7.17	10.4	8.51	|	|
1126	300	1400	100	17.75	7.93	13.3	187.2	7.28	6.9	10.00	|	|

AT 5/18/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski

SAMPLER(S) SIGNATURE(S): Arek Turolski

SAMPLING INITIATED AT: 1127

SAMPLING ENDED AT: 1129

PUMP OR TUBING DEPTH IN WELL (feet): 18

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH02-007-GW-018	2	PE	125				EPA 537M	APP	100

REMARKS: well pad complete. Sampled well without developing b/c it was dry on 5/8/18. water level dropped quickly today during sampling & kept dropping afterwords. well site is also in restricted area & access is limited.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/19

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: Site 2 (row 70, 80, 90)

WELL NO: MW18PFC0207

SAMPLE ID: ELSWH02-008-GW-029

DATE: 05/18/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 33.68 Ft - 23.68 Ft

STATIC DEPTH TO WATER (feet BTOC): 20.92

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (33.93 Ft - 20.97 Ft) x 0.163 gal/ft = 2.11 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/18/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 29'

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 29'

PURGING INITIATED AT: 0940

PURGING ENDED AT: 1015

TOTAL VOLUME PURGED ~~(gallons)~~ mL: 7000

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
0945	1000	1000	200	20.93	7.32	13.1	694	1.01	93.8	88.9	clear	none
0950	1000	2000	200	20.93	7.42	12.9	682	0.40	54.1	43.7	|	|
0955	1000	3000	200	20.93	7.48	12.9	678	0.33	0.2	28.2	|	|
1000	1000	4000	200	20.93	7.54	12.9	671	0.29	-34.0	23.3	|	|
1005	1000	5000	200	20.93	7.58	13.0	672	0.27	-51.1	17.4	|	|
1010	1000	6000	200	20.93	7.60	13.1	672	0.23	-68.8	16.2	|	|
1015	1000	7000	200	20.93	7.60	13.1	673	0.26	-84.9	13.2	|	|

AT 5/18/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turoski

SAMPLER(S) SIGNATURE(S): Arek Turoski

SAMPLING INITIATED AT: 1016

SAMPLING ENDED AT: 1017

PUMP OR TUBING DEPTH IN WELL (feet): 29

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH02-008-GW-029	2	PE	125				EPA 537M	APP	200
ESWH02-008-GW-929	2	PE	125				EPA 537M	APP	200

REMARKS: well pad complete.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**	Site: 3 (building 618)	
WELL NO: MW18PFC0301	SAMPLE ID: ELSWH03-001-GW-015	DATE: 5/24/18

PURGING DATA

WELL DIAMETER (inches): 2 ~~1/4 in OD~~ AT 5/24/18	TUBING DIAMETER (inches): 1/4 in OD	WELL SCREEN INTERVAL DEPTH: 20.13 Ft - 10.13 Ft	STATIC DEPTH TO WATER (feet BTOC): 9.01	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.38 Ft - 9.01 Ft) x 0.163 gal/ft = 1.85 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/24/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15	PURGING INITIATED AT: 1145	PURGING ENDED AT: 1208	TOTAL VOLUME PURGED ~~(gallons)~~ mL: 3450

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1150	750	750	150	9.39	7.71	14.5	461.6	1.84	-18.1	7.77	clear	none
1153	450	1200	150	9.45	7.54	14.2	458.6	1.01	-17.5	35.7		
1156	450	1650	150	9.51	7.52	13.8	449.3	0.80	-20.1	55.2		
1159	450	2100	150	9.55	7.63	13.6	442.4	0.77	-24.4	136.0		
1202	450	2550	150	9.57	7.84	13.2	439.2	0.76	-27.9	139.0		
1205	450	3000	150	9.60	7.73	13.2	438.0	0.83	-40.5	195		
1208	450	3450	150	9.60	7.81	13.1	437.5	0.83	-37.9	215		

AT 5/24/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski	SAMPLER(S) SIGNATURE(S): Arek Turolski	SAMPLING INITIATED AT: 1209	SAMPLING ENDED AT: 1210
PUMP OR TUBING DEPTH IN WELL (feet): 15	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH03-001-GW-015	2	PE	125				EPA 537M	APP	150

REMARKS: Well pad complete.
Took sample due to increasing turbidity.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

5/24

AerostarSESLLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003** Site: Site 3 (building 618)

WELL NO: MW18PFC0302 SAMPLE ID: ELSWH03-002-GW-017 DATE: 5/10/18

PURGING DATA

WELL DIAMETER (inches): 2 TUBING DIAMETER (inches): 1/4 in OD WELL SCREEN INTERVAL DEPTH: 20.08 Ft - 10.08 Ft STATIC DEPTH TO WATER (feet BTOC): 12.89 PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.33 Ft - 12.89 Ft) x 0.163 gal/ft = 1.22 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 17 FINAL PUMP OR TUBING DEPTH IN WELL (feet): 17 PURGING INITIATED AT: 1345 PURGING ENDED AT: 1420 TOTAL VOLUME PURGED (~~gallons~~) mL: 8500

TIME	VOLUME PURGED (~~gallons~~) mL	CUMUL. VOLUME PURGED (~~gallons~~) mL	PURGE RATE (~~gpm~~) mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1350	1500	1500	300	13.42	7.34	10.4	622	1.00	22.4	187	cloudy	none
1355	1500	3000	300	13.65	7.19	10.3	621	0.44	14.5	433	|	|
1400	1500	4500	300	13.61	7.19	10.2	623	0.64	5.1	551	|	|
1405	1000	5500	200	13.56	7.18	10.2	622	0.58	-2.8	325	|	|
1410	1000	6500	200	13.54	7.13	10.1	621	0.47	-12.1	106	clear	|
1415	1000	7500	200	13.54	7.13	10.0	618	0.31	-27.8	27.8	|	|
1420	1000	8500	200	13.54	7.17	10.0	613	0.24	-43.2	14.6	|	|

AT 5/10/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski SAMPLER(S) SIGNATURE(S): Arek Turolski SAMPLING INITIATED AT: 1421 SAMPLING ENDED AT: 1422

PUMP OR TUBING DEPTH IN WELL (feet): 17 TUBING MATERIAL CODE: PE FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH03-002-GW-017	2	PE	125				EPA 537M	APP	200

REMARKS: Well pad not complete, stickup = 1.51' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; **PE** = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: Site 3 (Building 618)

WELL NO: MW18PFC0303 | SAMPLE ID: ELSWH03-003-GW-016 | DATE: 5/10/18

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/4 in OD | WELL SCREEN INTERVAL DEPTH: 20.12 Ft - 10.12 Ft | STATIC DEPTH TO WATER (feet BTOC): 11.7 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.37 Ft - 11.7 Ft) x 0.163 gal/ft = 1.42 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 16 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 16 | PURGING INITIATED AT: 1225 | PURGING ENDED AT: 1320 | TOTAL VOLUME PURGED ~~(gallons)~~ mL: 16,500

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1230	1500	1500	300	12.42	7.44	9.8	491.2	5.45	39.5	138	clear	none
1235	1500	3000	300	12.69	7.16	9.6	464.0	5.58	25.1	588	cloudy	
1240	1500	4500	300	12.98	7.13	9.4	456.1	4.83	-3.2	OR		
1245	1500	6000	300	13.31	7.14	9.1	454.0	4.16	-36.6	OR		
1250	1500	7500	300	13.69	7.16	9.1	454.3	3.85	-53.9	OR		
1255	1500	9000	300	14.02	7.19	9.1	454.1	4.41	-55.9	963		
1300	1500	10500	300	14.41	7.15	9.0	453.9	4.33	-49.1	776		
1305	1500	12000	300	14.76	7.14	9.0	453.6	5.65	-38.3	OR		
1310	1500	13500	300	15.12	7.12	9.1	454.4	5.72	-34.5	608		
1315	1500	15000	300	15.48	7.11	9.2	454.0	5.96	-29.9	535		
1320	1500	16500	300	15.85	7.14	9.3	454.9	4.84	-26.5	603		

AT 5/10/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turobski | SAMPLER(S) SIGNATURE(S): Arek Turobski | SAMPLING INITIATED AT: 1321 | SAMPLING ENDED AT: 1322

PUMP OR TUBING DEPTH IN WELL (feet): 16 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] | TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH03-003-GW-016	2	PE	125				EPA 537M	APP	300

REMARKS: Well pad not complete. Stickup is 1.15' ags.
Well not clearing up. Took sample after 3 well volumes despite high turbidity.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/10

AerostarSES LLC

GROUNDWATER SAMPLING LOG *Well capped

Installation: Ellsworth AFB M2027.0003

Site: Site 4 - Former FTA

WELL NO: MW18PFC0401

SAMPLE ID: ELSWH04-001-GW-032

DATE: 5-31-18

PURGING DATA

WELL DIAMETER (inches): 2.0"

TUBING DIAMETER (inches): 1/4" OD

WELL SCREEN INTERVAL DEPTH: Ft - Ft

STATIC DEPTH TO WATER (feet BTOC): 26.37

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (34.06 Ft - 26.37 Ft) x 0.163 gal/ft = 1.25 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 32

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 32

PURGING INITIATED AT: 1720

PURGING ENDED AT: 1744

TOTAL VOLUME PURGED (gallons): 1.3

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. [✓ µS/cm]	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1720	—	—	0.05	26.4	—	—	—	—	—	—	Clear	none
1724	0.2	0.2	0.05	26.8	7.81	18.7	1638	3.99	72.2	207	Cloudy	
1728	0.2	0.4	0.05	27.03	7.79	18.2	1599	3.98	78.5	256		
1732	0.2	0.6	0.05	27.2	7.69	18.0	1589	3.86	84.6	181		
1736	0.2	0.8	0.05	27.44	7.53	18.3	1597	3.71	90.4	170		
1740	0.2	1.0	0.05	27.40	7.50	18.4	1598	3.68	94.8	156		
1744	0.2	1.2	0.05	27.82	7.49	18.5	1597	3.60	96.3	159		
1746	0.1	1.3	0.05	27.93	7.47	18.3	1599	3.58	97.2	165		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis (ASC)

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1746

SAMPLING ENDED AT: 1752

PUMP OR TUBING DEPTH IN WELL (feet): 32

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH04-001-GW-032	2	PE	125mL each				EPA 537M	APP	200

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

06/03

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: ~~[illegible]AFB~~ M2027.0003 ELLSWORTH AFB | Site: Site 4 - former FIRE station

WELL NO: MW18PFC0402 | SAMPLE ID: ELSWH04-002-GW-038 | DATE: 5-31-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 3/7" | *WELL SCREEN INTERVAL DEPTH: 43.51 Ft - 33.51 Ft | STATIC DEPTH TO WATER (feet BTOC): 29.28 | PURGE PUMP TYPE OR BAILER: Monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (*43.76 Ft - 29.28 Ft) x 0.163 gal/ft = 2.36 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) N/A = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 38 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 38 | PURGING INITIATED AT: 1346 | PURGING ENDED AT: 1412 | TOTAL VOLUME PURGED (gallons): 2.34

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. [✓ µS/cm]	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1346	–	–	0.09	30.1	–	–	–	–	–	–	OR	none
1350	0.36	0.36	0.09	31.5	7.82	13.6	1295	2.61	71.3	741	Cloud	
1354	0.36	0.72	0.09	32.7	7.82	14.5	1297	1.67	72.8	359		
1400	0.54	1.26	0.09	34.45	7.80	14.2	1278	2.41	75.6	274		
1404	0.36	1.62	0.09	35.1	7.78	14.3	1274	2.32	76.7	252		
1408	0.36	1.98	0.09	35.32	7.75	14.4	1280	2.45	72.8	265		
1412	0.36	2.34	0.09	35.67	7.73	14.4	1284	2.56	77.4	266		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. willis (ASC) | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1412 | SAMPLING ENDED AT: 1414

PUMP OR TUBING DEPTH IN WELL (feet): 38 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH04-002-GW-038	2	PE	125mL each				EPA 537M	APP	350

REMARKS: *well completed = TD - well end cap (0.25) = screen

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)
SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

8/03

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: ~~HIAFB~~ M2027.0003 ELLSWORTH AFB | Site: Site 4 - Former ~~FTA~~ Fire Station

WELL NO: MW18PFC10403 | SAMPLE ID: ELSWH04-003-GW-033 | DATE: 5-31-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 1/4 OD | *WELL SCREEN INTERVAL DEPTH: 38.67 Ft - 28.67 Ft | STATIC DEPTH TO WATER (feet BTOC): 27.48 | PURGE PUMP TYPE OR BAILER: mo-PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (*38.92 Ft - 27.48 Ft) x 0.163 gal/ft = 1.86 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 33 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 33 | PURGING INITIATED AT: 1132 | PURGING ENDED AT: 1150 | TOTAL VOLUME PURGED (gallons): ~~1.06~~ 0.9

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1132	—	—	0.05	27.48	~~7~~	—	—	—	—	—	Clear	none
1137	0.3	0.3	0.05	27.72	7.40	17.3	1295	3.42	102.7	71.9	|	|
1142	0.2	0.5	0.05	27.90	7.41	17.1	1273	2.89	102.3	55.0	|	|
1144	0.1	0.6	0.05	28.0	7.39	17.3	1269	2.75	100.4	36.6	|	|
1148	0.2	0.8	0.05	28.1	7.35	17.4	1266	2.63	98.1	28.1	|	|
1150	0.1	0.9	0.05	28.24	7.34	17.5	12.67	2.58	94.5	20.7	|	|

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis (ASL) | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1150 | SAMPLING ENDED AT: 1152

PUMP OR TUBING DEPTH IN WELL (feet): 33 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] | TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH04-003-GW-033	2	PE	125mL each				EPA 537M	APP	200

REMARKS: * well completed. Screen is TD - well end cap (0.25) = 38.67 - 28.67

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

06103

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**

Site: 5 (B-52 crash, 1970)

WELL NO: MW18PFC0501

SAMPLE ID: ELSWH05-001-GW-030

DATE: 5/4/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 in OD	WELL SCREEN INTERVAL DEPTH: 35.22 Ft - 25.22 Ft	STATIC DEPTH TO WATER (feet BTOC): 21.34	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (35.47 Ft - 21.34 Ft) x 0.163 gal/ft = 2.3 gal

~~EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME~~

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~

AT
5/4/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 30	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 30	PURGING INITIATED AT: 1500	PURGING ENDED AT: 1525
TOTAL VOLUME PURGED ~~(gallons)~~ mL: 8750			

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1505	1750	1750	350	22.56	7.28	14.2	2883	4.41	11.4	19.0	clear	none
1510	1750	3500	350	22.86	7.24	13.7	2807	3.53	-2.3	16.0	|	|
1515	1750	5250	350	22.98	7.22	13.4	2764	2.99	-17.0	12.5	|	|
1520	1750	7000	350	23.04	7.22	13.6	2772	2.77	-27.4	13.4	|	|
1525	1750	8750	350	23.16	7.20	13.3	2753	2.46	-34.9	10.3	|	|

AT
5/4/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turoski	SAMPLER(S) SIGNATURE(S): Arek Turoski	SAMPLING INITIATED AT: 1526	SAMPLING ENDED AT: 1527
PUMP OR TUBING DEPTH IN WELL (feet): 30	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH05-001-GW-030	2	PE	125				EPA 537M	APP	350

REMARKS: Well pad not complete. TOC is 1.14' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/07

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**
Site: 5 (B-52 crash, 1970)
WELL NO: MW18PFC0502
SAMPLE ID: ELSWH05-002-GW-025
DATE: 05/03/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 IN OD	WELL SCREEN INTERVAL DEPTH: 29.85 Ft - 19.85 Ft	STATIC DEPTH TO WATER (feet BTOC): 19.14	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (30.1 Ft - 19.14 Ft) x 0.163 gal/ft = 1.8 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/3/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 25'	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 25	PURGING INITIATED AT: 1535	PURGING ENDED AT: 1629	TOTAL VOLUME PURGED ~~(gallons)~~ mL 18,900

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1540	1750	1,750	350	19.65	7.43	12.2	2886	2.02	-32.6	159	clear	none
1545	1750	3,500	350	19.76	7.29	12.0	2848	1.07	-65.8	107	|	|
1550	1750	5,250	350	19.80	7.27	11.9	2869	0.96	-82.8	85.6	|	|
1555	1750	7,000	350	19.83	7.25	11.9	2920	0.92	-98.0	92.3	|	|
1600	1750	8,750	350	19.84	7.24	11.9	2969	0.97	-106.4	71.1	|	|
1610	3500	12,250	350	19.84	7.23	12.2	3136	0.98	-115.1	36.3	|	|
1620	3500	15,750	350	19.84	7.24	12.7	3266	1.64	-118.6	22.4	|	|
1623	1050	16,800	350	19.84	7.25	13.0	3308	1.55	-120.0	17.4	|	|
1626	1050	17,850	350	19.84	7.25	13.1	3316	1.70	-126.2	17.3	|	|
1629	1050	18,900	350	19.84	7.24	13.0	3322	1.70	-119.6	17.0	|	|
		AT 5/3/18										

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski	SAMPLER(S) SIGNATURE(S): Arek Turolski	SAMPLING INITIATED AT: 1630	SAMPLING ENDED AT: 1631
PUMP OR TUBING DEPTH IN WELL (feet): 25	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH05-002-GW-025	2	PE	125				EPA 537M	APP	350

REMARKS: well pad not complete, TOC is 0.9' above ground surface

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)
SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/07

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: 6 (1988 B-1 crash)

WELL NO: MW18PFC0601	SAMPLE ID: ELSWH06-001-GW-018	DATE: 5/9/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 m OD	WELL SCREEN INTERVAL DEPTH: 20.09 Ft - 10.09 Ft	STATIC DEPTH TO WATER (feet BTOC): 15.56	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.34 Ft - 15.56 Ft) x 0.163 gal/ft = 0.78 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) gal = (x Ft) + gal = gal

AT
5/9/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18	PURGING INITIATED AT: 1115	PURGING ENDED AT: 1132	TOTAL VOLUME PURGED ~~(gallons)~~ mL: 4250

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1120	1250	1250	250	15.69	7.40	13.8	521	6.34	15.1	89.6	clear	none
1123	750	2000	250	15.75	7.17	13.5	504	6.25	0.5	43.4	|	|
1126	750	2750	250	15.75	7.11	13.3	490.1	6.02	-8.7	18.8	|	|
1129	750	3500	250	15.75	7.14	13.1	476.2	7.00	-10.4	15.2	|	|
1132	750	4250	250	15.75	7.18	13.0	466.4	6.84	-9.6	12.6	|	|

AT
5/9/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turobski	SAMPLER(S) SIGNATURE(S): Arek Turobski	SAMPLING INITIATED AT: 1133	SAMPLING ENDED AT: 1134

PUMP OR TUBING DEPTH IN WELL (feet): 18	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filter Size mm Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH06-001-GW-018	2	PE	125				EPA 537M	APP	250

REMARKS: Well pad not complete. Stickup: 1.51' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/10

AerostarSES

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003** Site: 6 (1988 B-1 Crash)

WELL NO: MWL8PFC0602 SAMPLE ID: ELSWH06-002-GW-018 DATE: 5/9/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/4 in. OD	WELL SCREEN INTERVAL DEPTH: 20.11 Ft - 10.11 Ft	STATIC DEPTH TO WATER (feet BTOC): 15.52	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.36 Ft - 15.52 Ft) x 0.163 gal/ft = 0.8 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~

AT 5/9/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18	PURGING INITIATED AT: 1015	PURGING ENDED AT: 1034	TOTAL VOLUME PURGED (~~gallons~~) mL: 4500

TIME	VOLUME PURGED (~~gallons~~) mL	CUMUL. VOLUME PURGED (~~gallons~~) mL	PURGE RATE (~~gpm~~) mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1020	1500	1500	300	16.68	7.28	13.2	630	4.43	35.9	755	cloudy	none
1023	900	2400	300	17.05	7.13	13.0	564	4.49	35.6	394		
1026	900	3300	300	17.52	7.05	12.9	485	6.21	36.2	393		
1031	750	4050	150	17.65	7.14	14.4	508	5.71	32.6	700		
1034	450	4500	150	17.89	7.14	14.7	516	5.16	30.9	613		
	AT 5/9/18											

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski SAMPLER(S) SIGNATURE(S): Arek Turolski SAMPLING INITIATED AT: 1035 SAMPLING ENDED AT: 1043

PUMP OR TUBING DEPTH IN WELL (feet): 18 TUBING MATERIAL CODE: PE FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH06-002-GW-018	2	PE	125				EPA 537M	APP	150
ELSWH06-002-GW-018 MS/MSD	4	PE	125				EPA 537M	APP	150
ELSWH06-002-GW-918	2	PE	125				EPA 537M	APP	150

REMARKS: well pad not complete, Stickup: 1.23' ags. Due to restricted access of well site and dropping water level, took sample after one well volume purged despite high turbidity.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/10

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: 6 (1988 B-1 crash)

WELL NO: MW18PFC0603 | SAMPLE ID: ELSWH06-003-GW-055 | DATE: 5/7/18

PURGING DATA

WELL DIAMETER (inches): 2 | TUBING DIAMETER (inches): 1/2 in OD | WELL SCREEN INTERVAL DEPTH: 60.15 Ft - 50.15 Ft | STATIC DEPTH TO WATER (feet BTOC): 35.26 | PURGE PUMP TYPE OR BAILER: ESP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (60.40 Ft - 35.26 Ft) x 0.163 gal/ft = 4.1 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/7/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 55 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 55 | PURGING INITIATED AT: 1535 | PURGING ENDED AT: 1620 | TOTAL VOLUME PURGED ~~(gallons)~~ mL: 15,750

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1545	3500	3,500	350	38.95	6.74	15.0	4498	4.47	35.6	163	clear	none
1555	3500	7,000	350	42.76	6.73	14.4	4401	3.85	29.2	17.9		
1605	3500	10,500	350	46.26	6.75	14.6	4422	3.41	27.3	12.2		
1610	1750	12,250	350	47.42	6.74	14.7	4436	3.22	26.4	15.2		
1615	1750	14,000	350	48.87	6.74	14.6	4430	3.62	26.4	14.8		
1620	1750	15,750	350	50.61	6.73	14.9	4427	3.93	27.0	15.8		

AT 5/7/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski | SAMPLER(S) SIGNATURE(S): Arek Turolski | SAMPLING INITIATED AT: 1621 | SAMPLING ENDED AT: 1622

PUMP OR TUBING DEPTH IN WELL (feet): 55 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP [✓ Y] N | TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH06-003-GW-055	2	PE	125				EPA 537M	ESP	350

AT

REMARKS: Surface well pad not complete. well sticking: 0.88' ags

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: Site 7- Taxiway Delta Crash (2000)

WELL NO: MW18PFC0701

SAMPLE ID: ELSWH07-001-GW-035

DATE: 5-15-18

PURGING DATA

WELL DIAMETER (inches): 2.0"	TUBING DIAMETER (inches): 1/4" OD **	WELL SCREEN INTERVAL DEPTH: 40.13 Ft - 30.13 Ft	STATIC DEPTH TO WATER (feet BTOC): 14.80	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (** 40.38 Ft - 14.08 Ft) x 0.16 gal/ft = 4.21 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) N/A = gal = (x Ft) + gal gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 35	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 35	PURGING INITIATED AT: 1234	PURGING ENDED AT: 1255	TOTAL VOLUME PURGED (gallons): 0.84

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. [✓ µS/cm]	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1234	—	—	0.04	14.85	—	—	—	—	—	—	Clear	none
1240	0.24	0.24	0.04	16.45	7.07	13.7	0.294	2.54	-54.8	20.1	|	|
1245	0.20	0.44	0.04	16.96	7.17	13.5	0.297	2.75	-56.5	12.6	|	|
1250	0.20	0.64	0.04	17.34	7.18	13.3	0.300	2.73	-59.7	11.2	|	|
1255	0.20	0.84	0.04	18.25	7.17	13.1	0.302	2.52	-62.0	12.1	|	|

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.Willis CASL	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1255	SAMPLING ENDED AT: 1257
PUMP OR TUBING DEPTH IN WELL (feet): 35	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm
FIELD DECONTAMINATION:	PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
* ELSWH07-001-GW-035	2	PE	125mL each				EPA 537M	APP	150

REMARKS: * Rinseat ELSWH-RS-019 associated with this sample

** Well not completed

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

5/15

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: 7 (delta taxi west)

WELL NO: MW18PFC0702

SAMPLE ID: ELSWH07-002-GW-021

DATE: 5/21/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 25.65Ft - 15.65Ft

STATIC DEPTH TO WATER (feet BTOC): 14.09

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (25.9 Ft - 14.09 Ft) x 0.163 gal/ft = 1.93 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~

AT 5/21/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: ~~1680~~ 1650 AT 5/21/18

PURGING ENDED AT: 1714

TOTAL VOLUME PURGED ~~(gallons)~~: mL 4800

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1655	1000	1000	200	14.26	7.26	14.6	1644	2.77	-11.7	105	Clear	none
1700	1000	2000	200	14.28	7.17	13.8	1440	2.31	-14.7	54.9	|	|
1705	1000	3000	200	14.28	7.33	12.9	1244	4.88	-16.5	19.6	|	|
1708	600	3600	200	14.28	7.42	12.5	1209	6.30	-16.8	17.5	|	|
1711	600	4200	200	14.28	7.48	12.5	1193	6.99	-17.1	14.7	|	|
1714	600	4800	200	14.28	7.47	12.4	1184	7.18	-15.7	12.5	|	|

AT 5/21/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski

SAMPLER(S) SIGNATURE(S): Arek Turolski

SAMPLING INITIATED AT: 1715

SAMPLING ENDED AT: 1716

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH07-002-GW-021	2	PE	125				EPA 537M	APP	200

REMARKS: well pad complete

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/24

AerostarSESLLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**

Site: 7 (delta taxi west

WELL NO: MW18PFC0703

SAMPLE ID: ELSWH07-003-GW-021

DATE: 5/21/18

PURGING DATA

WELL DIAMETER (inches): 2

TUBING DIAMETER (inches): 1/4 in OD

WELL SCREEN INTERVAL DEPTH: 25.66 Ft - 15.66 Ft

STATIC DEPTH TO WATER (feet BTOC): 15.55

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (25.91 Ft - 15.55 Ft) x 0.163 gal/ft = 1.7 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal gal~~

AT
5/21/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 21

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 21

PURGING INITIATED AT: 1545

PURGING ENDED AT: 1620

TOTAL VOLUME PURGED ~~(gallons)~~: mL 5250

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/min	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1550	750	750	150	15.65	7.31	14.6	1037	4.10	-52.9	628	cloudy	none
1555	750	1500	150	15.65	7.25	13.3	999	4.25	-91.0	189	clear	none
1600	750	2250	150	15.65	7.32	12.7	1011	5.08	-98.3	97	|	|
1605	750	3000	150	15.65	7.37	12.5	1030	5.87	-102.5	61.4	|	|
1610	750	3750	150	15.65	7.37	12.4	1038	6.25	-104.6	33.6	|	|
1615	750	4500	150	15.65	7.50	12.1	1040	6.54	-106.6	22.6	|	|
1620	750	5250	150	15.65	7.49	12.2	1045	6.40	-108.3	18.8	|	|

AT
5/21/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Brek Turolski

SAMPLER(S) SIGNATURE(S): Brek Turolski

SAMPLING INITIATED AT: 1621

SAMPLING ENDED AT: 1622

PUMP OR TUBING DEPTH IN WELL (feet): 21

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH07-003-GW-021	2	PE	125				EPA 537M	APP	150

REMARKS: well pad complete.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: 8 (Marten crash 2006)

WELL NO: MW18PFC0801	SAMPLE ID: ELSWH08-001-GW-044	DATE: 5/1/18

PURGING DATA

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 1/2 in OD 3/8 ID	WELL SCREEN INTERVAL DEPTH: 51.28 Ft - 36.28 Ft	STATIC DEPTH TO WATER (feet BTOC): 16.03	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (51.58 Ft - 16.03 Ft) x 0.163 gal/ft = 5.78 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

~~(only fill out if applicable) = gal = (x Ft) + gal = gal~~ AT 5/1/18

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 44	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 44	PURGING INITIATED AT: 1010	PURGING ENDED AT: 1140	TOTAL VOLUME PURGED ~~(gallons)~~ mL: 22,500

TIME	VOLUME PURGED ~~(gallons)~~ mL	CUMUL. VOLUME PURGED ~~(gallons)~~ mL	PURGE RATE ~~(gpm)~~ mL/m	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1015	1250	1,250	250	17.24	6.68	10.6	25110	1.66	68.7	96.6	clear	none
1020	1250	2,500	250	17.72	6.76	10.7	24480	0.87	-19.1	175	clear	
1030	2500	5,000	250	18.40	6.87	10.9	24882	0.79	-57.7	278	cloudy	
1040	2500	7,500	250	19.05	6.94	10.9	24830	0.47	-83.8	381		
1050	2500	10,000	250	19.34	6.98	10.9	25361	0.34	-108.3	349		
1100	2500	12,500	250	19.42	7.02	10.8	25751	0.31	-122.3	353		
1110	2500	15,000	250	19.49	7.05	10.9	26202	0.28	-134.8	302		
1120	2500	17,500	250	19.54	7.08	11.0	26509	0.26	-134.1	262		
1130	2500	20,000	250	19.59	7.12	11.0	27157	0.25	-133.1	322		
1140	2500	22,500	250	19.62	7.15	11.1	27544	0.24	-136.8	718		

AT 5/1/18

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Arek Turolski	SAMPLER(S) SIGNATURE(S): Arek Turolski	SAMPLING INITIATED AT: 1141	SAMPLING ENDED AT: 1142
PUMP OR TUBING DEPTH IN WELL (feet): 44	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filtration Equipment Type:	Filter Size mm

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH08-001-GW-044	3	PE	125				EPA 537M	APP	250

REMARKS: Well pad not complete. Stick up of well ~0.35' ags. Collected sample after 1 well volume due to lack of decrease in turbidity. Collected 3 sample bottles due to turbidity.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: 8- Marten Crash

WELL NO: MW18PFC0802 | SAMPLE ID: ELSWH08-002-GW-045 | DATE: 4/26/18

PURGING DATA

WELL DIAMETER (inches): 2" | TUBING DIAMETER (inches): 1/4 | WELL SCREEN INTERVAL DEPTH: 49.38 Ft - 39.38 Ft | STATIC DEPTH TO WATER (feet BTOC): ~~49.63~~ 16.13 (MAN) | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (49.63 Ft - 16.13 Ft) x 0.16 gal/ft = 5.36 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) = 0 gal = (.0026 x 45 Ft) + .2 gal = 0.317 gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 45 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 45 | PURGING INITIATED AT: 1245 | PURGING ENDED AT: 1345 | TOTAL VOLUME PURGED (gallons): 5.40

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1245	-	-	.09	16.13	—	—	—	—	—	—	N	N
1255	0.90	0.90	.09	19.09	6.83	12.7	25037	1.39	-36.2	41.0	N	N
1305	~~1.80~~ 0.9	1.80	.09	20.73	6.81	12.6	24931	0.64	-40.0	31.6	N	N
1315	0.90	2.70	.09	21.99	6.86	12.6	25207	0.51	-48.7	14.7	N	N
1325	0.90	3.60	.09	22.83	6.86	12.5	25270	0.36	-55.8	15.6	N	N
1335	0.90	4.50	.09	23.38	6.86	12.7	25450	0.34	-62.5	11.3	N	N
1339	0.36	4.86	.09	23.45	6.87	12.6	25421	0.39	-63.9	9.47	N	N
1342	0.36	5.22	.09	23.46	6.87	12.6	25420	0.38	-64.1	8.68	N	N
1345	0.36	5.40	.09	23.49	6.86	12.7	25421	0.37	-65.4	7.45	N	N

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Miles Neilson | SAMPLER(S) SIGNATURE(S): Miles Matou | SAMPLING INITIATED AT: 1345 | SAMPLING ENDED AT: 1346

PUMP OR TUBING DEPTH IN WELL (feet): 45 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] | Filter Size mm
Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH08-002-GW-045	2	PE	125 each				EPA 537M	PP	350

REMARKS: well completed

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: 8 Marten Crash

WELL NO: MW18PFC0803 | SAMPLE ID: ELSWH08-003-GW-045 | DATE: 4/26/2018

PURGING DATA

WELL DIAMETER (inches): 2" | TUBING DIAMETER (inches): .17 ID 1/4 OD | WELL SCREEN INTERVAL DEPTH: 50.13 Ft - 40.13 Ft | STATIC DEPTH TO WATER (feet BTOC): 16.14 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) ~~34.24~~ MAN 5.48 = (50.38 Ft - 16.14 Ft) x 0.16 gal/ft = ~~34.24~~ gal MAN 5.48

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) = 0.0 gal = (.0026 x 45 Ft) + .2 gal = 0.317 gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 45 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 45 | PURGING INITIATED AT: 1010 | PURGING ENDED AT: 1139 | TOTAL VOLUME PURGED (gallons): 5.62

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1010	—	~~2.00~~ .05	.05	16.14	—	—	—	—	—	—	None	None
1015	~~.26~~ .05	0.26	.05	18.80	6.82	12.10	23800	2.30	138.5	21.9	N	N
1020	.25	0.50	.05	20.05	6.83	12.10	23719	2.15	103.2	22.1	N	N
1025	.25	0.75	.05	20.55	6.81	12.20	23776	2.25	94.7	25.7	N	N
1030	.25	1.00	.05	20.91	6.82	12.20	23712	2.26	83.5	17.9	N	N
1040	0.50	1.50	.05	21.65	6.56	12.20	23736	2.53	51.6	21.0	N	N
1050	0.50	2.00	.05	22.30	6.79	12.30	23785	2.09	42.6	20.2	N	N
1100	0.50	2.50	~~.05~~	22.80	6.78	12.3	23880	2.24	33.5	25.5	N	N
1110	~~0.80~~	3.30	.08	22.90	6.76	12.40	24013	2.08	28.5	17.1	N	N
1120	0.8	4.10	.08	24.85	6.75	12.4	24285	1.47	19.1	30.5	N	N
1130	0.8	4.90	.08	25.45	6.76	12.4	24379	1.43	13.8	11.6	N	N
1133	0.24	5.14	.08	25.6	6.77	12.4	24418	1.33	8.5	7.85	N	N
1136	0.24	5.38	.08	25.5	6.78	12.3	24403	1.36	6.4	7.97	N	N
1139	0.24	5.62	.08	25.55	6.77	12.5	24405	1.29	3.5	7.81	N	N

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Ash Willis / ASL Miles Nelson / ASL | SAMPLER(S) SIGNATURE(S): Miles Nelson | SAMPLING INITIATED AT: 1139 | SAMPLING ENDED AT: 1143

PUMP OR TUBING DEPTH IN WELL (feet): 45' | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH08-003-GW-045	2	PE	125 each				EPA 537M	PP	200

REMARKS: Well Completed

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/10

AerostarSES LLC

GROUNDWATER SAMPLING LOG *(well completed)

Installation: ~~HI AFB M2027.0003~~ ELLSWORTH AFB | Site: Site 9

WELL NO: MW18PFC0901A | SAMPLE ID: ELSWH09-001-GW-033A | DATE: 5-31-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 1/4" | WELL SCREEN INTERVAL DEPTH: 35.13 Ft - 25.13 Ft | STATIC DEPTH TO WATER (feet BTOC): 31.70 | PURGE PUMP TYPE OR BAILER: O ~~PP~~ Monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) * = (33.91 Ft 31.70 Ft) x 0.163 gal/ft = 0.36 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA ~~= gal = (x Ft) + gal = gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 33 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 33 | PURGING INITIATED AT: ~~1602~~ 1558 | PURGING ENDED AT: 1602 | TOTAL VOLUME PURGED (gallons): 0.28

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1558	—	—	0.08	31.53	—	—	—	—	—	—	Turbid	none
1602	0.27	0.28	0.08	33.50	7.45	18.1	3978	3.23	865	OR		
		Took Sample – about to run well dry.										

