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AIR FORCE CIVIL ENGINEER CENTER
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15 March 2018

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SUBJECT: Ellsworth Air Force Base Final Technical Memorandum, Proposed Groundwater Monitoring Well Locations, Perfluorinated Compound Delineation, Area of Concern Perfluorinated Compound 1

Dear Ms. Lineburg and Ms. Smith:

Ayuda has prepared the enclosed Final Technical Memorandum, Proposed Groundwater Monitoring Well Locations, Perfluorinated Compound Delineation, Area of Concern Perfluorinated Compound 1, dated November 2017, for your records. If you have any questions or would like additional information, please contact me at (605) 385-2677.

Sincerely,

MELODY A. JENSEN
Environmental Restoration Program Manager

cc: Mr. Levi Todd, Ayuda

Enclosed

FINAL TECHNICAL MEMORANDUM

Proposed Groundwater Monitoring Well Locations
Perfluorinated Compound Delineation,
Area of Concern Perfluorinated Compound-1
Ellsworth Air Force Base, South Dakota

Contract No.: W912PP-13-D-0011
Task Order: 0002

November 2017







Prepared for:
U.S. Army Corps of Engineers,
Albuquerque District
4101 Jefferson Plaza NE
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FINAL TECHNICAL MEMORANDUM

Proposed Groundwater Monitoring Well Locations Perfluorinated Compound Delineation, Area of Concern Perfluorinated Compound-1

Ellsworth Air Force Base, South Dakota

November 2017

Prepared for:

U.S. Army Corps of Engineers
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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS V

1.0 INTRODUCTION 1-1
1.1 Report Organization 1-1

2.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS 2-1

3.0 DATA SCREENING VALUES 3-1
3.1 Groundwater and Surface Water 3-1
3.2 Soil and Sediment 3-2

4.0 SAMPLING LOCATIONS AND RATIONALE 4-1
4.1 Stage 1 Field Activities and Sampling Locations 4-1

5.0 FIELD METHODS 5-1
5.1 Sediment and Surface Water Sampling 5-1
5.2 Surface and Subsurface Soil Sampling 5-1
5.2.1 Direct Push Soil Borings, Surface Soil Sampling, and Subsurface Soil Sampling 5-1
5.3 Groundwater Sampling 5-2
5.4 Decontamination Procedures 5-2
5.5 Investigation-Derived Waste 5-3

6.0 RESULTS 6-1
6.1 Soil Sampling 6-1
6.1.1 PSA 1 – Former Fire Protection Training Area 6-1
6.1.2 PSA 2 – Approximate Location of Dredged Solids from Pond 1 6-1
6.1.3 PSA 3 – Historical Upgradient Groundwater Injection Trench 6-2
6.1.4 PSA 4 – Historical Cross-Gradient Groundwater Injection Trench 6-2
6.1.5 Non-Source Area 6-2
6.2 Temporary & Permanent Well Groundwater Sampling 6-2
6.2.1 PFBS Concentrations in Groundwater 6-3
6.2.2 PFOA Concentrations in Groundwater 6-3
6.2.3 PFOS Concentrations in Groundwater 6-3
6.2.4 Combined PFOA and PFOS Concentrations in Groundwater 6-3
6.2.5 PFC Concentrations in Groundwater other than PFBS, PFOA, and PFOS 6-3
6.3 Sediment & Surface Water Sampling 6-3
6.4 Stage 1 Delineation Summary 6-4

7.0 DATA QUALITY 7-1

8.0 STAGE 2 FIELD ACTIVITIES 8-1
8.1 Soil Borings and Monitoring Well Installation 8-1
8.2 Surface Water and Sediment Sampling 8-2
8.3 Groundwater Gauging and Sampling 8-2
8.4 Residential Well Sampling 8-2

9.0 CONCLUSIONS 9-1

10.0 REFERENCES 10-1

FIGURES

Figure 1-1 Ellsworth Air Force Base Site Location Map
Figure 1-2 Area of Concern Perfluorinated Compounds-1 Location Map
Figure 4-1 March 2016 Surface Water and Sediment Sample Locations
Figure 4-2 March 2016 Surface and Subsurface Soil Sample Locations
Figure 4-3 March 2016 Groundwater Sample Locations
Figure 6-1 March 2016 Perfluorobutanesulfonic Acid Concentrations in Soil
Figure 6-2 March 2016 Perfluorooctanoic Acid Concentrations in Soil
Figure 6-3 March 2016 Perfluorooctanesulfonic Acid Concentrations in Soil
Figure 6-4 March 2016 Groundwater Table Surface Map
Figure 6-5 March 2016 Perfluorinated Compound Concentrations in Groundwater
Figure 6-6 March 2016 Perfluorobutanesulfonic Acid Concentrations in Groundwater
Figure 6-7 March 2016 Perfluorooctanoic Acid Concentrations in Groundwater
Figure 6-8 March 2016 Perfluorooctanesulfonic Acid Concentrations in Groundwater
Figure 6-9 March 2016 Combined PFOS and PFOA Concentrations in Groundwater
Figure 6-10 March 2016 Perfluorinated Compounds Concentrations in Sediment
Figure 6-11 March 2016 Perfluorinated Compounds Concentrations in Surface Water
Figure 8-1 Proposed Stage 2 Investigation Field Activities
Figure 8-2 Proposed Stage 2 Investigation PSA-1 Area

TABLES

Table 5-0 Stage 1 Groundwater Quality Parameters
Table 6-0 Coordinate and Ground Surface Elevation Data for Stage 1 Sample Point Locations
Table 6-1 Surface Soil Analytical Results
Table 6-2 Subsurface Soil Analytical Results
Table 6-3a Soil Analytical Results Depth Profile-Potential Source Area 1
Table 6-3b Soil Analytical Results Depth Profile-Potential Source Area 2
Table 6-3c Soil Analytical Results Depth Profile-Potential Source Area 3
Table 6-3d Soil Analytical Results Depth Profile-Potential Source Area 4
Table 6-3e Soil Analytical Results Depth Profile-Non-Source Area
Table 6-4 March 14, 2016 Groundwater Level Measurements
Table 6-5 Permanent Well Groundwater Analytical Results
Table 6-6 Temporary Well Groundwater Analytical Results
Table 6-7 Sediment Analytical Results
Table 6-8 Surface Water Analytical Results
Table 7-1 Field Quality Control Sample Summary
Table 8-1 Proposed Stage 2 Field Activities Summary and Rationale

APPENDICES

Appendix A Daily Quality Control Reports
Appendix B Soil Boring Logs
Appendix C Temporary Well Completion Details
Appendix D Equipment Blanks
Appendix E Groundwater Sampling Logs
Appendix F Analytical Laboratory Reports
Appendix G Data Validation Reports
Appendix H Technical Memorandum Response to Comments

ACRONYMS AND ABBREVIATIONS

%	percent
#	number (specific to Worksheet numbers)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Engineering and the Environment
AFFF	aqueous film-forming foam
AOC	Area of Concern
ATSDR	Agency for Toxic Substances and Disease Registry
Ayuda Partners	Ayuda Partners Joint Venture, LLC
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
DL	detection limits
DO	dissolved oxygen
DoD	Department of Defense
DP	Direct Push
DTW	depth to static water
EAFB	Ellsworth Air Force Base
EB	Equipment Blanks
FD	Field Duplicate
FS	Feasibility Study
FSP	Field Sampling Plan
ft	foot/feet
FTS	fluorotelomer sulfonate
(FT001)	Former Fire Training Area
HA	Health Advisory
HHRA	Human Health Risk Assessment
IDW	Investigation Derived Waste
in	inch(es)
JP-4	jet propellant-4
MDLs	Method DLs
MOD	Modified
mg/kg	milligrams per kilogram
mg/L	milligrams per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	not applicable
No.	Number
NPL	National Priorities List
NS	no standard
OSRTI	Office of Superfund Remediation and Technology Innovation
OU	Operable Unit
OW	Office of Water
PPE	personal protective equipment
ppm	parts per million
PFBS	Perfluorobutanesulfonic Acid
PFC	perfluorinated compounds
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid

PID	photoionization detector
pH	potential of Hydrogen
PHA	provisional health advisory
PSA	potential source area
PVC	Polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
QSM v.5.0	Quality System Manual version 5.0
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SDDENR	South Dakota Department of Environment and Natural Resources
Site	OU-1 (FT001)
SOPs	Standard Operating Procedures
SLs	Screening Levels
SWDA	Safe Water Drinking Act
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
TWPs	Temporary Well Points
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile organic compounds
WS	Worksheet

1.0 INTRODUCTION

This Proposed Groundwater Monitoring Well Locations Technical Memorandum designates the location and rationale for 19 new monitoring wells, for the purpose of delineating the extent of perfluorinated compound (PFC) contamination during Stage 2 of the Remedial Investigation (RI) at Area of Concern (AOC) PFC-1, formerly Operable Unit (OU)-1 Former Fire Training Area (FT001), at Ellsworth Air Force Base (EAFB). The results of Stage 1 field activities conducted in March 2016 are presented in this report. These data were used to identify data gaps in the Stage 1 investigation and prepare and support the Stage 2 recommendations.

The location of EAFB is shown on **Figure 1-1** and AOC PFC-1 is shown on **Figure 1-2**. This document has been prepared by Ayuda Partners Joint Venture, LLC (Ayuda Partners) for the United States (U.S.) Army Corps of Engineers (USACE) under Contract Number W912PP-13-D-0011, Task Order 0002. The site name, AOC PFC-1, has been designated for purposes of this investigation because previously detected PFCs in soil and groundwater were present beyond the strict boundaries of OU-1 (FT001).

In order to avoid confusion, historical documents and activities referencing OU-1 will retain the OU-1 (FT001) nomenclature. Discussion of current and future PFC investigations will refer to the area as AOC PFC-1. Spatially, AOC PFC-1 includes OU-1 (FT001), as well as areas potentially affected by the historical placement of PFC-containing materials in the vicinity of OU-1 (FT001) (see **Figure 1-2**). Additionally, because of the southerly flow pattern observed in the groundwater table, and the proximity of AOC PFC-1 to the southern boundary of EAFB, Stage 1 investigations included a residential area immediately south of the EAFB.

For purposes of this Technical Memorandum, discussion regarding Stage 2 of the AOC PFC-1 delineation will refer to the investigation of per- and polyfluoroalkyl substances (PFAS), which encompass both PFCs and fluoroakyl substances that may be indicator compounds for and potentially degrade to PFCs (National Groundwater Association, 2017). Two fluorotelomer sulfonate compounds commonly used in firefighting surfactant manufacturing, 6:2 fluorotelomer sulfonate (FTS) and 8:2 FTS, have been added to the list of 12 PFCs to be analyzed as part of the Stage 2 delineation at AOC PFC-1.

1.1 Report Organization

This Proposed Groundwater Monitoring Well Locations Technical Memorandum describes field activities conducted as part of Stage 1 PFC delineation at EAFB AOC PFC-1, presents Stage 1 sample analytical results by individual media, and provides rationale for the Stage 2 sampling program. The Technical Memorandum is organized and presented, as follows:

- Section 1 is the Introduction and briefly describes the purpose of this Technical Memorandum;
- Section 2 describes the AOC PFC-1 history and previous investigations conducted at OU-1 (FT001);
- Section 3 describes data screening values for PFCs;
- Section 4 describes field activities conducted during Stage 1;
- Section 5 describes field methods applied during Stage 1 sampling;
- Section 6 presents results of Stage 1 sampling by individual media;
- Section 7 describes data quality and data validation results;
- Section 8 presents Stage 2 sample locations and rationale;
- Section 9 describes conclusions drawn from Stage 1 field activities and sample results;
- Appendix A includes Daily Quality Control Reports (DQCRs) from Stage 1 field activities;
- Appendix B includes soil boring logs from Stage 1 direct push (DP) locations;
- Appendix C includes temporary well completion details for Stage 1 locations;
- Appendix D includes results from equipment blanks (EBs) collected during Stage 1;
- Appendix E includes groundwater sampling (purge) logs from permanent monitoring wells sampled during Stage 1;

- Appendix F includes analytical laboratory reports from Stage 1 sampling;
- Appendix G includes data validation reports for Stage 1 data; and
- Appendix H includes response to U.S. Environmental Protection Agency (USEPA) and South Dakota Department of Environment and Natural Resources (SDDENR) comments on the Technical Memorandum.

2.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS

EAFB is located approximately ten miles northeast of Rapid City, South Dakota, and is adjacent to the City of Box Elder (**Figure 1-1**). 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 EAFB, and residences, ranches, and commercial areas lie to the east and south.

OU-1 (FT001) is a former fire training area, which was operational from 1942 to 1990. Waste materials burned included solvents, oils, aviation fuels, and jet propellant-4 (JP-4). Extinguishing chemicals used during fire training exercises included aqueous film-forming foam (AFFF), Halon, protein foams, carbon dioxide, dry chemicals, and chlorobromomethane. AFFF contain PFCs, which are now considered emerging contaminants by the United States Air Force. An "emerging contaminant" is a contaminant that (1) has a reasonably possible pathway to enter the environment; (2) presents a potential unacceptable human health or environmental risk; and (3) does not have regulatory standards based on peer-reviewed science, or the regulatory standards are evolving due to new science, detection capabilities, or pathways. Perfluorooctanoic Acid (PFOA), and Perfluorooctanesulfonic Acid (PFOS) are two of the PFCs included in the AFFF previously used at OU-1 (FT001), and were identified as emerging contaminants by the USEPA in 2014 (USEPA, 2014). Perfluorobutanesulfonic Acid (PFBS) was not identified during the AFFF inventory, but typically accompanies the other two contaminants.

Due to their chemical stability and low volatility in ionic form, when released into the environment, PFCs are persistent in water and soil (Agency for Toxic Substances and Disease Registry [ATSDR], 2009). They do not hydrolyze, photolyze, or biodegrade under typical environmental conditions.

Previous work at OU-1 (FT001) included a Remedial Investigation (RI; USAF, 1994), Feasibility Study (FS; USAF ACC, 1995), and Record of Decision (ROD; USAF, 1996) in the early to mid-1990s that addressed soil and groundwater impacts from petroleum products (benzene, toluene, ethylbenzene, and xylenes [BTEX]) and chlorinated volatile organic compounds (VOCs), but did not include analysis of PFCs. Impacted groundwater extended more than 1,000 feet (ft) south of OU-1 (FT001). Various remedial actions, including soil vapor extraction, bioventing, and active (pump and treat) treatment were conducted from 1995 to 2010. Passive (enhanced reductive dechlorination) treatment for the chlorinated solvents in groundwater was implemented in 2007 and is ongoing. Oxygen infusion using iSOC® units for petroleum constituents in groundwater at OU-1 (FT001) was conducted from September 2008 through the summer of 2015. The management of impacted groundwater at OU-1 (FT001) was transferred into OU-11 (Basewide Groundwater) in 2005 via a memorandum of record. The transfer was formalized in an Explanation of Significant Differences in 2007. A partial deletion of the site from the National Priorities List (NPL) in 2012 deleted the surface soil, unsaturated subsurface soil, sediment, and surface water at OU-1.

The Air Force Civil Engineer Center (AFCEC), formerly the Air Force Center for Engineering and the Environment (AFCEE), initiated limited environmental sampling of soil and groundwater for PFCs at OU-1 (FT001) in 2011 as part of a Broad Agency Announcement research project. This limited investigation confirmed the release of PFOS at 75 micrograms per liter (µg/L) and PFOA at 360 µg/L in groundwater, both of which were above the United States Environmental Protection Agency (USEPA) provisional health advisory (PHA) levels of 0.2 µg/L and 0.4 µg/L, respectively, in effect at that time (EAFB, 2012). Subsequently, the USEPA PHAs for PFOS and PFOA have been lowered to 0.07 µg/L individually as well as combined (USEPA, 2016a). The investigation also documented the presence of PFOS and PFOA in soil. The highest concentration of PFOS in soil was 88 milligrams per kilogram (mg/kg) and the highest concentration of PFOA in soil was 11.48 mg/kg. Releases of PFCs are also suspected due to discharge of treated groundwater from OU-1 (FT001) to a surface water ditch and, at different periods, to reinjection trenches (the groundwater was treated for fuels/chlorinated VOC contamination, but not for PFCs). In addition, sediments from the pond (catch basin) downstream of the surface water ditch have been previously removed and placed northwest of OU-1 (FT001).

The AOC PFC-1 is illustrated in **Figure 1-1** and **Figure 1-2**. AOC PFC-1 includes OU-1 (FT001), the historical reinjection trenches, existing sediments and surface water in the ditch and pond, the area in which dredged pond solids are suspected to have been placed and spread, and groundwater downgradient of these potential source areas (PSA). For purposes of this document, source areas throughout the remainder of this document will be referenced as:

PSA 1 – Former Fire Training Area;
PSA 2 – Dredged Solids from Pond 1;
PSA 3 – Historical Upgradient Groundwater Injection Trench; and
PSA 4 – Historical Cross-gradient Groundwater Injection Trench.

The source areas are also illustrated on **Figure 1-2**. Historical and recent groundwater potentiometric surfaces indicate that local groundwater flow direction is to the south in the vicinity of AOC PFC-1. Because the southern extent to which PFCs in groundwater may have migrated is currently unknown, off-Base areas, including the Thunderbird Subdivision south of the EAFB boundary, are included within the AOC PFC-1.

Environmental activities are being performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and National Oil and Hazardous Substances Contingency Plan requirements, and with regulatory coordination with the SDDENR and the USEPA Region 8.

3.0 DATA SCREENING VALUES

In this section, screening levels (SLs) for environmental media investigated during Stage 1 at AOC PFC-1 are identified.

PFC impacts in groundwater, soil, sediment, and surface water will be delineated to laboratory method detection limits (DLs). Delineation is defined as the concentration to which contaminants will be characterized in specific media.

PFC analytical results in groundwater, soil and sediment, and surface water samples are herein compared to the screening values presented in the Final Work Plan Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1 (Work Plan) (Ayuda Partners, 2015), except for PFOA and PFOS, which have lifetime health advisory (HA) levels as of May 2016. Media-specific screening levels are discussed in **Sections 3.1** and **3.2**.

3.1 Groundwater and Surface Water

Due to their nature as contaminants of emerging concern, the regulatory framework for PFCs are still in development, and thus in some cases incomplete. Nevertheless, several technical documents provide guidance and limited regulations for the evaluation of analytical results in aqueous and solid media.

SLs for PFCs in groundwater and surface water for the Stage 1 Investigation were set based upon the following sources:

- USEPA Office of Water (OW) PHA Level for PFOA and PFOS in drinking water (USEPA, 2014).
  - Under the Safe Drinking Water Act (SWDA), USEPA HAs (including PHAs) are non-enforceable and non-regulatory and provide technical information to state agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination (USEPA, 2016a). However, these compounds are included under the authority of CERCLA to address potential risks to public health, welfare, and the environment.
  - In 2016, the USEPA updated the PHA levels for PFOA and PFOS in drinking water to establish lifetime HA levels. The USEPA reduced the PHA level for PFOA from 0.4 µg/L to 0.07 µg/L, and for PFOS from 0.2 µg/L to 0.07 µg/L. In addition, the USEPA indicated that the HA level for PFOA and PFOS combined was also 0.07 µg/L (USEPA, 2016a).
  - Although the Work Plan (Ayuda Partners, 2015) had identified the 2014 PHA levels as the SLs, the updated 2016 HA levels have been used in the evaluation of groundwater impacts within this report based on discussions with the USAF and USEPA.
- The groundwater screening level for PFBS is based on the USEPA May 2016 regional screening level (RSL) for Tapwater (USEPA, 2016b). The PFBS tapwater RSL was revised from 380 µg/L to 400 µg/L in June 2017 (USEPA, 2017), however, the May 2016 value has been retained for Stage 1 screening purposes as the revision does not substantively affect the evaluation of groundwater impacts at AOC PFC-1. The most current groundwater SLs will be applied during RI report development.
- For PFCs other than PFOA, PFOS, and PFBS, the South Dakota Administrative Rule 74:54:01:05 is applied. In accordance with this rule, the SL for each analyte has been set at the minimum DL achieved for that sample medium (i.e., water).

SLs will be used to identify whether a compound is a Chemical of Potential Concern (COPC) to be evaluated in the Human Health Risk Assessment (HHRA). Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified herein.

Based on the foregoing sources, the following SLs have been defined for groundwater and surface water:

- 0.07 µg/L for PFOA, PFOS and combined PFOA and PFOS
- 380 µg/L for PFBS
- DLs for all other PFCs

3.2 Soil and Sediment

Stage 1 SLs for PFCs in soil and sediment have been set in accordance with the following sources:

- Soil SLs for PFOA and PFOS are based on the USEPA Region 4 residential soil SLs (USEPA, 2009).
- The residential SL for PFBS of 1,600,000 micrograms per kilogram (µg/kg) is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016b). The PFBS residential soil RSL was revised from 1,600,000 µg/kg to 1,300,000 µg/kg in June 2017 (USEPA, 2017), however, the May 2016 value has been retained for Stage 1 screening purposes as the revision does not substantively affect the evaluation of soil impacts at AOC PFC-1. The most current soil SLs will be applied during RI report development.
- For PFCs other than PFOA, PFOS, and PFBS, at of the time of this writing there is no standard (NS), and therefore the soil screening and action limits are not applicable (NA). Analytical information for these compounds will be obtained to inform the conceptual site model.
- SLs will be used to identify whether a compound is a Chemical of Potential Concern COPC to be evaluated in the HHRA. Final action limits will be derived from the Risk Assessment and may or may not correspond to the limits specified herein.

Based on the guidance the following SLs were defined for Stage 1 soil and sediment:

- 16,000 µg/kg for PFOA
- 6,000 µg/kg for PFOS
- 1,600,000 µg/kg for PFBS

4.0 SAMPLING LOCATIONS AND RATIONALE

The primary purpose of the PFC Delineation RI is to define the nature and extent of PFC contamination in sediment, surface water, surface soil, subsurface soil, and groundwater at AOC PFC-1 at EAFB. The investigation is designed to define the potential source areas that have contributed PFC contamination to the media of interest, and evaluate the vertical and horizontal extent to which PFCs may be present beyond the source areas. This document describes the Stage 1 investigation activities where soil, groundwater, sediment, and surface water samples were collected. The locations and intervals are described below.

4.1 Stage 1 Field Activities and Sampling Locations

The major elements of Stage 1 included:

Sediment and Surface Water Sample Locations: Sediment and surface water samples (SD/SW0101 through SD/SW0104) were collected from four locations within AOC PFC-1. The locations are illustrated on **Figure 4-1**.

Surface Soil Sample Locations: Surface soil samples were collected at 51 locations, 43 of which were co-located with subsurface DP borings. The locations are illustrated on **Figure 4-2**. Surface soil samples were collected at depths between 0-6 inches (in). The number of borings and location rationale are provided in UFP-QAPP Worksheet (WS) #17 and the number of samples is identified in UFP-QAPP WS#18 and #20 (Ayuda Partners, 2015). The surface and subsurface soil samples for analysis of PFCs were collected as follows:

- **PSA 1 (Former Fire Protection Training Area)** Surface soil samples were collected on a 100-foot (ft) grid in and immediately surrounding the PSA 1. The 100-ft grid is intended to provide surface soil information at a density corresponding to a future residential use scenario. These surface soil samples were generally co-located with subsurface locations, except for eight samples that were surface soil only. A total of 29 surface soil samples (DP0108 through DP0136) associated with PSA 1 were collected.
- **PSA 2 (Dredged Solids from Pond 1)** Surface soil samples were collected from four locations (DP0104 through DP0107) within the PSA 2. Surface soil samples were co-located with subsurface locations in this area.
- **PSA 3 (Historical Upgradient Groundwater Injection Trench)** Surface soil samples were collected from three locations (DP0101 through DP0103) within the PSA 3. Surface soil samples were co-located with subsurface locations in this area.
- **PSA 4 (Historical Cross-gradient Groundwater Injection Trench)** Surface soil samples were collected from three locations (DP0149 through DP0151) within the PSA 4. These surface soil samples were co-located with subsurface locations in this area.
- **Non-source Area** Surface soil samples were collected from source area upgradient and downgradient borehole locations on an approximate 400-ft grid spacing to obtain data for use in the risk assessment and to assess airborne transport of contaminants. Surface soil samples were collected from 12 locations (DP0137 through DP0148) outside of the PSAs. Surface soil samples were co-located with subsurface soil sample locations.

Subsurface Soil Sample Locations: Subsurface soil samples were collected from 43 DP boring locations within AOC PFC-1. The locations are illustrated on **Figure 4-2**.

Within the PSAs, where possible downward migration of contaminants may have occurred, one composite sample from a specified interval was collected. Because there are no field indicators for PFC contamination, vertical contaminant information was planned to be obtained in two stages. During the Stage 1 investigation, composite sample intervals include 2-4, 4-6, 6-8, and 8-10 ft below ground surface (bgs). An approximately equal number of sample depth intervals were collected from the boring locations. These results will be used to select locations for complete vertical soil profiling of PFC contamination

during Stage 2. Outside the source areas, one composite subsurface soil sample was collected from the entire 2-10 ft interval at each location.