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.Willis (ASL) | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1602 | SAMPLING ENDED AT: 1604

PUMP OR TUBING DEPTH IN WELL (feet): 33 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH09-001-GW-033A	*3	PE	125mL each				EPA 537M	monsoon O	300

REMARKS: * Due to turbidity – 3 bottles sampled

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

06/01

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: ~~HFLAFB - M2027.000~~ ELLSWORTH AFB | Site: Site 9.

WELL NO: MW18PFC0902A | SAMPLE ID: ELSWH09-002-GW-030A | DATE: 5-31-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 1/4" OD | WELL SCREEN INTERVAL DEPTH: 34.86 Ft - 24.86 Ft | STATIC DEPTH TO WATER (feet BTOC): 26.73 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (35.55 Ft - 26.73 Ft) x 0.163 gal/ft = 1.43 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) N/A ~~= gal = (x Ft) + gal gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 30 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 30 | PURGING INITIATED AT: 156 | PURGING ENDED AT: | TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. [✓ µS/cm]	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1516	—	—	0.05	26.92	—	—	—	—	—	—	Clear	none
1518	0.1	0.1	0.05	27.23	7.58	16.5	1242	3.11	123.0	121		
1522	0.25	0.35	0.05	27.40	7.77	16.3	1130	3.62	124.6	96.5		
1524	0.1	0.45	0.05	27.53	7.75	16.5	1128	3.64	124.6	52.4		
1528	0.25	~~0.55~~70	0.05	27.83	7.76	16.5	1120	3.50	122.4	24.1		
1532	0.25	0.95	0.05	28.01	7.74	16.7	1128	3.54	119.9	20.2		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.Willis / ASL | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1532 | SAMPLING ENDED AT: 1535

PUMP OR TUBING DEPTH IN WELL (feet): 30 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH09-002-GW-030A	2	PE	125mL each				EPA 537M	APP	150

REMARKS: PAD not completed

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

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AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003
Site: SITE 10 - WWTP
WELL NO: MW18PFC1001
SAMPLE ID: ELSWH10-001-GW-045
DATE: 5-19-18

PURGING DATA

WELL DIAMETER (inches): 2.0"
TUBING DIAMETER (inches): 1/4" OD
WELL SCREEN INTERVAL DEPTH: 50.14 Ft - 40.14 Ft
STATIC DEPTH TO WATER (feet BTOC): 9.81
PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (50.39 Ft - 9.81 Ft) x 0.16 gal/ft = 6.6 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) NA = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 45
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 45
PURGING INITIATED AT: 1020
PURGING ENDED AT: 1036
TOTAL VOLUME PURGED (gallons): 0.64

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1020	—	—	0.04	9.80	—	—	—	—	—	—	clear	none
1025	0.2	0.2	0.04	9.91	7.46	10.2	5.41	1.82	61.9	17.4		
1028	0.12	0.32	0.04	10.25	7.63	10.3	5.43	1.79	62.3	18.0		
1032	0.16	0.48	0.04	11.21	7.60	10.3	5.50	1.68	62.5	11.1		
1036	0.16	0.64	0.04	12.68	7.60	10.4	5.52	1.64	61.4	16.3		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis M. Neilson (ASL)
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1036
SAMPLING ENDED AT: 1038
PUMP OR TUBING DEPTH IN WELL (feet): 45
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N] Filter Size mm
Filtration Equipment Type:
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
ELSWH10-001-GW-045	2	PE	125 mL each				EPA 537M	APP	150

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)
SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings
pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

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AerostarSES

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: Site 10 - WWTP

WELL NO: AW18PFC1002

SAMPLE ID: ELSWH10-002-GW-035

DATE: 5-19-18

PURGING DATA

WELL DIAMETER (inches): 20.0"

TUBING DIAMETER (inches): 1/4 OD

WELL SCREEN INTERVAL DEPTH: 40.15 Ft - 30.15 Ft

STATIC DEPTH TO WATER (feet BTOC): 10.85

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (40.40 Ft - 10.85 Ft) x 0.16 gal/ft = ~~4.68~~ 4.73 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 35

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 35

PURGING INITIATED AT: 0910

PURGING ENDED AT: 0932

TOTAL VOLUME PURGED (gallons): 0.88

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~uS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
0910	—	—	0.04	12.24	—	—	—	—	—	—		
0914	0.16	0.16	0.04	12.24	7.49	10.3	4.72	0.95	74.2	30.2	Clear	none
0920	0.24	0.40	0.04	13.02	7.46	10.4	4.74	0.75	69.5	21.4		
0925	0.20	0.60	0.04	13.71	7.45	10.5	4.74	0.70	63.3	18.2		
0932	0.28	0.88	0.04	14.63	7.45	10.6	4.74	0.65	62.9	6.85		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis M. Neilson (ASL)

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 0932

SAMPLING ENDED AT: 0936

PUMP OR TUBING DEPTH IN WELL (feet): 35

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: [✓ Y] N

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH10-002-GW-035	2	PE	125ml each				EPA 537M	APP	150
ELSWH10-002-GW-935	2	PE	125ml each				"	"	"

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

* Well completed

Installation: ~~TN AFB~~ M2027.0003 ELLSWORTH AFB

Site: Site 10 - WWTP

WELL NO: MW18PFC1003

SAMPLE ID: ELSWH10-003- GW-0~~45~~ 59

DATE: 6-3-18

PURGING DATA

WELL DIAMETER (inches): 2.0"

TUBING DIAMETER (inches): 3/8"

* WELL SCREEN INTERVAL DEPTH: 59.28 Ft - 49.28 Ft

STATIC DEPTH TO WATER (feet BTOC): 56.~~3~~8 4

PURGE PUMP TYPE OR BAILER: Monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (*59.53 Ft - 56.48 Ft) x 0.163 gal/ft = 0.49 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) N/A ~~= gal = (x Ft) + gal = gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 59

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 59

PURGING INITIATED AT: 1512

PURGING ENDED AT: 1518

TOTAL VOLUME PURGED (gallons): 0.30

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. µS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1512	—	—	0.05	56.29	—	—	—	—	—	—	—	—
1514	0.1	0.1	0.05	57.65	7.61	15.7	1355	6.01	172.1	OR	Turbid	none
1516	0.1	0.2	0.05	57.25	7.47	16.0	1352	1.99	146.8	OR	↓	↓
1517	0.05	0.25	0.05	**	7.49	16.2	1359	1.97	133.1	OR	↓	↓
1518	0.05	0.30	0.05	**	—	—	—	—	—	—	↓	↓

Well Dry After sample (1518)

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis / J. Voight (4) L

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1517

SAMPLING ENDED AT: 1518

PUMP OR TUBING DEPTH IN WELL (feet): 59

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N(replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH10-003-GW-059	3	PE	125mL each				EPA 537M	APP	200

REMARKS: * Well completed
** Water level below monsoon, WL meter on top of monsoon - no WL reading.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria (for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003

Site: Site 11- SPRAY NOZZLE TEST AREA

WELL NO: MW18PPC1101

SAMPLE ID: ELSWH11-001-GW-015

DATE: 5-20-18

PURGING DATA

WELL DIAMETER (inches): 2.0

TUBING DIAMETER (inches): 1/4" OD

WELL SCREEN INTERVAL DEPTH: 19.99 Ft - 9.95 Ft

STATIC DEPTH TO WATER (feet BTOC): 13.95

PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.2 Ft - 13.95 Ft) x 0.163 gal/ft = 1.02 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA ~~= gal = (x Ft) + gal gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15

FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15

PURGING INITIATED AT: 1556

PURGING ENDED AT: 1614

TOTAL VOLUME PURGED (gallons): 0.80

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ @ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1556	—	—	0.04	14.00	—	—	—	—	—	—	Cloudy @ ~~Clear~~	none
1600	0.16	0.16	0.04	14.00	7.72	11.0	0.78	6.78	-152.0	406		
1604	0.16	0.32	0.04	14.00	7.70	10.9	0.78	7.00	-159.1	153		
1608	0.16	0.48	0.04	14.00	7.67	10.7	0.77	6.89	-181.5	84.7		
1612	0.16	0.64	0.04	14.00	7.70	10.7	0.77	6.76	-183.9	64	Clear	
1614	0.16	0.80	0.04	14.00	7.72	10.6	0.77	6.80	-186.3	68		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis
M. Neilson (ASC)

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1614

SAMPLING ENDED AT: 1618

PUMP OR TUBING DEPTH IN WELL (feet): 15

TUBING MATERIAL CODE: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH11-001-GW-015	2	PE	125mL each				EPA 537M	APP	150

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/20

AerostarSESLLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: Site 11- SPRAY NOZZLE TEST AREA

WELL NO: MW19PFC1102 | SAMPLE ID: ELSWH11-002-GW-015 | DATE: 5-20-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 1/4" OD | WELL SCREEN INTERVAL DEPTH: 20.15 Ft - 10.05 Ft | STATIC DEPTH TO WATER (feet BTOC): 10.91 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (20.3 Ft - 10.91 Ft) x 0.163 gal/ft = 1.53 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA = gal = (x Ft) + gal = gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15 | PURGING INITIATED AT: 1442 | PURGING ENDED AT: 1500 | TOTAL VOLUME PURGED (gallons): 0.68

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1442	—	—	0.04	10.90	—	—	—	—	—	—	Clear	none
1446	0.16	0.16	0.04	11.02	8.07	10.9	0.404	1.45	176.9	131		
1450	0.16	0.32	0.04	11.05	7.95	10.6	0.401	1.40	173.4	80.4		
1455	0.16	0.48	0.04	11.05	7.92	10.3	0.407	0.79	167.8	48.9		
1458	0.12	0.60	0.04	11.05	7.90	10.2	0.410	0.77	162.2	25.2		
1500	0.08	0.68	0.04	11.05	7.93	10.2	0.409	0.77	161.9	28.2		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis M. Neilson (ASL) | SAMPLER(S) SIGNATURE(S): | SAMPLING INITIATED AT: 1500 | SAMPLING ENDED AT: 1502

PUMP OR TUBING DEPTH IN WELL (feet): 15 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y N (replaced) | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH11-002-GW-015	2	PE	125mL each				EPA 537M	APP	150

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/20

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003	Site: Site 11 – SPRAY NOZZLE TEST AREA
WELL NO: MW18PFC1103	SAMPLE ID: ELSWH11-003-GW-020 DATE: 5-20-18

PURGING DATA

WELL DIAMETER (inches): 2.0"	TUBING DIAMETER (inches): 1/4OD"	WELL SCREEN INTERVAL DEPTH: 25.15 Ft - 15.15 Ft	STATIC DEPTH TO WATER (feet BTOC): 13.55	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (25.4 Ft - 13.55 Ft) x 0.163 gal/ft = 1.93 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) NA ~~= gal = (x Ft) + gal = gal~~

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 20	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 20	PURGING INITIATED AT: 1524	PURGING ENDED AT: 1534	TOTAL VOLUME PURGED (gallons): 0.40

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1524	–	–	0.04	13.55	–	–	–	–	–	–	clear	none
1528	0.16	0.16	0.04	14.10	7.78	10.5	0.95	4.60	148.9	28.1	↓	↓
1530	0.08	0.24	0.04	14.45	7.79	10.6	0.95	4.04	-150.1	118	↓	↓
1532	0.08	0.32	0.04	14.8	7.82	10.5	0.94	3.95	-158.3	186	cloudy	↓
1534	0.08	0.40	0.04	14.91	7.85	10.4	0.94	4.00	-170.6	192	↓	↓

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.Willis M.Neilson	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1524	SAMPLING ENDED AT: 1526
PUMP OR TUBING DEPTH IN WELL (feet): 20	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y [✓ N] Filter Size mm Filtration Equipment Type:	
FIELD DECONTAMINATION: PUMP Y [✓ N]	TUBING Y [✓ N (replaced)]	DUPLICATE: Y [✓ N]	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH11-003-GW-020	2	PE	125mL each				EPA 537M	APP	150

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

05/20

AerostarSES

GROUNDWATER SAMPLING LOG

Installation: Ellsworth AFB M2027.0003 | Site: Site 12 - Building

WELL NO: MW BPFC1201 | SAMPLE ID: ELSWH12-001-GW-032 | DATE: 4-25-18

PURGING DATA

WELL DIAMETER (inches): 2.0" | TUBING DIAMETER (inches): 1/4" OD | WELL SCREEN INTERVAL DEPTH: 37.05 Ft - 27.05 Ft | STATIC DEPTH TO WATER (feet BTOC): 13.55 | PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (37.30 Ft - 13.65 Ft) x 0.163 gal/ft = 3.87 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) = 0 gal = (0.0026 x 32 Ft) + 0.2 gal = 0.28 gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 32 | FINAL PUMP OR TUBING DEPTH IN WELL (feet): 32 | PURGING INITIATED AT: 1210 | PURGING ENDED AT: 1255 | TOTAL VOLUME PURGED (gallons): 3.85

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1210	—	—	0.05	13.55	—	—	—	—	—	—	Clear	none
1215	0.25	0.25	0.05	13.62	7.45	11.6	19.45	7.45	189.2	165	Cloudy	
1220	0.45	0.70	0.09	14.20	7.45	11.5	19.50	7.40	193.0	130		
1225	0.45	1.15	0.09	17.72	7.50	11.5	19.57	8.37	192.3	189		
1230	0.45	1.6	0.09	21.01	7.51	11.3	19.57	8.35	191.7	185		
1235	0.45	2.05	0.09	24.5	7.50	11.3	19.52	8.33	189.3	167		
1245	0.9	2.95	0.09	25.94	7.50	11.4	19.53	8.31	187.0	161		
1255	0.9	3.85	0.09	26.75	7.51	11.4	19.50	8.33	185.2	157		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis | SAMPLER(S) SIGNATURE(S): AW | SAMPLING INITIATED AT: 1255 | SAMPLING ENDED AT: 1257

PUMP OR TUBING DEPTH IN WELL (feet): 32 | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y [✓ N] Filter Size mm | Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)] | DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH12-001-GW-032	2	PE	125mL each				EPA 537M	APP	350

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AW 5/10

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**
Site: Area 12 - Building 88240
WELL NO: MWPFC1202
SAMPLE ID: ELSWH12-002-GW-045
DATE: 4/22/2018

PURGING DATA

WELL DIAMETER (inches): 2"
TUBING DIAMETER (inches): 3/8" ID
WELL SCREEN INTERVAL DEPTH: 50.15 Ft - 40.15 Ft
STATIC DEPTH TO WATER (feet BTOC): 30.26
PURGE PUMP TYPE OR BAILER: Monsoon

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable) = (50.40 Ft - 30.26 Ft) x 0.163 gal/ft = 3.28 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable) = 0 gal = (0.006 x 45 Ft) + 0.20 gal = 0.47 gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 45
FINAL PUMP OR TUBING DEPTH IN WELL (feet): 45
PURGING INITIATED AT: 1414
PURGING ENDED AT: 1502
TOTAL VOLUME PURGED (gallons): 3.48

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	~~COLOR~~ (describe)	~~ODOR~~ (describe)
1414	—	—	0.05	29.79	—	—	—	—	—	—	cloudy	none initiated
1422	0.4	0.4	0.05	33.82	7.20	13.8	11.04	5.24	190.9	565	|	|
1427	0.25	0.65	0.05	33.88	7.20	14.1	11.10	5.07	193.1	589	|	|
1437	0.30	0.95	0.05	34.77	7.21	14.0	11.05	5.14	191.9	539	|	|
1440	0.63	1.58	0.09	35.79	7.22	14.3	11.05	5.20	189.9	497	|	|
1450	0.90	2.48	0.09	35.38	7.21	14.4	10.97	5.30	188.9	358	|	|
1500	0.90	3.38	0.09	35.91	7.20	14.6	11.03	5.30	187.4	223	|	|
1502	0.10	3.48	0.05	36.08	7.20	14.8	11.03	5.20	186.3	199	|	|

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A.Willis/M. Neilson(ASES)
SAMPLER(S) SIGNATURE(S):
SAMPLING INITIATED AT: 1502
SAMPLING ENDED AT: 1504
PUMP OR TUBING DEPTH IN WELL (feet): 45
TUBING MATERIAL CODE: PE
FIELD-FILTERED: Y [✓ N] Filter Size mm
Filtration Equipment Type:
FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]
DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Standard Units)			
ELSWH12-002-GW-045	2	PE	125mL each				EPA 537M	O Monsoon	200

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)
SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump;
RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

4/22/18

AerostarSES LLC

GROUNDWATER SAMPLING LOG

Installation: **Ellsworth AFB M2027.0003**

Site: Site 12 - Building 88240

WELL NO: MW18PFC1203

SAMPLE ID: ~~MW18PFC12-003-GW-016~~ ELSWH12-003-GW-016

DATE: 4-22-18

PURGING DATA

WELL DIAMETER (inches): 2.0"	TUBING DIAMETER (inches): 3/8" ID	WELL SCREEN INTERVAL DEPTH: 17.73 Ft - 7.73 Ft	STATIC DEPTH TO WATER (feet BTOC): 12.87	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH BTOC – STATIC DEPTH TO WATER) X WELL CAPACITY

(only fill out if applicable) = (17.93 Ft - 12.87 Ft) x 0.163 gal/ft = 0.83 gal

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME

(only fill out if applicable) = 0 gal = (0.006 x 16 Ft) + 0.20 gal = 0.29 gal

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 16	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 16	PURGING INITIATED AT: 1538	PURGING ENDED AT: 1555	TOTAL VOLUME PURGED (gallons): 0.85

TIME	VOLUME PURDED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet BTOC)	pH (standard units)	TEMP. (°C)	COND. ~~µS/cm~~ mS/cm	DISSOLVED OXYGEN mg/L	ORP (mV)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
1538	—	—	0.05	12.87	—	—	—	—	—	—	Clear	none
1542	0.20	0.20	0.05	13.45	7.50	11.8	16.61	10.03	207.4	167	⊥	
1546	0.20	0.40	0.05	13.99	7.50	11.4	16.20	9.53	200.7	308	Cloudy	
1550	0.20	0.60	0.05	14.35	7.49	11.3	15.00	9.56	197.3	421		
1555	0.25	0.85	0.05	14.71	7.45	11.3	15.01	9.50	191.3	400	⊥	⊥

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: A. Willis
M. Neilson (ASL)

SAMPLER(S) SIGNATURE(S):

SAMPLING INITIATED AT: 1555

SAMPLING ENDED AT: 1557

PUMP OR TUBING DEPTH IN WELL (feet): 16

TUBING MATERIAL ~~CODE~~: PE

FIELD-FILTERED: Y [✓ N] Filter Size mm

Filtration Equipment Type:

FIELD DECONTAMINATION: PUMP Y [✓ N] TUBING Y [✓ N (replaced)]

DUPLICATE: Y [✓ N]

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME (mL)	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH (Stanard Units)			
ELSWH12-003-GW-016	2	PE	125mL each				EPA 537M	APP	200

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

4/22/18

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE WATER / GROUNDWATER (GRAB)

Project Name: Site Inspections of AFFF Areas (USACE Omaha District)

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Date: 4-26-18

Sample Technician(s): A. Willis

Station ID: ELSWH02-004

Location Description:
3500', 240° SW of Building 7219 between Row 90 and Row 80

Type(s) of Sample (circle all that apply): [✓ Sediment] [✓ Surface Water] Groundwater

Sample Collected from (circle one): Channel/Ditch Holding Pond/Lagoon [✓ Lake/Pond] River/Stream Trench Other Pond #3

SEDIMENT SAMPLE

MS/MSD
ELSWH02-004-SD-901

Sample ID:	ELSWH02-004-SD-001	Sample Collection Time:	1440
Sample Depth:	0 -0.5	Sediment Description:	silt/organics
Collection Method:	Spoon	Analysis/Method:	EPA 537M
Sample Container:	3, 250mL PE	Preservative:	NONE

SURFACE WATER SAMPLE

MS/MSD
ELSWH02-004-SW-901

Sample ID:	ELSWH02-004-SW-001	Sample Collection Time:	1440
Sample Depth:	0 - 0.5	Collection Method:	GRAB
Analysis/Method:	EPA 537M	Sample Container:	8, 125mL PE
Preservative:	NONE	Water Quality (circle one):	[✓ Clear] Cloudy Turbid Other

GROUNDWATER SAMPLE (GRAB)

Sample ID:		Sample Collection Time:	
Sample Depth:		Collection Method:	
Analysis/Method:	EPA 537M	Sample Container:	
Preservative:	NONE	Water Quality (circle one):	Clear Cloudy Turbid Other

COMMENTS:

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE WATER / GROUNDWATER (GRAB)

Project Name: Site Inspections of AFFF Areas (USACE Omaha District)

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Date: 5-16-18

Sample Technician(s): A. Willis

Station ID: SW18PFC1004

Location Description:
475' SE of Building 3005

Type(s) of Sample (circle all that apply): [✓ Sediment] [✓ Surface Water] Groundwater

Sample Collected from (circle one): Channel/Ditch Holding Pond/Lagoon Lake/Pond River/Stream [✓ Trench] Other ____________

SEDIMENT SAMPLE

Sample ID: ELSWH10-004-SD-001
Sample Collection Time: 0945
Sample Depth: 0-0.5'
Sediment Description: organic silt
Collection Method: Spoon
Analysis/Method: EPA 537M
Sample Container: 1, 250mL
Preservative: NONE

SURFACE WATER SAMPLE

Sample ID: ELSWH10-004-SW-001
Sample Collection Time: 0945
Sample Depth: 0-0.5'
Collection Method: GRAB
Analysis/Method: EPA 537M
Sample Container: 2, 125mL each
Preservative: NONE
Water Quality (circle one): [✓ Clear] Cloudy Turbid Other

GROUNDWATER SAMPLE (GRAB)

Sample ID:
Sample Collection Time:
Sample Depth:
Collection Method:
Analysis/Method: EPA 537M
Sample Container:
Preservative: NONE
Water Quality (circle one): Clear Cloudy Turbid Other

COMMENTS: GPS ✓

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE WATER / GROUNDWATER (GRAB)

Project Name: Site Inspections of AFFF Areas (USACE Omaha District)

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Date: 5/16/18

Sample Technician(s): A.Willis

Station ID: SW18PFC1106

Location Description:

1300", 280 SW of Pump house #2

Type(s) of Sample (circle all that apply): [✓ Sediment] [✓ Surface Water] Groundwater

Sample Collected from (circle one): [✓ Channel/Ditch] Holding Pond/Lagoon Lake/Pond River/Stream Trench Other ____________

SEDIMENT SAMPLE

Sample ID: ELSWH11-006-SD-001

Sample Collection Time: 0900

Sample Depth: 0-0.5'

Sediment Description: organic silt

Collection Method: Spoon

Analysis/Method: EPA 537M

Sample Container: 1, 250mL

Preservative: NONE

SURFACE WATER SAMPLE

Sample ID: ELSWH11-006-SW-001

Sample Collection Time: 0900

Sample Depth: 0-0.5'

Collection Method: grab

Analysis/Method: EPA 537M

Sample Container: 2, 125mL each

Preservative: NONE

Water Quality (circle one): [✓ Clear] Cloudy Turbid Other

GROUNDWATER SAMPLE (GRAB)

Sample ID: ____________

Sample Collection Time: ____________

Sample Depth: ____________

Collection Method: ____________

Analysis/Method: EPA 537M

Sample Container: ____________

Preservative: NONE

Water Quality (circle one): Clear Cloudy Turbid Other

COMMENTS: GPS ✓

05/19

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE WATER / GROUNDWATER (GRAB)

Project Name: Site Inspections of AFFF Areas (USACE Omaha District)

ASL Project No: M2027.0003

Installation: **Ellsworth AFB**

Date: 4-22-18

Sample Technician(s): A. Willis / M. Neilson

Station ID: ~~70, 80, 90 Rows and Outfall #3 (Pond #3)~~ SW18PFC ~~0204~~ **1204 Site 12 - Building 88240**

Location Description:

3225', 210° SW of building 7230 near Row 90

Type(s) of Sample (circle all that apply): [✓ Sediment] [✓ Surface Water] Groundwater

Sample Collected from (circle one): Channel/Ditch Holding Pond/Lagoon Lake/Pond River/Stream Trench [✓ Other Culvert]

SEDIMENT SAMPLE

Sample ID:	ELSWH12-004-SD-001	Sample Collection Time:	1615
Sample Depth:	0-0.6	Sediment Description:	Sandy silt
Collection Method:	spoon	Analysis/Method:	EPA 537M
Sample Container:	1, 250mL PE	Preservative:	NONE

SURFACE WATER SAMPLE

Sample ID:	ELSW/H12-004-SW-001	Sample Collection Time:	1615
Sample Depth:	0-0.6	Collection Method:	GRAB
Analysis/Method:	EPA 537M	Sample Container:	2, 125mL PE
Preservative:	NONE	Water Quality (circle one):	Clear [✓ Cloudy] Turbid Other

GROUNDWATER SAMPLE (GRAB)

Sample ID:		Sample Collection Time:	
Sample Depth:		Collection Method:	
Analysis/Method:	EPA 537M	Sample Container:	
Preservative:	NONE	Water Quality (circle one):	Clear Cloudy Turbid Other

COMMENTS:

4/22/18

AerostarSES LLC

Depth To Water Record

Project Name: SI of AFFF Areas Omaha
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Date: Sites 1,2,3,4,5,6,7,8,9, 11,12 on 6-1-18 / Site 12 6-4-18
Sample Technician: A. Willis, J. Vrijak
Sheet: 1 of 2

Well:	**MW18PFC0101**	**Well:**	**MW18PFC0102**	**Well:**	**MW18PFC0103**
Time:	0945	Time:	1002	Time:	0952
DTW:	16.62 FT BTOC	DTW:	22.39 FT BTOC	DTW:	14.69 FT BTOC
Final TD of Well:	21.91	Final TD of Well:	40.36	Final TD of Well:	22.28
Well:	**MW18PFC0201**	**Well:**	**MW18PFC0202**	**Well:**	**MW18PFC0203**
Time:	1058	Time:	1044	Time:	1052
DTW:	14.07 FT BTOC	DTW:	13.02 FT BTOC	DTW:	4.47 FT BTOC
Final TD of Well:	39.88	Final TD of Well:	39.31	Final TD of Well:	18.20
Well:	**MW18PFC0204**	**Well:**	**MW18PFC0205**	**Well:**	**MW18PFC0206**
Time:	1334	Time:	1321	Time:	1326
DTW:	33.74 FT BTOC	DTW:	22.97 FT BTOC	DTW:	19.51 FT BTOC
Final TD of Well:	44.04	Final TD of Well:	33.47	Final TD of Well:	19.87
Well:	**MW18PFC0207**	**Well:**	* **MW18PFC0301**	**Well:**	**MW18PFC0302**
Time:	1315	Time:	0858	Time:	0901
DTW:	20.48 FT BTOC	DTW:	8.91 FT BTOC	DTW:	11.28 FT BTOC
Final TD of Well:	33.84	Final TD of Well:	18.97	Final TD of Well:	19.58
Well:	**MW18PFC0303**	**Well:**	**MW18PFC0401**	**Well:**	**MW18PFC0402**
Time:	0905	Time:	1440	Time:	1429
DTW:	9.32 FT BTOC	DTW:	20.38 FT BTOC	DTW:	29.28 FT BTOC
Final TD of Well:	18.90	Final TD of Well:	34.06	Final TD of Well:	43.76
Well:	**MW18PFC0403**	**Well:**	**MW18PFC0501**	**Well:**	**MW18PFC0502**
Time:	1432	Time:	0748	Time:	0752
DTW:	27.41 FT BTOC	DTW:	19.40 FT BTOC	DTW:	17.43 FT BTOC
Final TD of Well:	38.92	Final TD of Well:	34.69	Final TD of Well:	29.01
Well:	**MW18PFC0601**	**Well:**	**MW18PFC0602**	**Well:**	**MW18PFC0603**
Time:	0850	Time:	0919	Time:	0934
DTW:	13.18 FT BTOC	DTW:	10.77 FT BTOC	DTW:	14.92 FT BTOC
Final TD of Well:	18.79	Final TD of Well:	19.08	Final TD of Well:	59.55
Well:	**MW18PFC0701**	**Well:**	**MW18PFC0702**	**Well:**	**MW18PFC0703**
Time:	1020	Time:	1016	Time:	1025
DTW:	13.66 FT BTOC	DTW:	13.96 FT BTOC	DTW:	15.41 FT BTOC
Final TD of Well:	39.13	Final TD of Well:	24.23	Final TD of Well:	24.07
Well:	**MW18PFC0801**	**Well:**	**MW18PFC0802**	**Well:**	**MW18PFC0803**
Time:	1545	Time:	1543	Time:	1540
DTW:	14.36 FT BTOC	DTW:	14.71 FT BTOC	DTW:	15.07 FT BTOC
Final TD of Well:	51.09	Final TD of Well:	49.26	Final TD of Well:	49.83

* 0301 had standing water in vault up to TOC

Depth To Water Record

Project Name: SI of AFFF Areas Omaha
ASL Project No: M2027.0003
Installation: **Ellsworth AFB**
Date: site 1,2,3,4,5,6,7,8,9,11,12 6-1-18 / Site 10 6-4-18
Sample Technician: A. Willis, J. Vojak
Sheet: 2 of 2

Well:	MW18PFC0901A	**Well:**	MW18PFC0902A	**Well:**	MW18PFC1001
Time:	~~0945~~ 1341	Time:	~~1002~~ 1346	Time:	1413
DTW:	31.72 ~~16.62~~ FT BTOC	DTW:	25.70 ~~22.39~~ FT BTOC	DTW:	8.18 FT BTOC
Final TD of Well:	~~21.41~~ 33.91	Final TD of Well:	~~46.36~~ 34.4	Final TD of Well:	49.11
Well:	MW18PFC1002	**Well:**	MW18PFC1003	**Well:**	MW18PFC1101
Time:	1410	Time:	1520	Time:	0805
DTW:	9.80 FT BTOC	DTW:	56.61 FT BTOC	DTW:	12.57 FT BTOC
Final TD of Well:	39.31	Final TD of Well:	59.53	Final TD of Well:	19.14
Well:	MW18PFC1102	**Well:**	MW18PFC1103	**Well:**	MW18PFC1201
Time:	0921	Time:	0830	Time:	1240
DTW:	9.32 FT BTOC	DTW:	13.76 FT BTOC	DTW:	12.49 FT BTOC
Final TD of Well:	19.17	Final TD of Well:	23.71	Final TD of Well:	37.18
Well:	MW18PFC1202	**Well:**	MW18PFC1203	**Well:**	MW930107
Time:	1247	Time:	1254	Time:	1006
DTW:	30.50 FT BTOC	DTW:	12.81 FT BTOC	DTW:	31.75 FT BTOC
Final TD of Well:	50.65	Final TD of Well:	17.47	Final TD of Well:	37.28

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Appendix D
Laboratory Case Narratives
Data Validation Report
and
Analytical Data Sheets

DATA VALIDATION REPORT

M2027.0003 (Omaha) Ellsworth AFB

SAMPLE DELIVERY GROUP: B894616, B897127, B8A6782, B8B1135, B8C0381, B8C4298, B8D4761, B8J4786

Prepared for

Aerostar SES LLC

May 21, 2018, Revised August 13, 2018

MEC^{X}, Inc.
8864 Interchange Drive
Houston, Texas 77054

www.mecx.net

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ACRONYMS AND ABBREVIATIONS

°C	Celsius
%	Percent
%D	percent difference
B	blank contamination
CB	calibration blank
CCAL	continuing calibration
CCV	continuing calibration verification
COC	chain of custody
CLP	Contract Laboratory Program
DL	detection limit
EPA	US Environmental Protection Agency
ER	equipment rinsate
FB	field blank
FD	field duplicate
ICAL	initial calibration
ICV	initial calibration verification
IS	internal standard
J	estimated value
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantification
MB	method blank
MS	matrix spike
MSD	matrix spike duplicate
ND	nondetect
PARCC	precision, accuracy, representativeness, comparability, completeness
PFC	perfluorinated compound
QAPP	Quality Assurance Program Plan
QC	quality control
QSM	Quality Systems Manual
R	rejected
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
SDG	sample delivery group
TB	trip blank
U	not detected
UJ	not detected; associated value is an estimate

I. INTRODUCTION

Task Order Title: M2027.0003 (Omaha) Ellsworth AFB

Contract: W9128F-15-D-0051

MEC^X Project No.: 1529.001H.01

Sample Delivery Group: B894616, B897127, B8A6782, B8B1135, B8C0381, B8C4298, B8D4761, B8J4786

Project Manager: Jenny Vance

Matrix: Soil/Water

QC Level: Stage 2B, Stage 4

No. of Samples: 151

Laboratory: Maxxam

TABLE 1 - SAMPLE IDENTIFICATION

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH08-001-SO-030	GNR551	SO	2018-04-23 15:05	E537M	Stage 2B
ELSWH08-001-SS-001	GNR550	SO	2018-04-23 09:55	E537M	Stage 2B
ELSWH08-002-SO-040	GNR548	SO	2018-04-23 08:30	E537M	Stage 2B
ELSWH08-002-SO-940	GNR549	SO	2018-04-23 08:30	E537M	Stage 2B
ELSWH08-002-SS-001	GNR546	SO	2018-04-22 14:45	E537M	Stage 2B
ELSWH08-003-SO-046	GNR569	SO	2018-04-22 09:40	E537M	Stage 2B
ELSWH08-003-SS-001	GNR568	SO	2018-04-21 14:25	E537M	Stage 2B
ELSWH08-004-SO-051	GNR571	SO	2018-04-22 14:25	E537M	Stage 2B
ELSWH08-004-SS-001	GNR566	SO	2018-04-21 11:40	E537M	Stage 2B
ELSWH10-001-SS-001	GNR552	SO	2018-04-24 11:00	E537M	Stage 2B
ELSWH12-001-SO-023	GNR561	SO	2018-04-19 17:10	E537M	Stage 2B
ELSWH12-001-SS-001	GNR559	SO	2018-04-19 15:05	E537M	Stage 2B
ELSWH12-001-SS-901	GNR560	SO	2018-04-19 15:05	E537M	Stage 2B
ELSWH12-002-GW-045	GNR553	WG	2018-04-22 15:02	E537M	Stage 2B
ELSWH12-002-SO-036	GNR558	SO	2018-04-19 11:35	E537M	Stage 2B
ELSWH12-002-SS-001	GNR557	SO	2018-04-19 09:57	E537M	Stage 2B
ELSWH12-003-GW-016	GNR554	WG	2018-04-22 15:55	E537M	Stage 4

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH12-003-SO-006	GNR564	SO	2018-04-20 14:30	E537M	Stage 4
ELSWH12-003-SS-001	GNR565	SO	2018-04-20 09:57	E537M	Stage 2B
ELSWH12-004-SD-001	GNR555	SE	2018-04-22 16:15	E537M	Stage 4
ELSWH12-004-SW-001	GNR556	WS	2018-04-22 16:15	E537M	Stage 4
ELSWH-RS-001	GNR562	WQ	2018-04-19 16:45	E537M	Stage 2B
ELSWH-RS-002	GNR563	WQ	2018-04-20 14:25	E537M	Stage 2B
ELSWH-RS-003	GNR567	WQ	2018-04-21 14:20	E537M	Stage 2B
ELSWH-RS-004	GNR570	WQ	2018-04-22 14:22	E537M	Stage 2B
ELSWH-RS-005	GNR547	WQ	2018-04-23 08:25	E537M	Stage 2B
ELSWH02-001-SO-030	GOF439	SO	2018-04-26 12:57	E537M	Stage 2B
ELSWH02-002-SO-031	GOF438	SO	2018-04-25 15:25	E537M	Stage 2B
ELSWH02-003-GW-013	GOF448	WG	2018-04-26 15:41	E537M	Stage 2B
ELSWH02-003-SO-004	GOF437	SO	2018-04-25 11:00	E537M	Stage 2B
ELSWH02-004-SD-001	GOF444	SE	2018-04-26 14:40	E537M	Stage 2B
ELSWH02-004-SD-901	GOF445	SE	2018-04-26 14:40	E537M	Stage 2B
ELSWH02-004-SW-001	GOF446	WS	2018-04-26 14:40	E537M	Stage 2B
ELSWH02-004-SW-901	GOF447	WS	2018-04-26 14:40	E537M	Stage 2B
ELSWH08-002-GW-045	GOF443	WG	2018-04-26 13:45	E537M	Stage 2B
ELSWH08-003-GW-045	GOF442	WG	2018-04-26 11:39	E537M	Stage 2B
ELSWH10-001-SO-040	GOF435	SO	2018-04-24 15:35	E537M	Stage 2B
ELSWH12-001-GW-032	GOF441	WG	2018-04-25 12:55	E537M	Stage 2B
ELSWH-RS-006	GOF434	WQ	2018-04-24 15:25	E537M	Stage 2B
ELSWH-RS-007	GOF436	WQ	2018-04-25 10:53	E537M	Stage 2B
ELSWH-RS-008	GOF440	WQ	2018-04-26 12:40	E537M	Stage 2B
ELSWH02-001-GW-035	GQI097	WG	2018-05-04 12:31	E537M	Stage 2B
ELSWH02-002-GW-035	GQI096	WG	2018-05-04 09:31	E537M	Stage 2B
ELSWH02-006-GW-030	GQI099	WG	2018-05-04 13:50	E537M	Stage 4
ELSWH02-006-SO-024	GQI081	SO	2018-05-01 11:50	E537M	Stage 2B
ELSWH02-006-SS-001	GQI079	SO	2018-05-01 09:20	E537M	Stage 4

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH02-007-SS-001	GQI092	SO	2018-05-03 10:40	E537M	Stage 2B
ELSWH02-008-SS-001	GQI090	SO	2018-05-02 14:19	E537M	Stage 2B
ELSWH05-001-GW-030	GQI098	WG	2018-05-04 15:26	E537M	Stage 2B
ELSWH05-001-SO-028	GQI086	SO	2018-05-02 09:45	E537M	Stage 2B
ELSWH05-001-SS-001	GQI084	SO	2018-05-02 07:42	E537M	Stage 2B
ELSWH05-002-GW-025	GQI095	WG	2018-05-03 16:30	E537M	Stage 2B
ELSWH05-002-SO-020	GQI083	SO	2018-05-01 15:32	E537M	Stage 2B
ELSWH05-002-SS-001	GQI082	SO	2018-05-01 13:35	E537M	Stage 2B
ELSWH05-003-SO-009	GQI088	SO	2018-05-02 11:45	E537M	Stage 2B
ELSWH05-003-SO-909	GQI089	SO	2018-05-02 11:45	E537M	Stage 2B
ELSWH05-003-SS-001	GQI087	SO	2018-05-02 10:49	E537M	Stage 2B
ELSWH06-002-SO-010	GQI111	SO	2018-05-05 14:15	E537M	Stage 2B
ELSWH06-002-SS-001	GQI110	SO	2018-05-05 13:15	E537M	Stage 4
ELSWH06-003-SO-054	GQI109	SO	2018-05-05 11:40	E537M	Stage 2B
ELSWH06-003-SS-001	GQI107	SO	2018-05-05 08:08	E537M	Stage 2B
ELSWH08-001-GW-044	GQI094	WG	2018-05-01 11:41	E537M	Stage 2B
ELSWH09-003-SO-028	GQI101	SO	2018-05-04 09:57	E537M	Stage 2B
ELSWH09-003-SS-001	GQI093	SO	2018-05-04 08:00	E537M	Stage 2B
ELSWH10-002-SO-029	GQI106	SO	2018-05-04 17:10	E537M	Stage 2B
ELSWH10-002-SS-001	GQI105	SO	2018-05-04 15:22	E537M	Stage 2B
ELSWH11-003-SO-015	GQI103	SO	2018-05-04 13:00	E537M	Stage 2B
ELSWH11-003-SS-001	GQI102	SO	2018-05-04 11:00	E537M	Stage 2B
ELSWH11-005-SS-001	GQI104	SO	2018-05-04 13:15	E537M	Stage 2B
ELSWH-RS-009	GQI080	WQ	2018-05-01 11:40	E537M	Stage 2B
ELSWH-RS-010	GQI085	WQ	2018-05-02 08:00	E537M	Stage 2B
ELSWH-RS-011	GQI091	WQ	2018-05-03 09:32	E537M	Stage 2B
ELSWH-RS-012	GQI100	WQ	2018-05-04 09:52	E537M	Stage 2B
ELSWH-RS-013	GQI108	WQ	2018-05-05 11:35	E537M	Stage 2B
ELSWH02-005-SO-034	GRF770	SO	2018-05-07 13:05	E537M	Stage 2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH03-002-GW-017	GRF780	WG	2018-05-10 14:21	E537M	Stage 2B
ELSWH03-002-SO-011	GRF766	SO	2018-05-06 13:50	E537M	Stage 2B
ELSWH03-002-SO-911	GRF767	SO	2018-05-06 13:50	E537M	Stage 2B
ELSWH03-003-GW-016	GRF779	WG	2018-05-10 13:21	E537M	Stage 2B
ELSWH03-003-SO-011	GRF768	SO	2018-05-06 15:03	E537M	Stage 2B
ELSWH03-004-SO-011	GRF771	SO	2018-05-07 16:05	E537M	Stage 4
ELSWH06-001-GW-018	GRF778	WG	2018-05-09 11:33	E537M	Stage 4
ELSWH06-001-SO-012	GRF765	SO	2018-05-06 10:40	E537M	Stage 2B
ELSWH06-001-SS-001	GRF764	SO	2018-05-06 10:13	E537M	Stage 2B
ELSWH06-002-GW-018	GRF776	WG	2018-05-09 10:35	E537M	Stage 2B
ELSWH06-002-GW-918	GRF777	WG	2018-05-09 10:35	E537M	Stage 2B
ELSWH06-003-GW-055	GRF775	WG	2018-05-07 16:21	E537M	Stage 2B
ELSWH06-004-SO-035	GRF762	SO	2018-05-06 09:10	E537M	Stage 2B
ELSWH06-004-SS-001	GRF760	SO	2018-05-06 07:45	E537M	Stage 2B
ELSWH06-004-SS-901	GRF761	SO	2018-05-06 07:45	E537M	Stage 2B
ELSWH07-001-SO-029	GRF773	SO	2018-05-08 12:56	E537M	Stage 2B
ELSWH07-001-SS-001	GRF772	SO	2018-05-08 08:50	E537M	Stage 2B
ELSWH07-002-SS-001	GRF759	SO	2018-05-09 14:10	E537M	Stage 4
ELSWH07-004-SO-013	GRF747	SO	2018-05-08 14:00	E537M	Stage 2B
ELSWH07-004-SS-001	GRF774	SO	2018-05-08 13:20	E537M	Stage 2B
ELSWH11-001-SO-012	GRF755	SO	2018-05-09 10:48	E537M	Stage 2B
ELSWH11-001-SS-001	GRF754	SO	2018-05-09 10:00	E537M	Stage 2B
ELSWH11-002-SO-010	GRF751	SO	2018-05-09 09:35	E537M	Stage 2B
ELSWH11-002-SS-001	GRF750	SO	2018-05-09 08:42	E537M	Stage 2B
ELSWH11-004-SO-012	GRF757	SO	2018-05-09 11:25	E537M	Stage 2B
ELSWH11-004-SS-001	GRF756	SO	2018-05-09 11:11	E537M	Stage 2B
ELSWH11-005-SO-013	GRF758	SO	2018-05-09 12:45	E537M	Stage 2B
ELSWH11H-002-SO-910	GRF752	SO	2018-05-09 09:35	E537M	Stage 2B
ELSWH-RS-014	GRF763	WQ	2018-05-06 09:05	E537M	Stage 2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH-RS-015	GRF769	WQ	2018-05-07 13:01	E537M	Stage 2B
ELSWH-RS-016	GRF749	WQ	2018-05-08 13:55	E537M	Stage 2B
ELSWH-RS-017	GRF753	WQ	2018-05-09 09:30	E537M	Stage 2B
ELSWH-RS-018	GRF781	WQ	2018-05-10 12:15	E537M	Stage 2B
ELSWH-SB-001	GRF748	WQ	2018-05-08 14:15	E537M	Stage 2B
ELSWH01-001-GW-015	GTF558	WG	2018-05-20 09:25	E537M	Stage 2B
ELSWH01-001-GW-915	GTF559	WG	2018-05-20 09:25	E537M	Stage 2B
ELSWH01-001-SO-013	GTF550	SO	2018-05-17 09:47	E537M	Stage 4
ELSWH01-001-SO-913	GTF551	SO	2018-05-17 09:47	E537M	Stage 2B
ELSWH01-001-SS-001	GTF547	SO	2018-05-17 08:33	E537M	Stage 2B
ELSWH01-001-SS-901	GTF548	SO	2018-05-17 08:33	E537M	Stage 2B
ELSWH01-002-SO-012	GTF543	SO	2018-05-16 13:30	E537M	Stage 2B
ELSWH01-002-SS-001	GTF542	SO	2018-05-16 12:50	E537M	Stage 2B
ELSWH01-003-SO-025	GTF541	SO	2018-05-15 16:00	E537M	Stage 2B
ELSWH01-003-SS-001	GTF540	SO	2018-05-15 14:10	E537M	Stage 2B
ELSWH01-004-SO-012	GTF545	SO	2018-05-16 14:30	E537M	Stage 2B
ELSWH01-004-SS-001	GTF544	SO	2018-05-16 13:40	E537M	Stage 2B
ELSWH01-MW930107-GW-034	GTF530	WG	2018-05-16 15:54	E537M	Stage 2B
ELSWH02-007-GW-018	GTF537	WG	2018-05-18 11:27	E537M	Stage 4
ELSWH02-008-GW-029	GTF535	WG	2018-05-18 10:16	E537M	Stage 2B
ELSWH02-008-GW-929	GTF536	WG	2018-05-18 10:16	E537M	Stage 2B
ELSWH03-001-SO-009	GTF552	SO	2018-05-17 13:25	E537M	Stage 2B
ELSWH04-002-SO-035	GTF533	SO	2018-05-18 10:30	E537M	Stage 2B
ELSWH04-002-SS-001	GTF532	SO	2018-05-18 08:45	E537M	Stage 4
ELSWH07-001-GW-035	GTF525	WG	2018-05-15 12:55	E537M	Stage 2B
ELSWH07-002-SO-013	GTF534	SO	2018-05-09 16:10	E537M	Stage 2B
ELSWH07-003-SO-016	GTF539	SO	2018-05-15 11:50	E537M	Stage 2B
ELSWH07-003-SS-001	GTF538	SO	2018-05-15 10:15	E537M	Stage 2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH10-001-GW-045	GTF556	WG	2018-05-19 10:36	E537M	Stage 2B
ELSWH10-002-GW-035	GTF553	WG	2018-05-19 09:32	E537M	Stage 2B
ELSWH10-002-GW-935	GTF554	WG	2018-05-19 09:32	E537M	Stage 2B
ELSWH10-004-SD-001	GTF528	SE	2018-05-16 09:45	E537M	Stage 4
ELSWH10-004-SW-001	GTF529	WS	2018-05-16 09:45	E537M	Stage 2B
ELSWH11-001-GW-015	GTF562	WG	2018-05-20 16:14	E537M	Stage 2B
ELSWH11-002-GW-015	GTF560	WG	2018-05-20 15:00	E537M	Stage 2B
ELSWH11-003-GW-020	GTF561	WG	2018-05-20 14:34	E537M	Stage 2B
ELSWH11-006-SD-001	GTF526	SE	2018-05-16 09:00	E537M	Stage 2B
ELSWH11-006-SW-001	GTF527	WS	2018-05-16 09:00	E537M	Stage 2B
ELSWH-RS-019	GTF524	WG	2018-05-15 09:10	E537M	Stage 2B
ELSWH-RS-020	GTF546	WQ	2018-05-16 12:49	E537M	Stage 2B
ELSWH-RS-021	GTF549	WQ	2018-05-17 09:35	E537M	Stage 2B
ELSWH-RS-022	GTF531	WG	2018-05-18 08:40	E537M	Stage 2B
ELSWH-RS-023	GTF555	WQ	2018-05-19 09:55	E537M	Stage 2B
ELSWH-RS-024	GTF557	WQ	2018-05-20 08:10	E537M	Stage 2B
ELSWH01-003-GW-035	GUB621	WG	2018-05-21 11:02	E537M	Stage 2B
ELSWH01-004-GW-018	GUB622	WG	2018-05-21 15:11	E537M	Stage 2B
ELSWH02-005-GW-040	GUB625	WG	2018-05-23 14:35	E537M	Stage 2B
ELSWH03-001-GW-015	GUB627	WG	2018-05-24 12:09	E537M	Stage 2B
ELSWH04-001-SO-029	GUB619	SO	2018-05-22 14:57	E537M	Stage 2B
ELSWH04-001-SS-001	GUB618	SO	2018-05-22 12:52	E537M	Stage 2B
ELSWH04-003-SO-027	GUB616	SO	2018-05-18 14:10	E537M	Stage 2B
ELSWH04-003-SS-001	GUB608	SO	2018-05-18 12:18	E537M	Stage 2B
ELSWH04-004-SO-031	GUB609	SO	2018-05-18 15:15	E537M	Stage 2B
ELSWH04-005-SO-020	GUB610	SO	2018-05-18 16:15	E537M	Stage 4
ELSWH07-002-GW-021	GUB624	WG	2018-05-21 17:15	E537M	Stage 4
ELSWH07-003-GW-021	GUB623	WG	2018-05-21 16:21	E537M	Stage 2B
ELSWH09-001-SO-005	GUB615	SO	2018-05-21 14:30	E537M	Stage 2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
ELSWH09-001-SS-001	GUB614	SO	2018-05-21 12:12	E537M	Stage 2B
ELSWH09-002-SO-005	GUB620	SO	2018-05-21 10:25	E537M	Stage 2B
ELSWH09-002-SS-001	GUB612	SO	2018-05-21 08:55	E537M	Stage 2B
ELSWH09-002-SS-901	GUB613	SO	2018-05-21 08:55	E537M	Stage 2B
ELSWH-RS-025	GUB611	WQ	2018-05-21 08:45	E537M	Stage 2B
ELSWH-RS-026	GUB617	WQ	2018-05-22 10:55	E537M	Stage 2B
ELSWH-RS-027	GUB626	WQ	2018-05-23 13:40	E537M	Stage 2B
ELSWH04-001-GW-032	GWJ144	WG	2018-05-31 17:46	E537M	Stage 2B
ELSWH04-002-GW-038	GWJ141	WG	2018-05-31 14:12	E537M	Stage 2B
ELSWH04-003-GW-033	GWJ140	WG	2018-05-31 11:50	E537M	Stage 4
ELSWH09-001-GW-033A	GWJ143	WG	2018-05-31 16:02	E537M	Stage 2B
ELSWH09-002-GW-030A	GWJ142	WG	2018-05-31 15:32	E537M	Stage 2B
ELSWH10-003-GW-059	GWJ146	WG	2018-06-03 15:17	E537M	Stage 2B
ELSWH10-003-SO-050	GWJ151	SO	2018-05-31 12:00	E537M	Stage 2B
ELSWH10-003-SS-001	GWJ150	SO	2018-05-24 13:12	E537M	Stage 2B
ELSWH-RS-028	GWJ149	WQ	2018-05-24 13:09	E537M	Stage 2B
ELSWH-RS-030	GWJ145	WQ	2018-06-03 14:50	E537M	Stage 2B
ELSWH-RS-29	GWJ139	WQ	2018-05-31 11:10	E537M	Stage 2B
ELSWH-WS-001	GWJ148	SO	2018-06-03 18:00	E537M	Stage 2B
ELSWH-WW-001	GWJ147	WG	2018-06-03 18:00	E537M	Stage 2B
ELSWH02-004-SD-901A	HJG660	SE	2018-07-31 09:20	E537M	Stage 2B
ELSWH02-004-SW-001A	HJG661	WS	2018-07-31 09:15	E537M	Stage 2B
ELSWH02-004-SW-901A	HJG662	WS	2018-07-31 09:15	E537M	Stage 2B
ELSWH02-004-SD-001A	HJG659	SE	2018-07-31 09:20	E537M	Stage 2B
ELSWH-RS-001A	HJG658	WQ	2018-07-31 09:05	E537M	Stage 2B

II. SAMPLE MANAGEMENT

According to the case narratives and the chains-of-custody (COCs) provided by the laboratory for sample delivery groups (SDGs) B894616, B897127, B8A6782, B8B1135, B8C0381, B8C4298, B8D4761 and B8J4786:

- Cooler temperatures recorded on the COCs indicated all samples were received at temperatures within the control limits of ≤10ºC.
- Field and laboratory personnel signed and dated the COCs.
- Some COC corrections were made by overwriting the original entry, rather than lining out.
- The case narratives for these SDGs and the COCs noted custody seals were present and intact on the coolers upon receipt at the laboratory.
- In SDG B8B1135, sample containers for ELSWH03-002-SO-911 were labelled as ELSWH03-002-GW-911. The sample was a soil, the client was notified and the sample was logged in according to the correct identification on the COC.
- SDG B8C0381 soil and water samples were reported in separate pdf sample packages due to the size.

TABLE 2 - DATA QUALIFIER REFERENCE

Qualifier	Definition
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and to meet quality control (QC) criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was nondetect (ND) above the reported sample quantification limit.
B	The reported concentration is less than 5 times the concentration reported in an associated field or lab blank.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ	The material was analyzed for but was ND. The associated value is an estimate and may be inaccurate or imprecise.

TABLE 3 - REASON CODE REFERENCE

Reason Code	Definition
01	Sample received outside of 4+/-2 degrees Celsius (°C)
01A	Improper sample preservation
02	Holding time exceeded
02A	Extraction
02B	Analysis
03	Instrument performance – outside criteria
03A*	Bromofluorobenzene (BFB)
03B*	Decafluorotriphenylphosphine (DFTPP)
03C*	dichlorodiphenyltrichloroethane (DDT) and/or endrin % breakdown exceeds criteria
03D	Retention time windows
03E	Resolution
04	ICAL results outside specified criteria
04A	Compound mean RRF QC criteria not met
04B	Individual % RSD criteria not met
04C	$r < 0.995$ or $r^2 < 0.99$
04D	ICAL % Recovery
05	Continuing calibration results outside specified criteria
05A	Compound mean RRF QC criteria not met

Reason Code	Definition
05B	Compound % Difference QC criteria not met
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or preparation blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate recoveries outside control limits
07A	Sample
07B	Associated MB or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	% RPD outside acceptance criteria (precision)
09*	Post digestion spike outside criteria graphite furnace atomic absorption (GFAA)
10	Internal standards outside specified control limits
10A	Recovery
10B	Retention time
11	LCS recoveries outside specified limits
11A	Recovery
11B	% RPD (if run in duplicate)
12*	Interference check standard
13*	Serial dilution
14*	Tentatively identified compounds
15	Quantification
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria is exceeded
18*	Percent difference between original and second column exceeds QC criteria
19	Professional judgment was used to qualify the data
20*	Pesticide clean-up checks
21	Target compound identification
22*	Radiological calibration

Reason Code	Definition
23*	Radiological quantification
24	Reported result and/or lab qualifier revised to reflect validation findings

*Indicates that this code is not expected to apply to the evaluation of PFAS analyses

III. METHOD ANALYSIS- PERFLUORINATED COMPOUNDS BY MODIFIED EPA METHOD 537 MODIFIED

K. Zilis of MEC^X reviewed these SDGs May22-August 12, 2018.

III.1. HOLDING TIMES

All samples were extracted within 28 days of collection and analyzed within 45 days of extraction.

III.2. CALIBRATION

Calibration criteria were met except for the outliers noted below.

III.2.1. *INITIAL CALIBRATION*

Initial calibration criteria were met. Recoveries were within 70-130% for the lowest level of each initial calibration and 75-125% for the remaining levels, and all correlation coefficient r^2 values were within the control limit of ≥0.990 or r values ≥0.995. Applicable %RSDs were within the control limit of ≤20%. The calculated peak asymmetry factors were within the control range of 0.8-1.5. MEC^X noted the laboratory utilized as the calibration method a weighted (1/X) linear initial calibration standard curve not forced through zero.

III.2.2. *CONTINUING CALIBRATION*

The initial calibration verification (ICV) and continuing calibration verification (CCV) recoveries were within the control limits of 75-125%. Low-level check standard (ICS) recoveries were within the control limits of 70-130%.

III.3. QUALITY CONTROL SAMPLES

III.3.1. *METHOD BLANKS*

The method blanks associated with the analyses of the soil and water samples had no target analyte detects above the respective soil and water detection limits (DLs).

III.3.2. *LABORATORY CONTROL SAMPLES*

LCS recoveries were within the control limits of 70-130%, and RPDs for water LCS/LCSD pairs were within the control limit of ≤30%.

III.3.3. *MATRIX SPIKE/MATRIX SPIKE DUPLICATE*

Outliers affecting parent sample data and qualifications assigned are noted below. Qualifications were not assigned for recovery outliers not occurring in both the MS and MSD, or for RPD outliers or high recoveries if the outlier compound was not detected in the parent sample. If the parent sample concentration of an analyte exceeded 4× the spike amount, recoveries and the RPD were not evaluated. With exceptions noted below, recoveries and RPDs affecting sample data were within the control limits of 70-130% and ≤30%, respectively.

SDG B894616
MS/MSD analyses were performed on soil sample ELSWH12-001-SS-001. Recoveries were outside of QC limits for PFHxS and PFOS. Both analytes were present in the native sample, PFOS was present at greater than 4x the spike concentration. Qualifications were not assigned for PFHxS as only the MSD recovery exceeded QC limits.

Matrix spikes were not requested or performed for water samples.

SDG B897127
MS/MSD analyses were performed on soil sample ELSWH02-004-SD-001 and on water sample ELSWH02-004-SW-001. All soil sample MS/MSD recoveries were compliant except for the PFBS RPD at 31%. Spike recoveries were 79 and 108%. This compound was not detected in the sample and no qualifiers were applied.

Recoveries were above the control limits of 70-130% for PFTrDA in the MS and MSD of the water sample, at 137% and 133%, respectively. The 13C2-PFTeDA internal standard recovery in the native sample analysis, as well as both matrix spikes was below QC limits and results for associated compounds PFTeDA and PFTrDA were previously qualified for the internal standard recovery. These compounds were not detected in the sample.

SDG B8A6782
MS/MSD analyses were performed on soil samples ELSWH05-003-SO-009 and ELSWH06-002-SO-010. All recoveries and RPDs affecting sample data were within the control limits of 70-130% and ≤30%, respectively.

SDG B8B1135
MS/MSD analyses were performed on soil samples ELSWH11-002-SO-010 and ELSWH06-004-SS-001, and water sample ELSWH06-002-GW-018. All recoveries and RPDs for the ELSWH11-002-SO-010 matrix spikes were within the control limits of 70-130% and ≤30%, respectively, with the following exceptions. The recovery of PFOS was high in sample ELSWH06-004-SS-001 in the MS and MSD at 142 and 167%. This compound was detected in the sample at 29 ug/L and was qualified as estimated. The water matrix spike PFDS recovery was low at 54% below the control limits of 70-130%. In addition, extracted internal standards MPFDoDA and MPFTrDA had low recoveries at 46 and 49% respectively, with lower control limit of 50%. The MSD internal standard and target compound recoveries were within control limits but the RPD was high at 44% with a control limit of 30%. The undetected result for PFDS in sample ELSWH06-002-GW-018 was qualified as estimated for the precision measure outlier.

SDG B8C0381
As designated on the COC, soil samples ELSWH01-001-SS-001 and ELSWH01-001-SO-013, and water sample ELSWH01-001-GW-015 were used for the matrix spike and matrix spike duplicate analyses. Due to high concentrations of target compounds in the sample, a matrix duplicate was performed instead of MS/MSD for samples ELSWH01-001-SS-001 and ELSWH01-001-GW-015. Recoveries and the RPD were not evaluated for 8:2 FTS and PFOS in the spike analyses for ELSWH01-001-SO-013 because the native sample concentrations were greater than 4 times the spiked amount.

SDG B8C4298
Samples were not designated on the COC for matrix spike analysis. Matrix spikes were performed on soil sample ELSWH04-005-SO-020. Matrix spikes were not performed on a water sample. Water QC batch 5557332 was shared with SDG B8C0381 (see above) and due to high concentrations of target compounds in SDG B8C0381 sample ELSWH01-001-GW-015, a matrix duplicate was performed instead of MS/MSD.

SDG B8D4761

Samples were not designated on the COC for matrix spike analysis. Matrix spikes were performed on water sample ELSWH10-003-GW-059. Soil MS/MSD analysis was not performed on a project sample and precision data was not available.

SDG B8J4786

MS/MSD analyses were performed on soil sample ELSWH02-004-SD-001A and water sample ELSWH02-004-SW-001A. All recoveries and RPDs were compliant.

III.4. FIELD QC SAMPLES

MEC^X evaluated field QC samples, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. MEC^X used the remaining detects to evaluate the associated site samples. Findings associated with field QC samples are summarized below.

III.4.1. *FIELD BLANKS AND EQUIPMENT BLANKS*

Field blanks and equipment blanks are listed in the table below. There were no reported detections above the LOD in any of the blanks.

Table 4-FB/EB Detects

SDG B894616

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-001	none	N/A	N/A
ELSWH-RS-002	none	N/A	N/A
ELSWH-RS-003	none	N/A	N/A
ELSWH-RS-005	none	N/A	N/A

SDG B897127

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-006	none	N/A	N/A
ELSWH-RS-007	none	N/A	N/A
ELSWH-RS-008	none	N/A	N/A

SDG B8A6782

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-009	none	N/A	N/A
ELSWH-RS-010	none	N/A	N/A
ELSWH-RS-011	none	N/A	N/A
ELSWH-RS-012	none	N/A	N/A
ELSWH-RS-013	none	N/A	N/A

SDG B8B1135

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-014	none	N/A	N/A
ELSWH-RS-015	none	N/A	N/A
ELSWH-RS-016	none	N/A	N/A
ELSWH-RS-017	none	N/A	N/A
ELSWH-RS-018	none	N/A	N/A
ELSWH-SB-001	none	N/A	N/A

SDG B8C0381

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-019	none	N/A	N/A
ELSWH-RS-020	none	N/A	N/A
ELSWH-RS-021	none	N/A	N/A
ELSWH-RS-022	none	N/A	N/A
ELSWH-RS-023	none	N/A	N/A
ELSWH-RS-024	none	N/A	N/A

SDG B8C4298

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-025	none	N/A	N/A
ELSWH-RS-026	none	N/A	N/A
ELSWH-RS-027	PFHxS	0.0081 J	0.02

Adjusting for matrix, 0.0081 µg/L PFHxS * 0.125L/0.0025kg = 0.405 µg/kg. PFHxS has been qualified based on the equipment blank results up to 5x this value, or 2.02 µg/kg.

SDG B8D4167

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-028	none	N/A	N/A
ELSWH-RS-029	none	N/A	N/A
ELSWH-RS-030	6:2 FTS	0.012 J	0.02

6:2 FTS was not detected in any of the soil samples and no qualifiers have been applied.

SDG B8J4786

Field or Equipment Blank	Detects	Concentration µg/L	LOQ µg/L
ELSWH-RS-001A	none	N/A	N/A

III.4.2. *FIELD DUPLICATES*

Field duplicate pairs are listed below. RPDs for detections above the LOQ were within the control limit of ≤30%, and detects below the LOQ, in one or both samples of a pair, were within the control limit of ±LOQ, with exceptions noted in the table below. Results for the outlier target analytes were qualified as estimated (J for detects or UJ for nondetects) in both samples of a pair.

Table 5-FD RPDs

SDG B894616

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH08-002-SO-040	ELSWH08-002-SO-940	N/A	None
ELSWH12-001-SS-001	ELSWH12-001-SS-901	PFOS	40%

SDG B897127

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH02-004-SD-001	ELSWH02-004-SD-901	PFOS	45%
ELSWH02-004-SW-001	ELSWH02-004-SW-901	N/A	None

SDG B8A6782

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH05-003-SO-009	ELSWH05-003-SO-909	N/A	None

SDG B8B1135

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH06-002-GW-018	ELSWH06-002-GW-918	N/A	None
ELSWH06-004-SS-001	ELSWH06-004-SS-901	PFOA	40%
ELSWH03-002-SO-011	ELSWH03-002-SO-911	PFHxS	49%
ELSWH11-002-SO-010	ELSWH11H-002-SO-910	N/A	None

SDG B8C0381

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH02-008-GW-029	ELSWH02-008-GW-929	6:2 FTS PFBS PFBA PFHpA PFHS PFHxA PFOA PFOS PFPeA	89% ±LOQ 98% ±LOQ 83% 94% 100% 88% 93%
ELSWH01-001-SS-001	ELSWH01-001-SS-901	6:2 FTS 8:2 FTS PFHS PFOA	166% 55% 130% ±LOQ

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
		PFOS	54%
ELSWH01-001-SO-013	ELSWH01-001-SO-913	None	None
ELSWH01-001-GW-015	ELSWH01-001-GW-915	PFHeA PFPeA	34% 32%

ELSWH02-008-GW-029 is consistently higher than the duplicate sample.
ELSWH01-001-SS-001 is consistently lower than the duplicate sample.

SDG B8C4298

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH09-002-SS-001	ELSWH09-002-SS-901	PFOS	154%

The sample and sample duplicate PFOS concentrations were 4 and 31 µg/L respectively.

SDG B8D4761
Field duplicates were not collected with this SDG

SDG B8J4786

Parent Sample	Field Duplicate	Target Analyte	RPD Outliers
ELSWH02-004-SD-001A	ELSWH02-004-SD-901A	PFOS	70.6%
ELSWH02-004-SW-001A	ELSWH02-004-SW-901A	N/A	None

The sample and sample duplicate PFOS concentrations were 23 and 11 µg/L respectively

III.5. INTERNAL STANDARDS PERFORMANCE

III.5.1. *EXTRACTED INTERNAL STANDARD RECOVERY*

As stated on the certificate of analysis for the samples, "Per- and polyfluoroalkyl substances (PFAS) as identified as surrogates on the certificate of analysis represent the extracted internal standard." Except as noted in the tables below, all extracted internal standards were within DoD QSM 5.1.1 Table B-15 criteria of 50-150% recovery.

Table 6-Extracted Internal Standards

SDG B894616

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
13C2-PFDoA 13C2-PFTeDA	NA	ELSWH08-002-SS-001	PFDoA PFTeDA, PFTrDA

The samples were reextracted and analyzed at a 10x dilution. Extracted internal standards were compliant and results were reported from this analysis. Reporting limits were raised accordingly

The recovery of 13C2PFBA was low in the LCSD waters extraction batch. The samples were reextracted for PFBA in batch 5514083. All results were based on compliant QC and compliant internal standard recoveries.

SDG B897127

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
13C2-PFTeDA	42%	ELSWH02-004-SW-001	PFTeDA, PFTrDA
13C2-PFDoA 13C2-PFTeDA 13C2-PFUnA	NA	ELSWH02-004-SD-001	PFDoA PFTeDA, PFTrDA PFUnA
13C2-PFTeDA	NA	ELSWH02-004-SD-901	PFTeDA, PFTrDA

The results for the affected target compounds in the water sample, ELSWH02-004-SW-001, have been qualified as estimated (UJ).

The soil samples, ELSWH02-004-SD-001 and ELSWH02-004-SD-901, were reextracted and analyzed at a 10x dilution. Extracted internal standards were compliant and results were reported from this analysis.

SDG B894616

All extracted internal standards were within DoD QSM 5.1.1 Table B-15 criteria of 50-150% recovery.