One subsurface soil sample from each DP boring was collected at or below the groundwater table, where a) water was directly observed in the boring or on the core barrel, b) a saturated sandy zone was observed, c) in areas in or near OU-1 (FT001) where water was not encountered but the boring depth was interpreted to have intersected the Spring 2014 groundwater table surface, occasionally in conjunction with an increased drilling rate.

The subsurface soil samples for analysis of PFCs were collected as follows:

- **PSA 1 (Former Fire Protection Training Area)** 21 subsurface boreholes (DP0108-DP0109, DP0112-DP0115, DP0118, DP0119, DP0121-DP124, DP0127, DP0128, DP0130-DP0136) on a 100-ft grid were collected in and immediately surrounding PSA 1, in order to characterize the horizontal and vertical extent of contamination and obtain data for use in the HHRA.
- **PSA 2 (Dredged Solids from Pond 1**) Subsurface soil samples were collected from four locations (DP0104-DP0107) within the PSA 2 to characterize the horizontal and vertical extent of contamination and obtain data for use in the risk assessment.
- **PSA 3 (Historical Upgradient Groundwater Injection Trench)** Subsurface soil samples were collected from three locations (DP0101-DP0103) within the PSA 3 to characterize the horizontal and vertical extent of contamination and obtain data for use in the risk assessment.
- **PSA 4 (Historical Cross-gradient Groundwater Injection Trench)** Subsurface soil samples were collected from three locations (DP0149 and DP0151) within the PSA 4 to characterize the horizontal and vertical extent of contamination and obtain data for use in the risk assessment.
- **Non-Source Area** Subsurface soil samples were collected from 12 downgradient and cross-gradient subsurface borehole locations (approximate 400-ft grid spacing) to characterize the horizontal and vertical extent of contamination and obtain data for use in the risk assessment. Subsurface soil samples were collected from 12 locations (DP0137-DP0148) outside of the potential source areas.

Collection of Groundwater Samples:

- Twenty-four Polyvinyl chloride (PVC) well points were installed and completed with filter sand and grout in accordance with SOP 10 (Ayuda Partners, 2015). Of the 24 PVC well points installed, 20 were sampled either the following day, or at the end of the sampling event if insufficient water to collect a groundwater was initially present.
- Temporary wells were installed in a total of 24 borings where a) water was directly observed in the boring or on the core barrel, b) a saturated sandy zone was observed, c) in areas in or near OU-1 (FT001) where water was not encountered but the boring was advanced to a sufficient depth to intersect the Spring 2014 water table surface. A total of 24 temporary wells were installed, and 20 had sufficient water to collect groundwater samples (**Figure 4-3**).
- Two boreholes (DP0123 and DP0125) experienced collapse to a degree that precluded installation of a PVC well point. A hydropunch was advanced to the maximum boring depth, and revisited the following day, and at the end of the sampling event. Water levels were not collected from these locations due to the hydropunch diameter. Sampling was attempted with a stainless-steel foot valve and PVC tubing. No samples were collected due to insufficient water at these locations.
- Temporary wells were not installed in some boreholes due to the perceived absence of groundwater, collapse of the borehole, and/or refusal at shallow depths.
- Two locations, TW0113 and TW0138, were mistakenly sampled twice, one day after installation and at the end of sampling event.
- Groundwater samples were also collected from 12 existing monitoring wells located on and off the Base (**Figure 4-3**). The groundwater monitoring wells identified in the Work Plan were sampled with two exceptions: MW950102 was sampled in lieu of MW960101 (abandoned), and MW930105 was sampled in lieu of MW870101 (insufficient water).

5.0 FIELD METHODS

This section outlines the field methods applied during the Stage 1 of the PFC Delineation RI at EAFB AOC PFC-1. Sample numbers, locations, and Quality Assurance/Quality Control (QA/QC) samples are described in the Work Plan (Ayuda Partners, 2015). All samples were collected in accordance with the Work Plan (Ayuda Partners, 2015), except as noted herein.

In order to ensure the integrity of investigative samples, site-specific personal protective equipment (PPE) and field materials were selected to prevent the introduction of PFCs from outside sources.

Field activities were documented daily on the DQCR (**Appendix A**), and submitted to the USACE Project Manager in a timely manner to facilitate project progress. A PID was used to identify investigation derived waste (IDW) samples to be characterized, and for health and safety air monitoring in the breathing zone.

5.1 Sediment and Surface Water Sampling

Sediment and surface water samples were collocated in areas prone to sediment deposition, and collected at water depths of less than three ft at locations upgradient and downgradient of a point where groundwater treated for VOCs was historically discharged. Surface water samples were collected first from just below the surface of the water so as not to disrupt sediment. Field measurements for temperature, conductivity, potential of hydrogen (pH), and dissolved oxygen (DO) were collected from the water prior to sample collection.

Sediment samples were collected from an area approximately 4-in by 4-in and at a depth up to 1-in. The sampling team noted that there was not a distinct transition from liquid to solid at the surface water and sediment transition. Instead, the sediments tended to be suspended and gradually became denser with depth. The sediment sample was collected from the upper 1-in of sediment that was sufficiently dense to collect a solid phase sample. This depth varied from approximately two to six inches below the start of the apparent surface water-sediment transition.

The Work Plan indicated that the collection of surface water and sediment samples would progress from the furthest downstream location upstream to the location nearest the discharge point or source. This upstream sample collection progression is typical for surface water and sediment sampling in order to avoid potential concerns with downstream samples being impacted by upstream disturbance. However, samples were inadvertently collected in a progression from the furthest upstream sample location to the downstream sample location. As discussed subsequently in **Section 6**, the surface water sample results indicate the highest concentrations of PFCs in the two furthest downstream locations (lowest PFC concentrations in the upstream locations), closest to the point(s) of suspected historical discharge, making it unlikely that the upstream sampling contributed to the higher concentrations downstream. The potential effect of the sampling progression is discussed further in **Section 6**.

5.2 Surface and Subsurface Soil Sampling

The soil boring locations proposed in the Work Plan (Ayuda Partners, 2015) were adhered to with the exception of DP0104, DP0116, and DP0147, which were moved due to drill rig access issues to adjacent locations within the radius of the utility clearance (approximately 30 ft).

5.2.1 Direct Push Soil Borings, Surface Soil Sampling, and Subsurface Soil Sampling

Soil borings were completed at AOC PFC-1 using DP drilling methods and continuous core sampling to two to three ft below the groundwater table, when encountered. Cores from the soil borings were enclosed in acetate liners, and core barrels were decontaminated between locations. When evidence of the water table was observed (i.e., significant moisture in core interval, significant moisture on core barrel, or predicted intersection with the Spring 2014 water table), DP soil borings were advanced another several ft and a temporary piezometer was installed.

Soil samples were collected continuously using a 2-in diameter Geoprobe Macrocore sampler or a 3.25-in continuous dual tube sampling system. Based on the vendor recommendations, the larger diameter dual tube sampling system was initially used to advance the core for DP108, DP109, DP0116, and DP0141. However, after two days of getting refusal at relatively shallow depths due to the tight clays encountered in some areas (downgradient of the source area), or gravels (in the source area), the remaining locations were advanced with the Macrocore system. However, the Macrocore system requires tripping out of the borehole with the entire casing each time, which increases the potential for borehole collapse. This occurred at two locations (DP0123 and DP0125) during Stage 1 soil boring advancement.

The borings were advanced in 4- and 5-ft sampling runs or less if the rate of advancement was less than approximately one ft per minute. Recovered soil samples from all borings were visually classified using the Unified Soil Classification System. Due to the historical presence of VOCs in some areas proposed for PFC investigation, each sample was field-screened using a PID and headspace analysis, and the results recorded on the boring log. A boring log was completed for each soil boring (see **Appendix B**).

DP soil borings were abandoned by backfilling the boring(s) with granular bentonite to within approximately three ft of ground surface. The bentonite was hydrated with potable water implemented in 1-ft increments. The remaining portion of the hole was filled with native soil. Surface disturbances caused by the advancement of soil borings were restored to match surrounding conditions. To the extent possible, temporary wells were removed from the ground. If the PVC broke off during removal, the well was abandoned in accordance with boring abandonment methods.

5.3 Groundwater Sampling

PVC temporary well points (TWPs) were installed and completed with filter sand and grout (well completion details are presented in **Appendix C**), and groundwater sampling was conducted the following day, if possible. Hydropunch samplers were installed at two locations due to borehole collapse.

Groundwater elevations were collected from 21 temporary well points and 32 existing monitoring wells (see **Figure 4-3** for well locations). Before sampling, depth to static water level (DTW) was measured in every well with an electronic water level indicator to the nearest 0.01 ft to the top of casing. Water level measurements were reviewed from previous investigations to refine groundwater flow directions and verify gauging accuracy during Stage 1 field activities at AOC PFC-1.

Low-flow groundwater purging and sampling protocols were used to collect groundwater samples from permanent wells in accordance with the Work Plan (Ayuda Partners, 2015). Water quality parameters were measured with a Horiba U-20. Each monitoring well was purged prior to sampling using a peristaltic pump or dedicated Whale® pump with dedicated polyethylene tubing, or in two instances, disposable polyethylene bailers. Water quality parameters were recorded until stabilization was achieved. Parameter stabilization is defined as three consecutive readings with no more than the following fluctuations:

- pH ±0.1 specific units;
- Electrical Conductivity ±3 percent (%) micromhos per centimeter;
- Turbidity ±10% or less than 10 nephelometric turbidity units;
- DO ±10% for values greater than 0.5 milligrams per liter (mg/L) or three consecutive readings at less than 0.5 mg/L;
- Oxidation Reduction Potential ±10 millivolts; and
- Temperature ±3% as degrees Celsius.
- Water quality parameters recorded at the time of sample collection are provided in **Table 5-0**.

5.4 Decontamination Procedures

Decontamination of non-disposable sampling and drilling equipment was completed in order to ensure sample integrity and prevent cross-contamination. All reusable sampling equipment was decontaminated before starting work and between sample locations. The DP rig and drilling rods were decontaminated

using a steam and power washer at the central staging area. Sampling equipment was decontaminated using Alconox mixed in deionized, PFC-free water provided by SGS (previously Accutest). Decontamination fluids were containerized as IDW, and remain onsite pending disposal.

EBs were collected when decontaminating reusable sampling equipment. Concentrations of PFCs were detected in a limited number of EBs as indicated in **Appendix D**. These detections and the samples potentially affected by the detections are discussed in **Section 6**.

5.5 Investigation-Derived Waste

IDW generated during Stage 1 AOC PFC-1 characterization activities consists of soil cuttings, decontamination fluids, purged groundwater, and PPE.

Purge water from groundwater sampling and decontamination fluids were containerized in one 55-gallon drum, which, as of the date of this report, remains onsite at the on-base wastewater treatment facility (Building 6908) pending disposal. This water is not hazardous based on historical concentrations of VOCs in the sampled permanent wells and will remain staged at EAFB until Stage 2 investigations are completed, at which point means for treatment and disposal will be coordinated with USACE and EAFB (Ayuda Partners, 2015). The drum includes sufficient headspace to allow for expansion if it freezes.

In accordance with the Work Plan (Ayuda Partners, 2015), soil from the DP soil borings was field screened using a PID (measurements recorded on soil boring logs in **Appendix B**) to determine IDW sample collection intervals. Following field screening, soil IDW was placed in 55-gallon drums, labeled, and stored. The sample having the highest PID reading from all boreholes associated with a soil IDW drum was submitted for laboratory analysis (VOCs, RCRA 8 metals, Total Petroleum Hydrocarbon [TPH]-Gasoline Range Organics and TPH-Diesel Range Organics). Three drums of soil IDW were produced during Stage 1 field activities. The soil from DP0108 was used to characterize soil in IDW drum #1; the soil from DP0136 was used to characterize soil in IDW drum #2; and soil from DP0101 was used to characterize soil in IDW drum #3. Petroleum-impacted soil was observed at boring location DP0136.

Results of soil IDW analysis were first compared to 2015 EAFB Basewide QAPP PALs (ARGO/LRS JV, 2015) to determine whether containerized soil could be spread directly to ground surface. Based on Stage 1 analytical results, soil IDW exceeded PALs for TPH, arsenic, and lead, and will therefore be disposed off-site. In addition, the 20x rule was applied to reported concentrations to make a hazardous waste determination. According to Section 1.2 of Method 1311, Toxicity Characteristic Leaching Procedure (TCLP), “If a total analysis of a waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run.” The 20x rule employs the 20:1 liquid-to-solid ratio utilized in the TCLP to determine the presence or absence of hazardous analyte concentrations in a 100% solid matrix. The results of total constituent analysis are divided by 20 to convert the total results into the maximum leachate concentration. No soil IDW sample results exceeded the 20x rule concentrations for a hazardous waste. The Work Plan describes procedures for IDW sample selection and screening in greater detail (Ayuda Partners, 2015).