SDG B8B1135

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
13C2PFBA	36%	ELSWH06-003-GW-055	PFBA

The results for the affected target compound in the water sample, ELSWH06-003-GW-055, has been qualified as estimated (UJ).

SDG B8C0381

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
13C2-PFTeDA	NA	ELSWH10-004-SD-001 ELSWH01-002-SS-001	PFTeDA, PFTrDA

The recovery of internal standard 13C2-PFTeDA was below QC criteria in the original analysis. The samples were reextracted and analyzed at a dilution. Extracted internal standards were compliant and results were reported from this analysis. Reporting limits were raised accordingly

III.5.2. *INJECTED INTERNAL STANDARD RECOVERY*

The applicable labeled internal standard recoveries were all within the control limits of ±50% of the peak areas of the response for standard level 4 of the calibration curve with the following exceptions exception of ELSWH11-004-SO-012 and ELSWH02-005-SO-034. The area response of both injected internal standards, MPFHxA and MPFDA, were slightly higher than 50% more than the response for standard level 4 of the calibration curve. As a conservative approach, the detects were flagged as estimated (J) even though the extraction internal standards (upon which the quantitation is based) were within the control limits. Injection internal standards were added post extraction by the laboratory as required by the DoD QSM 5.1.1 Table B-15.

Table 7-Injected Internal Standards

SDGs B8B1135

Internal Standard	% Recovery	Affected Sample	Associated Target Analyte(s)
13C6-PFHxA 13C9-PFDA	153% 152%	ELSWH11-004-SO-012	all
13C6-PFHxA 13C9-PFDA	151% 151%	ELSWH02-005-SO-034	all

SDGs B8C0381

Internal Standard	% Recovery	Affected Sample	Associated Target Analyte(s)
13C6-PFHxA 13C9-PFDA	150.4% 158%	ELSWH01-004-SS-001 100X	PFOS
13C9-PFDA	155%	ELSWH01-004-SO-012 100X	PFOS
13C9-PFDA	152%	ELSWH01-001-SS-001 100X	PFOS
13C6-PFHxA 13C9-PFDA	156% 161%	ELSWH01-001-SS-901 100X	PFOS
13C9-PFDA	151%	ELSWH01-001-SS-901 10X	All except PFOS
13C6-PFHxA 13C9-PFDA	152% 155%	ELSWH01-001-SO-913 10x	PFOS, 6:2 FTS
13C9-PFDA	153%	ELSWH03-001-SO-009 10x	PFOS

The laboratory noted that the sample extracts showed visible indication of evaporation. The high response for the injection internal standards should be accounted for with the extracted internal standards which would reflect any evaporation affecting the target compounds. As a conservative approach, the detects were flagged as estimated (J) even though the extraction internal standards (upon which the quantitation is based) were within the control limits.

III.6. COMPOUND IDENTIFICATION

Compound identification was verified for the following samples:

SDG B894616
Soil samples ELSWH12-004-SD-001, and ELSWH12-003-SO-006 and water samples ELSWH12-003-GW-016 and ELSWH12-004-SW-001

SDGs B897127
None.

SDGs B8A6782
Soil samples ELSWH02-006-SS-001 and ELSWH06-002-SS-001 and water sample ELSWH02-006-GW-030, were validated at a level 4.

SDGs B8B1135
Soil samples ELSWH07-002-SS-001 and ELSWH03-004-SO-011, and water sample ELSWH06-001-GW-018 were validated at a level 4.

SDGs B8C0381
Soil samples ELSWH10-004-SD-001, ELSWH04-002-SS-001 and ELSWH01-001-SO-013, and water sample ELSWH02-007-GW-018 were validated at a level 4.

Review of retention times and the ion chromatograms indicated no issues with compound identification. The laboratory analyzed for 18 perfluorinated compounds by Modified EPA Method 537. Review of retention time and the ion chromatograms indicated no issues with compound identification.

SDGs B8C4298
Soil sample ELSWH04-005-SO-020 and water sample ELSWH07-002-GW-021 were validated at a level 4. ELSWH04-003-GW-033

SDGs B8D4761
Water sample ELSWH04-003-GW-033 was validated at a level 4.

SDGs B8J4786
All samples were validated at a level 2B.

III.7. COMPOUND QUANTIFICATION AND REPORTED DETECTION LIMITS

Calculations were verified and sample results reported on the sample result summaries were verified against the raw data for the samples listed above (see Compound Identification section), based on extracted sample amount and applicable dilution factors. The laboratory calculated and reported compound-specific detection limits. Detects below the LOQ were qualified as estimated (J). Nondetects are valid to the LOD.

The laboratory integrated isomeric forms for the PFCs with linear and branched isomers as required by Revision 1.1 of EPA Method 537.

Most samples were initially analyzed undiluted. The samples listed below were either extracted using reduced sample volumes and/or reanalyzed at one or more further dilutions to report various target analytes within the linear range of the calibration. Analytes were reported from the least dilute analysis possible of multiple dilutions to report all target analytes within the linear calibration range.

SDG B894616
Based on screening results indicating the presence of high concentrations of target analytes, two of the three water site samples were extracted using reduced sample volumes, resulting in effective initial dilutions and five of the 18 soil or sediment samples were analyzed at dilutions. The table below summarizes the initial analysis dilutions and further dilutions required for the specific target compounds listed. Reporting limits were raised accordingly.

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH12-003-GW-016	2×	20×	PFHxS PFHxA
ELSWH12-004-SW-001	5×	50×	PFHxS PFHxA
ELSWH12-002-SS-001 ELSWH12-001-SS-001	1x	10x	PFOS

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH12-003-SS-001			
ELSWH12-001-SS-901	10x	100x	PFOS
ELSWH12-003-SO-006	1x	10x	PFPeA

SDG B897127
Dilutions were not required for analyses in this SDG to bring target compounds within the linear range of the instrument. Reporting limits were however elevated due to dilutions for internal standard compliance (See III.5.1).

SDG B897127
All samples were originally analyzed without dilutions or reduced sample volumes so no undetected results were reported with elevated reporting limits. Sample ELSWH02-002-GW-035 was analyzed with a reduced sample volume to quantitate PFHxA and the reporting limit was elevated 10x. Samples ELSWH05-001-SS-001 and ELSWH05-003-SS-001 were analyzed at a 10x dilution to quantitate PFOS in the linear range and the reporting limit for this compound was elevated accordingly.

SDG B8B1135
All samples were originally analyzed without dilutions or reduced sample volumes so no undetected results were reported with elevated reporting limits. Sample ELSWH06-001-SS-001 was analyzed at a 10x dilution to quantitate PFOS in the linear range and the reporting limit for this compound was elevated accordingly. Water samples ELSWH03-003-GW-016 and ELSWH03-002-GW-017were analyzed with a reduced sample volume to quantitate PFHxS and PFOS and the reporting limit was elevated 10x.

SDG B8C0381
Based on screening results indicating the presence of high concentrations of target analytes, samples were diluted or extracted using reduced sample volumes, resulting in effective initial dilutions. The table below summarizes the initial analysis dilutions and further dilutions required for the specific target compounds listed. Reporting limits were raised accordingly. Sample ELSWH01-MW930107-GW-034 was analyzed by the high level methodology for the quantitation of PFHxS, effectively a 400x dilution.

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH10-004-SD-001	1x	10x	PFOS
ELSWH04-002-SS-001	1x	10x	PFOS
ELSWH01-003-SS-001	1x	10x	PFOS
ELSWH01-002-SS-001	1x	100x	PFOS
ELSWH01-002-SO-012	10x	100x	PFOS
ELSWH01-004-SS-001	10x	100x	PFOS
ELSWH01-004-SO-012	1x	100x	PFOS
ELSWH01-001-SS-001	10x	100x	PFOS
ELSWH01-001-SS-901	10x	100x	PFOS
ELSWH01-001-SO-013	1x	10x	6:2 FTS, PFOS

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH01-001-SO-913	1x	10x	6:2 FTS, PFOS
ELSWH03-001-SO-009	1x	10x	PFOS
ELSWH01-MW930107-GW-034	100x	400x	PFHxS
ELSWH10-004-SW-001	1x	10x	PFHxS
ELSWH02-008-GW-029	1x	10x	PFOS
ELSWH01-001-GW-015	10x	100x	6:2 FTS PFBS PFBA PFHxS PFHA PFOS PFPeA
ELSWH01-001-GW-915	10x	100x	6:2 FTS PFBA PFHxS PFHA PFOS PFPeA

SDG B8C4298

Based on screening results indicating the presence of high concentrations of target analytes, samples were diluted or extracted using reduced sample volumes, resulting in effective initial dilutions. The table below summarizes the initial analysis dilutions and further dilutions required for the specific target compounds listed. Reporting limits were raised accordingly.

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH04-003-SS-001	10×	100×	PFOS
ELSWH01-003-GW-035	10×	100×	6:2 FTS PFBS PFHxS PFHxA PFPeA PFOS
ELSWH01-004-GW-018	10×	100×	6:2 FTS PFHxS PFHxA PFPeA PFOS
ELSWH02-005-GW-040	1x	10x	6:2 FTS PFHxS
ELSWH03-001-GW-015	1x	10x	PFOS

SDG B8D4761

Based on screening results indicating the presence of high concentrations of target analytes, samples were diluted or extracted using reduced sample volumes, resulting in effective initial dilutions. The table below summarizes the initial analysis dilutions and further dilutions required for the specific target compounds listed. Reporting limits were raised accordingly.

Sample	Initial Analysis	Reanalysis	Target Compounds
ELSWH-WW-001	10×	100×	6:2 FTS PFBS PFHxA PFHxS PFPeA PFOS

The rest of the samples were originally analyzed without dilutions or reduced sample volumes so no undetected results were reported with elevated reporting limits, with the exception of PFTeDA, PFTrDA and PFDoA in sample ELSWH10-003-SO-050 which were reported from a dilution analysis because the extracted internal standard recovery was low in the original analysis (see section III.5.1). Sample ELSWH04-003-GW-033 was analyzed with a reduced sample volume to quantitate 6:2 FTS, PFHxS and PFHxA and the reporting limit was elevated 10x. Sample ELSWH10-003-SS-001 was analyzed at a 10x dilution to quantitate PFOS within the calibration range.

SDG B8J4786

All samples were analyzed without dilutions or reduced sample volumes. No undetected results were reported with elevated reporting limits.

III.8. SYSTEM PERFORMANCE

SDGs B894616, B897127, B8A6782, B8B1135, B8C0381, B8C4298, B8D4761, B8J4786

No issues were noted with system performance.

IV. SUMMARY AND CONCLUSIONS

MEC^X evaluated a total of 2,772 data records from field samples during the validation and qualified 72 records (2.6% of the data) as estimated values (J for a detect and UJ for a nondetect). The qualification was required for potential equipment blank contamination, MS/MSD accuracy and precision outliers, internal standard outliers and field duplicate precision outliers. Nondetect compounds were flagged (U) to indicate that the compound was analyzed for but not detected above the laboratory detection limit (DL). Specific qualification were discussed in the text above.

Overall, the quality of the data was acceptable. The precision and accuracy results were acceptable. Other data quality indicators (DQI) (representativeness, comparability and completeness) met the project objectives. Each of these DQIs is discussed below.

IV.1. PRECISION

Precision is a measure of the agreement between duplicate sample measurements of the same quantity and is reflected in the relative percent difference (RPD) between spikes and the RPD for the field duplicate pair analysis. The outliers in the precision measurements were due to an MS/MSD RPD outlier and to field duplicate outliers. Precision was considered acceptable for the project.

IV.2. ACCURACY

Accuracy is measured by the results from the recovery of known amounts of compounds or elements from calibration, method blanks, laboratory control samples (LCS), matrix spikes (MS), internal standard recoveries and surrogate recoveries. The outliers in the accuracy measurements were due to potential equipment blank contamination, an MS/MSD recovery outlier and extraction and injection internal standard outliers. Accuracy was considered acceptable for the project.

IV.3. REPRESENTATIVENESS

The measures of representativeness – sample handling, analytical blank analysis, were met. Designated analytical protocols were followed. Four analytes were flagged for potential equipment blank contamination. The laboratory did utilize a weighted 1/X calibration curve which was not forced through zero. Although this is a deviation from Method 537, it is acceptable on DoD projects and was considered acceptable by the reviewer. Holding times were met for all analyses. No analytical problems were noted which would impact data representativeness.

IV.4. COMPARABILITY

The samples were analyzed using appropriate approved methods of analysis. All data were reported correctly using standard units.

IV.5. COMPLETENESS

Completeness is the amount of validated data compared to the planned amount of data and is expressed as a percentage of the usable data divided by the total number of data points. Although one data point was rejected by the reviewer, it was not a target compound and was not counted against the overall percent completeness. Of the 2,772 target data points, no data points were rejected, resulting in a completeness of 100%.

V. REFERENCES

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Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package
(Level IV)

Analysis: PFOS and PFOA in water and soil (Method 537 mod.)

Maxxam Job #: B8A6782

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I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

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Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8A6782 – Soil Analysis

Sample Analysis

Samples were initially extracted on QC batches 5526291 (2018/05/11) and 5526314 (2018/05/11). During analytical set up, a discrepancy was observed in sample vial labels, indicating possible sample mix-up. These QC batches were rejected and not analyzed. Samples were re-extracted and analyzed on QC batches 5531867 (2018/05/16) and 5531868 (2018/05/16). Due to contamination of 6:2 Fluorotelomersulfonate (6:2FTS) in the Method Blank (Blank) on QC batch 5531868 (2018/05/16), samples GQI110 *(ELSWH06-002-SS-001)* and GQI111 *(ELSWH06-002-SO-010)* were further re-extracted and re-analyzed for this analyte on QC batch 5540201 (2018/05/22).

Due to high concentrations, dilutions were required for Perfluorooctanesulfonate (PFOS) in the following samples:

GQI084	*ELSWH05-001-SS-001*
GQI087	*ELSWH05-003-SS-001*

Detection limits were adjusted accordingly.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B8A6782 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batch 5524158 (2018/05/10). Due to high concentration, the following sample was analyzed for Perfluorohexanoic acid (PFHxA) using a reduced sample extraction volume:

GQI096 *ELSWH02-002-GW-035*

Detection limit was adjusted accordingly.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GQI079	ELSWH02-006-SS-001	2018/05/01	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI081	ELSWH02-006-SO-024	2018/05/01	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI082	ELSWH05-002-SS-001	2018/05/01	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI083	ELSWH05-002-SO-020	2018/05/01	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI084	ELSWH05-001-SS-001	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI086	ELSWH05-001-SO-028	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI087	ELSWH05-003-SS-001	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI088	ELSWH05-003-SO-009	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI089	ELSWH05-003-SO-909	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI090	ELSWH02-008-SS-001	2018/05/02	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI092	ELSWH02-007-SS-001	2018/05/03	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI093	ELSWH09-003-SS-001	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI101	ELSWH09-003-SO-028	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI102	ELSWH11-003-SS-001	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI103	ELSWH11-003-SO-015	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI104	ELSWH11-005-SS-001	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI105	ELSWH10-002-SS-001	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI106	ELSWH10-002-SO-029	2018/05/04	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI107	ELSWH06-003-SS-001	2018/05/05	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI109	ELSWH06-003-SO-054	2018/05/05	2018/05/08	2018/05/15	2018/05/16	2018/05/16
GQI110	ELSWH06-002-SS-001	2018/05/05	2018/05/08	2018/05/19	2018/05/22	2018/05/16 & 2018/05/22
GQI111	ELSWH06-002-SO-010	2018/05/05	2018/05/08	2018/05/19	2018/05/22	2018/05/16 & 2018/05/22
PFOS and PFOA in water by SPE/LCMS						
GQI080	ELSWH-RS-009	2018/05/01	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI085	ELSWH-RS-010	2018/05/02	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI091	ELSWH-RS-011	2018/05/03	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI094	ELSWH08-001-GW-044	2018/05/01	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI095	ELSWH05-002-GW-025	2018/05/03	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI096	ELSWH02-002-GW-035	2018/05/04	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI097	ELSWH02-001-GW-035	2018/05/04	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI098	ELSWH05-001-GW-030	2018/05/04	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI099	ELSWH02-006-GW-030	2018/05/04	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI100	ELSWH-RS-012	2018/05/04	2018/05/08	2018/05/10	2018/05/10	2018/05/10
GQI108	ELSWH-RS-013	2018/05/05	2018/05/08	2018/05/10	2018/05/10	2018/05/10

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seal was present and intact.

c) Documentation Problems: none encountered

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

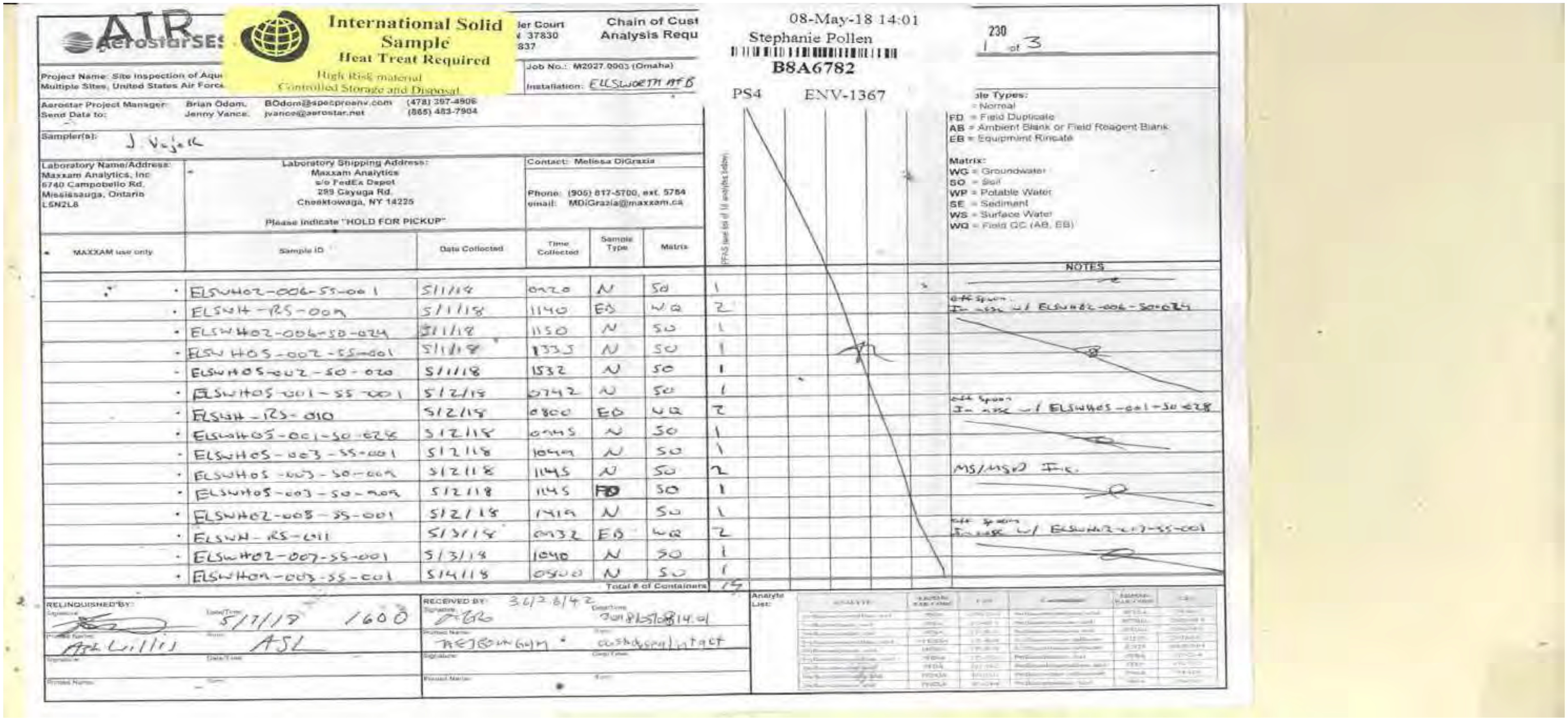
In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Faller

Project Manager- Site Assessment
and Remediation/ Ultra Trace

2018/05/25

Date



AIR AerostarSES

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

ler Court
N 37830
837

Chain of Cust
Analysis Requ

08-May-18 14:01
Stephanie Pollen
B8A6782
PS4 ENV-1367

230
1 of 3

Project Name: Site Inspection of Aqu
Multiple Sites, United States Air Force

Job No.: M2027.0003 (Omaha)
Installation: Ellsworth AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): J. Vajcik

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

Sample Types:
= Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

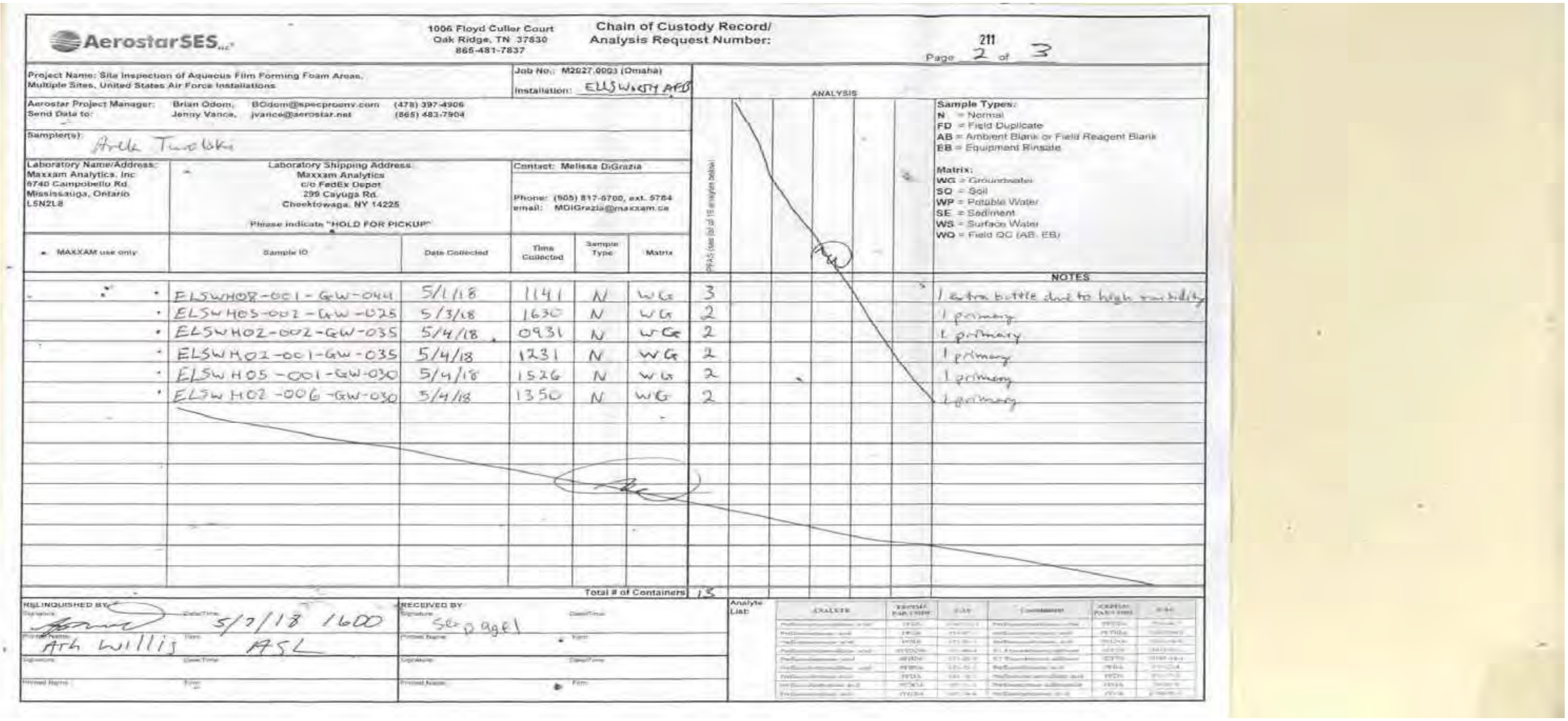
Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH02-006-SS-001	5/1/18	0920	N	SO	1	
	ELSWH-RS-009	5/1/18	1140	EB	WQ	2	Off spoon In assoc w/ ELSWH02-006-SO-024
	ELSWH02-006-SO-024	5/1/18	1150	N	SO	1	
	ELSWH05-002-SS-001	5/1/18	1335	N	SO	1	
	ELSWH05-002-SO-020	5/1/18	1532	N	SO	1	
	ELSWH05-001-SS-001	5/2/18	0742	N	SO	1	
	ELSWH-RS-010	5/2/18	0800	EB	WQ	2	Off spoon In assoc w/ ELSWH05-001-SO-028
	ELSWH05-001-SO-028	5/2/18	0945	N	SO	1	
	ELSWH05-003-SS-001	5/2/18	1049	N	SO	1	
	ELSWH05-003-SO-009	5/2/18	1145	N	SO	2	MS/MSD Ex.
	ELSWH05-003-SO-909	5/2/18	1145	FD	SO	1	
	ELSWH02-008-SS-001	5/2/18	1419	N	SO	1	
	ELSWH-RS-011	5/3/18	0932	EB	WQ	2	Off spoon In assoc w/ ELSWH02-007-SS-001
	ELSWH02-007-SS-001	5/3/18	1040	N	SO	1	
	ELSWH09-003-SS-001	5/4/18	0900	N	SO	1	
					Total # of Containers	15	

RELINQUISHED BY:
Signature:
Date/Time: 5/7/18 1600
Printed Name: Art Willis
Firm: ASL
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY: 36/2.8/42
Signature:
Date/Time: 2018/05/08 14:01
Printed Name: REJBONGUM
Firm: custody seal intact
Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:



AerostarSES

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/
Analysis Request Number:

211

Page 2 of 3

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Arek Twolski

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

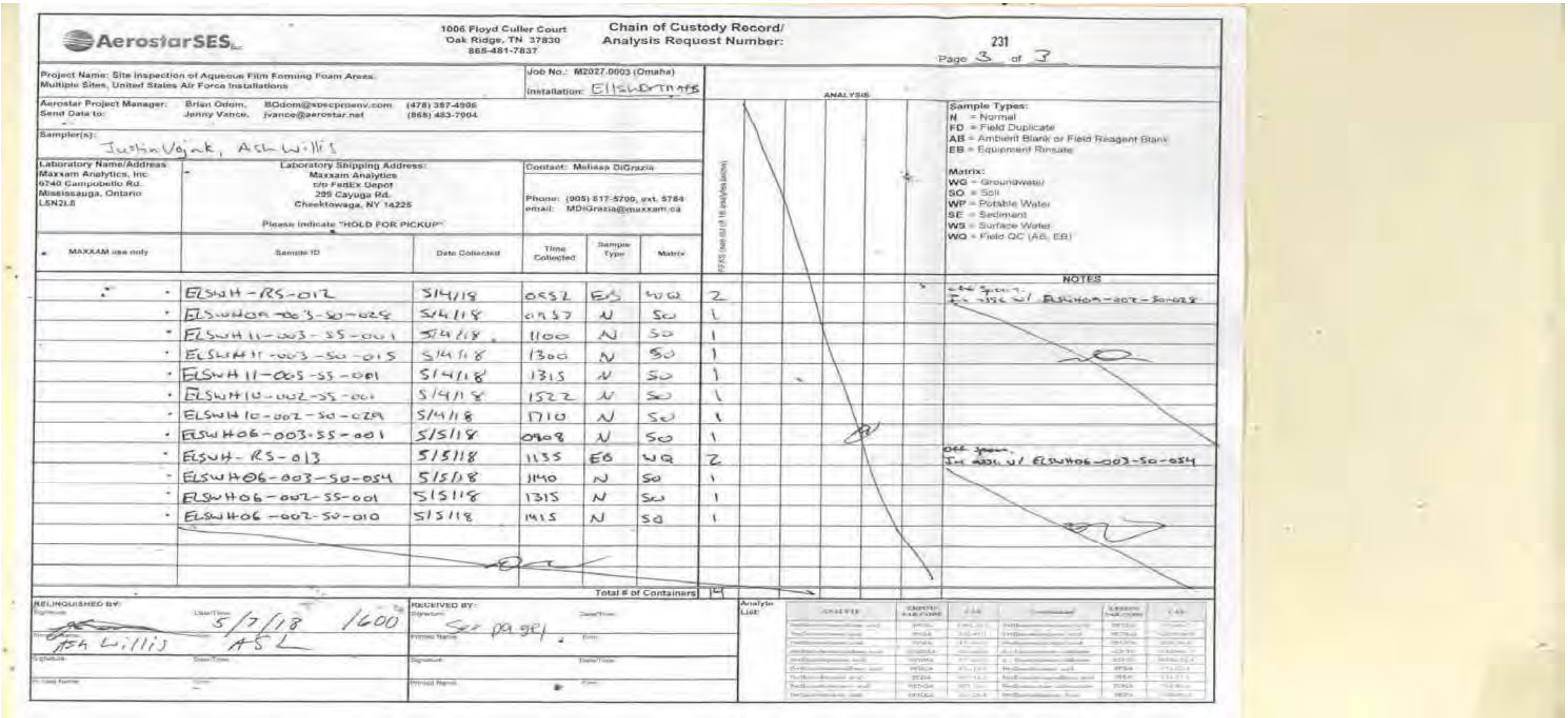
MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 15 analytes below)	NOTES
	ELSWH08-001-GW-044	5/1/18	1141	N	WG	3	1 extra bottle due to high turbidity
	ELSWH05-002-GW-025	5/3/18	1630	N	WG	2	1 primary
	ELSWH02-002-GW-035	5/4/18	0931	N	WG	2	1 primary
	ELSWH02-001-GW-035	5/4/18	1231	N	WG	2	1 primary
	ELSWH05-001-GW-030	5/4/18	1526	N	WG	2	1 primary
	ELSWH02-006-GW-030	5/4/18	1350	N	WG	2	1 primary

Total # of Containers 13

RELINQUISHED BY
Signature: Date/Time: 5/7/18 1600
Printed Name: Ath Willis Firm: ASL
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY
Signature: Se D agel Date/Time:
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:



AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/
Analysis Request Number: 231

Page 3 of 3

Project Name: Site Inspection of Aqueous Film Forming Foam Areas,
Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)
Installation: Ellsworth AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Justin Vojak, Ash Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225
Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-012	5/4/18	0552	EB	WQ	2						Off Spoon: In assoc w/ ELSWH09-003-SO-028
	ELSWH09-003-SO-028	5/4/18	0957	N	SO	1						
	ELSWH11-003-SS-001	5/4/18	1100	N	SO	1						
	ELSWH11-003-SO-015	5/4/18	1300	N	SO	1						
	ELSWH11-005-SS-001	5/4/18	1315	N	SO	1						
	ELSWH10-002-SS-001	5/4/18	1522	N	SO	1						
	ELSWH10-002-SO-029	5/4/18	1710	N	SO	1						
	ELSWH06-003-SS-001	5/5/18	0908	N	SO	1						
	ELSWH-RS-013	5/5/18	1135	EB	WQ	2						Off Spoon. In assoc. w/ ELSWH06-003-SO-054
	ELSWH06-003-SO-054	5/5/18	1140	N	SO	1						
	ELSWH06-002-SS-001	5/5/18	1315	N	SO	1						
	ELSWH06-002-SO-010	5/5/18	1415	N	SO	1						
				Total # of Containers		14						

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

RELINQUISHED BY:
Signature: Date/Time: 5/7/18 1600
Printed Name: Ash Willis Firm: ASL
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: See page 1 Date/Time:
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

Page 3 of 3

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: n/a

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/23
Report #: R5165433
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8A6782
Received: 2018/05/08, 14:01

Sample Matrix: Ground Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	6	2018/05/10	2018/05/10	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 22

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	22	N/A	2018/05/10	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	22	2018/05/15	2018/05/16	CAM SOP-00894	EPA537 m

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/05/10	2018/05/10	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: n/a

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/23
Report #: R5165433
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8A6782
Received: 2018/05/08, 14:01

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

Stephanie Pollen
Project Manager
23 May 2018 14:11:29

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
===

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package

(Level IV)

Analysis: PFOS and PFOA in water and soil (Method 537 mod.)

Maxxam Job #: B8B1135

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP’s and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Steph. Pollen
Project Manager
Maxxam
A Bureau Veritas Group Company

Stephanie
Pollen
2018.06.04
10:40:03 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8B1135 – Soil Analysis

Sample Analysis

Soil extracts were initially pre-screened and estimated concentrations were obtained so that samples could be appropriately diluted for analysis on QC batches 5541157 (2018/05/25) and 5543059 (2018/05/25). Due to high concentration, dilution was required for Perfluorooctanesulfonate (PFOS) in the following sample:

GRF764 *ELSWH06-001-SS-001*

Detection limit was adjusted accordingly.

Peak areas of injection internal standard analytes were marginally above the upper control limit for the following samples:

GRF757 *ELSWH11-004-SO-012*
GRF770 *ELSWH02-005-SO-034*

There is no impact on data quality. All other QC acceptance criteria including extracted internal standard analyte recoveries were met for these samples.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B8B1135 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batches 5536376 (2018/05/18), 5538474 (2018/05/24) and 5540994 (2018/05/24). Due to high concentrations, the following samples were analyzed for selected analytes using reduced sample extraction volumes:

GRF779	*ELSWH03-003-GW-016*	*Perfluorohexanesulfonate (PFHxS), Perfluorooctanesulfonate (PFOS)*
GRF780	*ELSWH03-002-GW-017*	*Perfluorohexanesulfonate (PFHxS), Perfluorooctanesulfonate (PFOS)*

Detection limits were adjusted accordingly.

The following samples were initially analyzed on QC batch 5538474 (2018/05/24):

GRF748	*ELSWH-SB-001*
GRF749	*ELSWH-RS-016*
GRF763	*ELSWH-RS-014*

Due to 6:2 Fluorotelomersulfonate (6:2FTS) contamination in the Method Blank, samples were re-extracted and re-analyzed for this analyte on QC batch 5547534 (2018/05/26), past the method defined hold time. Because of their chemical structures, per- and polyfluorinated alkyl substances (PFAS) are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest the hold time exceedance would not have a significant impact on the data quality.

Extracted Internal Standard Analytes

The extracted internal standard analytes $^{13}C_4$-Perfluorobutanoic acid ($^{13}C_4$-PFBA), $^{13}C_5$-Perfluoropentanoic acid ($^{13}C_5$-PFPeA), $^{13}C_2$-Perfluorohexanoic acid ($^{13}C_2$-PFHxA), $^{18}O_2$-Perfluorohexanesulfonate ($^{18}O_2$-PFHxS), $^{13}C_4$-Perfluoroheptanoic acid ($^{13}C_4$-PFHpA), $^{13}C_4$-Perfluorooctanoic acid ($^{13}C_4$-PFOA), $^{13}C_4$-Perfluorooctanesulfonate ($^{13}C_4$-PFOS), $^{13}C_5$-Perfluorononanoic acid ($^{13}C_5$-PFNA), $^{13}C_2$-Perfluorodecanoic acid ($^{13}C_2$-PFDA), $^{13}C_2$-Perfluoroundecanoic acid ($^{13}C_2$-PFUnA), $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA), $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA), $^{13}C_8$-Perfluorooctane sulfonamide ($^{13}C_8$-PFOSA), $^{13}C_2$-6:2 Fluorotelomersulfonate ($^{13}C_2$-6:2FTS) and $^{13}C_2$-8:2 Fluorotelomersulfonate ($^{13}C_2$-8:2FTS) are used to quantify native Perfluorobutanoic acid (PFBA), Perfluoropentanoic acid (PFPeA), Perfluorohexanoic acid (PFHxA), Perfluorobutanesulfonate (PFBS) & Perfluorohexanesulfonate (PFHxS), Perfluoroheptanoic acid (PFHpA), Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonate (PFOS), Perfluorononanoic acid (PFNA), Perfluorodecanoic acid (PFDA) & Perfluorodecanesulfonate (PFDS), Perfluoroundecanoic acid (PFUnA), Perfluorododecanoic acid (PFDoA), Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA), Perfluorooctane sulfonamide (PFOSA), 6:2 Fluorotelomersulfonate (6:2FTS) and 8:2 Fluorotelomersulfonate (8:2FTS) respectively. The recoveries observed for selected extracted internal standard analytes were below the defined lower control limit (LCL) for the following samples:

GRF753	*ELSWH-RS-017*	*($^{13}C_2$-PFDoA, $^{13}C_2$-PFTeDA)*
GRF775	*ELSWH06-003-GW-055*	*(All extracted internal standard analytes)*

These samples were re-extracted and re-analyzed for the associated native analytes on QC batches 5551160 (2018/05/29) and 5543607 (2018/05/25) respectively. Acceptable $^{13}C_2$-PFDoA and $^{13}C_2$-PFTeDA recoveries were obtained for sample GRF753 *(ELSWH-RS-017)* on re-analysis. Low recovery of $^{13}C_4$-PFBA was confirmed in sample GRF775 *(ELSWH06-003-GW-055)*. Acceptable recoveries were obtained for all other extracted internal standards in this sample. Both samples were re-analyzed past the method defined hold time. Because of their chemical structures, per- and polyfluorinated alkyl substances (PFAS) are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest the hold time exceedance would not have a significant impact on the data quality.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

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J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
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PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GRF747	ELSWH07-004-SO-013	2018/05/08	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF750	ELSWH11-002-SS-001	2018/05/09	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF751	ELSWH11-002-SO-010	2018/05/09	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF752	ELSWH11H-002-SO-910	2018/05/09	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF754	ELSWH11-001-SS-001	2018/05/09	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF755	ELSWH11-001-SO-012	2018/05/09	2018/05/11	2018/05/22	2018/05/25	2018/05/25
GRF756	ELSWH11-004-SS-001	2018/05/09	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF757	ELSWH11-004-SO-012	2018/05/09	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF758	ELSWH11-005-SO-013	2018/05/09	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF759	ELSWH07-002-SS-001	2018/05/09	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF760	ELSWH06-004-SS-001	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF761	ELSWH06-004-SS-901	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF762	ELSWH06-004-SO-035	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF764	ELSWH06-001-SS-001	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF765	ELSWH06-001-SO-012	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF766	ELSWH03-002-SO-011	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF767	ELSWH03-002-SO-911	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF768	ELSWH03-003-SO-011	2018/05/06	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF770	ELSWH02-005-SO-034	2018/05/07	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF771	ELSWH03-004-SO-011	2018/05/07	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF772	ELSWH07-001-SS-001	2018/05/08	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF773	ELSWH07-001-SO-029	2018/05/08	2018/05/11	2018/05/23	2018/05/25	2018/05/25
GRF774	ELSWH07-004-SS-001	2018/05/08	2018/05/11	2018/05/23	2018/05/25	2018/05/25
PFOS and PFOA in water by SPE/LCMS						
GRF748	ELSWH-SB-001	2018/05/08	2018/05/11	2018/05/25	2018/05/26	2018/05/24 & 2018/05/26
GRF749	ELSWH-RS-016	2018/05/08	2018/05/11	2018/05/25	2018/05/26	2018/05/24 & 2018/05/26
GRF753	ELSWH-RS-017	2018/05/09	2018/05/11	2018/05/22	2018/05/24	2018/05/24 & 2018/05/29
GRF763	ELSWH-RS-014	2018/05/06	2018/05/11	2018/05/25	2018/05/26	2018/05/24 & 2018/05/26
GRF769	ELSWH-RS-015	2018/05/07	2018/05/11	2018/05/17	2018/05/18	2018/05/18
GRF775	ELSWH06-003-GW-055	2018/05/07	2018/05/11	2018/05/23	2018/05/25	2018/05/18
GRF776	ELSWH06-002-GW-018	2018/05/09	2018/05/11	2018/05/22	2018/05/24	2018/05/24
GRF777	ELSWH06-002-GW-918	2018/05/09	2018/05/11	2018/05/22	2018/05/24	2018/05/25
GRF778	ELSWH06-001-GW-018	2018/05/09	2018/05/11	2018/05/22	2018/05/24	2018/05/24
GRF779	ELSWH03-003-GW-016	2018/05/10	2018/05/11	2018/05/22	2018/05/24	2018/05/24
GRF780	ELSWH03-002-GW-017	2018/05/10	2018/05/11	2018/05/22	2018/05/24	2018/05/24
GRF781	ELSWH-RS-018	2018/05/10	2018/05/11	2018/05/22	2018/05/24	2018/05/24

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seal was present and intact.

c) Documentation Problems: Sample "ELSWH03-002-SO-911" was labelled as "ELSWH03-002-GW-911", proceeded with ID on the COC with client's consent.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: Due to rework requirements, the following samples were analyzed past hold time: ELSWH-SB-001 ELSWH-RS-016, and ELSWH-RS-014 (for 6:2FTS), ELSWH-RS-017 (for PFDoA, PFTrDA, PFTedA), and ELSWH06-003-GW-055 (for all analytes).

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Fallon

Project Manager- Site Assessment
and Remediation/ Ultra Trace

2018/06/04
Date

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 238

Page 1 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): J. Vojak, A. Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH07-004-SO-013	5/08/18	1400	N	SO	1	
	ELSWH-SB-001	5/08/18	1415	AB	WQ	2	Drillers water, Sourced from base.
	~~ELSWH07-004-SO~~ ELSWH-RS-016 JV 5/8/18	5/08/18	1355	EB	WQ	2	off spoon. In assc w/ ELSWH07-004-SO-013
	ELSWH11-002-SS-001	5/09/18	0842	N	SO	1	
	ELSWH11-002-SO-010	5/09/18	0935	N	SO	2	MS/MSD Inc
	ELSW11H-002-SO-910	5/09/18	0935	FD	SO	1	
	ELSWH-RS-017	5/09/18	0930	EB	WQ	2	off spoon. In assc. w/ ELSWH11-002-SO-010
	ELSWH11-001-SS-001	5/09/18	1000	N	SO	1	
	ELSWH11-001-SO-012	5/09/18	1048	N	SO	1	
	ELSWH11-004-SS-001	5/09/18	1111	N	SO	1	
	ELSWH11-004-SO-012	5/09/18	1125	N	SO	1	
	ELSWH11-005-SO-013	5/09/18	1245	N	SO	1	
	ELSWH07-002-SS-001	5/09/18	1410	N	SO	1	

Total # of Containers 17

11-May-18 13:53
Stephanie Pollen
B8B1135
J_L ENV-1345

RELINQUISHED BY:		RECEIVED BY:	
Signature:	Date/Time: 5/10/18 1600	Signature:	Date/Time: 2018/05/11 13:53
Printed Name: Ash Willis	Firm: ASL	Printed Name: Papert k Parsewit	Firm: Maxxam
Signature:	Date/Time:	Signature:	Date/Time:
Printed Name:	Firm:	Printed Name:	Firm:

Analyte List:

INTERNATIONAL
SOLID SAMPLE
HEAT TREAT REQUIRED

ERPIMS PAR CODE	CAS
PFTEA	376-06-7
PFTRIA	72629-94-8
PFUNA	2058-94-8
62FTS	27619-97-2
82FTS	39108-34-4
PFBA	375-22-4
PFDS	335-77-3
FOSA	754-91-6
PFPA	2706-90-3

MWH 4/2 2026

Custody Seal Present 4.2/4.5 / 3.9

AerostarSESLLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 243

Page 2 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): J. Vojak, A. Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
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WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH06-004-SS-001	5/06/18	0745	N	SO	2						MS/MSD Inc.
	ELSWH06-004-SS-901	5/06/18	0745	FD	SO	1						
	ELSWH06-004-SO-035	5/06/18	0910	N	SO	1						
	ELSWH-RS-014	5/06/18	0905	EB	WQ	2						Off Spoon. In assc. w/ ELSWH06-004-SO-035
	ELSWH06-001-SS-001	5/06/18	1013	N	SO	1						
	ELSWH06-001-SO-012	5/06/18	~~1030~~ 1040	N	SO	1						
	ELSWH03-002-SO-011	5/06/18	1350	N	SO	1						
	ELSWH03-002-SO-911	5/06/18	1350	FD	SO	1						
	ELSWH03-003-SO-011	5/06/18	1503	N	SO	1						
	ELSWH-RS-015	5/07/18	1301	EB	WQ	2						Off Spoon. In assc. w/ ELSWH02-005-SO-034
	ELSWH02-005-SO-034	5/07/18	1305	N	SO	1						
	ELSWH03-004-SO-011	5/07/18	1605	N	SO	1						
	ELSWH07-001-SS-001	5/08/18	0850	N	SO	1						
	ELSWH07-001-SO-029	5/08/18	1256	N	SO	1						
	ELSWH07-004-SS-001	5/08/18	1320	N	SO	1						
					Total # of Containers	18						

RELINQUISHED BY:
Signature: Date/Time: 5/10/18 1600
Printed Name: Ash Willis Firm: ASL
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: See Pg-1 Date/Time:
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

221

Page 3 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ______________

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Arek Turalski

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

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Matrix:
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WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH06-003-GW-055	5/7/18	1621	N	WG	2						
	ELSWH06-002-GW-018	5/09/18	1035	N	WG	6						MS/MOD Inc.
	ELSWH06-002-GW-918	5/09/18	1035	FD	WG	2						
	ELSWH06-001-GW-018	5/09/18	1133	N	WG	2						

Total # of Containers 12

RELINQUISHED BY:
Signature:
Date/Time: 05/10/18 1600
Printed Name: Ash Willis
Firm: ASL

Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature: See PS-1
Date/Time:
Printed Name:
Firm:

Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 222

Page 4 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Arek Turolski

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH03-003-GW-016	5/10/18	1321	N	WG	2						
	ELSWH03-002-GW-017	5/10/18	1421	N	WG	2						
	ELSWH~~03~~-RS-018	5/10/18	1215	EB	WQ	2						Rinsate taken off tubing associated with sample ELSWH03-003-GW-016

Total # of Containers 6

RELINQUISHED BY:
Signature:
Date/Time: 05/10/18 1600
Printed Name:
Firm:

RECEIVED BY:
Signature: Sceby
Date/Time:
Printed Name:
Firm:

Signature:
Date/Time:
Printed Name:
Firm:

Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

Page 4 of 4

Stephanie Pollen

To: Stephanie Pollen
Subject: RE: [JOB#:B8B1135] FLAG resolution sample ID correction

Please note, this message originated outside of the Maxxam mail system. Please use caution when opening links or attachments.

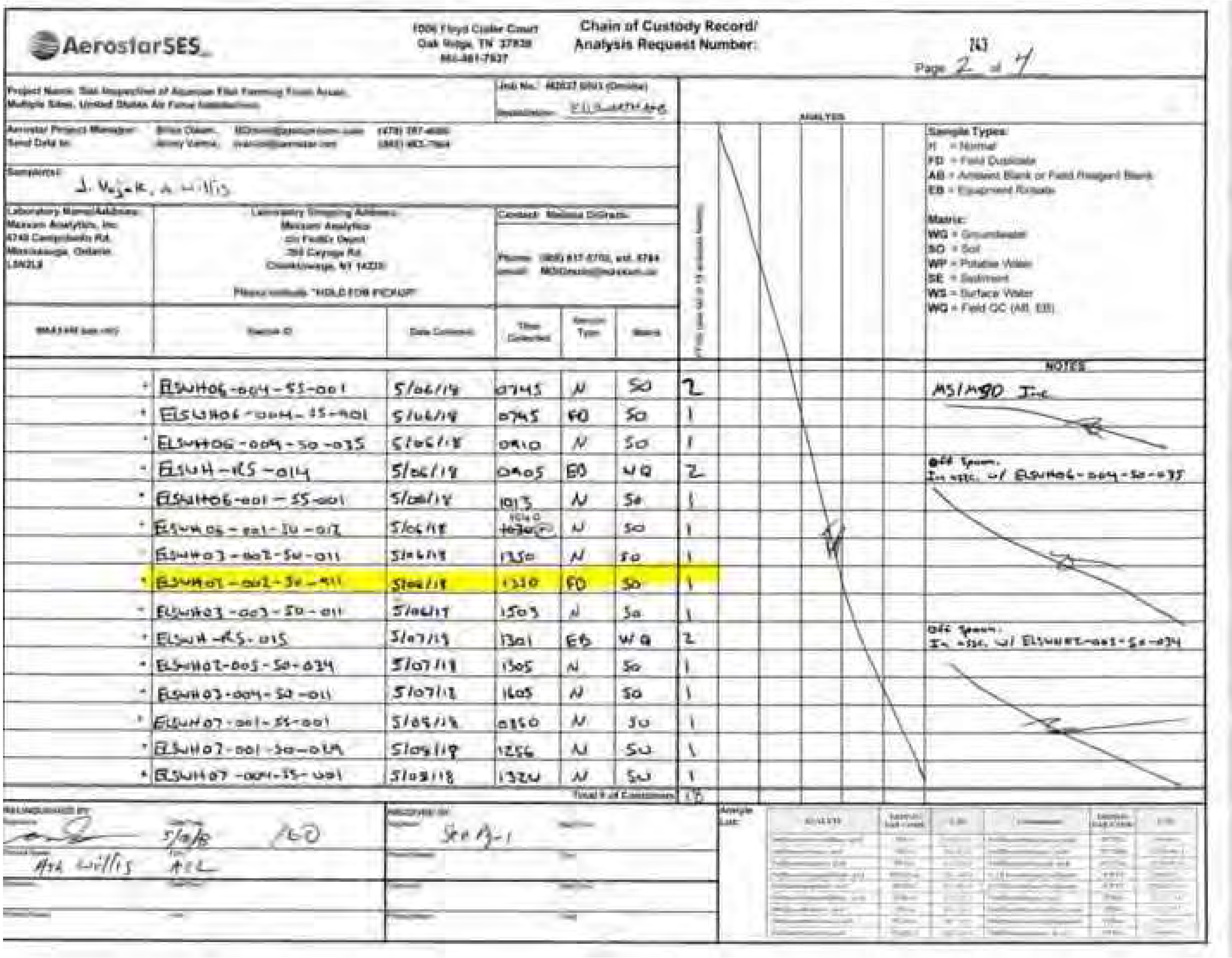
Thanks, Stephanie – I agree with you.

From: Stephanie Pollen [mailto:SPollen@maxxam.ca]
Sent: Friday, May 11, 2018 4:19 PM
To: Jenny Vance <JVance@aerostar.net>; Laura Natzke <LNatzke@aerostar.net>
Cc: Ashley Willis <AWillis@aerostar.net>
Subject: Ellsworth AFB (Maxxam job B

Good afternoon,

We received the below submission for Ellsworth AFB and our sample inspection staff has informed me that sample "ELSWH03-002-SO-911" is labelled on the bottle as "ELSWH03-002-**GW**-911". The sample is soil, I am assuming this was just a transcription error so we will proceed with the ID as per the CoC.
Please let me know otherwise.

Thank you and have a great weekend!



AerostarSES

1006 Floyd Culler Court
Oak Ridge, TN 37830

Chain of Custody Record/
Analysis Request Number: 243

Page 2 of 4

Samplers: J. Vajak, A. Willis

Installation: Ellsworth AFB

Please include "HOLD FOR PICKUP"

	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	
*	ELSWH06-004-SS-001	5/06/18	0745	N	SO	2
*	ELSWH06-004-SS-901	5/06/18	0745	FD	SO	1
*	ELSWH06-004-SO-035	5/06/18	0810	N	SO	1
*	ELSWH-RS-014	5/06/18	0905	EB	WQ	2
*	ELSWH06-001-SS-001	5/06/18	1013	N	SO	1
*	ELSWH06-001-SO-017	5/06/18	~~1030~~ 1040	N	SO	1
*	ELSWH03-002-SO-011	5/06/18	1350	N	SO	1
*	ELSWH03-002-SO-911	5/06/18	1350	FD	SO	1
*	ELSWH03-003-SO-011	5/06/18	1503	N	SO	1
*	ELSWH-RS-015	5/07/18	1301	EB	WQ	2
*	ELSWH02-005-SO-034	5/07/18	1305	N	SO	1
*	ELSWH03-004-SO-011	5/07/18	1605	N	SO	1
*	ELSWH07-001-SS-001	5/08/18	0850	N	SO	1
*	ELSWH07-001-SO-019	5/08/18	1256	N	SO	1
*	ELSWH07-004-SS-001	5/08/18	1320	N	SO	1
				Total # of Containers		18

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

NOTES:
MS/MSD Inc.
Off Spoon. In assc. w/ ELSWH06-004-SO-035
Off Spoon. In assc. w/ ELSWH02-005-SO-034

Relinquished by:
Date: 5/8/18 Time: 1600
Printed Name: Asa Willis Firm: AEE

Received by: See B-1

Kind regards,

STEPHANIE POLLEN, B.Sc.
Project Manager, Site Assessment and Remediation/Ultra Trace Analysis

Office 905.817.5830
Mobile 416.432.3443
Toll free 800 565 7227
spollen@maxxam.ca

6740 Campobello Rd. / Mississauga, ON Canada L5N 2L8
maxxam.ca

Please Note: Maxxam will be CLOSED Monday May 21 for Victoria Day.

Maxxam
A Bureau Veritas Group Company
Success Through Science®

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Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/30
Report #: R5184408
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8B1135
Received: 2018/05/11, 13:53

Sample Matrix: Ground Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/05/22	2018/05/24	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/23	2018/05/25	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 23

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	23	N/A	2018/05/14	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	6	2018/05/22	2018/05/25	CAM SOP-00894	EPA537 m
PFOS and PFOA in soil by SPE/LCMS (1)	17	2018/05/23	2018/05/25	CAM SOP-00894	EPA537 m

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/17	2018/05/18	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/05/18	2018/05/24	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/22	2018/05/24	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Maxxam
A Bureau Veritas Group Company

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/30
Report #: R5184408
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8B1135
Received: 2018/05/11, 13:53

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

Stephanie Pollen
Project Manager
30 May 2018 15:59:01

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package
(Level IV)

Analysis: PFOS and PFOA in soil (Method 537 mod.)

Maxxam Job #: B8C0381

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Steph Pollen
Project Manager
Maxxam
A Bureau Veritas Group Company

Stephanie
Pollen
2018.06.18
12:16:24 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8C0381 – Soil Analysis

Sample Analysis

Soil extracts were initially pre-screened and estimated concentrations were obtained so that samples could be appropriately diluted for analysis on QC batches 5549693 (2018/05/28-30) and 5549696 (2018/05/28-29). Due to high concentrations, dilutions were required for selected analytes in the following samples:

GTF528	*ELSWH10-004-SD-001*	*Perfluorooctanesulfonate (PFOS)*
GTF532	*ELSWH04-002-SS-001*	*Perfluorooctanesulfonate (PFOS)*
GTF540	*ELSWH01-003-SS-001*	*Perfluorooctanesulfonate (PFOS)*
GTF542	*ELSWH01-002-SS-001*	*Perfluorooctanesulfonate (PFOS)*
GTF543	*ELSWH01-002-SO-012*	*All analytes*
GTF544	*ELSWH01-004-SS-001*	*All analytes*
GTF545	*ELSWH01-004-SO-012*	*Perfluorooctanesulfonate (PFOS)*
GTF547	*ELSWH01-001-SS-001*	*All analytes*
GTF548	*ELSWH01-001-SS-901*	*All analytes*
GTF550	*ELSWH01-001-SO-013*	*Perfluorooctanesulfonate (PFOS), 6:2 Fluorotelomersulfonate (6:2FTS)*
GTF551	*ELSWH01-001-SO-913*	*Perfluorooctanesulfonate (PFOS), 6:2 Fluorotelomersulfonate (6:2FTS)*
GTF552	*ELSWH03-001-SO-009*	*Perfluorooctanesulfonate (PFOS)*

Detection limits were adjusted accordingly.

Peak areas of injection internal standard analytes were above the defined upper control limit (UCL) for selected dilutions in the following samples:

GTF544	*ELSWH01-004-SS-001*
GTF548	*ELSWH01-001-SS-901*
GTF551	*ELSWH01-001-SO-913*

Sample vials were visually inspected and evaporation of vial contents was observed. Because quantitation is performed using isotope dilution and internal standard techniques, any apparent gains of the target compound that may occur during extract evaporation will be mirrored by a similar gain of the labeled internal standard, and as such can be accounted for and corrected. Therefore, the quantitation of target and extracted internal standard analytes is not affected by the high injection internal standard analyte peak areas.

Extracted Internal Standard Analytes

The extracted internal standard analyte $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) is used to quantify native Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA). The recoveries observed for this extracted internal standard analyte were below the defined lower control limit (LCL) for the following samples:

GTF528	*ELSWH10-004-SD-001*
GTF542	*ELSWH01-002-SS-001*

Samples were re-extracted and re-analyzed for the associated native analytes on QC batch 5554876 (2018/06/02-03). Results were reported from diluted extracts where acceptable $^{13}C_2$-PFTeDA recoveries were obtained. Detection limits were adjusted accordingly.

QC Samples

Matrix Spike and Matrix Spike Duplicate (MS/MSD) was performed on sample GTF547 *(ELSWH01-001-SS-001)* on QC batch 5549693 (2018/05/28-30) but not analyzed due to high concentrations of target analytes in the native sample.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GTF526	ELSWH11-006-SD-001	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF528	ELSWH10-004-SD-001	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30 & 2018/06/02-03
GTF532	ELSWH04-002-SS-001	2018/05/18	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF533	ELSWH04-002-SO-035	2018/05/18	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF534	ELSWH07-002-SO-013	2018/05/09	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF538	ELSWH07-003-SS-001	2018/05/15	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF539	ELSWH07-003-SO-016	2018/05/15	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF540	ELSWH01-003-SS-001	2018/05/15	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF541	ELSWH01-003-SO-025	2018/05/15	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF542	ELSWH01-002-SS-001	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30 & 2018/06/02-03
GTF543	ELSWH01-002-SO-012	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF544	ELSWH01-004-SS-001	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF545	ELSWH01-004-SO-012	2018/05/16	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF547	ELSWH01-001-SS-001	2018/05/17	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF548	ELSWH01-001-SS-901	2018/05/17	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF550	ELSWH01-001-SO-013	2018/05/17	2018/05/22	2018/05/26	2018/05/29	2018/05/28-29
GTF551	ELSWH01-001-SO-913	2018/05/17	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30
GTF552	ELSWH03-001-SO-009	2018/05/17	2018/05/22	2018/05/26	2018/05/28	2018/05/28-30

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seals were present and intact.

c) Documentation Problems: Sample ELSWH01-MW930107-GW-034 required high level analysis, client confirmed to proceed. Due to the size of the submission, the Data Package was split into soil and water versions.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: Due to rework requirements, the following samples were analyzed past hold time; ELSWH02-008-GW-029, ELSWH02-008-GW-929, and ELSWH02-007-GW-018.

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Fallr
Project Manager- Site Assessment
and Remediation/ Ultra Trace

2018/06/18
Date

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

0305 ④

Page 1 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): A. Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Stephanie Pollen
Phone: (905) 817-5830
email: Spollen@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-019	2018/05/15	0910	EB	WQ	2						Associated w/ ELSWH07-001-GW-035 [illegible]
	ELSWH07-001-GW-035	2018/05/15	1255	N	WG	2						
	ELSWH11-006-SD-001	2018/05/16	0900	N	SE	2						
	ELSWH11-006-SW-001	2018/05/16	0900	N	WS	2						
	ELSWH10-004-SD-001	2018/05/16	0945	N	SE	2						
	ELSWH10-004-SW-001	2018/05/16	0945	N	WS	2						
	ELSWH01-MW930107-GW-034	2018/05/16	1554	N	WG	2						
					Total # of Containers	14						

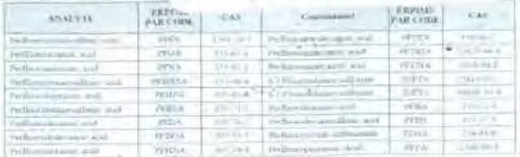
INTERNATIONAL
SOLID SAMPLE
HEAT TREAT REQUIRED

22-May-18 14:19
Stephanie Pollen
B8C0381
HGL ENV-980

RELINQUISHED BY:		RECEIVED BY:	
Signature:	Date/Time: 05/~~20~~ 21/18 1600	Signature: Dipika Singh	Date/Time: 2018/05/22 14:19
Printed Name: Ash Willis	Firm: ASL	Printed Name: DIPIKA SINGH	Firm: 4.6/5.4/5.6
Signature:	Date/Time:	Signature:	Date/Time: 4.3/5.8/5.3
Printed Name:	Firm:	Printed Name:	Firm: Custody Seal Present

Custody Seal Intact

Analyte List:



AerostarSES

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

232

Page 2 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: Ellsworth

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): A. Willis, Arek T.

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-022	5/18/18	0840	EB	WQ	2						
	ELSWH04-002-SS-001	5/18/18	0845	N	SO	1						
	ELSWH04-002-SO-035	5/18/18	1030	N	SO	1						
	ELSWH07-002-SO-013	5/9/18	1610	N	SO	1						
	ELSWH02-008-GW-029	5/18/18	1016	N	WG	2						
	ELSWH02-008-GW-929	5/18/18	1016	FD	WG	2						
	ELSWH02-007-GW-018	5/18/18	1127	N	WG	2						

Total # of Containers 11

RELINQUISHED BY:
Signature
Date/Time 05/21/18 1600
Printed Name Ash Willis
Firm ASL

Signature
Date/Time
Printed Name
Firm

RECEIVED BY:
Signature
Date/Time SEE PG#1
Printed Name
Firm

Signature
Date/Time
Printed Name
Firm

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Constituent	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	[illegible]	Perfluorotridecanoic acid	PFTrIA	[illegible]
Perfluorooctanoic acid	PFOA	[illegible]	Perfluorotetradecanoic acid	PFTeA	[illegible]
Perfluorononanoic acid	PFNA	[illegible]	Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorohexanesulfonic acid	PFHxS	355-46-4	6:2 Fluorotelomer sulfonate	6:2 FTS	[illegible]
Perfluoroheptanoic acid	PFHpA	375-85-9	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBS	[illegible]	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	[illegible]	Perfluorodecanesulfonic acid	PFDS	[illegible]
Perfluorododecanoic acid	PFDoA	[illegible]	Perfluorooctane sulfonamide	FOSA	[illegible]
Perfluorohexanoic acid	PFHxA	307-24-4	Perfluoropentanoic Acid	PFPA	[illegible]

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 223

Page 3 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations	Job No.: M2027.0003 (Omaha) Installation: Ellsworth
Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906 Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904	
Sampler(s): Arek T, Justin V.	
Laboratory Name/Address: Maxxam Analytics, Inc 6740 Campobello Rd. Mississauga, Ontario L5N2L8	Laboratory Shipping Address: Maxxam Analytics c/o FedEx Depot 299 Cayuga Rd. Cheektowaga, NY 14225 Please indicate "HOLD FOR PICKUP"
Contact: Melissa DiGrazia	Phone: (905) 817-5700, ext. 5784 email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH07-003-SS-001	2013/05/15	1015	N	SO	1						
	ELSWH07-003-SO-016	2018/05/15	1150	N	SO	1						
	ELSWH01-003-SS-001	2018/05/15	1410	N	SO	1						
	ELSWH01-003-SO-025	2018/05/15	1600	N	SO	1						
	ELSWH01-002-SS-001	2018/05/16	1250	N	SO	1						
	ELSWH01-002-SO-012	2018/05/16	1330	N	SO	1						
	ELSWH01-004-SS-001	2018/05/16	1340	N	SO	1						
	ELSWH01-004-SO-012	2018/05/16	1430	N	SO	1						
	ELSWH-RS-020	2018/05/16	1249	EB	WQ	2						Associated w/sample ELSWH01-002-SS-001
	ELSWH01-001-SS-001	5/17/18	0833	N	SO	2						MS/MSD Inc
	ELSWH01-001-SS-901	5/17/18	0833	FD	SO	1						
	ELSWH-RS-021	5/17/18	0935	EB	WQ	2						off Spoon EB assc w/ ELSWH01-001-SO-013
	ELSWH01-001-SO-013	5/17/18	0947	N	SO	2						MS/MSD Inc
	ELSWH01-001-SO-913	5/17/18	0947	FD	SO	1						
	ELSWH03-001-SO-00[illegible]	5/17/18	1325	N	SO	1						
					Total # of Containers	19						

RELINQUISHED BY:		RECEIVED BY:	
Signature	Date/Time 05/21/18 1600	Signature	Date/Time SEE PG #1
Printed Name Ash Willis	Firm ASL	Printed Name	Firm
Signature	Date/Time	Signature	Date/Time
Printed Name	Firm	Printed Name	Firm

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecane sulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

0298

Page 4 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)
Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s):
A. Willis, M. Neilson

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Stephanie Pollen

Phone: (905) 817-5830
email: Spollen@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
•	ELSWH10-002-GW-035	2018/05/19	0932	N	WG	2						
•	ELSWH10-002-GW-935	2018/05/19	0932	FD	WG	2						
•	ELSWH-RS-023	2018/05/19	0955	EB	WQ	2						Associated w/ ELSWH10-001-GW-045 off of WL meter
•	ELSWH10-001-GW-045	2018/05/19	1036	N	WG	2						
•	ELSWH-RS-024	2018/05/20	0810	N	WG	2						Associated w/ ELSWH01-001-GW-015 off of WL METER
•	ELSWH01-001-GW-015	2018/05/20	0925	N	WG	6						MS/MSD
•	ELSWH01-001-GW-915	2018/05/20	0925	FD	WG	2						
•	ELSWH11-002-GW-015	2018/05/20	1500	N	WG	2						
•	ELSWH11-003-GW-020	2018/05/20	1534	N	WG	2						
•	ELSWH11-001-GW-015	2018/05/20	1614	N	WG	2						
					Total # of Containers	24						

RELINQUISHED BY:
Signature:
Date/Time: 05/21/18 1600
Printed Name: A. Willis
Firm: ASL
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature:
Date/Time: SEE PG#1
Printed Name:
Firm:
Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Stephanie Pollen

From: Jenny Vance <JVance@aerostar.net>
Sent: Thursday, May 24, 2018 12:18 PM
To: Stephanie Pollen
Cc: Laura Natzke; Brian Odom
Subject: RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Please note, this message originated outside of the Maxxam mail system. Please use caution when opening links or attachments.

Thanks, Stephanie.
Go ahead, but keep us posted.

From: Stephanie Pollen [mailto:SPollen@maxxam.ca]
Sent: Thursday, May 24, 2018 12:02 PM
To: Jenny Vance <JVance@aerostar.net>
Cc: Laura Natzke <LNatzke@aerostar.net>; Brian Odom <BOdom@specproenv.com>
Subject: RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Hi Jenny,

The lab has confirmed PFHxS will definitely need high level. PFHxA, PFOS & 6:2-FTS might need it, we'll need to see the results of the 100x SPE first.

Kind regards,

STEPHANIE POLLEN, B.Sc.
Project Manager, Site Assessment and Remediation/Ultra Trace Analysis

Office 905.817.5830
Mobile 416.432.3443
Toll free 800 565 7227
spollen@maxxam.ca

6740 Campobello Rd. / Mississauga, ON Canada L5N 2L8
maxxam.ca

Success Through Science®

From: Jenny Vance [mailto:JVance@aerostar.net]
Sent: Thursday, May 24, 2018 11:09 AM
To: Stephanie Pollen
Cc: Laura Natzke; Brian Odom
Subject: RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

I suspect the samples were prescreened and showed high levels of one or more analytes. If so, can you tell us which analytes are requiring a 100x dilution? As always, my fear is that we won't be able to determine whether PFOS or PFOA exceed regulatory criteria. If one or both of those was detected at high levels, I don't think we have a problem (well – except for the obvious contamination at the well).

From: Stephanie Pollen [mailto:SPollen@maxxam.ca]
Sent: Thursday, May 24, 2018 11:01 AM
To: Jenny Vance <JVance@aerostar.net>
Cc: Laura Natzke <LNatzke@aerostar.net>
Subject: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Good morning Jenny,

The lab has informed me that the below samples require high-level analysis. Can you please confirm if we are OK to proceed?

Maxxam job B8C0381 (Ellsworth AFB)

ELSWH01-MW930107-GW-034 (GFT530)
ELSWH01-001-GW-015 (GFT558)
ELSWH01-001-GW-915 (GFT559)

Kind regards,

STEPHANIE POLLEN, B.Sc.
Project Manager, Site Assessment and Remediation/Ultra Trace Analysis

Office 905.817.5830
Mobile 416.432.3443
Toll free 800 565 7227
spollen@maxxam.ca

6740 Campobello Rd. / Mississauga, ON Canada L5N 2L8
maxxam.ca

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.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Sample Matrix: Ground Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/25	2018/06/06	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/05/30	2018/06/01	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/06/04	2018/06/11	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 16

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	16	N/A	2018/05/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	15	2018/05/26	2018/05/28	CAM SOP-00894	EPA537 m
PFOS and PFOA in soil by SPE/LCMS (1)	1	2018/05/26	2018/05/29	CAM SOP-00894	EPA537 m

Sample Matrix: SEDIMENT
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	2	N/A	2018/05/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2018/05/26	2018/05/28	CAM SOP-00894	EPA537 m

Sample Matrix: Surface Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance
Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/25	2018/06/06	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/28	2018/06/02	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/30	2018/06/01	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Maxxam
A Bureau Veritas Group Company

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Encryption Key

Stephanie Pollen
Project Manager
12 Jun 2018 14:03:51

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package

(Level IV)

Analysis: PFOS and PFOA in water (Method 537 mod.)