All IDW containers were properly labeled with the sample identification code, date of collection, and Ayuda contact information. Used PPE (e.g., gloves) and disposable materials (e.g., stainless steel spoons and aluminum foil) were placed in plastic garbage bags, and disposed of as municipal solid waste at Building 6908.

6.0 RESULTS

This section provides a summary of results of laboratory analyses and field parameter measurements collected at EAFB during the March 2016 Stage 1 field event. Soil, groundwater, surface water, and sediment samples were sent to SGS (previously Accutest) for analyses of PFCs in accordance with DoD Quality Systems Manual Version 5.0 (QSM v5.0) and USEPA Method 537 Modified (MOD), for which SGS is Environmental Laboratories Accreditation Program (ELAP) certified. Coordinate and ground surface elevation data for each sample point are presented in **Table 6-0**. **Table 6-0** also notes additional sample location-specific information, such as "collapsed borehole."

Figures 6-1 through **6-3** and **6-5** through **6-9** show Stage 1 PFC concentrations relative to the composite OU1 VOC plume as reported in the Spring 2013 Long Term Monitoring Report for EAFB (ARGO/LRS JV, 2014).

The discussion in this section emphasizes the laboratory analytical results that exceeded SLs.

6.1 Soil Sampling

Table 6-1 presents the PFC analytical results for the 51 surface soil samples. **Table 6-2** presents the PFC analytical results for the 43 subsurface soil borings. The soil analytical results for PFBS, PFOA, and PFOS are illustrated on **Figure 6-1, Figure 6-2,** and **Figure 6-3, respectively.**

Stage 1 SLs for soil and sediment are:

- 16,000 µg/kg for PFOA
- 6,000 µg/kg for PFOS
- 1,600,000 µg/kg for PFBS

6.1.1 PSA 1 – Former Fire Protection Training Area

Results indicate that PFBS was not detected above the SL of 1,600,000 µg/kg in soil samples collected at PSA 1. PFBS was not detected in any of the soil samples collected in the non-source area. The highest concentrations were detected near the center of the former fire protection training area, with the maximum concentration of PFBS, 864 µg/kg, detected in the surface soil sample at location DP0114 (**Figure 6-1**). PFBS in soil was observed at the surface, subsurface, and at depths corresponding to the groundwater table in PSA-1. PFBS was also detected in subsurface soil at a depth of 8 to 10 ft bgs. Soil sample analytical results for PSA 1 are in **Table 6-3a**.

All surface and subsurface soil sample results for PFOA were below the SL of 16,000 µg/kg. The maximum concentration of 7,220 µg/kg was detected in the surface soil sample at location DP0114 near the center of the former fire protection training area. Concentrations of PFOA on the periphery of the former fire protection training area were below the SL at DP0109 (0.5 ft) and DP0130 (2-4 ft) at concentrations of 5.83 µg/kg and 105 µg/kg, respectively. At DP0114, the concentration of PFOA in subsurface soil was less than the surface soil concentration. However, at most other locations in the source area the concentration of PFOA in subsurface soil was greater than the concentration in the surface soil sample interval. Concentrations of PFOA in soil at or below the groundwater table were less than the concentration in the surface and subsurface soil sample intervals within that same boring.

Soil sample results indicate that PFOS was detected above the SL of 6,000 µg/kg in surface soil at locations DP0113, DO0114, and DP0118 as shown on **Figure 6-3**. These borings are located near the center of the former fire protection training area. The maximum PFOS concentration of 38,300 µg/kg was observed in the surface soil sample at location DP0118. There were no PFOS SLs exceedances in subsurface soil.

6.1.2 PSA 2 – Approximate Location of Dredged Solids from Pond 1

PFBS and PFOA were not detected in any of the soil samples collected at PSA 2. PFOS was detected at concentrations below the SL of 6,000 µg/kg at soil boring locations DP0104, and DP0107 as shown on

Figure 6-3. The maximum observed concentration of PFOS was 44.9 µg/kg in the 4–6 ft sample from boring DP0104. Additional borings are recommended to define the horizontal and vertical extent of PFOS. Soil sample analytical results for PSA 2 are in **Table 6-3b**.

6.1.3 PSA 3 – Historical Upgradient Groundwater Injection Trench

PFBS and PFOA were not detected in any of the soil samples collected at PSA 3. PFOS was detected in subsurface soil at concentrations below the SL of 6,000 µg/kg at soil boring location DP0102. The maximum observed concentration of PFOS was 12.8 µg/kg in the 6-8 ft sample from boring DP0102. Additional borings are recommended to define the horizontal and vertical extent of PFOS. Soil sample analytical results for PSA 3 are in **Table 6-3c**.

6.1.4 PSA 4 – Historical Cross-Gradient Groundwater Injection Trench

PFBS and PFOA were not detected in any of the soil samples collected at PSA 4. PFOS was detected at concentrations below the SL of 6,000 µg/kg at soil boring location DP0149. The maximum observed concentration of PFOS was 53.5 µg/kg in the 25 ft sample from boring DP0149, whereas in the surface sample the concentration of PFOS was 8.46 µg/kg. Soil from the 25 ft sample was saturated and is likely associated with groundwater transport. Additional borings are recommended to define the horizontal and vertical extent. Soil sample analytical results for PSA 4 are in **Table 6-3d**.

6.1.5 Non-Source Area

PFOS was detected at concentrations below the SL of 6,000 µg/kg at ten soil boring locations located south of the former fire protection training area. The maximum concentration of PFOS detected was 311 µg/kg in the 13 ft sample from boring DP0147 near the southern boundary of EAFB. DP0143 was the only non-source area boring in which PFOA was detected above the DL at a concentration of 13.5 µg/kg at the 2-10 ft sample interval. PFBS was not detected at any of the non-source area soil borings. Additional borings are recommended to define the horizontal and vertical extent. Soil sample analytical results for the Non-Source area are in **Table 6-3e**.

6.2 Temporary & Permanent Well Groundwater Sampling

Groundwater levels were collected from 32 permanent monitoring wells on March 14, 2016. The results are summarized in **Table 6-4.** Groundwater levels were also measured in 21 temporary wells 24 hours after installation or, if groundwater had not infiltrated the well after 24 hours, prior to concluding field activities. Three temporary wells did not have sufficient groundwater for water level measurement.

Figure 6-4 illustrates groundwater table elevations and flow direction based on measurements from the 32 permanent monitoring wells. Groundwater flow direction is predominantly to the south, with a southeasterly component northwest of OU-1. North of OU-1, such as in the vicinity of PSA-2 and PSA-3, the primary groundwater flow direction is to the east-southeast. This flow pattern is consistent with historical groundwater table measurements from the Spring of 2014 and 2015.

During the Stage 1 groundwater monitoring events, 12 permanent monitoring wells and 20 temporary well points were sampled for PFCs. Purge logs for permanent wells are included in **Appendix E**. PFC groundwater analytical results are presented in **Table 6-5** for permanent monitoring wells, and **Table 6-6** for temporary wells. **Figure 6-5** through **Figure 6-9** illustrate the contaminant distributions of PFBS, PFOA, PFOS, and combined PFOS and PFOA in groundwater. The PFC results presented in the tables and figures are compared to the following SLs for groundwater and surface water:

- 0.07 µg/L for PFOA, PFOS and combined PFOA and PFOS
- 380 µg/L for PFBS
- DL for PFCs other than PFOA, PFOS, and PFBS

6.2.1 PFBS Concentrations in Groundwater

Groundwater sample results indicate that PFBS was not detected above the SL of 380 µg/L in any of the groundwater samples collected. The maximum concentration of PFBS was 139 µg/L in temporary well TW0113 located in the center of PSA 1. While no PFBS SL exceedances were observed in groundwater, at present the SL (380 µg/L) for this analyte is four orders of magnitude higher than those for PFOA and PFOS (0.07µg/L).

6.2.2 PFOA Concentrations in Groundwater

PFOA was detected above the SL of 0.07 µg/L at each of the four PSAs. The maximum concentration detected was 221 µg/L in temporary well TW0113 in PSA-1. **Figure 6-7** illustrates the estimated PFOA plume, which extends south to the southern boundary of EAFB. The width of the plume generally approximates the width of the greater PSA-1 area. The PFOA plume is consistent with the general groundwater flow direction in the area. The horizontal extent has not been defined and additional monitoring well installation is recommended.

6.2.3 PFOS Concentrations in Groundwater

PFOS was detected above the SL of 0.07 µg/L at each of the four PSAs. The maximum concentration detected was 345 µg/L in temporary well TW0122 in PSA-1, immediately downgradient from TW0113. **Figure 6-8** illustrates the estimated PFOS plume, which extends south to the southern boundary of EAFB. The width of the plume generally approximates the width of the greater PSA-1 area. The PFOS plume is consistent with the general groundwater flow direction in the area. The horizontal extent has not been defined and additional monitoring well installation is recommended.

6.2.4 Combined PFOA and PFOS Concentrations in Groundwater

Combined PFOA and PFOS were detected above the SL of 0.07 µg/L at each of the four PSAs. The maximum combined concentration detected was 551 µg/L in temporary well TW0122 in PSA-1. **Figure 6-9** illustrates the combined PFOA and PFOS plume, which extends south to the southern boundary of EAFB. The width of the plume generally approximates the width of the greater PSA-1 area. The horizontal extent has not been defined and additional monitoring well installation is recommended.

6.2.5 PFC Concentrations in Groundwater other than PFBS, PFOA, and PFOS

PFCs for which the laboratory DL is the SL, including perfluorohexanoic acid, perfluoroheptanoic acid, perfluorononanoic acid, perfluorodecanoic acid, and perfluorohexanesulfonic acid, were detected in site groundwater. The laboratory DL for these compounds is 0.008 µg/L.

The only wells in which other PFCs were detected that were not collocated with PFBS, PFOA, and PFOS SL exceedances were MW960401 and MW990401, located to the west and cross-gradient of the former fire training area. Perfluorohexanoic acid, perfluoroheptanoic acid, and perfluorohexanesulfonic acid were detected in MW960401 at concentrations of 0.198 µg/L, 0.0349 µg/L, and 0.441 µg/L, respectively. MW990401 concentrations of these compounds did not exceed those observed in MW960401. Concentrations of other PFCS in groundwater at MW960401 and MW990401 are shown on **Figure 6-5**.

6.3 Sediment & Surface Water Sampling

Table 6-7 presents the PFC analytical results for the four sediment samples collected from the drainage located east of OU-1. The results are illustrated in **Figure 6-10**. **Table 6-8** presents the PFC analytical results for the four surface water samples collected from the drainage located east of OU-1. These results are illustrated in **Figure 6-11**.

PFBS, PFOA, and PFOS were not detected in sediment at concentrations above the SLs. The maximum concentration of PFBS was 33.2 µg/kg detected at location SD0103. The maximum concentration of PFOA was 17.4 µg/kg detected at SD0103. The maximum estimated concentration of PFOS was 130 µg/kg at location SD0103. Although these concentrations are orders of magnitude less than the SLs, the extent of

PFCs in sediment has not been defined to the DL to the upstream and downstream of the Stage 1 sample locations and additional sediment sampling is recommended.

PFBS was not detected above SLs in any of the surface water samples collected. The maximum concentration of PFBS was 5.55 µg/L at location SW0103. PFOA and PFOS were detected above SLs in all surface water samples. The maximum concentration of PFOA was 1.4 µg/L detected at location SW0104. The maximum concentration of PFOS was 5.58 µg/L detected at location SW0103. The extent of PFOA and PFOS in surface water has not been defined upstream and downstream of the Stage 1 sample locations, thus additional surface water sampling is recommended.

As mentioned in **Section 5.0**, sediment and surface water samples were collected in a progression from the furthest upstream sample location to the downstream sample location, opposite to the progression identified in the Work Plan (Ayuda, 2015). The sampling team was not sufficiently aware of the progression specified in the Work Plan, and sampled in a manner from locations most likely to be least contaminated (upstream of PSAs) to locations more likely to be impacted (adjacent to or downstream of PSAs). PFOS concentrations of 5.16 µg/L and 5.24 µg/L in groundwater collected from TW0139 and MW930109, respectively, are comparable to the PFOS concentrations of 5.58 µg/L at SW0103 and 3.99 µg/L at SW0104 in surface water along this stretch. These concentrations are strongly suggestive that groundwater and surface water are interacting in this area.

The highest PFC concentration (PFOS) in sediment, was observed in the furthest upgradient sample location, not in the downstream locations as was the case for surface water. The potential source for this upstream PFOS detection is uncertain.

The Stage 1 surface water and sediment sampling showed that PFCs are present in both media upstream as well as downstream of PSAs and additional sampling is recommended in Stage 2.

6.4 Stage 1 Delineation Summary

In total, only three soil locations exceeded residential soil SLs for PFCs. Of those three locations, the only exceedances were for PFOS in PSA 1 surface soil. Additional soil sampling for PFCs will be conducted as part of Stage 2 field activities to continue delineating the vertical and aerial extent of PFCs at AOC PFC-1.

A total of 30 groundwater sample locations exceeded groundwater SLs for PFOA, PFOS, or combined PFOA and PFOS groundwater SLs, with none of the 30 locations exceeding SLs for PFBS. Groundwater samples will be collected from existing monitoring wells and analyzed for PFCs during Stage 2 field activities, as well as additional monitoring wells to be installed as part of Stage 2 efforts.

Perfluorohexanoic acid, perfluoroheptanoic acid, and perfluorohexanesulfonic acid were detected in groundwater at MW960401 and MW990401. These were the only wells in which other PFCs were detected that were not collocated with PFBS, PFOA, and PFOS SL exceedances.

Each of the four surface water sample locations exceeded surface water SLs for PFCs. Concentrations were in excess of both PFOA and PFOS SLs at the four locations, with no samples exceeding PFBS SLs. None of the four sediment samples exceeded respective SLs for PFCs.

Additional soil, groundwater, surface water, and sediment samples will be collected as part of Stage 2 field activities to better define the vertical and aerial extent of PFC contamination at AOC PFC-1. Proposed Stage 2 sampling is discussed in **Section 8**.

7.0 DATA QUALITY

Field QC samples including, Matrix Spike/Matrix Spike Duplicate (MS/MSD), Field Duplicate (FD), and EBs, were collected to ensure the quality and usability of the investigative samples. QC goals were achieved, as documented in **Table 7-1**.

In accordance with the UFP-QAPP (Ayuda Partners, 2015) an EB associated with the sediment samples was collected from the stainless-steel bowl and spoon used to collect the sample. Due to field conditions requiring the use of reusable sampling/measurement equipment for soil composite and groundwater samples, EBs representative of the decontamination procedures for the equipment associated with these media were collected to ensure sample integrity.

Qualifier flags were applied to some analytical results, as presented in **Section 6**, and discussed herein. These include:

- reported value is from a dilution (D),
- reported value is a quantitative estimate (J),
- reported result has been manually integrated (M),
- reported results had one or more QC criteria fail (Q), and
- reported result is below the DLs (U).

Additional information regarding qualifier flags is presented within the analytical laboratory reports (**Appendix F**) and data validation reports (**Appendix G**).

Laboratory Data Consultants, Inc. (LDC) conducted data validation in accordance with the UFP-QAPP (Ayuda Partners, 2015) and DOD QSM 5.0. In accordance with those documents, professional judgment concerning laboratory practices, project objectives, and matrix interferences were also used during the data validation process. The purpose of the data validation was to confirm the integrity and reliability of the laboratory data resulting from the sampling efforts. In order to ensure that the data met project quality objectives, analytical results were evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability parameters.

The data validation report for the March 2016 sampling event (**Appendix G**) confirms the integrity of the samples with the following exceptions, as summarized below:

- Ninety-three analytical results (approximately 4%) from 31 Parent Samples (three IDW, two surface soil, six subsurface soil, five EBs, one sediment, four surface water, and 10 groundwater samples from temporary wells) out of a total of 206 samples and approximately 2,210 analytical results were qualified as estimated (J; UJ for non-detects) as follows:
    - Matrix Spike – A total of 29 analytical results from 14 analytes (seven PFCs, one metal compound, six VOCs) from three IDW, two surface soil, five subsurface soil, one groundwater, and one sediment sample were qualified as estimated (J; UJ for non-detects) due to percent recoveries (%R) outside of QC Limits. The seven PFC analytes were a mix of compounds, but were primarily perfluorotridecanoic acid and perfluorotetradecanoic acid. The qualification did not apply to PFBS and PFOA. The qualification applied to two PFOS results, one for TW0101-00-0316 and one for SD0103-00-0316. PFOS matrix spike recovery in TW0101-00-0316 was below QC limits, however PFOS matrix spike duplicate recovery was above QC limits, thus a biased low or biased high determination cannot be made for results from this sample. PFOS matrix spike recovery in SD0103-00-0316 was below QC limits, thus sample results should be considered biased low.
    - Matrix Spike/Matrix Spike Duplicates – a total of four PFC results from two surface soil, one subsurface soil, and one groundwater sample were qualified as estimated (J) due to the Relative Percent Differences (RPD) outside of the laboratory-specified range (≥30%). PFOS was qualified for two samples and PFOA was qualified for one sample. RPD outside of control

limits can suggest imprecision (lack of reproducibility) within a data set, most commonly due to matrix interference or heterogeneity across samples, especially within a soil matrix. In sample TW0101-00-0316 (aqueous), both the %R and RPD were outside of control limits, indicating a potential accuracy issue as well. Precision issues are less frequently observed in aqueous samples because duplicate samples are more likely to be homogeneous. High RPD in MS/MSDs can also be an indicator of non-representative sample collection. RPD is indeterminate for bias.

- Continuing Calibration – Perfluoroheptanoic acid in one subsurface soil sample (DP0109-00-0316-19) was qualified as non-detect estimated (UJ) due to continuing calibration percent differences greater than QC limits.
- Laboratory Control Samples – Percent recoveries outside of control limits affected 11 perfluorotridecanoic acid and 11 perfluorotetradecanoic acid results in two EBs and nine groundwater samples collected from temporary well points.
- Serial Dilution – four total metal analytical results in three IDW samples were qualified as estimated (J; UJ for Non-Detects) due to serial dilution greater than QC limits.
- Surrogates – A total of 33 PFC analytical results from three EBs and three surface water samples were qualified as estimated (J; UJ for non-detects) due to %R outside of QC Limits. These qualifications did not apply to PFBS, PFOA, or PFOS.

Based on the limited number of qualifications and their nature, the overall analytical program is acceptable and meets the performance objectives for the project. In addition, no PFBS nor PFOS results were qualified and there was only one instance in which PFOA was qualified. The data are considered usable and can be used without restriction with potential minor exceptions depending on end use for those qualifications discussed above.

8.0 STAGE 2 FIELD ACTIVITIES

All field activities presented in this technical memorandum will be completed in accordance with the Work Plan (Ayuda Partners, 2015) and Work Plan Addendum, Stage 2 (Ayuda Partners, 2017a). The Work Plan and Stage 2 Work Plan Addendum will govern the collection of Stage 2 data. This Section 8 is provided for information purposes only.

Stage 2 field activities include surface and subsurface soil sampling, monitoring well installation, groundwater sampling of existing and new monitoring wells, and expanded surface water and sediment sampling. All site media scheduled for Stage 2 sampling activities will be analyzed for PFOA, PFOS, and PFBS, as well as the additional nine PFCs investigated during Stage 1 plus two fluorotelomer compounds. The proposed Stage 2 field activities are illustrated on **Figure 8-1** and **Figure 8-2** and summarized in **Table 8-1**.

Stage 2 investigation objectives include, but are not limited to, the following:

- Evaluate the extent of the PSA-1 groundwater plume, and the extent of PSA-2 through -4 groundwater contamination that may be in excess of HA levels;
- Evaluate the extent of surface water contamination that may be in excess of HA and ecological screening levels;
- Collect groundwater, sediment, and surface water samples at the same locations as Stage 1 for data trend and analysis;
- Further evaluate the relationship between groundwater and surface water contamination in PSA-1, PSA-3, and PSA-4;
- Evaluate the extent of soil and sediment contamination that may be in excess of the SSLs for protection of groundwater and human health;
- Evaluate the upper and lower extent of sediment and surface water contamination, and evaluate whether concentrations are affected by relationship to PSAs (i.e., reduced between PSAs);
- Refine the groundwater gradient and elevations and evaluate how those elevations relate to SW elevations; and
- As necessary to inform the site characterization, resample in areas where Stage 1 QC samples were outside of laboratory control limits.

8.1 Soil Borings and Monitoring Well Installation

A total of 31 soil borings will be sampled for PFAS by the LC-MS/MS, DoD QSM 5.1, Table B-15 compliant method from ground surface to the approximate depth of the water table as measured during the March 2016 sampling event. These depths may be modified in the field based on observations and/or using current depth to water measurements from the closest monitoring wells at the time of drilling.

Proposed soil boring and monitoring well installation locations were selected based on soil and groundwater results from Stage 1 sampling. **Figures 8-1** and **8-2** show proposed soil boring and monitoring well locations relative to PFC detections in soil during Stage 1. It should be noted that these figures do not distinguish between Stage 1 sample depth intervals.

All Stage 2 borings will be continuously sampled and logged for lithologic purposes, including those advanced for the installation of monitoring wells. In addition, soil samples will be collected from most, but not all, borings for PFAS characterization, consistent with the UFP-QAPP. Proposed Stage 2 soil borings within PSA-1 will be sampled for complete vertical soil PFAS contaminant data due to SL exceedances from Stage 1 soil borings in the general area of the proposed Stage 2 soil borings. Proposed borings proximate to PSAs 2-4 will be used to evaluate potential soil contamination based on low PFC concentrations observed during Stage 1 (orders of magnitude less than SLs). Those proposed Stage 2 boring locations outside the footprint of a PSA will be sampled for characterization purposes. Boreholes associated with new monitoring wells installed in areas not covered by the Stage 1 program will also be characterized for

PFAS contamination. Two proposed monitoring well locations will be logged for lithology only and no soil samples will be collected based on adequate characterization of these areas during the Stage 1 program.

Soil samples for PFAS characterization will be collected from proposed Stage 2 boring locations as follows:

- Collect one surface sample from 0-6 in bgs, and subsurface soil samples every two ft from 2-10 ft bgs and every five ft from 10 ft bgs to the top of the groundwater table
  - Proposed monitoring well locations: SB/MW170109 within PSA-1
  - Proposed soil boring locations: SB170120 –21 within PSA-1

- Collect one surface sample from 0-6 in bgs, one composite soil sample from 2-10 ft bgs, and one soil sample at the top of the groundwater table
  - Proposed monitoring well locations: SB/MW170101, SB/MW170103 – 04, SB/MW170106 – 08, SB/MW170110 – 19
  - Proposed soil boring locations: SB170122 – 33 (SB170132 is collocated with Stage 1 boring DP0116 and SB170133 is collocated with Stage 1 boring DP0140).

- Soil samples ***will not*** be collected from the following proposed monitoring well locations
  - SB/MW170102, SB/MW170105

Soil borings (SB170101 through SB170119) will be converted to monitoring wells for groundwater sampling. Seven of the 19 borings planned for monitoring well conversion are located south of the Base boundary. Off-base boring locations were selected to evaluate the extent of off-site PFAS migration based on concentrations in groundwater samples collected near the southern Base boundary and surface water samples collected from the OU-1 drainage. Proposed soil boring depths and sampling rationales are summarized in **Table 8-1**.

8.2 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected for ten locations (SD/SW0101 through SD/SW0101-0110). Samples at locations SD/SW0101 through SD/SW0104 will be collected at the same approximate location as previously sampled during Stage 1 field activities to provide data for trend analysis. The additional locations were selected to provide more complete aerial coverage of AOC PFC-1. Elevations of the stream or ponds will also be collected at the time of groundwater gauging to provide hydrogeologic data for comparison to groundwater elevations.

8.3 Groundwater Gauging and Sampling

Groundwater sampling will be conducted from 32 existing wells and 19 new monitoring wells during Stage 2 field activities (see **Table 8-1**). All monitoring wells sampled during Stage 1 will be sampled during Stage 2 to provide data for trend analysis. Additional existing wells and the proposed monitoring well locations have been selected to refine the extent of contamination in groundwater. Groundwater gauging will be conducted within the same time period as the collection of surface water elevation data in order to provide information on the groundwater-surface water interaction.

All those wells gauged for groundwater levels during Stage 1 field activities will be gauged during Stage 2, including those wells scheduled for Stage 2 groundwater sampling.

8.4 Residential Well Sampling

Residential well sampling is proposed to be conducted at the wells identified in the Residential Well Survey Technical Memorandum (Ayuda Partners, 2017b). The residential wells proposed to be sampled include the Don Newman well, Tom Farrar Well located 100 ft south of Country Road 214, and DW930412 (Sanders) well as shown on **Figure 8-1**.