Maxxam Job #: B8C0381

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Steph Pollen
Project Manager
Maxxam
A Bureau Veritas Group Company

Stephanie
Pollen
2018.06.18
11:59:04 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8C0381 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batches 5548287 (2018/06/06), 5549674 (2018/05/27), 5551465 (2018/06/02), 5554565 (2018/06/03), 5555549 (2018/06/01-02) and 5557332 (2018/06/04-05). Due to high concentrations, the following samples were analyzed for selected analytes using reduced sample extraction volumes:

GTF529	*ELSWH10-004-SW-001*	*Perfluorohexanesulfonate (PFHxS)*
GTF530	*ELSWH01-MW930107-GW-034*	*All analytes*
GTF535	*ELSWH02-008-GW-029*	*Perfluorooctanesulfonate (PFOS)*
GTF558	*ELSWH01-001-GW-015*	*All analytes*
GTF559	*ELSWH01-001-GW-915*	*All analytes*

In addition, sample GTF530 *(ELSWH01-MW930107-GW-034)* was analyzed for Perfluorohexanesulfonate (PFHxS) by high level analysis with serial dilution on QC batch 5548299 (2018/05/28), with project approval by the client. Detection limits were adjusted accordingly.

Re-Analysis of QC batch 5548287

QC batch 5548287 was initially analyzed on 2018/05/28. During assembly of the Level IV data package, it was observed that raw data was not available for the Instrument Sensitivity Check (ISC) sample on this QC batch. Several samples on this QC batch required re-injection due to possible analyte carryover. A 2nd ISC was injected prior to these sample re-injections, and it is likely that the raw data for the original ISC was overwritten during this process. Because initial ISC data was no longer available, the entire batch was re-analyzed on 2018/06/06. Based on the initial analytical results (2018/05/28), the following sample was re-extracted for Perfluorobutanoic acid (PFBA) on QC batch 5555549 (2018/06/01-02) due to low recovery of the associated extracted internal standard analyte ($^{13}C_4$-Perfluorobutanoic acid, $^{13}C_4$-PFBA):

GTF525	*ELSWH07-001-GW-035*

On re-analysis of QC batch 5548287 (2018/06/06), acceptable recovery was obtained for $^{13}C_4$-PFBA. The final result for Perfluorobutanoic acid (PFBA) was therefore reported from this re-analysis and the result from the re-extraction on QC batch 5555549 (2018/06/01-02) was not used.

QC Batch 5554565

The following samples were initially analyzed on QC batch 5554565 (2018/06/03):

GTF535	*ELSWH02-008-GW-029*
GTF536	*ELSWH02-008-GW-929*
GTF537	*ELSWH02-007-GW-018*

Due to failure of QC acceptance criteria in the Spike (LCS), samples were re-extracted and re-analyzed on QC batch 5563245 (2018/06/05-11), past the method defined hold time. Because of their chemical structures, per- and polyfluorinated alkyl substances (PFAS) are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest the hold time exceedance would not have a significant impact on the data quality. On the initial analysis of QC batch 5563245 (2018/06/05), the recovery observed for 8:2 Fluorotelomersulfonate (8:2FTS) in the Instrument Sensitivity Check (ISC) sample did not meet acceptance criteria. The entire batch was re-injected for this analyte on 2018/06/11.

Sample GTF531 (ELSWH-RS-022)

The following sample was initially analyzed on QC batch 5555549 (2018/06/01-02):

GTF531 *ELSWH-RS-022*

Due to discrepancies between the initial screening and analytical results, the sample was re-extracted and re-analyzed on QC batch 5563245 (2018/06/05-11), past the method defined hold time. Results from the re-analysis confirmed the initial results obtained on QC batch 5555549 (2018/06/01-02). Final results were therefore reported from the initial analysis on QC batch 5555549 (2018/06/01-02) which had been analyzed within hold time.

QC Samples

Matrix Spike and Matrix Spike Duplicate (MS/MSD) was required for sample GTF558 *(ELSWH01-001-GW-015)* on QC batch 5557332 (2018/06/04-05) but not performed to high concentrations of target analytes in the native sample. A Matrix Duplicate (MD) was analyzed instead.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in water by SPE/LCMS						
GTF524	ELSWH-RS-019	2018/05/15	2018/05/22	2018/05/25	2018/06/06	2018/06/06
GTF525	ELSWH07-001-GW-035	2018/05/15	2018/05/22	2018/05/25	2018/06/06	2018/06/06
GTF527	ELSWH11-006-SW-001	2018/05/16	2018/05/22	2018/05/26	2018/05/27	2018/05/27
GTF529	ELSWH10-004-SW-001	2018/05/16	2018/05/22	2018/05/26	2018/05/27	2018/05/27
GTF530	ELSWH01-MW930107-GW-034	2018/05/16	2018/05/22	2018/05/26	2018/05/27	2018/05/27 & 2018/05/28
GTF530 Dup	ELSWH01-MW930107-GW-034	2018/05/16	2018/05/22	2018/05/25	2018/05/28	2018/05/28
GTF531	ELSWH-RS-022	2018/05/18	2018/05/22	2018/05/30	2018/06/01	2018/06/01-02
GTF535	ELSWH02-008-GW-029	2018/05/18	2018/05/22	2018/06/04	2018/06/11	2018/06/05-11
GTF536	ELSWH02-008-GW-929	2018/05/18	2018/05/22	2018/06/04	2018/06/11	2018/06/05-11
GTF537	ELSWH02-007-GW-018	2018/05/18	2018/05/22	2018/06/04	2018/06/11	2018/06/05-11
GTF546	ELSWH-RS-020	2018/05/16	2018/05/22	2018/05/26	2018/05/27	2018/05/27
GTF549	ELSWH-RS-021	2018/05/17	2018/05/22	2018/05/28	2018/06/02	2018/06/02
GTF553	ELSWH10-002-GW-035	2018/05/19	2018/05/22	2018/05/30	2018/06/01	2018/06/01-02
GTF554	ELSWH10-002-GW-935	2018/05/19	2018/05/22	2018/05/30	2018/06/01	2018/06/01-02
GTF555	ELSWH-RS-023	2018/05/19	2018/05/22	2018/05/30	2018/06/01	2018/06/01-02
GTF556	ELSWH10-001-GW-045	2018/05/19	2018/05/22	2018/05/30	2018/06/01	2018/06/01-02
GTF557	ELSWH-RS-024	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF558	ELSWH01-001-GW-015	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF558 Dup	ELSWH01-001-GW-015	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF559	ELSWH01-001-GW-915	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF560	ELSWH11-002-GW-015	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF561	ELSWH11-003-GW-020	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05
GTF562	ELSWH11-001-GW-015	2018/05/20	2018/05/22	2018/05/31	2018/06/04	2018/06/04-05

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seals were present and intact.

c) Documentation Problems: Sample ELSWH01-MW930107-GW-034 required high level analysis, client confirmed to proceed. Due to the size of the submission, the Data Package was split into soil and water versions.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: Due to rework requirements, the following samples were analyzed past hold time; ELSWH02-008-GW-029, ELSWH02-008-GW-929, and ELSWH02-007-GW-018.

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

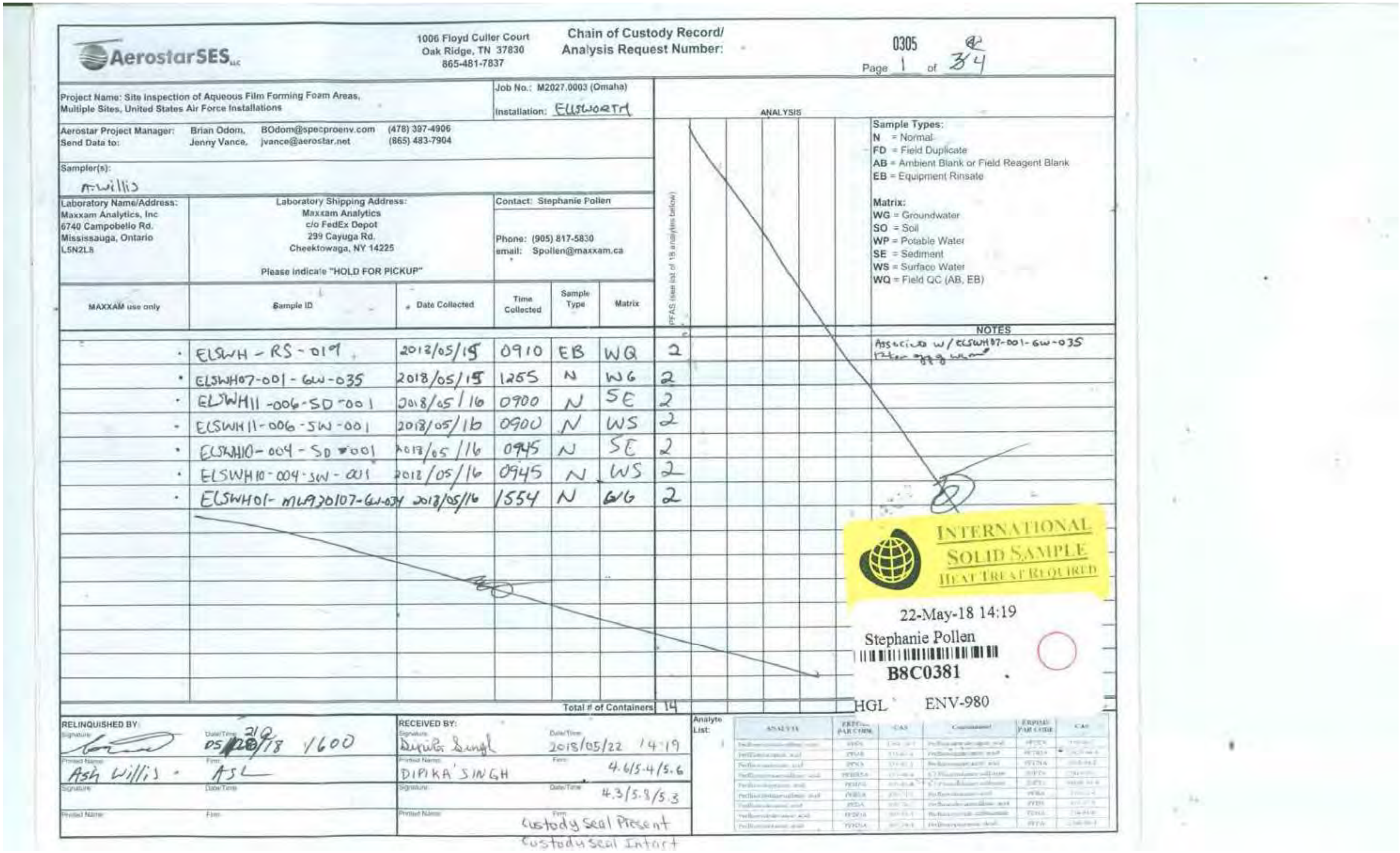
In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Pallen

Project Manager- Site Assessment and Remediation/ Ultra Trace

2018/06/18

Date



AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 0305

Page 1 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906

Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): A. Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Stephanie Pollen

Phone: (905) 817-5830
email: Spollen@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH-RS-019	2018/05/15	0910	EB	WQ	2	Associated w/ ELSWH07-001-GW-035 [illegible]
	ELSWH07-001-GW-035	2018/05/15	1255	N	WG	2	
	ELSWH11-006-SD-001	2018/05/16	0900	N	SE	2	
	ELSWH11-006-SW-001	2018/05/16	0900	N	WS	2	
	ELSWH10-004-SD-001	2018/05/16	0945	N	SE	2	
	ELSWH10-004-SW-001	2018/05/16	0945	N	WS	2	
	ELSWH01-MW930107-GW-034	2018/05/16	1554	N	WG	2	

Total # of Containers: 14

INTERNATIONAL
SOLID SAMPLE
HEAT TREAT REQUIRED

22-May-18 14:19
Stephanie Pollen
B8C0381
HGL ENV-980

RELINQUISHED BY:
Signature:
Date/Time: 05/21/18 1600
Printed Name: Ash Willis
Firm: ASL
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature: Dipika Singh
Date/Time: 2018/05/22 14:19
Printed Name: DIPIKA SINGH
Firm: 4.6/5.4/5.6
Signature:
Date/Time: 4.3/5.3/5.3
Printed Name:
Firm: Custody Seal Present
Custody Seal Intact

Analyte List:

AerostarSES

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

232
Page 2 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: EllSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): A. Willis, Arek T.

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH-RS-022	5/18/18	0840	EB	WQ	2	
	ELSWH04-002-SS-001	5/18/18	0845	N	SO	1	
	ELSWH04-002-SO-035	5/18/18	1030	N	SO	1	
	ELSWH07-002-SO-013	5/9/18	1610	N	SO	1	
	ELSWH02-008-GW-029	5/18/18	1016	N	WG	2	
	ELSWH02-008-GW-929	5/18/18	1016	FD	WG	2	
	ELSWH02-007-GW-018	5/18/18	1127	N	WG	2	
					Total # of Containers	11	

RELINQUISHED BY:
Signature: Date/Time: 05/21/18 1600
Printed Name: Ash Willis Firm: ASL
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: Date/Time: SEE PG#1
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Compound	ERPIMS PAR CODE	CAS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	6:2 Fluorotelomer sulfonate	[illegible]	[illegible]
[illegible]	PFHPA	[illegible]	8:2 Fluorotelomer sulfonate	8:2FTS	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	PFBA	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

223 ⑦

Page 3 of ~~3~~ 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Arek T, Justin V.

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH07-003-SS-001	2018/05/15	1015	N	SO	1	
	ELSWH07-003-SO-016	2018/05/15	1150	N	SO	1	
	ELSWH01-003-SS-001	2018/05/15	1410	N	SO	1	
	ELSWH01-003-SO-025	2018/05/15	1600	N	SO	1	
	ELSWH01-002-SS-001	2018/05/16	1250	N	SO	1	
	ELSWH01-002-SO-012	2018/05/16	1330	N	SO	1	
	ELSWH01-004-SS-001	2018/05/16	1340	N	SO	1	
	ELSWH01-004-SO-012	2018/05/16	1430	N	SO	1	
	ELSWH-RS-020	2018/05/16	1249	EB	WQ	2	Associated w/ sample ELSWH01-002-SS-001
	ELSWH01-001-SS-001	5/17/18	0833	N	SO	2	MS/MSD Inc
	ELSWH01-001-SS-901	5/17/18	0833	FD	SO	1	
	ELSWH-RS-021	5/17/18	0935	EB	WQ	2	off spoon En assc w/ ELSWH01-001-SO-013
	ELSWH01-001-SO-013	5/17/18	0947	N	SO	2	MS/MSD Inc
	ELSWH01-001-SO-913	5/17/18	0947	FD	SO	1	
	ELSWH03-001-SO-009	5/17/18	1325	N	SO	1	
					Total # of Containers	19	

RELINQUISHED BY:
Signature:
Date/Time: 05/21/18 1600
Printed Name: Ash Willis
Firm: ASL

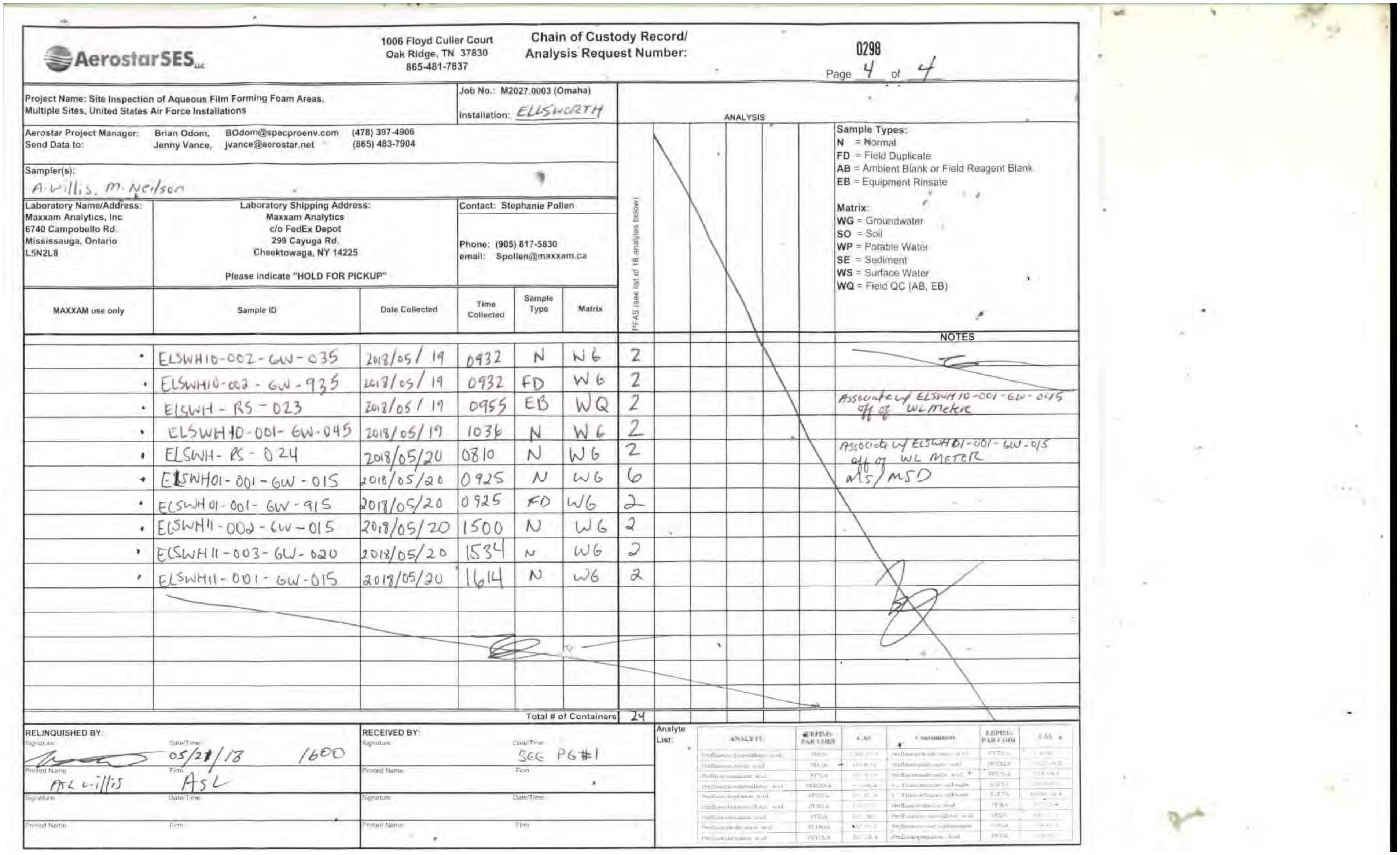
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature:
Date/Time: SEE PG #1
Printed Name:
Firm:

Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	[illegible]	Perfluorotetradecanoic acid	PFTEA	[illegible]
Perfluorooctanoic acid	PFOA	[illegible]	Perfluorotridecanoic acid	PFTRIA	[illegible]
Perfluorononanoic acid	PFNA	[illegible]	Perfluorohexanoic acid	PFHXA	[illegible]
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	[illegible]
Perfluoroheptanoic acid	PFHPA	[illegible]	8:2 Fluorotelomer sulfonate	8:2FTS	[illegible]
Perfluorobutanesulfonic acid	PFBSA	[illegible]	Perfluorobutanoic acid	PFBA	[illegible]
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecane sulfonic acid	PFDS	[illegible]
Perfluoroundecanoic acid	PFUDA	[illegible]	Perfluorooctane sulfonamide	FOSA	[illegible]
Perfluorododecanoic acid	PFDOA	[illegible]	Perfluoropentanoic Acid	PFPA	[illegible]



Stephanie Pollen

From:	Jenny Vance <JVance@aerostar.net>
Sent:	Thursday, May 24, 2018 12:18 PM
To:	Stephanie Pollen
Cc:	Laura Natzke; Brian Odom
Subject:	RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Please note, this message originated outside of the Maxxam mail system. Please use caution when opening links or attachments.

Thanks, Stephanie.

Go ahead, but keep us posted.

From: Stephanie Pollen [mailto:SPollen@maxxam.ca]
Sent: Thursday, May 24, 2018 12:02 PM
To: Jenny Vance <JVance@aerostar.net>
Cc: Laura Natzke <LNatzke@aerostar.net>; Brian Odom <BOdom@specproenv.com>
Subject: RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Hi Jenny,

The lab has confirmed PFHxS will definitely need high level. PFHxA, PFOS & 6:2-FTS might need it, we'll need to see the results of the 100x SPE first.

Kind regards,

STEPHANIE POLLEN, B.Sc.
Project Manager, Site Assessment and Remediation/Ultra Trace Analysis

Office 905.817.5830
Mobile 416.432.3443
Toll free 800 565 7227
spollen@maxxam.ca

6740 Campobello Rd. / Mississauga, ON Canada L5N 2L8
maxxam.ca

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Success Through Science®

From: Jenny Vance [mailto:JVance@aerostar.net]
Sent: Thursday, May 24, 2018 11:09 AM
To: Stephanie Pollen
Cc: Laura Natzke; Brian Odom
Subject: RE: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Please note, this message originated outside of the Maxxam mail system. Please use caution when opening links or attachments.

I suspect the samples were prescreened and showed high levels of one or more analytes. If so, can you tell us which analytes are requiring a 100x dilution? As always, my fear is that we won't be able to determine whether PFOS or PFOA exceed regulatory criteria. If one or both of those was detected at high levels, I don't think we have a problem (well – except for the obvious contamination at the well).

From: Stephanie Pollen [mailto:SPollen@maxxam.ca]
Sent: Thursday, May 24, 2018 11:01 AM
To: Jenny Vance <JVance@aerostar.net>
Cc: Laura Natzke <LNatzke@aerostar.net>
Subject: High Level Analysis: Ellsworth AFB (Maxxam job B8C0381)

Good morning Jenny,

The lab has informed me that the below samples require high-level analysis. Can you please confirm if we are OK to proceed?

Maxxam job B8C0381 (Ellsworth AFB)

ELSWH01-MW930107-GW-034 (GFT530)
ELSWH01-001-GW-015 (GFT558)
ELSWH01-001-GW-915 (GFT559)

Kind regards,

STEPHANIE POLLEN, B.Sc.
Project Manager, Site Assessment and Remediation/Ultra Trace Analysis

Office 905.817.5830
Mobile 416.432.3443
Toll free 800 565 7227
spollen@maxxam.ca

6740 Campobello Rd. / Mississauga, ON Canada L5N 2L8
maxxam.ca

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A Bureau Veritas Group Company

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Sample Matrix: Ground Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/25	2018/06/06	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/05/30	2018/06/01	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/06/04	2018/06/11	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 16

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	16	N/A	2018/05/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	15	2018/05/26	2018/05/28	CAM SOP-00894	EPA537 m
PFOS and PFOA in soil by SPE/LCMS (1)	1	2018/05/26	2018/05/29	CAM SOP-00894	EPA537 m

Sample Matrix: SEDIMENT
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	2	N/A	2018/05/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2018/05/26	2018/05/28	CAM SOP-00894	EPA537 m

Sample Matrix: Surface Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/25	2018/06/06	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/26	2018/05/27	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/28	2018/06/02	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/30	2018/06/01	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/12
Report #: R5232914
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C0381
Received: 2018/05/22, 14:19

Encryption Key

Stephanie Pollen
Project Manager
12 Jun 2018 14:03:51

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 3

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH

Analytical Data Package
(Level IV)

Analysis: PFOS and PFOA in water (Method 537 mod.)

Maxxam Job #: B8C4298

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Project Manager

Maxxam

A Bureau Veritas Group Company

Patricia Legette
2018.06.20
15:42:54 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD***): An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8C4298 – Soil Analysis

Sample Analysis

Soil extracts were initially pre-screened and estimated concentrations were obtained so that samples could be appropriately diluted for analysis on QC batch 5559410 (2018/06/05). Due to high concentrations, dilution was required for the following sample:

GUB608 *ELSWH04-003-SS-001*

Detection limits were adjusted accordingly.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B8C4298 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batch 5557332 (2018/06/04-05). Due to high concentrations, the following samples were analyzed for selected analytes using reduced sample extraction volumes:

GUB621	*ELSWH01-003-GW-035*	*All analytes*
GUB622	*ELSWH01-004-GW-018*	*All analytes*
GUB625	*ELSWH02-005-GW-040*	*Perfluorohexanesulfonate (PFHxS), 6:2 Fluorotelomersulfonate (6:2FTS)*
GUB627	*ELSWH03-001-GW-015*	*Perfluorooctanesulfonate (PFOS)*

Detection limits were adjusted accordingly.

The following samples were analyzed after an Instrument Blank (IB) with a concentration of 6:2 Fluorotelomersulfonate (6:2FTS) above the upper control limit (>1/2 LOQ):

GUB622	*ELSWH01-004-GW-018*
GUB623	*ELSWH07-003-GW-021*
GUB624	*ELSWH07-002-GW-021*
GUB625	*ELSWH02-005-GW-040*

These samples were re-injected together with an acceptable IB for verification of potential analyte carryover.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GUB608	ELSWH04-003-SS-001	2018/05/18	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB609	ELSWH04-004-SO-031	2018/05/18	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB610	ELSWH04-005-SO-020	2018/05/18	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB612	ELSWH09-002-SS-001	2018/05/21	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB613	ELSWH09-002-SS-901	2018/05/21	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB614	ELSWH09-001-SS-001	2018/05/21	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB615	ELSWH09-001-SO-005	2018/05/21	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB616	ELSWH04-003-SO-027	2018/05/18	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB618	ELSWH04-001-SS-001	2018/05/22	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB619	ELSWH04-001-SO-029	2018/05/22	2018/05/25	2018/06/01	2018/06/05	2018/06/05
GUB620	ELSWH09-002-SO-005	2018/05/21	2018/05/25	2018/06/01	2018/06/05	2018/06/05
PFOS and PFOA in water by SPE/LCMS						
GUB611	ELSWH-RS-025	2018/05/21	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB617	ELSWH-RS-026	2018/05/22	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB621	ELSWH01-003-GW-035	2018/05/21	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB622	ELSWH01-004-GW-018	2018/05/21	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB623	ELSWH07-003-GW-021	2018/05/21	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB624	ELSWH07-002-GW-021	2018/05/21	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB625	ELSWH02-005-GW-040	2018/05/23	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB626	ELSWH-RS-027	2018/05/23	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05
GUB627	ELSWH03-001-GW-015	2018/05/24	2018/05/25	2018/05/31	2018/06/04	2018/06/04-05

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees celcius.
Cooler custody seal was present and intact.

c) Documentation Problems: Lab proceeded with sample ID ELSWH09-002-SS-901 as per information listed on the container label.
Sampling date for sample ID ELSWH01-003-GW-035 was confirmed to be 2018/05/21.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Project Manager- Site Assessment and Remediation/ Ultra Trace

2018/06/20

Date

AerostarSES LLC

AIR

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 233

Page 1 of 2

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Justin Vojak

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

INTERNATIONAL
SOLID SAMPLE
HEAT TREAT REQUIRED

Types:
rmal
ld Duplicate
bient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH04-003-SS-001	5/19/18	1218	N	SO	1	
	ELSWH04-004-SO-031	5/18/18	1515	N	SO	1	
	ELSWH04-005-SO-020	5/18/18	1615	N	SO	1	
	ELSWH-RS-025	5/21/18	0845	EB	WQ	2	off spoon. In assc. w/ ELSWH09-002-SS-001
	ELSWH09-002-SS-001	5/21/18	0855	N	SO	1	
	ELSWH09-002-~~[illegible]~~ S 905 JUS [illegible]	5/21/18	0855	FD	SO	1	
	ELSWH09-001-SS-001	5/21/18	1212	N	SO	1	
	ELSWH09-001-SO-005	5/21/18	1430	N	SO	1	
	ELSWH04-003-SO-027	5/18/18	1410	N	SO	1	
	ELSWH-RS-026	5/22/18	1055	EB	WQ	2	off spoon. In assc. w/ ELSWH04-001-SS-001
	ELSWH04-001-SS-001	5/22/18	1252	N	SO	1	
	ELSWH04-001-SO-029	5/22/18	1457	N	SO	1	
	ELSWH09-002-SO-005	5-21-18	1025	N	SO	1	

Total # of Containers ~~16~~ 15

25-May-18 13:30
Stephanie Pollen
B8C4298
TLI env-1302

RELINQUISHED BY:
Signature:
Date/Time: 05-24-18 1600
Printed Name: A. Willis
Firm: ASC
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature:
Date/Time: 2018/05/25 13:30
Printed Name:
Firm: 2.8|4.4|3.0
Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

Intact On Ice,

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

224

Page 2 of 2

Project Name: Site Inspection ~~of Aqueous~~ Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: Ellsworth AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Arek Turolski, Miles Neilson

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

ANALYSIS

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH01-003-GW-035	5/21/18	1102	N	WG	2						
	ELSWH01-004-GW-018	5/21/18	1511	N	WG	2						
	ELSWH07-003-GW-021	5/21/18	1621	N	WG	2						
	ELSWH07-002-GW-021	5/21/18	1715	N	WG	2						
	ELSWH02-~~001~~004-GW-040 SB	5/23/18	1435	N	WG	2						
	ELSWH-RS-027	5/23/18	1340	EB	WQ	2						Associate w/ ELSWH02-004-GW-040 taken off of WLM
	ELSWH03-001-GW-015	5/24/18	1209	N	WG	2						

Total # of Containers: 19

RELINQUISHED BY:
Signature: Date/Time: 05/24/18 1600
Printed Name: Asa Willis Firm: ASC
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: Seebass Date/Time:
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH
Your C.O.C. #: 233

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/08
Report #: R5223525
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C4298
Received: 2018/05/25, 13:30

Sample Matrix: Ground Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	6	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	11	N/A	2018/05/29	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	11	2018/06/01	2018/06/05	CAM SOP-00894	EPA537 m

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/05/31	2018/06/04	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH
Your C.O.C. #: 233

Attention: Jenny Vance
Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/08
Report #: R5223525
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8C4298
Received: 2018/05/25, 13:30

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

Stephanie Pollen
Project Manager
08 Jun 2018 10:05:33

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package
(Level IV)

Analysis: PFOS and PFOA in water (Method 537 mod.)

Maxxam Job #: B8D4761

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP’s and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Project Manager

Maxxam
A Bureau Veritas Group Company

Patricia Legette
2018.06.26
15:41:00 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*****)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8D4761 – Soil Analysis

Sample Analysis

Soil extracts were initially pre-screened and estimated concentrations were obtained so that samples could be appropriately diluted for analysis on QC batch 5573623 (2018/06/12). Due to high concentration, dilution was required for Perfluorooctanesulfonate (PFOS) in the following sample:

GWJ150 *ELSWH10-003-SS-001*

Detection limit was adjusted accordingly.

Extracted Internal Standard Analytes

The extracted internal standard analytes $^{13}C_4$-Perfluorooctanesulfonate ($^{13}C_4$-PFOS), $^{13}C_2$-Perfluorodecanoic acid ($^{13}C_2$-PFDA), $^{13}C_2$-Perfluoroundecanoic acid ($^{13}C_2$-PFUnA), $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA) and $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) are used to quantify native Perfluorooctanesulfonate (PFOS), Perfluorodecanoic acid (PFDA), Perfluoroundecanoic acid (PFUnA), Perfluorododecanoic acid (PFDoA) and Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA) respectively. The recoveries observed for selected extracted internal standard analytes were below the defined lower control limit (LCL) for the following samples:

GWJ148	*ELSWH-WS-001*	*($^{13}C_2$-PFTeDA)*
GWJ151	*ELSWH10-003-SO-050*	*($^{13}C_4$-PFOS, $^{13}C_2$-PFDA, $^{13}C_2$-PFUnA, $^{13}C_2$-PFDoA, $^{13}C_2$-PFTeDA)*

Samples were re-extracted and re-analyzed for the associated native analytes on QC batch 5580295 (2018/06/16). Acceptable extracted internal standard analyte recoveries were obtained on re-analysis, except for $^{13}C_2$-PFDoA and $^{13}C_2$-PFTeDA in sample GWJ151 *(ELSWH10-003-SO-050)*. Results for Perfluorododecanoic acid (PFDoA), Perfluorotridecanoic acid (PFTrDA) and Perfluorotetradecanoic acid (PFTeDA) were reported from the reduced volume extract for this sample, where acceptable extracted internal standard analyte recoveries were obtained. Detection limits were adjusted accordingly for these analytes.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B8D4761 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batch 5569357 (2018/06/08). Due to high concentrations, the following samples were analyzed for selected analytes using reduced sample extraction volumes:

GWJ140	*ELSWH04-003-GW-033*	*Perfluorohexanoic acid (PFHxA), Perfluorohexanesulfonate (PFHxS), 6:2 Fluorotelomersulfonate (6:2FTS)*
GWJ147	*ELSWH-WW-001*	*All analytes*

Detection limits were adjusted accordingly.

During initial setup of the analytical batch sequence, it was observed that the following sample vials were not in the expected positions on the extraction vial rack:

GWJ144	*ELSWH04-001-GW-032*
GWJ147	*ELSWH-WW-001*

Inconsistencies were also observed between results from the reduced and full volume extracts for these samples. As a result, these samples were re-extracted and re-analyzed on QC batch 5574399 (2018/06/12) for confirmatory analysis.