9.0 CONCLUSIONS

Stage 1 analytical results indicate that the concentration of PFOS in surface soil is present above its SL only within the historical OU-1 area. No other PFCs were detected above risk-based SLs in surface or subsurface soil. Concentrations of PFOA and PFOS in groundwater were above their respective SL in all four PSAs. Concentrations of PFOA and PFOS in groundwater above their respective SL also extended beyond the southern boundary of EAFB to MW020402. Additional PFCs for which the laboratory DL is the SL, including perfluorohexanoic acid, perfluoroheptanoic acid, perfluorononanoic acid, perfluorodecanoic acid, and perfluorohexanesulfonic acid, were detected in site groundwater. Concentrations of PFOA and PFOS in surface water exceed their respective SL at all four sampled locations, including both adjacent to and downstream of suspected source areas, as well as the upstream location.

Concentrations of PFCs did not exceed SLs in subsurface soil or sediments, although PFCs were detected in these media. The Stage 1 DP investigation met the objective of providing sufficient information to design a Stage 2 investigation that will allow the objectives of the project to be achieved. These objectives are (Ayuda Partners, 2015):

- Complete an RI at AOC PFC-1 to delineate the extent of PFOS, PFOA, and other PFCs (PFAS) in surface water, sediment, soil, and groundwater;
- Evaluate the presence or absence of PFOS, PFOA and other PFCs (PFAS) in wells located off-Base and within the AOC PFC-1 including the Thunderbird Subdivision, located approximately 1,400 ft south of the Base boundary;
- Complete a HHRA by conducting a pathway evaluation to determine potential risk to human health of on-Base workers or off-Base migration to the general public;
- Evaluate the presence or absence of PFCs (PFAS) at areas where treated OU-1 (FT001) groundwater was discharged to groundwater via injection trenches upgradient of surface water features; and
- Conduct ecological risk screening of PFCs (PFAS) in surface water.

These objectives are proposed to be met through the proposed Stage 2 investigation activities discussed in **Section 8**.

10.0 REFERENCES

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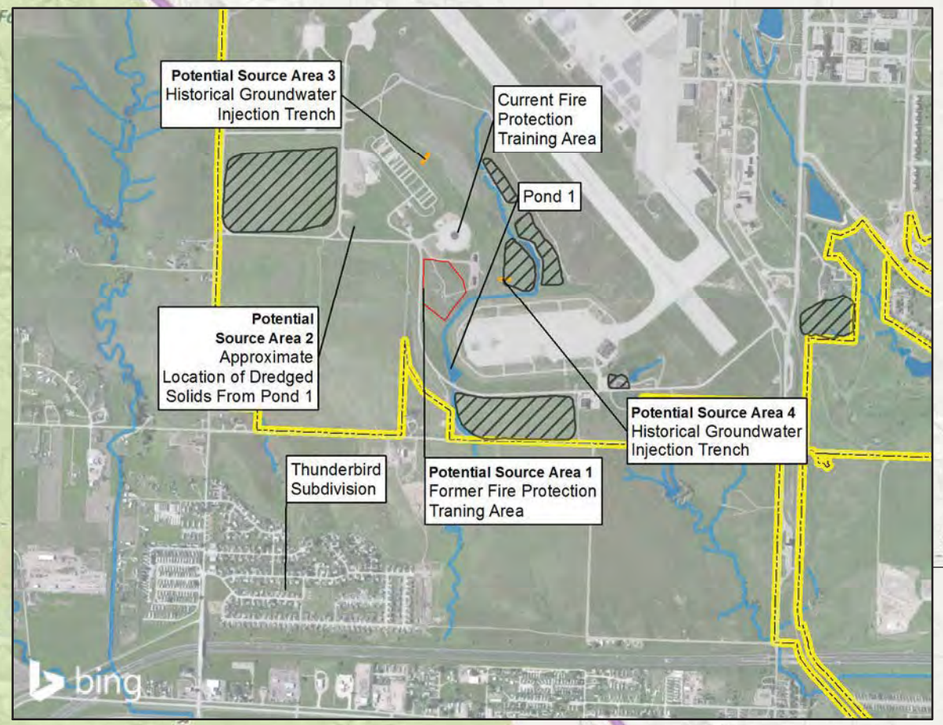
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Figures



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SIO © 2016 Microsoft Corporation. Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station.

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SITE:
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SOUTH DAKOTA
44.139378°, -103.093020°

PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND
DELINEATION

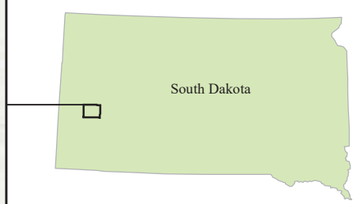
STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
ELLSWORTH AIR FORCE BASE
SITE LOCATION MAP

LEGEND:

- Former Fire Protection Training Area
- Landfill Covers
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water



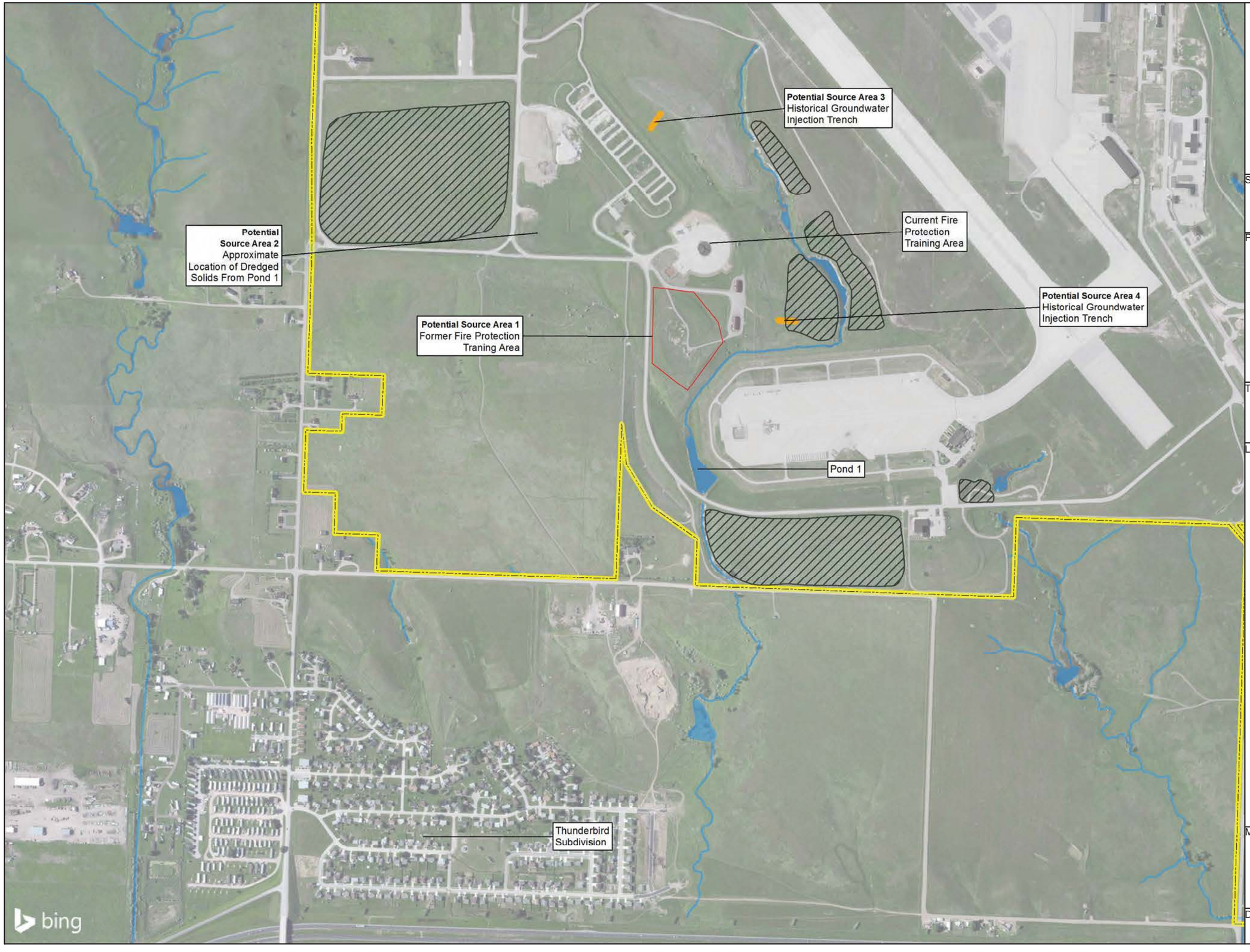
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0 0.5 1 2
Miles

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	1/16/2017 REV: 3	**1-1**



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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
AREA OF CONCERN PERFLUORINATED COMPOUNDS-1 LOCATION MAP

LEGEND:

- Former Fire Protection Training Area
- Landfill Covers
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

MAIN SCALE: 1:9,000

N

0 250 500 1000
Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/10/2017 REV: 4	**1-2**



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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
SURFACE WATER
AND SEDIMENT
SAMPLE LOCATIONS

LEGEND:

- Surface Water and Sediment Sample Location
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

SCALE: 1:2,500

N

0 100 200 400

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/2/2017 REV: 3	**4-1**



Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station.

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PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
SURFACE AND SUBSURFACE
SOIL SAMPLE LOCATIONS

LEGEND:

Soil Borings
- Surface and Subsurface
- Surface Only

Monitoring Wells
- Gauged and Sampled
- Gauged Only
- No Action

- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

SCALE: 1:5,000

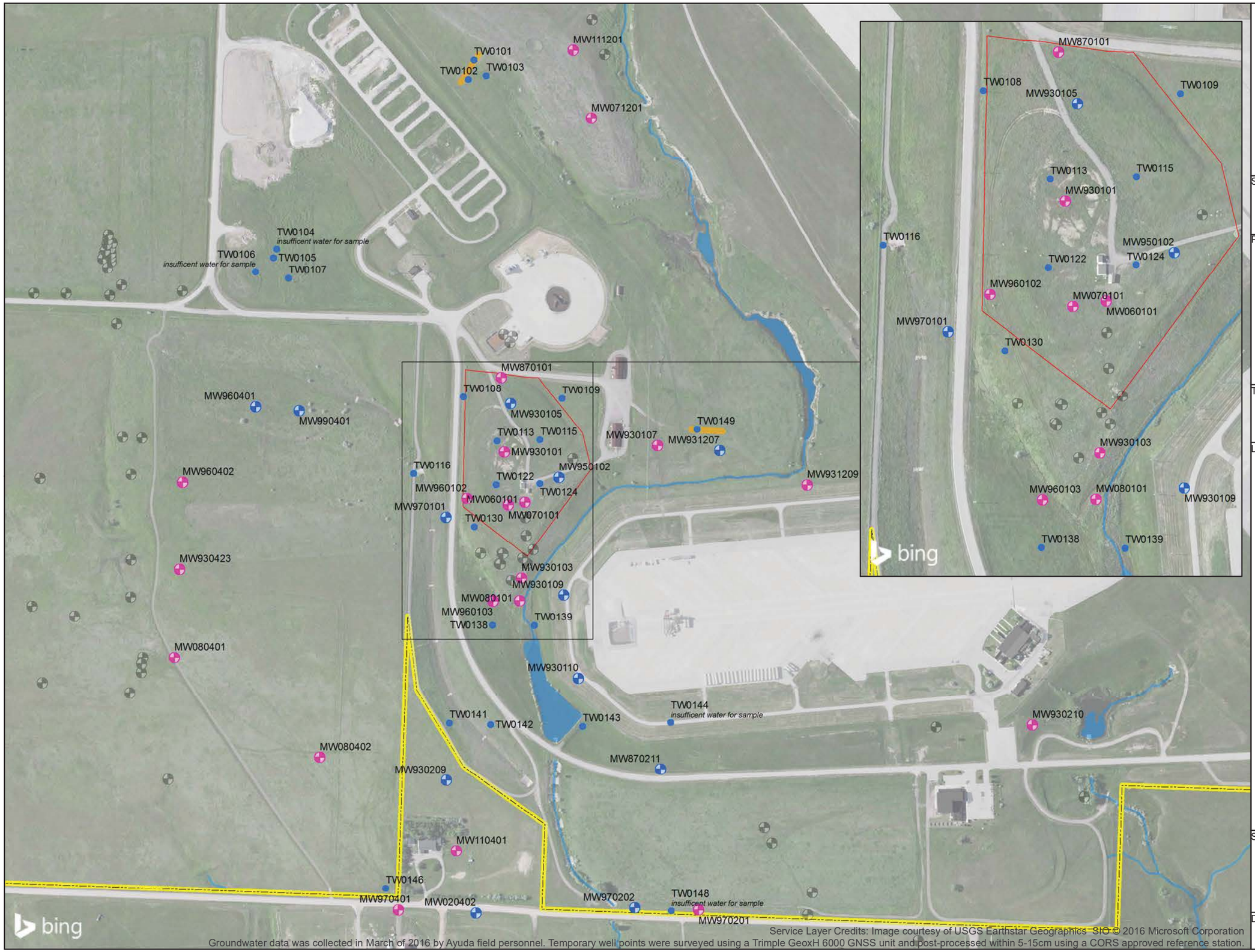
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Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/2/2017 REV: 2	**4-2**