Extracted Internal Standard Analytes

The extracted internal standard analyte $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) is used to quantify native Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA). The recovery observed for this extracted internal standard analyte was below the defined lower control limit (LCL) for the following sample on QC batch 5569357 (2018/06/08):

GWJ139 *ELSWH-RS-29*

The sample was re-extracted and re-analyzed for the associated native analytes on QC batch 5574399 (2018/06/12). Acceptable $^{13}C_2$-PFTeDA recovery was obtained on re-analysis.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

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J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
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PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GWJ148	ELSWH-WS-001	2018/06/03	2018/06/05	2018/06/11	2018/06/12	2018/06/12
GWJ150	ELSWH10-003-SS-001	2018/05/24	2018/06/05	2018/06/11	2018/06/12	2018/06/12
GWJ151	ELSWH10-003-SO-050	2018/05/31	2018/06/05	2018/06/11	2018/06/12	2018/06/12
PFOS and PFOA in water by SPE/LCMS						
GWJ139	ELSWH-RS-29	2018/05/31	2018/06/05	2018/06/07	2018/06/08	2018/06/12
GWJ140	ELSWH04-003-GW-033	2018/05/31	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ141	ELSWH04-002-GW-038	2018/05/31	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ142	ELSWH09-002-GW-030A	2018/05/31	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ143	ELSWH09-001-GW-033A	2018/05/31	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ144	ELSWH04-001-GW-032	2018/05/31	2018/06/05	2018/06/11	2018/06/12	2018/06/12
GWJ145	ELSWH-RS-030	2018/06/03	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ146	ELSWH10-003-GW-059	2018/06/03	2018/06/05	2018/06/07	2018/06/08	2018/06/08
GWJ147	ELSWH-WW-001	2018/06/03	2018/06/05	2018/06/11	2018/06/12	2018/06/12
GWJ149	ELSWH-RS-028	2018/05/24	2018/06/05	2018/06/07	2018/06/08	2018/06/08

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees celsius.
Cooler custody seal was present and intact.

c) Documentation Problems: For sample ELSWH10-003-GW-059, all three bottles received contained sediment.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Project Manager- Site Assessment and Remediation/ Ultra Trace

2018/06/26

Date

AerostarSES AIR

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

227

Page 1 of 2

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): A. willis, J. vojak (ASL)

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-29	2018/05/31	1110	EB	WQ	X2						Associated w/ ELSWH04-003-GW-033 off of WL meter
	ELSWH04-003-GW-033	2018/05/31	1150	N	WG	2						
	ELSWH04-002-GW-033	2018/05/31	1412	N	WG	2						
	ELSWH09-002-GW-030A	2018/05/31	1532	N	WG	2						
	ELSWH09-001-GW-033A	2018/05/31	1602	N	WG	3						extra bottle due to high turbidity
	ELSWH04-001-GW-032	2018/05/31	1746	N	WG	2						
	ELSWH-RS-030	2018/06/03	1450	EB	WQ	2						associated w/ ELSWH10-003-GW-045 59e off of Monsoon
	ELSWH10-003-GW-045 59e	2018/06/03	1517	N	WG	3						high turbidity - 3 bottles
	ELSWH-WW-001	2018/06/03	1800	N	WG	2						
	ELSWH-WS-001	2018/06/03	1800	N	SO	1						
					Total # of Containers	21						

05-Jun-18 14:11
Stephanie Pollen
B8D4761
TLI ENV-928

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

RELINQUISHED BY: Signature:	Date/Time: 6-4-18 1600	RECEIVED BY: Signature:	Date/Time: 18/06/05 14:11
Printed Name: Ash Willis	Firm: ASL	Printed Name: JUNAID Umar	Firm: Maxxam
Signature:	Date/Time:	Signature:	Date/Time: custody seal intact
Printed Name:	Firm:	Printed Name:	Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

WB 422046 4.1 | 3.8 | 3.5

AerostarSESLLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

234

Page 2 of 2

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Justin Vojcik (ASL

Laboratory Name/Address:
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Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

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SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-028	5/24/18	1309	EB	WQ	2						Off Spoon, In assc w/ ELSWH10-003-SS-001
	ELSWH10-003-SS-001	5/24/18	1312	N	SO	1						
	ELSWH10-003-SO-050	5/31/18	1200	N	SO	1						

Total # of Containers 4

RELINQUISHED BY:
Signature
Date/Time 6-4-18 /1600
Printed Name Ash Lillis
Firm ASL
Signature
Date/Time
Printed Name
Firm

RECEIVED BY:
Signature
Date/Time 18/06/05 14:11
Printed Name JUNAID USMAN
Firm Maxxam
Signature
Date/Time
Printed Name
Firm

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS

WB 422046 4.1 | 3.4 | 3.5

Maxxam
A Bureau Veritas Group Company

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/19
Report #: R5254242
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8D4761
Received: 2018/06/05, 14:11

Sample Matrix: Ground Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/06/07	2018/06/08	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/06/11	2018/06/12	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	3	N/A	2018/06/07	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	3	2018/06/11	2018/06/12	CAM SOP-00894	EPA537 m

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/06/07	2018/06/08	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/06/19
Report #: R5254242
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8D4761
Received: 2018/06/05, 14:11

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

```
Stephanie Pollen
Project Manager
19 Jun 2018 15:18:43
```

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Prepared for: Aerostar SES LLC

Project: M2027.003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package
(Level IV)

Analysis: PFOS and PFOA in water (Method 537 mod.)

Maxxam Job #: B8J4786

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Project Manager
Maxxam
A Bureau Veritas Group Company

Patricia Legette
2018.08.09
12:59:04 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

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- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B8J4786

Sample Analysis

Aqueous samples were analyzed on QC batches 5660879 (2018/08/03) and 5660880 (2018/08/03). Soil samples were analyzed on QC batch 5661601 (2018/08/04). No analytical difficulties were encountered.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Adam Robinson
Arobinson@maxxam.ca
Office 905 817 5700, ext. 4057

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
HJG659	ELSWH02-004-SD-001A	2018/07/31	2018/08/01	2018/08/02	2018/08/04	2018/08/04
HJG660	ELSWH02-004-SD-901A	2018/07/31	2018/08/01	2018/08/02	2018/08/04	2018/08/04
PFOS and PFOA in water by SPE/LCMS						
HJG658	ELSWH-RS-001A	2018/07/31	2018/08/01	2018/08/02	2018/08/03	2018/08/03
HJG661	ELSWH02-004-SW-001A	2018/07/31	2018/08/01	2018/08/02	2018/08/03	2018/08/03
HJG662	ELSWH02-004-SW-901A	2018/07/31	2018/08/01	2018/08/02	2018/08/03	2018/08/03

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees celsius.
Cooler custody seal was present and intact.

c) Documentation Problems: none encountered

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Project Manager- Site Assessment
and Remediation/ Ultra Trace

2018/08/09
Date

RUSH!

AerostarSES LLC RUSH

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 0308

Page ____ of ____

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, ~~United~~ ..ates Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ________

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

RUSH

Sampler(s): J. Vajak, G Carlson

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Stephanie Pollen
Phone: (905) 817-5830
email: Spollen@maxxam.ca

ANALYSIS RUSH

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)						NOTES
	ELSWH-RS-001A	07-31-18	0905	EB	WQ	2						
	ELSWH02-004-SD-001A	07-31-18	0920	N	WS	1						MS/MSD
	ELSWH02-004-SD-901A	07-31-18	0920	FD	WS	1						
	ELSWH02-004-SW-001A	07-31-18	0915	N	SE	4						MS/MSD
	ELSWH02-004-SW-901A	07-31-18	0915	FD	SE	2						
	4.1/4.0/3.9											
				Total # of Containers		11	—	—	—	—	—	

07-31-18

01-Aug-18 13:50
Stephanie Pollen
B8J4786
URE ENV-1245

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

RELINQUISHED BY:
Signature: Date/Time: 1730 - 07/31/18
Printed Name: Greg Carlson Firm: ASI
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY: PARAMSEET SINGH
Signature: Rjeet Date/Time: 13:50 2018/08/01
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Custody seal present

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
[illegible]	PFOS	[illegible]	[illegible]	PFTEDA	[illegible]
[illegible]	PFOA	[illegible]	[illegible]	PFTRDA	[illegible]
[illegible]	PFNA	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	PFHXSA	[illegible]	6:2 Fluorotelomer sulfonate	6:2FTS	[illegible]
[illegible]	PFHPA	[illegible]	8:2 Fluorotelomer sulfonate	8:2FTS	[illegible]
[illegible]	PFBSA	[illegible]	[illegible]	PFBA	[illegible]
[illegible]	PFDA	[illegible]	[illegible]	PFDS	[illegible]
[illegible]	PFDOA	[illegible]	[illegible]	FOSA	[illegible]
[illegible]	PFHXA	[illegible]	[illegible]	PFPA	[illegible]

Your Project #: M2027.003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: n/a

Attention: Jenny Vance
Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/08/09
Report #: R5349363
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8J4786
Received: 2018/08/01, 13:50

Sample Matrix: SEDIMENT
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	2	N/A	2018/08/02	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2018/08/02	2018/08/04	CAM SOP-00894	EPA537 m

Sample Matrix: Surface Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/08/02	2018/08/03	CAM SOP-00894	EPA 537 m

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/08/02	2018/08/03	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Your Project #: M2027.003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: n/a

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/08/09
Report #: R5349363
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8J4786
Received: 2018/08/01, 13:50

Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

```
Patricia Legette
Project Manager
09 Aug 2018 12:40:46
```

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package

(Level IV)

Analysis: PFOS and PFOA in water and soil (Method 537 mod.)

Maxxam Job #: B894616

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP’s and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Steph Pollen
Project Manager
Maxxam
A Bureau Veritas Group Company

Stephanie
Pollen
2018.05.17
16:29:12 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD)***: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR –*** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B894616 – Soil Analysis

Sample Analysis

Soil extracts were initially pre-screened and estimated concentrations were obtained so that samples could be appropriately diluted for analysis on QC batch 5507325 (2018/05/01-02). Due to exceedance of control chart limits, all samples were re-extracted and re-analyzed on QC batch 5513877 (2018/05/05). Dilutions were required for selected analytes in the following samples:

GNR557	*ELSWH12-002-SS-001*	*Perfluorooctanesulfonate (PFOS)*
GNR559	*ELSWH12-001-SS-001*	*Perfluorooctanesulfonate (PFOS)*
GNR560	*ELSWH12-001-SS-901*	*All analytes*
GNR564	*ELSWH12-003-SO-006*	*Perfluorooctanesulfonate (PFOS)*
GNR565	*ELSWH12-003-SS-001*	*Perfluorooctanesulfonate (PFOS)*

Detection limits were adjusted accordingly.

Extracted Internal Standard Analytes

The extracted internal standard analytes $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA) and $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) are used to quantify native Perfluorododecanoic acid (PFDoA) and Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA) respectively. The recoveries observed for these internal standard analytes were below the defined lower control limit (LCL) for the following sample:

GNR546 *ELSWH08-002-SS-001*

These recoveries were confirmed by re-extraction and re-analysis of the sample on QC batch 5518131 (2018/05/08). Results for the associated native analytes were reported from a 10x diluted sample where acceptable extracted internal standard analyte recoveries were obtained.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B894616 – Water Analysis

Sample Analysis

Samples were initially pre-screened and estimated concentrations were obtained so that appropriate sample volumes could be extracted on QC batch 5509182 (2018/05/02). Due to high concentrations, the following samples were analyzed using reduced sample extraction volumes:

GNR554	*ELSWH12-003-GW-016*
GNR556	*ELSWH12-004-SW-001*

Detection limits were adjusted accordingly.

The extracted internal standard analyte $^{13}C_4$-Perfluorobutanoic acid ($^{13}C_4$-PFBA) is used to quantify native Perfluorobutanoic acid (PFBA). The recovery observed for this extracted internal standard analyte was below the defined lower control limit (LCL) for the Spike Duplicate (LCS Dup) on QC batch 5509182 (2018/05/02). All samples were re-extracted and re-analyzed for Perfluorobutanoic acid (PFBA) on QC batch 5514083 (2018/05/08).

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GNR546	ELSWH08-002-SS-001	2018/04/22	2018/04/25	2018/05/03	2018/05/05	2018/05/05 & 2018/05/08
GNR548	ELSWH08-002-SO-040	2018/04/23	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR549	ELSWH08-002-SO-940	2018/04/23	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR550	ELSWH08-001-SS-001	2018/04/23	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR551	ELSWH08-001-SO-030	2018/04/23	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR552	ELSWH10-001-SS-001	2018/04/24	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR555	ELSWH12-004-SD-001	2018/04/22	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR557	ELSWH12-002-SS-001	2018/04/19	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR558	ELSWH12-002-SO-036	2018/04/19	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR559	ELSWH12-001-SS-001	2018/04/19	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR560	ELSWH12-001-SS-901	2018/04/19	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR561	ELSWH12-001-SO-023	2018/04/19	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR564	ELSWH12-003-SO-006	2018/04/20	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR565	ELSWH12-003-SS-001	2018/04/20	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR566	ELSWH08-004-SS-001	2018/04/21	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR568	ELSWH08-003-SS-001	2018/04/21	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR569	ELSWH08-003-SO-046	2018/04/22	2018/04/25	2018/05/03	2018/05/05	2018/05/05
GNR571	ELSWH08-004-SO-051	2018/04/22	2018/04/25	2018/05/03	2018/05/05	2018/05/05
PFOS and PFOA in water by SPE/LCMS						
GNR547	ELSWH-RS-005	2018/04/23	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR553	ELSWH12-002-GW-045	2018/04/22	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR554	ELSWH12-003-GW-016	2018/04/22	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR556	ELSWH12-004-SW-001	2018/04/22	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR562	ELSWH-RS-001	2018/04/19	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR563	ELSWH-RS-002	2018/04/20	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR567	ELSWH-RS-003	2018/04/21	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08
GNR570	ELSWH-RS-004	2018/04/22	2018/04/25	2018/05/01	2018/05/02	2018/05/02 & 2018/05/08

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seal was present and intact.

c) Documentation Problems: none encountered

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Faller

Project Manager- Site Assessment
and Remediation/ Ultra Trace

2018/05/17
Date

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

228

Page 1 of 2

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): J. Vojat / A. Willis

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)
	ELSWH08-002-SS-001	4/22/18	1445	N	SO	1
	ELSWH-RS-005	4/23/18	0835	EB	WQ	2
	ELSWH08-002-SO-040	4/23/18	0830	N	SO	1
	ELSWH08-002-SO-940	4/23/18	0830	N	SO	1
	ELSWH08-001-SS-001	4/22/18	0955	N	SO	1
	ELSWH08-001-SO-030	4/23/18	1505	N	SO	1
	ELSWH10-001-SS-001	4/24/18	1100	N	SO	1
	ELSWH12-002-GW-045	2018/04/22	1502	N	WG	2
	ELSWH12-003-GW-016	2018/04/22	1555	N	WG	2
	ELSWH12-004-SD-001	2018/04/22	1615	N	SE	1
	ELSWH12-004-SW-001	2018/04/22	1615	N	WS	2

NOTES

[illegible] SS spoon associated w/ ELSWH08-002-SO-040

25-Apr-18 13:58
Stephanie Pollen
B894616
GK1 ENV-916

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

Total # of Containers 15

RELINQUISHED BY:
Signature:
Date/Time: 4/24/18 1800
Printed Name:
Firm:
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY: Parjeet
Signature
Date/Time: 2018/04/25 13:58
Printed Name: PARAMJEET SINGH
Firm: 5.7/4.9/5.1
Signature:
Date/Time:
Printed Name:
Firm:

Custody seal present

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTriA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorohexanesulfonic acid	PFHxS	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHpA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBS	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDoA	307-55-1	Perfluorooctane sulfonamide	PFOSA	754-91-6
Perfluorohexanoic acid	PFHxA	307-24-4	Perfluoropentanoic acid	PFPeA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number:

226

Page 2 of 2

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELLSWORTH AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): J. Vojacek

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH12-002-SS-001	04/19/18	0957	N	SO	1	
	ELSWH12-002-SO-036	04/19/18	1135	N	SO	1	
	ELSWH12-001-SS-001	04/19/19	1505	N	SO	3	MS/MSD Inc.
	ELSWH12-001-SS-901	04/19/18	1505	FD	SO	1	
	ELSWH12-001-SO-023	04/19/18	1710	N	SO	1	
	ELSWH-RS-001	04/19/18	1645	EB	WQ	2	Off spoon in assc w/ ELSWH12-001-SO-023
	ELSWH-RS-002	04/20/18	1425	EB	WQ	2	Off spoon in assc w/ ELSWH12-003-SO-006
	ELSWH12-003-SO-006	04/20/18	1430	N	SO	1	
	ELSWH12-003-SS-001	04/20/18	0957	N	SO	1	
	ELSWH08-004-SS-001	04/21/18	1140	N	SO	1	
	ELSWH-RS-003	04/21/18	1420	EB	WQ	2	Off spoon in assc w/ ELSWH08-003-SS-001
	ELSWH08-003-SS-001	04/21/18	1425	N	SO	1	
	ELSWH08-003-SO-046	04/22/18	0940	N	SO	1	
	ELSWH-RS-004	04/22/18	1422	EB	WQ	2	Off spoon in assc w/ ELSWH08-004-SO-051
	ELSWH08-004-SO-051	04/22/18	1425	N	SO	1	
					Total # of Containers	[illegible]	

RELINQUISHED BY:
Signature: Date/Time: 4/24/18 1800
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: SEE PAGE 1 Date/Time:
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PARLCODE	CAS	Contaminant	ERPIMS PARLCODE	CAS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/09
Report #: R5116443
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B894616
Received: 2018/04/25, 13:58

Sample Matrix: Ground Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/01	2018/05/02	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 17

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	17	N/A	2018/04/26	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	17	2018/05/03	2018/05/05	CAM SOP-00894	EPA537 m

Sample Matrix: SEDIMENT
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	1	N/A	2018/04/26	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	1	2018/05/03	2018/05/05	CAM SOP-00894	EPA537 m

Sample Matrix: Surface Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	1	2018/05/01	2018/05/02	CAM SOP-00894	EPA 537 m

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	5	2018/05/01	2018/05/02	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: na

Attention: Jenny Vance
Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/09
Report #: R5116443
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B894616
Received: 2018/04/25, 13:58

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

Stephanie Pollen
Project Manager
09 May 2018 16:13:28

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Prepared for: Aerostar SES LLC

Project: M2027.0003 (OMAHA)
ELLSWORTH AFB

Analytical Data Package

(Level IV)

Analysis: PFOS and PFOA in water and soil (Method 537 mod.)

Maxxam Job #: B897127

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

I hereby certify that to the best of my knowledge all analytical data presented in this report:

- Has been checked for completeness.
- Is accurate, legible and error free.
- Has been conducted in accordance with approved SOP's and that all deviations are clearly listed in the Case Narrative.
- This report has been generated in .pdf format.

Review Performed By:

Steph Pollen
Project Manager
Maxxam
A Bureau Veritas Group Company

Stephanie Pollen 2018.05.17 14:33:26 -04'00'

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Glossary of Terms

- ***Detection Limit (DL)*** this can also be called ***Method Detection Limit (MDL***): The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

- ***Limit of Detection (LOD*)**: An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent. (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

- ***Limits of Quantitation (LOQ)*** this can also be called ***Reporting Detection Limit (RDL)***: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

- ***Acceptance Criteria*** are values used by the laboratory to determine that a process is in control.

- ***Accuracy*** is the degree of agreement of a measured value with the true or expected value.

- ***Calibration Standards*** are a set of solutions containing the analytes of interest at a specified concentration.

- ***Calibration Verification Standard*** consists of a calibration standard solution of intermediate concentration (mid-point initial calibration level) used to access whether the initial calibration is still valid

- ***Certified Reference Material*** is a stable homogenous material that is certified by repetitive analysis from a supplier who is certified to generate said materials.

- ***Internal Standard*** a deuterated or ^{13}C-labelled analyte that is added to a sample extract prior to instrumental analysis to compensate for injection variability.

- ***Isomer*** is a member of a group of compounds that differ from each other only in the locations of a specific number of common substituent atoms or groups of atoms on the parent compound.

- ***Method Blank*** is a laboratory control sample using reagents that are known to be free of contamination.

- ***Precision*** is the degree of agreement between the data generated from repetitive measurements under specific conditions.

- ***Quality Assurance*** is a system of activities whose purpose is to provide the producer or user of a product with the assurance that the product meets a defined standard of quality.

- ***Quality Control*** is the overall system of activities whose purpose is to control the quality of a product so that it meets the needs of the end user.

- ***RSD*** is the relative standard deviation.

- ***Blank Spike*** is a laboratory control sample that has been fortified with native analytes of interest.

- ***Window Defining Mixture*** is a solution containing only the earliest and latest eluting congeners within each homologous group of target analytes on a specified GC column.

- ***RPD*** or Relative Percent Difference. A measure used to compare duplicate sample analysis.

- ***EMPC/NDR* –** Peak detected does not meet ratio criteria and has resulted in a higher detection limit.

Maxxam Job: B897127 – Soil Analysis

Sample Analysis

Samples were initially analyzed on QC batches 5518131 (2018/05/08) and 5518141 (2018/05/08). The extracted internal standard analytes $^{13}C_2$-Perfluoroundecanoic acid ($^{13}C_2$-PFUnA), $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA) and $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) are used to quantify native Perfluoroundecanoic acid (PFUnA), Perfluorododecanoic acid (PFDoA) and Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA) respectively. The recoveries observed for selected extracted internal standard analytes were below the defined lower control limit (LCL) for the following samples:

GOF444	*ELSWH02-004-SD-001*	*($^{13}C_2$-PFUnA, $^{13}C_2$-PFDoA, $^{13}C_2$-PFTeDA)*
GOF445	*ELSWH02-004-SD-901*	*($^{13}C_2$-PFTeDA)*

These recoveries were confirmed by re-extraction and re-analysis of GOF444 *(ELSWH02-004-SD-001)* on QC batch 5522080 (2018/05/10-14) and GOF445 *(ELSWH02-004-SD-901)* on QC batch 5522046 (2018/05/10-14). Results for the associated native analytes were reported from 10x dilutions of these samples where acceptable extracted internal standard recoveries were obtained. Detection limits were adjusted accordingly.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

Maxxam Job: B897127 – Water Analysis

Sample Analysis

Samples were initially analyzed on QC batch 5520643 (2018/05/09-10). The extracted internal standard analyte $^{13}C_2$-Perfluorotetradecanoic acid ($^{13}C_2$-PFTeDA) is used to quantify native Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA). The recovery observed for this extracted internal standard analyte was below the defined lower control limit (LCL) for the following sample:

GOF446 *ELSWH02-004-SW-001*

The recovery was confirmed by re-extraction and re-analysis of the sample on QC batch 5525844 (2018/05/11).

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctane sulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which are calibrated using certified branched and linear isomer mixtures. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

U – Analyte was not detected and is reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.

J – The reported result is an estimated value (e.g., matrix interference was observed, or the analyte was detected at a concentration outside the calibration range).

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil by SPE/LCMS						
GOF435	ELSWH10-001-SO-040	2018/04/24	2018/04/27	2018/05/07	2018/05/08	2018/05/08
GOF437	ELSWH02-003-SO-004	2018/04/25	2018/04/27	2018/05/07	2018/05/08	2018/05/08
GOF438	ELSWH02-002-SO-031	2018/04/25	2018/04/27	2018/05/07	2018/05/08	2018/05/08
GOF439	ELSWH02-001-SO-030	2018/04/26	2018/04/27	2018/05/07	2018/05/08	2018/05/08
GOF444	ELSWH02-004-SD-001	2018/04/26	2018/04/27	2018/05/07	2018/05/08	2018/05/08 & 2018/05/10-14
GOF445	ELSWH02-004-SD-901	2018/04/26	2018/04/27	2018/05/07	2018/05/08	2018/05/08 & 2018/05/10-14
PFOS and PFOA in water by SPE/LCMS						
GOF434	ELSWH-RS-006	2018/04/24	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF436	ELSWH-RS-007	2018/04/25	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF440	ELSWH-RS-008	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF441	ELSWH12-001-GW-032	2018/04/25	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF442	ELSWH08-003-GW-045	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF443	ELSWH08-002-GW-045	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF446	ELSWH02-004-SW-001	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10 & 2018/05/11
GOF447	ELSWH02-004-SW-901	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10
GOF448	ELSWH02-003-GW-013	2018/04/26	2018/04/27	2018/05/08	2018/05/09	2018/05/09-10

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: Samples were received with temperature less than 10 degrees Celsius. Cooler custody seal was present and intact.

c) Documentation Problems: none encountered

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

Steph Pallen

Project Manager- Site Assessment and Remediation/ Ultra Trace

2018/05/17
Date

AerostarSES

AIR

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 229

Page 1 of 1

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: ELSWORTH

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906

Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Miles Neilson, Ash Willis, Justin Vojak, Arek Turbolski (1 of 1) ASL

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia

Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

27-Apr-18 14:05
Stephanie Pollen
B897127
GID ENV-1388

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

ypes:
nal
Duplicate
ent Blank or Field Reagent Blank
ment Rinsate
ndwater
le Water
ment
ce Water
QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	ELSWH-RS-006	4/24/18	1525	N	SO	1	In assc w/ ELSWH10-001-SO-040 Off Spoon
	ELSWH10-001-SO-040	4/24/18	1535	N	SO	1	
	ELSWH-RS-007	4/25/18	1053	EB	WQ	2	Off Spoon. In assc w/ ELSWH02-003-SO-004
	ELSWH02-003-SO-004	4/25/18	1100	N	SO	1	
	ELSWH02-002-SO-031	4/25/18	1525	N	SO	1	
	ELSWH02-001-SO-030	4/26/18	1257	N	SO	1	
	ELSWH-RS-008	4/26/18	1240	EB	WQ	2	Off Spoon. In assc w/ ELSWH02-001-SO-030
	ELSWH12-001-GW-032	4/25/18	1255	N	WG	2	
	ELSWH08-003-GW-045	4/26/18	1139	N	WG	2	
	ELSWH08-002-GW-045	4/26/18	1345	N	WG	2	
	ELSWH02-004-SD-001	4/26/18	1440	N	SE	2	*MS/MSD included
	ELSWH02-004-SD-901	4/26/18	1440	FD	SE	1	
	ELSWH02-004-SW-001	4/26/18	1440	N	WS	6	*MS/MSD Included
	ELSWH02-004-SW-901	4/26/18	1440	FD	WS	2	
	ELSWH02-003-GW-013	4/26/18	1541	N	WG	2	
					Total # of Containers	28	

RELINQUISHED BY:
Signature:
Date/Time: 4-26-18 1800
Printed Name: A. Willis
Firm: ASL
Signature:
Date/Time:
Printed Name:
Firm:

RECEIVED BY:
Signature: Pareep
Date/Time: 2018/04/27 14:05
Printed Name: Pareep F Puveenel
Firm: MWH 422013
Signature:
Date/Time:
Printed Name:
Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

Custody Seal Present 4.6/4.2/3.9

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: 229

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/14
Report #: R5142082
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B897127
Received: 2018/04/27, 14:05

Sample Matrix: Ground Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	4	2018/05/08	2018/05/09	CAM SOP-00894	EPA 537 m

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	4	N/A	2018/04/30	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	4	2018/05/07	2018/05/08	CAM SOP-00894	EPA537 m

Sample Matrix: SEDIMENT
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	2	N/A	2018/04/30	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2018/05/07	2018/05/08	CAM SOP-00894	EPA537 m

Sample Matrix: Surface Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	2	2018/05/08	2018/05/09	CAM SOP-00894	EPA 537 m

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/05/08	2018/05/09	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

Your Project #: M2027.0003 (OMAHA)
Site Location: ELLSWORTH AFB
Your C.O.C. #: 229

Attention: Jenny Vance

Aerostar SES LLC
SES Construction and Fuel Serv
1006 Floyd Culler Court
Oak Ridge, TN
USA 37830

Report Date: 2018/05/14
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B897127
Received: 2018/04/27, 14:05

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key

Steph Pollen

Stephanie Pollen
Project Manager
14 May 2018 17:07:58

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Validated Sample Result Forms: B8A6782

Analysis Method: EPA 537 m

Sample Name ELSWH02-001-GW-035 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI097 **Sample Date/Time:** 2018-05-04 12:31 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.021	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	0.023	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	0.017	0.0075	0.018	0.020	ug/L	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-002-GW-035 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI096 **Sample Date/Time:** 2018-05-04 09:31 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.026	0.0066	0.015	0.020	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.63	0.0054	0.015	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.32	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.14	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.96	0.0056	0.015	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	1.3	0.035	0.10	0.20	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.0079	0.0034	0.010	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.28	0.0060	0.015	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.78	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.44	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-006-GW-030 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI099 **Sample Date/Time:** 2018-05-04 13:50 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.011	0.0054	0.015	0.020	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.019	0.0055	0.015	0.020	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.022	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.093	0.0056	0.015	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.046	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.074	0.0060	0.015	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.030	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.053	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-006-SO-024 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI081 **Sample Date/Time:** 2018-05-01 11:50 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.55	0.25	0.55	1.1	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.55	0.21	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.55	0.26	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	0.48	0.15	0.55	1.1	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.55	0.24	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.1	0.29	0.88	1.1	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-006-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI079 **Sample Date/Time:** 2018-05-01 09:20 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<1.0	0.34	1.0	1.3	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<1.0	0.43	1.0	1.3	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.65	0.22	0.65	1.3	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.60	0.30	0.65	1.3	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<1.0	0.51	1.0	1.3	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.58	0.36	1.0	1.3	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<1.0	0.36	1.0	1.3	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.66	0.25	0.65	1.3	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.1	0.31	0.65	1.3	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.65	0.18	0.65	1.3	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.93	0.29	0.65	1.3	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.42	0.18	0.65	1.3	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	47	0.34	1.0	1.3	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.4	0.33	1.0	1.3	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.73	0.33	1.0	1.3	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<1.0	0.40	1.0	1.3	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<1.0	0.43	1.0	1.3	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<1.0	0.44	1.0	1.3	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-007-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI092 **Sample Date/Time:** 2018-05-03 10:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.35	0.29	0.88	1.1	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.69	0.25	0.55	1.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.72	0.31	0.88	1.1	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	0.44	0.31	0.88	1.1	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	0.65	0.21	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.59	0.26	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.77	0.15	0.55	1.1	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.67	0.24	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	9.1	0.29	0.88	1.1	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.4	0.28	0.88	1.1	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.88	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	0.40	0.34	0.88	1.1	ug/kg	J	J	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH02-008-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI090 **Sample Date/Time:** 2018-05-02 14:19 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.51	0.25	0.55	1.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.55	0.31	0.88	1.1	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.49	0.21	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.56	0.26	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.54	0.15	0.55	1.1	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.51	0.24	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	4.6	0.29	0.88	1.1	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.83	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.60	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-001-GW-030 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI098 **Sample Date/Time:** 2018-05-04 15:26 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.015	0.0054	0.015	0.020	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.041	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.050	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.23	0.0056	0.015	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.090	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.0097	0.0087	0.018	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.012	0.0034	0.010	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.34	0.0060	0.015	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.095	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.095	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-001-SO-028 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI086 **Sample Date/Time:** 2018-05-02 09:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.77	0.25	0.77	0.96	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.48	0.16	0.48	0.96	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.48	0.22	0.48	0.96	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.77	0.37	0.77	0.96	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.48	0.18	0.48	0.96	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.48	0.23	0.48	0.96	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.48	0.21	0.48	0.96	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.37	0.25	0.77	0.96	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.77	0.24	0.77	0.96	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.77	0.24	0.77	0.96	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.77	0.30	0.77	0.96	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.77	0.33	0.77	0.96	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI084 **Sample Date/Time:** 2018-05-02 07:42 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.40	0.26	0.80	1.0	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.67	0.23	0.50	1.0	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.93	0.28	0.80	1.0	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	0.41	0.28	0.80	1.0	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	0.66	0.19	0.50	1.0	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.2	0.24	0.50	1.0	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.78	0.14	0.50	1.0	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	1.2	0.22	0.50	1.0	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.44	0.14	0.50	1.0	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	68	2.6	8.0	10	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.8	0.25	0.80	1.0	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.88	0.25	0.80	1.0	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.44	0.34	0.80	1.0	ug/kg	J	J	

Analysis Method: EPA 537 m

Sample Name ELSWH05-002-GW-025 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI095 **Sample Date/Time:** 2018-05-03 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.014	0.0054	0.015	0.020	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.033	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.051	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.23	0.0056	0.015	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.12	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.018	0.0034	0.010	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.24	0.0060	0.015	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.088	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.12	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-002-SO-020 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI083 **Sample Date/Time:** 2018-05-01 15:32 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.73	0.24	0.73	0.91	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.46	0.15	0.46	0.91	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.46	0.21	0.46	0.91	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.73	0.35	0.73	0.91	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.46	0.17	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.46	0.22	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.46	0.20	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.73	0.24	0.73	0.91	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.73	0.23	0.73	0.91	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.73	0.23	0.73	0.91	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.73	0.28	0.73	0.91	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.73	0.31	0.73	0.91	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI082 **Sample Date/Time:** 2018-05-01 13:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.96	0.31	0.96	1.2	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.60	0.20	0.60	1.2	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.53	0.28	0.60	1.2	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.96	0.47	0.96	1.2	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.96	0.34	0.96	1.2	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.96	0.34	0.96	1.2	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.50	0.23	0.60	1.2	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.69	0.29	0.60	1.2	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.55	0.17	0.60	1.2	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.60	0.26	0.60	1.2	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.41	0.17	0.60	1.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	11	0.31	0.96	1.2	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.62	0.30	0.96	1.2	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.61	0.30	0.96	1.2	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.96	0.37	0.96	1.2	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.96	0.41	0.96	1.2	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-003-SO-009 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI088 **Sample Date/Time:** 2018-05-02 11:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.90	0.26	0.80	1.0	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH05-003-SO-909 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI089 **Sample Date/Time:** 2018-05-02 11:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.30	0.24	0.75	0.94	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.75	0.31	0.75	0.94	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.47	0.16	0.47	0.94	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.37	0.22	0.47	0.94	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.75	0.37	0.75	0.94	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.38	0.26	0.75	0.94	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	0.35	0.26	0.75	0.94	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.47	0.18	0.47	0.94	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.50	0.23	0.47	0.94	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.34	0.13	0.47	0.94	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.47	0.21	0.47	0.94	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.47	0.13	0.47	0.94	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.4	0.24	0.75	0.94	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.37	0.24	0.75	0.94	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.36	0.24	0.75	0.94	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	0.35	0.29	0.75	0.94	ug/kg	J	J	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.75	0.31	0.75	0.94	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.36	0.32	0.75	0.94	ug/kg	J	J	

Analysis Method: EPA 537 m

Sample Name ELSWH05-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI087 **Sample Date/Time:** 2018-05-02 10:49 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.79	0.25	0.55	1.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.70	0.31	0.88	1.1	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	0.37	0.31	0.88	1.1	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	1.2	0.21	0.55	1.1	ug/kg			
PERFLUOROHEXANE SULFONATE	108427-53-8	1.6	0.26	0.55	1.1	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	1.3	0.15	0.55	1.1	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	0.99	0.24	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.45	0.15	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	75	2.9	8.8	11	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	3.1	0.28	0.88	1.1	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	1.2	0.28	0.88	1.1	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.40	0.37	0.88	1.1	ug/kg	J	J	

Analysis Method: EPA 537 m

Sample Name ELSWH06-002-SO-010 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI111 **Sample Date/Time:** 2018-05-05 14:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.76	0.25	0.76	0.95	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.76	0.31	0.76	0.95	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.48	0.16	0.48	0.95	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.48	0.22	0.48	0.95	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.76	0.37	0.76	0.95	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.76	0.27	0.76	0.95	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.76	0.27	0.76	0.95	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.48	0.18	0.48	0.95	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.48	0.23	0.48	0.95	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.48	0.13	0.48	0.95	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.48	0.21	0.48	0.95	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.48	0.13	0.48	0.95	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.51	0.25	0.76	0.95	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.76	0.24	0.76	0.95	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.76	0.24	0.76	0.95	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.76	0.29	0.76	0.95	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.76	0.31	0.76	0.95	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.76	0.32	0.76	0.95	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI110 **Sample Date/Time:** 2018-05-05 13:15 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.75	0.25	0.55	1.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.48	0.21	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.55	0.26	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	1.0	0.24	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	6.8	0.29	0.88	1.1	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.73	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.78	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-003-SO-054 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI109 **Sample Date/Time:** 2018-05-05 11:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.73	0.24	0.73	0.91	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.46	0.15	0.46	0.91	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.46	0.21	0.46	0.91	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.73	0.35	0.73	0.91	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.46	0.17	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.46	0.22	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.46	0.20	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.73	0.24	0.73	0.91	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.73	0.23	0.73	0.91	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.73	0.23	0.73	0.91	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.73	0.28	0.73	0.91	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.73	0.31	0.73	0.91	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI107 **Sample Date/Time:** 2018-05-05 08:08 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.78	0.25	0.78	0.98	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.78	0.32	0.78	0.98	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.49	0.17	0.49	0.98	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.51	0.23	0.49	0.98	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.78	0.38	0.78	0.98	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.78	0.27	0.78	0.98	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.78	0.27	0.78	0.98	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.44	0.19	0.49	0.98	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.46	0.24	0.49	0.98	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.38	0.14	0.49	0.98	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.52	0.22	0.49	0.98	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.49	0.14	0.49	0.98	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	4.6	0.25	0.78	0.98	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.57	0.25	0.78	0.98	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.46	0.25	0.78	0.98	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.78	0.30	0.78	0.98	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.78	0.32	0.78	0.98	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.78	0.33	0.78	0.98	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH08-001-GW-044 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI094 **Sample Date/Time:** 2018-05-01 11:41 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH09-003-SO-028 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI101 **Sample Date/Time:** 2018-05-04 09:57 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.67	0.22	0.67	0.84	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.67	0.28	0.67	0.84	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.42	0.14	0.42	0.84	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.42	0.19	0.42	0.84	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.67	0.33	0.67	0.84	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.67	0.24	0.67	0.84	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.67	0.24	0.67	0.84	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.42	0.16	0.42	0.84	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.42	0.20	0.42	0.84	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.42	0.12	0.42	0.84	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.42	0.18	0.42	0.84	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.42	0.12	0.42	0.84	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.67	0.22	0.67	0.84	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.67	0.21	0.67	0.84	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.67	0.21	0.67	0.84	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.67	0.26	0.67	0.84	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.67	0.28	0.67	0.84	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.67	0.29	0.67	0.84	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH09-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI093 **Sample Date/Time:** 2018-05-04 08:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.96	0.31	0.96	1.2	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.60	0.20	0.60	1.2	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.60	0.28	0.60	1.2	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.96	0.47	0.96	1.2	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	2.3	0.34	0.96	1.2	ug/kg			
PERFLUORODODECANOIC ACID	307-55-1	0.78	0.34	0.96	1.2	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.60	0.23	0.60	1.2	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.60	0.29	0.60	1.2	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	0.45	0.17	0.60	1.2	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.60	0.26	0.60	1.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.41	0.17	0.60	1.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	3.0	0.31	0.96	1.2	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.1	0.30	0.96	1.2	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.48	0.30	0.96	1.2	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	0.48	0.37	0.96	1.2	ug/kg	J	J	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.51	0.41	0.96	1.2	ug/kg	J	J	

Analysis Method: EPA 537 m

Sample Name ELSWH10-002-SO-029 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI106 **Sample Date/Time:** 2018-05-04 17:10 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.55	0.25	0.55	1.1	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.55	0.21	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.55	0.26	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.55	0.24	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.88	0.29	0.88	1.1	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH10-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI105 **Sample Date/Time:** 2018-05-04 15:22 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.96	0.31	0.96	1.2	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.60	0.20	0.60	1.2	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.81	0.28	0.60	1.2	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.96	0.47	0.96	1.2	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.96	0.34	0.96	1.2	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.96	0.34	0.96	1.2	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.91	0.23	0.60	1.2	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	3.2	0.29	0.60	1.2	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.73	0.17	0.60	1.2	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.75	0.26	0.60	1.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.60	0.17	0.60	1.2	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	5.2	0.31	0.96	1.2	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.5	0.30	0.96	1.2	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	1.3	0.30	0.96	1.2	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.96	0.37	0.96	1.2	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.96	0.40	0.96	1.2	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.96	0.41	0.96	1.2	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-003-SO-015 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI103 **Sample Date/Time:** 2018-05-04 13:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.73	0.24	0.73	0.91	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.46	0.15	0.46	0.91	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.46	0.21	0.46	0.91	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.73	0.35	0.73	0.91	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.46	0.17	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.69	0.22	0.46	0.91	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.34	0.13	0.46	0.91	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.46	0.20	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.49	0.13	0.46	0.91	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.0	0.24	0.73	0.91	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.42	0.23	0.73	0.91	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.73	0.23	0.73	0.91	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.73	0.28	0.73	0.91	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.73	0.31	0.73	0.91	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI102 **Sample Date/Time:** 2018-05-04 11:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.51	0.23	0.50	1.0	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.44	0.24	0.50	1.0	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.38	0.14	0.50	1.0	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.46	0.26	0.80	1.0	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	0.37	0.25	0.80	1.0	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-005-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GQI104 **Sample Date/Time:** 2018-05-04 13:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.29	0.25	0.77	0.96	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.48	0.16	0.48	0.96	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.37	0.22	0.48	0.96	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.77	0.37	0.77	0.96	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.43	0.18	0.48	0.96	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.44	0.23	0.48	0.96	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.38	0.13	0.48	0.96	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.54	0.21	0.48	0.96	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.34	0.13	0.48	0.96	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	9.6	0.25	0.77	0.96	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.59	0.24	0.77	0.96	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.38	0.24	0.77	0.96	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.77	0.30	0.77	0.96	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.77	0.33	0.77	0.96	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-009 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI080 **Sample Date/Time:** 2018-05-01 11:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-010 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI085 **Sample Date/Time:** 2018-05-02 08:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-011 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI091 **Sample Date/Time:** 2018-05-03 09:32 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-012 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI100 **Sample Date/Time:** 2018-05-04 09:52 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-013 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GQI108 **Sample Date/Time:** 2018-05-05 11:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Validated Sample Result Forms: B8B1135

Analysis Method: EPA 537 m

Sample Name ELSWH02-005-SO-034 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF770 **Sample Date/Time:** 2018-05-07 13:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.81	0.21	0.66	0.82	ug/kg	J	J	10A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	1.8	0.27	0.66	0.82	ug/kg		J	10A
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.41	0.14	0.41	0.82	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.41	0.19	0.41	0.82	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.66	0.32	0.66	0.82	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.66	0.23	0.66	0.82	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.66	0.23	0.66	0.82	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.52	0.16	0.41	0.82	ug/kg	J	J	10A
PERFLUOROHEXANE SULFONATE	108427-53-8	0.95	0.20	0.41	0.82	ug/kg		J	10A
PERFLUOROHEXANOIC ACID	307-24-4	0.57	0.11	0.41	0.82	ug/kg	J	J	10A
PERFLUORONONANOIC ACID	375-95-1	<0.41	0.18	0.41	0.82	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.41	0.11	0.41	0.82	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	27	0.21	0.66	0.82	ug/kg		J	10A
PERFLUOROOCTANOIC ACID	335-67-1	<0.66	0.21	0.66	0.82	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	0.30	0.21	0.66	0.82	ug/kg	J	J	10A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.66	0.25	0.66	0.82	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.66	0.27	0.66	0.82	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.66	0.28	0.66	0.82	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-002-GW-017 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF780 **Sample Date/Time:** 2018-05-10 14:21 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.042	0.0066	0.015	0.020	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.024	0.0066	0.015	0.020	ug/L			
PERFLUOROBUTANE SULFONATE	29420-43-3	0.059	0.0054	0.015	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.068	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.12	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	1.2	0.056	0.15	0.20	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.27	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.016	0.0087	0.018	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.4	0.060	0.15	0.20	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.12	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.19	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-002-SO-011 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF766 **Sample Date/Time:** 2018-05-06 13:50 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.4	0.24	0.50	1.0	ug/kg		J	17
PERFLUOROHEXANOIC ACID	307-24-4	0.49	0.14	0.50	1.0	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.80	0.26	0.80	1.0	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-002-SO-911 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF767 **Sample Date/Time:** 2018-05-06 13:50 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.78	0.25	0.78	0.98	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.78	0.32	0.78	0.98	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.49	0.17	0.49	0.98	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.49	0.23	0.49	0.98	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.78	0.38	0.78	0.98	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.78	0.27	0.78	0.98	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.78	0.27	0.78	0.98	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.58	0.19	0.49	0.98	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	2.3	0.24	0.49	0.98	ug/kg		J	17
PERFLUOROHEXANOIC ACID	307-24-4	0.57	0.14	0.49	0.98	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.49	0.22	0.49	0.98	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.49	0.14	0.49	0.98	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.47	0.25	0.78	0.98	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.78	0.25	0.78	0.98	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	0.38	0.25	0.78	0.98	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.78	0.30	0.78	0.98	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.78	0.32	0.78	0.98	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.78	0.33	0.78	0.98	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-003-GW-016 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF779 **Sample Date/Time:** 2018-05-10 13:21 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.047	0.0066	0.015	0.020	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.086	0.0054	0.015	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.039	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.081	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	1.3	0.056	0.15	0.20	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.31	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.012	0.0087	0.018	0.020	ug/L	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.3	0.060	0.15	0.20	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.10	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.17	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-003-SO-011 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF768 **Sample Date/Time:** 2018-05-06 15:03 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.74	0.24	0.74	0.93	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.74	0.31	0.74	0.93	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.47	0.16	0.47	0.93	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.47	0.21	0.47	0.93	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.74	0.36	0.74	0.93	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.74	0.26	0.74	0.93	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.74	0.26	0.74	0.93	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.47	0.18	0.47	0.93	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.84	0.22	0.47	0.93	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	<0.47	0.13	0.47	0.93	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.47	0.20	0.47	0.93	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.47	0.13	0.47	0.93	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	8.5	0.24	0.74	0.93	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	<0.74	0.23	0.74	0.93	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.74	0.23	0.74	0.93	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.74	0.29	0.74	0.93	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.74	0.31	0.74	0.93	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.74	0.32	0.74	0.93	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH03-004-SO-011 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF771 **Sample Date/Time:** 2018-05-07 16:05 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.72	0.23	0.72	0.90	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.72	0.30	0.72	0.90	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.45	0.15	0.45	0.90	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.45	0.21	0.45	0.90	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.72	0.35	0.72	0.90	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.72	0.25	0.72	0.90	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.72	0.25	0.72	0.90	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.45	0.17	0.45	0.90	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.41	0.22	0.45	0.90	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	<0.45	0.13	0.45	0.90	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.45	0.20	0.45	0.90	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.45	0.13	0.45	0.90	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	5.6	0.23	0.72	0.90	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	<0.72	0.23	0.72	0.90	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.72	0.23	0.72	0.90	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.72	0.28	0.72	0.90	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.72	0.30	0.72	0.90	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.72	0.31	0.72	0.90	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-001-GW-018 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF778 **Sample Date/Time:** 2018-05-09 11:33 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.090	0.0066	0.015	0.020	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.018	0.0066	0.015	0.020	ug/L	J	J	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.022	0.0054	0.015	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.21	0.0055	0.015	0.020	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.70	0.0074	0.015	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.33	0.0056	0.015	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.46	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.030	0.0087	0.018	0.020	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.40	0.0060	0.015	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.19	0.0033	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.71	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-001-SO-012 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF765 **Sample Date/Time:** 2018-05-06 10:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.68	0.22	0.68	0.85	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.68	0.28	0.68	0.85	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.43	0.14	0.43	0.85	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.43	0.20	0.43	0.85	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.68	0.33	0.68	0.85	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.68	0.24	0.68	0.85	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.68	0.24	0.68	0.85	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.43	0.16	0.43	0.85	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.43	0.20	0.43	0.85	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.43	0.12	0.43	0.85	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.43	0.19	0.43	0.85	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.43	0.12	0.43	0.85	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.77	0.22	0.68	0.85	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.68	0.21	0.68	0.85	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.68	0.21	0.68	0.85	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.68	0.26	0.68	0.85	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.68	0.28	0.68	0.85	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.68	0.29	0.68	0.85	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF764 **Sample Date/Time:** 2018-05-06 10:13 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.31	0.23	0.72	0.90	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.72	0.30	0.72	0.90	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.45	0.15	0.45	0.90	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.99	0.21	0.45	0.90	ug/kg			
PERFLUORODECANE SULFONATE	335-77-3	<0.72	0.35	0.72	0.90	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.50	0.25	0.72	0.90	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.72	0.25	0.72	0.90	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.52	0.17	0.45	0.90	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.65	0.22	0.45	0.90	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.40	0.13	0.45	0.90	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.93	0.20	0.45	0.90	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.45	0.13	0.45	0.90	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	61	2.3	7.2	9.0	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.79	0.23	0.72	0.90	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.82	0.23	0.72	0.90	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.72	0.28	0.72	0.90	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.72	0.30	0.72	0.90	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.72	0.31	0.72	0.90	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-002-GW-018 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF776 **Sample Date/Time:** 2018-05-09 10:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	**U**	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	**U**	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.016	0.0054	0.015	0.020	ug/L	J	**J**	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	**U**	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	**UJ**	**08B**
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	**U**	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	**U**	
PERFLUOROHEPTANOIC ACID	375-85-9	0.015	0.0074	0.015	0.020	ug/L	J	**J**	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.015	0.0056	0.015	0.020	ug/L	J	**J**	
PERFLUOROHEXANOIC ACID	307-24-4	0.042	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	**U**	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	**U**	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	**U**	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	**U**	
PERFLUOROPENTANOIC ACID	2706-90-3	0.060	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	**U**	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	**U**	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	**U**	

Analysis Method: EPA 537 m

Sample Name ELSWH06-002-GW-918 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF777 **Sample Date/Time:** 2018-05-09 10:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.015	0.0054	0.015	0.020	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.014	0.0074	0.015	0.020	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.017	0.0056	0.015	0.020	ug/L	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.039	0.0035	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	0.060	0.0075	0.018	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-003-GW-055 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF775 **Sample Date/Time:** 2018-05-07 16:21 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.0092	0.0066	0.015	0.020	ug/L	J	**J**	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	**U**	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	**U**	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	**UJ**	**10A**
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	**U**	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	**U**	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	**U**	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	**U**	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	**U**	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	**U**	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	**U**	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	**U**	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	**U**	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	**U**	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	**U**	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	**U**	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	**U**	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	**U**	

Analysis Method: EPA 537 m

Sample Name ELSWH06-004-SO-035 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF762 **Sample Date/Time:** 2018-05-06 09:10 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.80	0.26	0.80	1.0	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-004-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF760 **Sample Date/Time:** 2018-05-06 07:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.73	0.24	0.73	0.91	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.46	0.15	0.46	0.91	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.62	0.21	0.46	0.91	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.73	0.35	0.73	0.91	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.73	0.25	0.73	0.91	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.46	0.17	0.46	0.91	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.59	0.22	0.46	0.91	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	2.3	0.20	0.46	0.91	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.46	0.13	0.46	0.91	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	29	0.24	0.73	0.91	ug/kg		J	08A
PERFLUOROOCTANOIC ACID	335-67-1	1.2	0.23	0.73	0.91	ug/kg		J	17
PERFLUOROPENTANOIC ACID	2706-90-3	0.80	0.23	0.73	0.91	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.73	0.28	0.73	0.91	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.73	0.30	0.73	0.91	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.73	0.31	0.73	0.91	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH06-004-SS-901 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF761 **Sample Date/Time:** 2018-05-06 07:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.78	0.25	0.78	0.97	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.78	0.32	0.78	0.97	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.49	0.16	0.49	0.97	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.79	0.22	0.49	0.97	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.78	0.38	0.78	0.97	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.78	0.27	0.78	0.97	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.78	0.27	0.78	0.97	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.58	0.18	0.49	0.97	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.71	0.23	0.49	0.97	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.45	0.14	0.49	0.97	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	2.6	0.21	0.49	0.97	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.49	0.14	0.49	0.97	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	22	0.25	0.78	0.97	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.8	0.24	0.78	0.97	ug/kg		J	17
PERFLUOROPENTANOIC ACID	2706-90-3	1.3	0.24	0.78	0.97	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.78	0.30	0.78	0.97	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.78	0.32	0.78	0.97	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.78	0.33	0.78	0.97	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH07-001-SO-029 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF773 **Sample Date/Time:** 2018-05-08 12:56 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.80	0.26	0.80	1.0	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH07-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF772 **Sample Date/Time:** 2018-05-08 08:50 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.61	0.25	0.55	1.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.73	0.21	0.55	1.1	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.2	0.26	0.55	1.1	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.61	0.15	0.55	1.1	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.66	0.24	0.55	1.1	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	18	0.29	0.88	1.1	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	2.6	0.28	0.88	1.1	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.80	0.28	0.88	1.1	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH07-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF759 **Sample Date/Time:** 2018-05-09 14:10 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.71	0.23	0.71	0.89	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.71	0.29	0.71	0.89	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.45	0.15	0.45	0.89	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.45	0.20	0.45	0.89	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.71	0.35	0.71	0.89	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.71	0.25	0.71	0.89	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.71	0.25	0.71	0.89	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.45	0.17	0.45	0.89	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.45	0.21	0.45	0.89	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.45	0.12	0.45	0.89	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	0.41	0.20	0.45	0.89	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.45	0.12	0.45	0.89	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	18	0.23	0.71	0.89	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.36	0.22	0.71	0.89	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.71	0.22	0.71	0.89	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.71	0.28	0.71	0.89	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.71	0.29	0.71	0.89	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.71	0.30	0.71	0.89	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH07-004-SO-013 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF747 **Sample Date/Time:** 2018-05-08 14:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.65	0.21	0.65	0.81	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.65	0.27	0.65	0.81	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.41	0.14	0.41	0.81	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.41	0.19	0.41	0.81	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.65	0.32	0.65	0.81	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.65	0.23	0.65	0.81	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.65	0.23	0.65	0.81	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.41	0.15	0.41	0.81	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.41	0.19	0.41	0.81	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.41	0.11	0.41	0.81	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.41	0.18	0.41	0.81	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.41	0.11	0.41	0.81	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.65	0.21	0.65	0.81	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.65	0.20	0.65	0.81	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.65	0.20	0.65	0.81	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.65	0.25	0.65	0.81	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.65	0.27	0.65	0.81	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.65	0.28	0.65	0.81	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH07-004-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF774 **Sample Date/Time:** 2018-05-08 13:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	5.9	0.26	0.80	1.0	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.60	0.25	0.80	1.0	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-001-SO-012 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF755 **Sample Date/Time:** 2018-05-09 10:48 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.65	0.21	0.65	0.81	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.65	0.27	0.65	0.81	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.41	0.14	0.41	0.81	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.41	0.19	0.41	0.81	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.65	0.32	0.65	0.81	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.65	0.23	0.65	0.81	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.65	0.23	0.65	0.81	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.41	0.15	0.41	0.81	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.41	0.19	0.41	0.81	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.41	0.11	0.41	0.81	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.41	0.18	0.41	0.81	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.41	0.11	0.41	0.81	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.51	0.21	0.65	0.81	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.65	0.20	0.65	0.81	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.65	0.20	0.65	0.81	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.65	0.25	0.65	0.81	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.65	0.27	0.65	0.81	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.65	0.28	0.65	0.81	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF754 **Sample Date/Time:** 2018-05-09 10:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.68	0.22	0.68	0.85	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.68	0.28	0.68	0.85	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.43	0.14	0.43	0.85	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.43	0.20	0.43	0.85	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.68	0.33	0.68	0.85	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.68	0.24	0.68	0.85	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.68	0.24	0.68	0.85	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.43	0.16	0.43	0.85	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.31	0.20	0.43	0.85	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.54	0.12	0.43	0.85	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.43	0.19	0.43	0.85	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.43	0.12	0.43	0.85	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	5.9	0.22	0.68	0.85	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.1	0.21	0.68	0.85	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.37	0.21	0.68	0.85	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.68	0.26	0.68	0.85	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.68	0.28	0.68	0.85	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.68	0.29	0.68	0.85	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-002-SO-010 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF751 **Sample Date/Time:** 2018-05-09 09:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.79	0.26	0.79	0.99	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.79	0.33	0.79	0.99	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	0.99	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	0.99	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.79	0.39	0.79	0.99	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.79	0.28	0.79	0.99	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.79	0.28	0.79	0.99	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	0.99	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	0.99	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	0.99	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	0.99	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	0.99	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.79	0.26	0.79	0.99	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.79	0.25	0.79	0.99	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.79	0.25	0.79	0.99	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.79	0.31	0.79	0.99	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.79	0.33	0.79	0.99	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.79	0.34	0.79	0.99	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF750 **Sample Date/Time:** 2018-05-09 08:42 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.66	0.22	0.66	0.83	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.66	0.27	0.66	0.83	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.42	0.14	0.42	0.83	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.42	0.19	0.42	0.83	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.66	0.32	0.66	0.83	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.66	0.23	0.66	0.83	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.66	0.23	0.66	0.83	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.42	0.16	0.42	0.83	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.47	0.20	0.42	0.83	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	<0.42	0.12	0.42	0.83	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.42	0.18	0.42	0.83	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.42	0.12	0.42	0.83	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	6.7	0.22	0.66	0.83	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.34	0.21	0.66	0.83	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.66	0.21	0.66	0.83	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.66	0.26	0.66	0.83	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.66	0.27	0.66	0.83	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.66	0.28	0.66	0.83	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-004-SO-012 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF757 **Sample Date/Time:** 2018-05-09 11:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.88	0.29	0.88	1.1	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.55	0.19	0.55	1.1	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.55	0.25	0.55	1.1	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.88	0.43	0.88	1.1	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.88	0.31	0.88	1.1	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.55	0.21	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.55	0.26	0.55	1.1	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.55	0.24	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.55	0.15	0.55	1.1	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.88	0.29	0.88	1.1	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.88	0.28	0.88	1.1	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.88	0.34	0.88	1.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.88	0.36	0.88	1.1	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.88	0.37	0.88	1.1	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-004-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF756 **Sample Date/Time:** 2018-05-09 11:11 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.77	0.25	0.77	0.96	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.48	0.16	0.48	0.96	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.48	0.22	0.48	0.96	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.77	0.37	0.77	0.96	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.48	0.18	0.48	0.96	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.40	0.23	0.48	0.96	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	0.44	0.21	0.48	0.96	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	15	0.25	0.77	0.96	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.59	0.24	0.77	0.96	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.77	0.24	0.77	0.96	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.77	0.30	0.77	0.96	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.77	0.33	0.77	0.96	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11-005-SO-013 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF758 **Sample Date/Time:** 2018-05-09 12:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.77	0.25	0.77	0.96	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.48	0.16	0.48	0.96	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.48	0.22	0.48	0.96	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.77	0.37	0.77	0.96	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.77	0.27	0.77	0.96	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.48	0.18	0.48	0.96	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.48	0.23	0.48	0.96	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.48	0.21	0.48	0.96	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.48	0.13	0.48	0.96	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.31	0.25	0.77	0.96	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.77	0.24	0.77	0.96	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.77	0.24	0.77	0.96	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.77	0.30	0.77	0.96	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.77	0.32	0.77	0.96	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.77	0.33	0.77	0.96	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH11H-002-SO-910 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GRF752 **Sample Date/Time:** 2018-05-09 09:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.80	0.26	0.80	1.0	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.50	0.17	0.50	1.0	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.50	0.23	0.50	1.0	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.80	0.39	0.80	1.0	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.80	0.28	0.80	1.0	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.50	0.19	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.50	0.24	0.50	1.0	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.50	0.22	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.50	0.14	0.50	1.0	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.80	0.26	0.80	1.0	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.80	0.25	0.80	1.0	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.80	0.31	0.80	1.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.80	0.33	0.80	1.0	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.80	0.34	0.80	1.0	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-014 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF763 **Sample Date/Time:** 2018-05-06 09:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-015 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF769 **Sample Date/Time:** 2018-05-07 13:01 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-016 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF749 **Sample Date/Time:** 2018-05-08 13:55 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-017 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF753 **Sample Date/Time:** 2018-05-09 09:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-RS-018 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF781 **Sample Date/Time:** 2018-05-10 12:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH-SB-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: GRF748 **Sample Date/Time:** 2018-05-08 14:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.015	0.0066	0.015	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.015	0.0066	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.015	0.0054	0.015	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.015	0.0055	0.015	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.015	0.0061	0.015	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.010	0.0050	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.015	0.0074	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.015	0.0056	0.015	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.010	0.0035	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.018	0.0087	0.018	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.010	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.015	0.0060	0.015	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.010	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.018	0.0075	0.018	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.010	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.010	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.010	0.0025	0.010	0.020	ug/L	U	U	

Validated Sample Result Forms: B8C0381

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-GW-015 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GTF558 **Sample Date/Time:** 2018-05-20 09:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	63	0.66	1.5	2.0	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.68	0.066	0.15	0.20	ug/L			
PERFLUOROBUTANE SULFONATE	29420-43-3	13	0.54	1.5	2.0	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	14	0.55	1.5	2.0	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.15	0.060	0.15	0.20	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.12	0.061	0.15	0.20	ug/L	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.10	0.050	0.10	0.20	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	7.1	0.074	0.15	0.20	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	86	0.56	1.5	2.0	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	99	0.35	1.0	2.0	ug/L		J	17
PERFLUORONONANOIC ACID	375-95-1	0.56	0.087	0.18	0.20	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.10	0.034	0.10	0.20	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	41	0.60	1.5	2.0	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	9.7	0.033	0.10	0.20	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	29	0.75	1.8	2.0	ug/L		J	17
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.10	0.027	0.10	0.20	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.10	0.038	0.10	0.20	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.10	0.025	0.10	0.20	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-GW-915 **Matrix Type:** **Result Type:** TRG

Lab Sample Name: GTF559 **Sample Date/Time:** 2018-05-20 09:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	52	0.66	1.5	2.0	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.77	0.066	0.15	0.20	ug/L			
PERFLUOROBUTANE SULFONATE	29420-43-3	9.9	0.054	0.15	0.20	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	11	0.55	1.5	2.0	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.15	0.060	0.15	0.20	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.12	0.061	0.15	0.20	ug/L	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.10	0.050	0.10	0.20	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	5.4	0.074	0.15	0.20	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	73	0.56	1.5	2.0	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	70	0.35	1.0	2.0	ug/L		J	17
PERFLUORONONANOIC ACID	375-95-1	0.52	0.087	0.18	0.20	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.096	0.034	0.10	0.20	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	44	0.60	1.5	2.0	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	8.3	0.033	0.10	0.20	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	21	0.75	1.8	2.0	ug/L		J	17
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.10	0.027	0.10	0.20	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.10	0.038	0.10	0.20	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.10	0.025	0.10	0.20	ug/L	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-SO-013 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GTF550 **Sample Date/Time:** 2018-05-17 09:47 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	93	2.2	6.7	8.4	ug/kg			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	8.0	0.28	0.67	0.84	ug/kg			
PERFLUOROBUTANE SULFONATE	29420-43-3	0.71	0.14	0.42	0.84	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	1.3	0.19	0.42	0.84	ug/kg			
PERFLUORODECANE SULFONATE	335-77-3	<0.67	0.33	0.67	0.84	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.41	0.24	0.67	0.84	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.67	0.24	0.67	0.84	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.80	0.16	0.42	0.84	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	4.0	0.20	0.42	0.84	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	8.8	0.12	0.42	0.84	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	0.31	0.18	0.42	0.84	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.28	0.12	0.42	0.84	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	72	2.2	6.7	8.4	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.4	0.21	0.67	0.84	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	3.0	0.21	0.67	0.84	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.67	0.26	0.67	0.84	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.67	0.28	0.67	0.84	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.67	0.29	0.67	0.84	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-SO-913 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GTF551 **Sample Date/Time:** 2018-05-17 09:47 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	100	2.2	6.7	8.4	ug/kg		J	10A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	7.9	0.28	0.67	0.84	ug/kg			
PERFLUOROBUTANE SULFONATE	29420-43-3	0.82	0.14	0.42	0.84	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	1.1	0.19	0.42	0.84	ug/kg			
PERFLUORODECANE SULFONATE	335-77-3	<0.67	0.33	0.67	0.84	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.52	0.24	0.67	0.84	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.67	0.24	0.67	0.84	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.77	0.16	0.42	0.84	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	4.4	0.20	0.42	0.84	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	7.1	0.12	0.42	0.84	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	<0.42	0.18	0.42	0.84	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.35	0.12	0.42	0.84	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	70	2.2	6.7	8.4	ug/kg		J	10A
PERFLUOROOCTANOIC ACID	335-67-1	1.2	0.21	0.67	0.84	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	2.2	0.21	0.67	0.84	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.67	0.26	0.67	0.84	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.67	0.28	0.67	0.84	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.67	0.29	0.67	0.84	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GTF547 **Sample Date/Time:** 2018-05-17 08:33 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	14	2.5	7.8	9.7	ug/kg		**J**	**17**
8:2 FLUOROTELOMER SULFONATE	39108-34-4	16	3.2	7.8	9.7	ug/kg		**J**	**17**
PERFLUOROBUTANE SULFONATE	29420-43-3	4.9	1.6	4.9	9.7	ug/kg	J	**J**	
PERFLUOROBUTANOIC ACID	375-22-4	8.2	2.2	4.9	9.7	ug/kg	J	**J**	
PERFLUORODECANE SULFONATE	335-77-3	<7.8	3.8	7.8	9.7	ug/kg	U	**U**	
PERFLUORODECANOIC ACID	335-76-2	4.8	2.7	7.8	9.7	ug/kg	J	**J**	
PERFLUORODODECANOIC ACID	307-55-1	<7.8	2.7	7.8	9.7	ug/kg	U	**U**	
PERFLUOROHEPTANOIC ACID	375-85-9	<4.9	1.8	4.9	9.7	ug/kg	U	**U**	
PERFLUOROHEXANE SULFONATE	108427-53-8	18	2.3	4.9	9.7	ug/kg		**J**	**17**
PERFLUOROHEXANOIC ACID	307-24-4	5.4	1.4	4.9	9.7	ug/kg	J	**J**	
PERFLUORONONANOIC ACID	375-95-1	5.0	2.1	4.9	9.7	ug/kg	J	**J**	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	3.5	1.4	4.9	9.7	ug/kg	J	**J**	
PERFLUOROOCTANE SULFONATE	1763-23-1	1900	25	78	97	ug/kg		**J**	**10A;17**
PERFLUOROOCTANOIC ACID	335-67-1	4.1	2.4	7.8	9.7	ug/kg	J	**J**	**17**
PERFLUOROPENTANOIC ACID	2706-90-3	6.7	2.4	7.8	9.7	ug/kg	J	**J**	
PERFLUOROTETRADECANOIC ACID	376-06-7	<7.8	3.0	7.8	9.7	ug/kg	U	**U**	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<7.8	3.2	7.8	9.7	ug/kg	U	**U**	
PERFLUOROUNDECANOIC ACID	2058-94-8	<7.8	3.3	7.8	9.7	ug/kg	U	**U**	

Analysis Method: EPA 537 m

Sample Name ELSWH01-001-SS-901 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GTF548 **Sample Date/Time:** 2018-05-17 08:33 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	150	2.5	7.8	9.7	ug/kg		J	10A;17
8:2 FLUOROTELOMER SULFONATE	39108-34-4	28	3.2	7.8	9.7	ug/kg		J	10A;17
PERFLUOROBUTANE SULFONATE	29420-43-3	4.1	1.6	4.9	9.7	ug/kg	J	J	10A
PERFLUOROBUTANOIC ACID	375-22-4	5.8	2.2	4.9	9.7	ug/kg	J	J	10A
PERFLUORODECANE SULFONATE	335-77-3	<7.8	3.8	7.8	9.7	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	3.8	2.7	7.8	9.7	ug/kg	J	J	10A
PERFLUORODODECANOIC ACID	307-55-1	<7.8	2.7	7.8	9.7	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<4.9	1.8	4.9	9.7	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	85	2.3	4.9	9.7	ug/kg		J	10A;17
PERFLUOROHEXANOIC ACID	307-24-4	4.4	1.4	4.9	9.7	ug/kg	J	J	10A
PERFLUORONONANOIC ACID	375-95-1	8.1	2.1	4.9	9.7	ug/kg	J	J	10A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	4.3	1.4	4.9	9.7	ug/kg	J	J	10A
PERFLUOROOCTANE SULFONATE	1763-23-1	3300	25	78	97	ug/kg		J	10A;17
PERFLUOROOCTANOIC ACID	335-67-1	15	2.4	7.8	9.7	ug/kg		J	10A;17
PERFLUOROPENTANOIC ACID	2706-90-3	5.5	2.4	7.8	9.7	ug/kg	J	J	10A
PERFLUOROTETRADECANOIC ACID	376-06-7	<7.8	3.0	7.8	9.7	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<7.8	3.2	7.8	9.7	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<7.8	3.3	7.8	9.7	ug/kg	U	U	

Analysis Method: EPA 537 m

Sample Name ELSWH01-002-SO-012 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: GTF543 **Sample Date/Time:** 2018-05-16 13:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	29	2.1	6.6	8.2	ug/kg			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	4.0	2.7	6.6	8.2	ug/kg	J	J	
PERFLUOROBUTANE SULFONATE	29420-43-3	2.5	1.4	4.1	8.2	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	<4.1	1.9	4.1	8.2	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<6.6	3.2	6.6	8.2	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	2.7	2.3	6.6	8.2	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<6.6	2.3	6.6	8.2	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	2.9	1.6	4.1	8.2	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	12	2.0	4.1	8.2	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	7.4	1.1	4.1	8.2	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	5.0	1.8	4.1	8.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	1.9	1.1	4.1	8.2	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	630	21	66	82	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	4.1	2.1	6.6	8.2	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	6.6	2.1	6.6	8.2	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<6.6	2.5	6.6	8.2	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<6.6	2.7	6.6	8.2	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<6.6	2.8	6.6	8.2	ug/kg	U	U	