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PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
GROUNDWATER SAMPLE
LOCATIONS

LEGEND:

Groundwater Sample Locations
- Monitoring Wel - Sampled
- Temporary Monitoring Well - Sampled
- Monitoring Well - Gauged Only
- Monitoring Well - No Action

- Historical Groundwater Injection Trenches
- Former Fire Protection Training Area
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

SCALE: 1:5,000

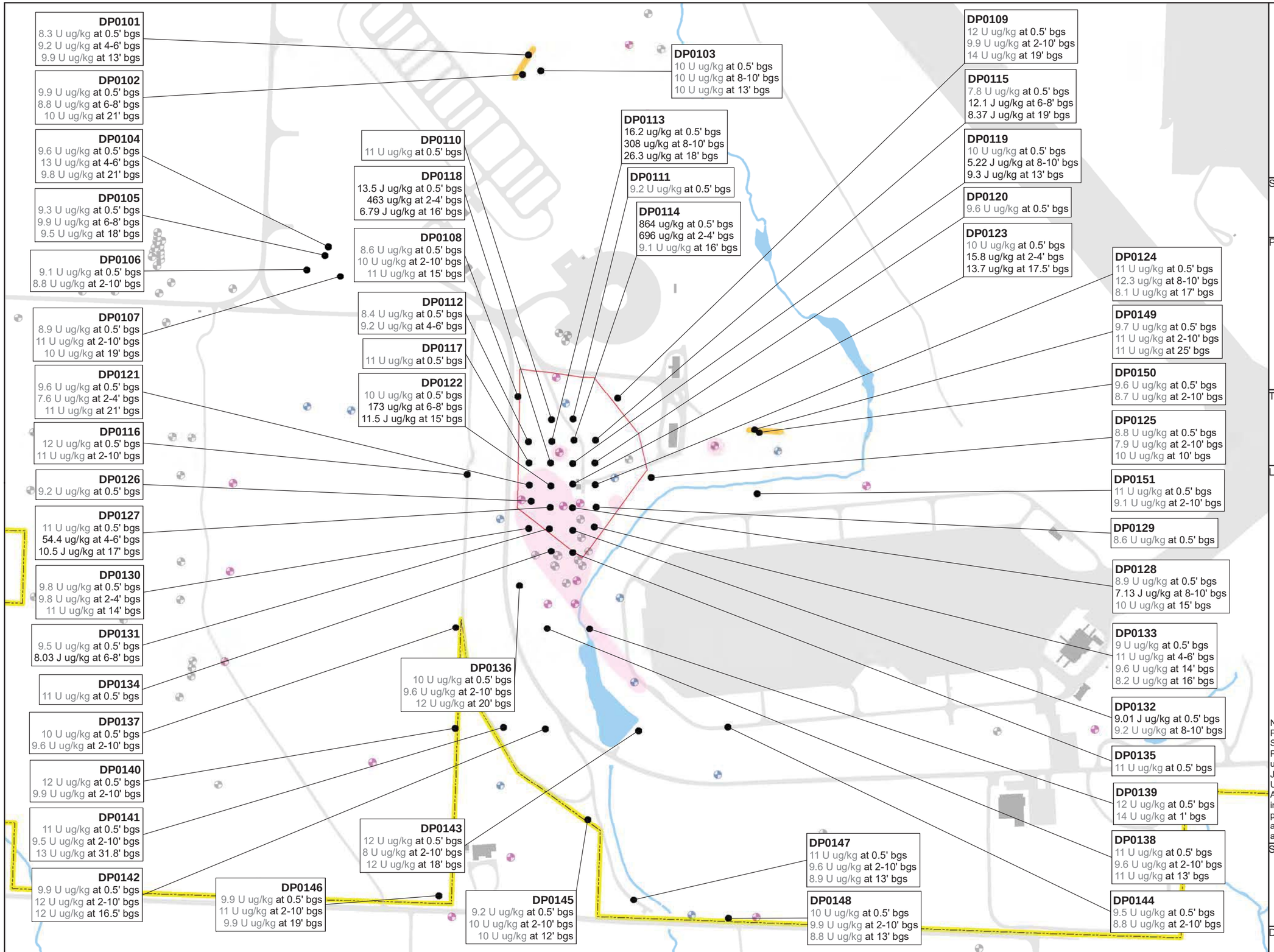
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Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/2/2017 REV: 2	**4-3**



Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station. OU1 Composit Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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44.139378°, -103.093020°

PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016 PERFLUOROBUTANESULFONIC ACID CONCENTRATIONS IN SOIL

LEGEND:

- Soil Borings
- Monitoring Wells
  - Gauged and Sampled
  - Gauged Only
  - No Action
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated compounds
SL = screening level level
PFBS = perfluorobutanesulfonic acid [SL: 1,600,000 ug/kg]
ug/kg = micrograms per kilogram
J = estimated value
U = results below laboratory limit of detection
Analytical results for PFC concentrations in soils are reported in ug/kg and were collected in March of 2016. Results presented in red, indicate an exceedance in the soil screening action levels. For visual purposes the sample IDs have been abbreviated to display only the boring IDs.

SCALE: 1:5,000

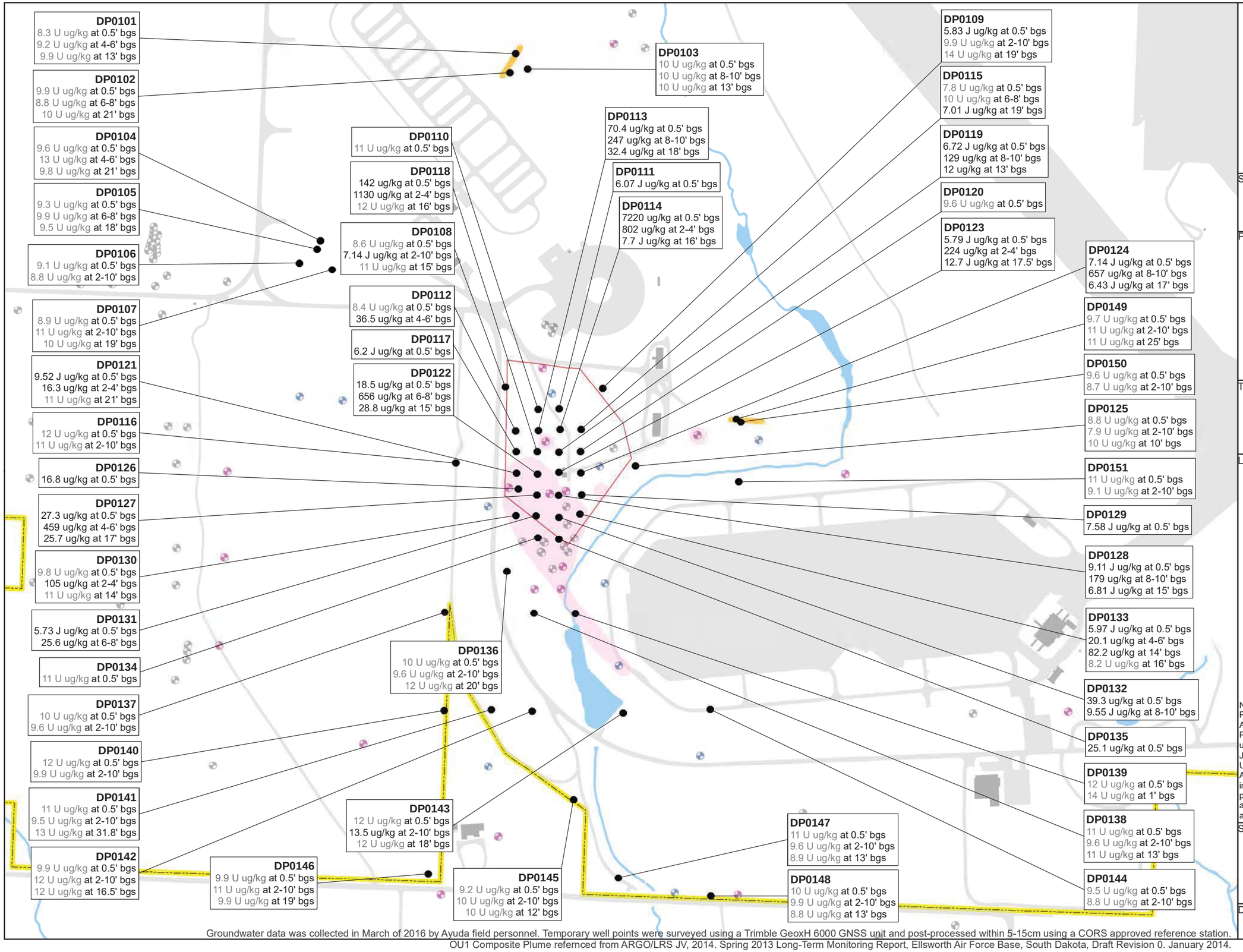
N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 2	6-1



Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station.
OU1 Composite Plume refernced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016 PERFLUOROOCTANOIC ACID CONCENTRATIONS IN SOIL

LEGEND:

Soil Borings
- PFOA Results (ug/kg)

Monitoring Wells
- Gauged and Sampled
- Gauged Only
- No Action

- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated compounds
AL = action level
PFOA = perfluorooctanoic acid [AL: 16,000 ug/kg]
ug/kg = micrograms per kilogram
J = estimated value
U = results below laboratory limit of detection
Analytical results for PFC concentrations in soils are reported in ug/kg and were collected in March of 2016. Results presented in red, indicate an exceedance in the soil screening action levels. For visual purposes the sample IDs have been abbreviated to display only the boring IDs.

SCALE: 1:5,000

N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 2	6-2

DP0101
8.3 U ug/kg at 0.5' bgs
9.2 U ug/kg at 4-6' bgs
9.9 U ug/kg at 13' bgs

DP0102
9.9 U ug/kg at 0.5' bgs
12.8 ug/kg at 6-8' bgs
10 U ug/kg at 21' bgs

DP0104
5.13 J ug/kg at 0.5' bgs
44.9 ug/kg at 4-6' bgs
9.8 U ug/kg at 21' bgs

DP0105
9.3 U ug/kg at 0.5' bgs
9.9 U ug/kg at 6-8' bgs
9.5 U ug/kg at 18' bgs

DP0106
9.1 U ug/kg at 0.5' bgs
8.8 U ug/kg at 2-10' bgs

DP0107
8.9 U ug/kg at 0.5' bgs
8.47 J ug/kg at 2-10' bgs
10 U ug/kg at 19' bgs

DP0121
298 ug/kg at 0.5' bgs
28.1 ug/kg at 2-4' bgs
8.14 J ug/kg at 21' bgs

DP0116
12 U ug/kg at 0.5' bgs
11 U ug/kg at 2-10' bgs

DP0126
80.1 ug/kg at 0.5' bgs

DP0127
3,150 ug/kg at 0.5' bgs
2,630 ug/kg at 4-6' bgs
117 ug/kg at 17' bgs

DP0130
504 ug/kg at 0.5' bgs
641 ug/kg at 2-4' bgs
11 U ug/kg at 14' bgs

DP0131
475 ug/kg at 0.5' bgs
16.1 ug/kg at 6-8' bgs

DP0134
77.8 ug/kg at 0.5' bgs

DP0137
10 U ug/kg at 0.5' bgs
9.6 U ug/kg at 2-10' bgs

DP0140
12 U ug/kg at 0.5' bgs
9.9 U ug/kg at 2-10' bgs

DP0141
11.8 J ug/kg at 0.5' bgs
9.5 U ug/kg at 2-10' bgs
13 U ug/kg at 31.8' bgs

DP0142
9.9 U ug/kg at 0.5' bgs
12 U ug/kg at 2-10' bgs
12 U ug/kg at 16.5' bgs

DP0103
10 U ug/kg at 0.5' bgs
10 U ug/kg at 8-10' bgs
10 U ug/kg at 13' bgs

DP0110
106 ug/kg at 0.5' bgs

DP0118
38,300 ug/kg at 0.5' bgs
584 ug/kg at 2-4' bgs
12 U ug/kg at 16' bgs

DP0108
192 ug/kg at 0.5' bgs
144 ug/kg at 2-10' bgs
11 U ug/kg at 15' bgs

DP0112
414 ug/kg at 0.5' bgs
19.5 ug/kg at 4-6' bgs

DP0117
533 ug/kg at 0.5' bgs

DP0122
1,460 ug/kg at 0.5' bgs
1,150 ug/kg at 6-8' bgs
193 ug/kg at 15' bgs

DP0113
10,000 ug/kg at 0.5' bgs
29.2 ug/kg at 8-10' bgs
51 ug/kg at 18' bgs

DP0111
1,680 ug/kg at 0.5' bgs

DP0114
32,900 ug/kg at 0.5' bgs
148 ug/kg at 2-4' bgs
48.8 ug/kg at 16' bgs

DP0109
51.1 ug/kg at 0.5' bgs
23 ug/kg at 2-10' bgs
14 U ug/kg at 19' bgs

DP0115
731 ug/kg at 0.5' bgs
10 U ug/kg at 6-8' bgs
10.8 J ug/kg at 19' bgs

DP0119
588 ug/kg at 0.5' bgs
1,750 ug/kg at 8-10' bgs
175 ug/kg at 13' bgs

DP0120
279 ug/kg at 0.5' bgs

DP0123
251 ug/kg at 0.5' bgs
3,840 ug/kg at 2-4' bgs
25 ug/kg at 17.5' bgs

DP0124
803 ug/kg at 0.5' bgs
1,350 ug/kg at 8-10' bgs
49.7 ug/kg at 17' bgs

DP0149
8.46 J ug/kg at 0.5' bgs
11 U ug/kg at 2-10' bgs
53.5 ug/kg at 25' bgs

DP0150
9.6 U ug/kg at 0.5' bgs
8.7 U ug/kg at 2-10' bgs

DP0125
71 ug/kg at 0.5' bgs
99 ug/kg at 2-10' bgs
23.3 ug/kg at 10' bgs

DP0151
13.6 J ug/kg at 0.5' bgs
9.1 U ug/kg at 2-10' bgs

DP0129
757 ug/kg at 0.5' bgs

DP0128
189 ug/kg at 0.5' bgs
609 ug/kg at 8-10' bgs
122 ug/kg at 15' bgs

DP0133
58.6 ug/kg at 0.5' bgs
2,050 ug/kg at 4-6' bgs
2,040 ug/kg at 14' bgs
321 ug/kg at 16' bgs

DP0132
186 ug/kg at 0.5' bgs
29.1 ug/kg at 8-10' bgs

DP0135
3,250 ug/kg at 0.5' bgs

DP0139
34.2 ug/kg at 0.5' bgs
23.1 ug/kg at 1' bgs

DP0138
5.75 J ug/kg at 0.5' bgs
9.6 U ug/kg at 2-10' bgs
11 U ug/kg at 13' bgs

DP0144
5.02 J ug/kg at 0.5' bgs
8.8 U ug/kg at 2-10' bgs

DP0136
12.8 J ug/kg at 0.5' bgs
9.6 U ug/kg at 2-10' bgs
12 U ug/kg at 20' bgs

DP0143
179 ug/kg at 0.5' bgs
14.6 ug/kg at 2-10' bgs
12 U ug/kg at 18' bgs

DP0146
9.9 U ug/kg at 0.5' bgs
11 U ug/kg at 2-10' bgs
9.9 U ug/kg at 19' bgs

DP0145
85.7 ug/kg at 0.5' bgs
7.31 J ug/kg at 2-10' bgs
10 U ug/kg at 12' bgs

DP0147
74.1 ug/kg at 0.5' bgs
38.2 ug/kg at 2-10' bgs
311 ug/kg at 13' bgs

DP0148
8.05 J ug/kg at 0.5' bgs
9.9 U ug/kg at 2-10' bgs
5.87 J ug/kg at 13' bgs

Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station.
OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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SITE:
ELLSWORTH AIR FORCE BASE
SOUTH DAKOTA
44.139378°, -103.093020°

PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

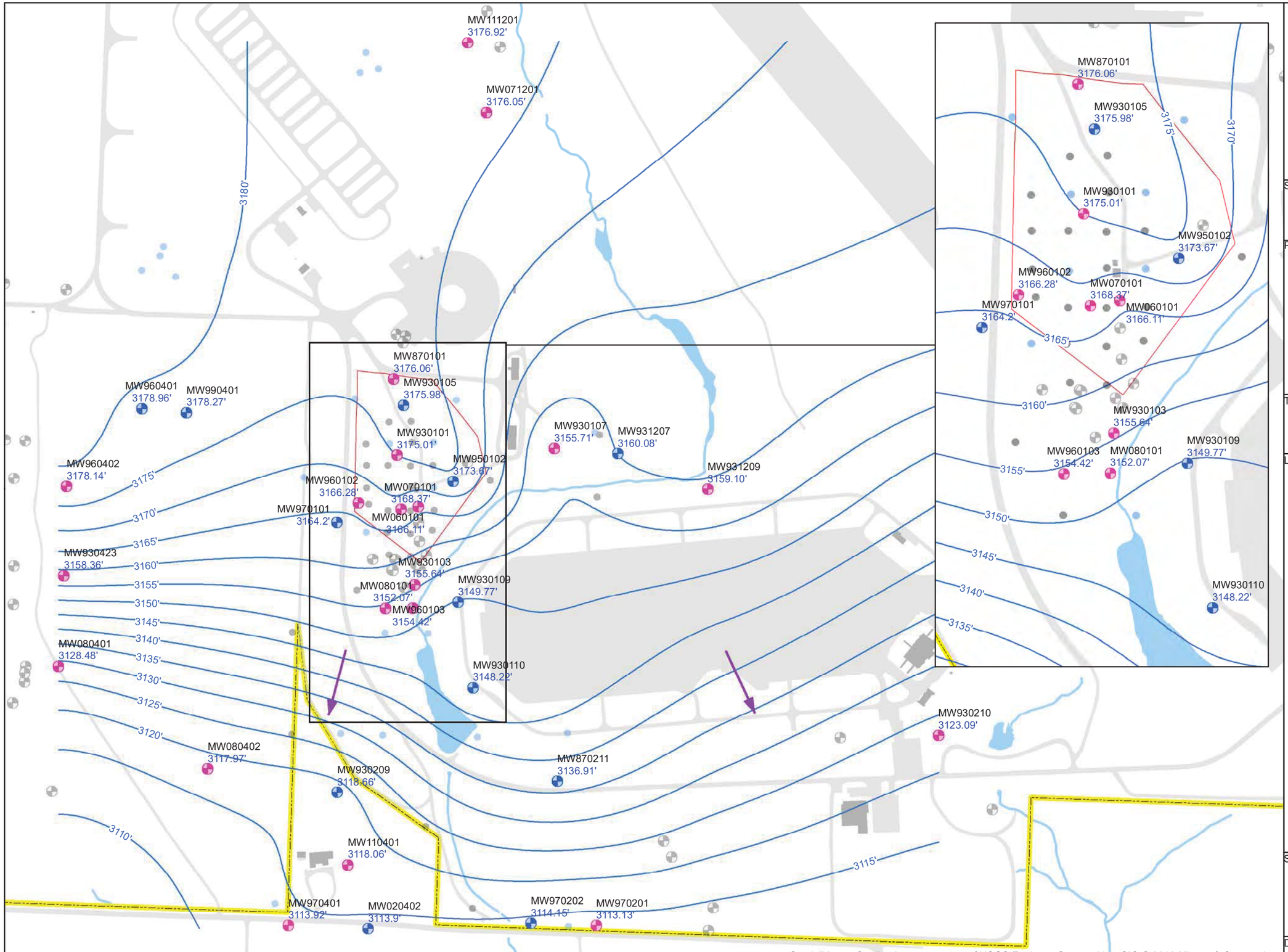
TITLE:
MARCH 2016 PERFLUOROOCTANESULFONIC ACID CONCENTRATIONS IN SOIL

LEGEND:
- Soil Borings
  - PFOS Results Exceeding 6,000 ug/kg
  - Other PFOS Results
- Monitoring Wells
  - Gauged and Sampled *ft,msl*
  - Gauged Only
  - No Action
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated compounds
AL = action level
PFOS = perfluorooctanesulfonic acid [AL: 6,000 ug/kg]
ug/kg = micrograms per kilogram
J = estimated value
U = results below laboratory limit of detection
Analytical results for PFC concentrations in soils are reported in ug/kg and were collected in March of 2016. Results presented in red, indicate an exceedance in the soil screening action levels. For visual purposes the sample IDs have been abbreviated to display only the boring IDs.

SCALE: 1:5,000
N
0 200 400 800
Feet
NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 2	6-3



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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
GROUNDWATER TABLE
SURFACE MAP

LEGEND:

Monitoring Wells

Elevations reported in feet above mean sea level (ft amsl)

- Gauged and Sampled
- Gauged Only
- No Action

Soil Borings

- Temporary Monitoring Well
- Other Boring
- Groundwater Elevation Contours
- Groundwater Flow Direction
- Former Fire Protection Training Area
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
Groundwater elevations are reported in feet above mean sea level (ft amsl) and were collected on March 14, 2016.

SCALE: 1:5,000

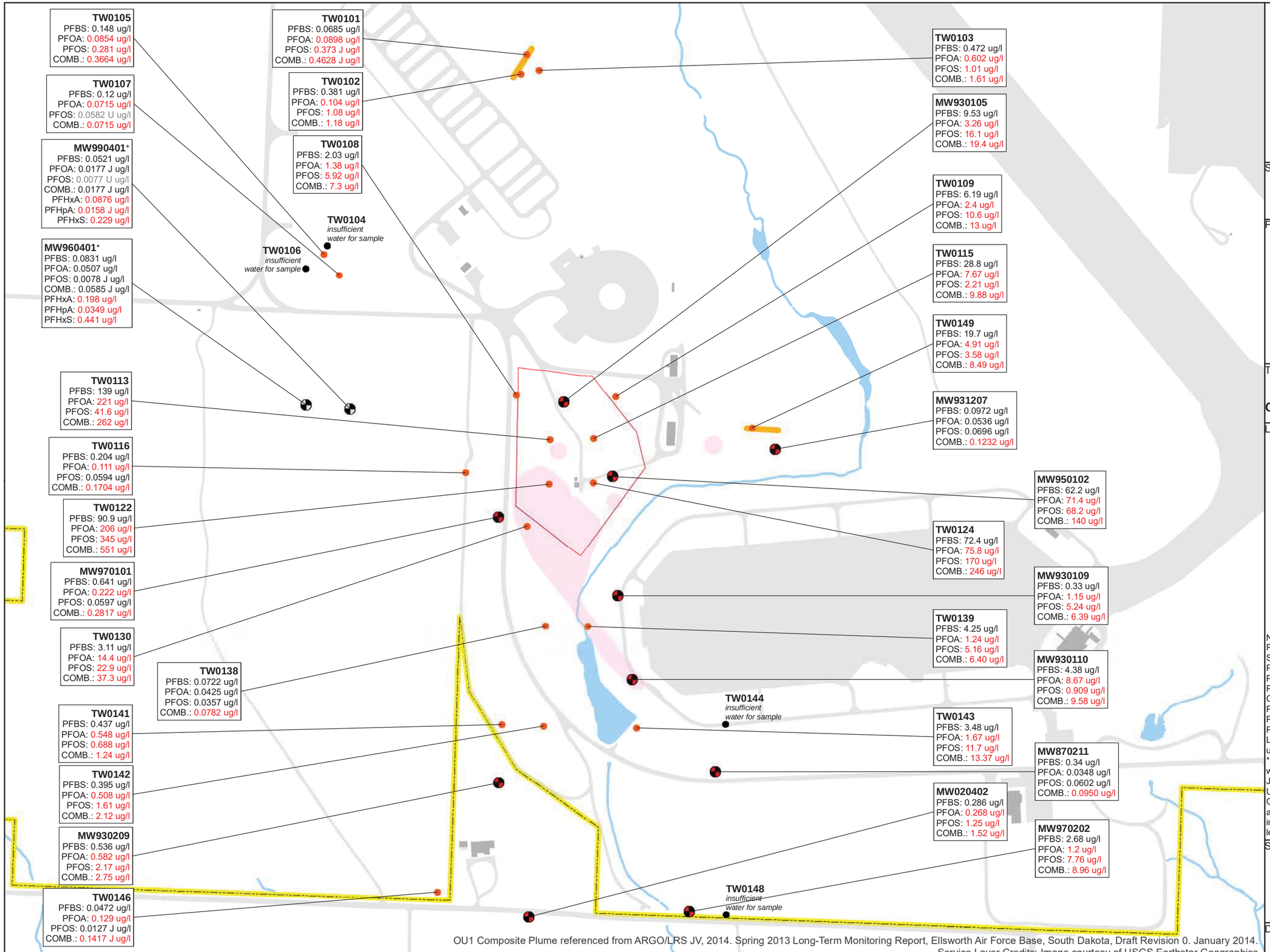
N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/2/2017 REV: 2	**6-4**



OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.
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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

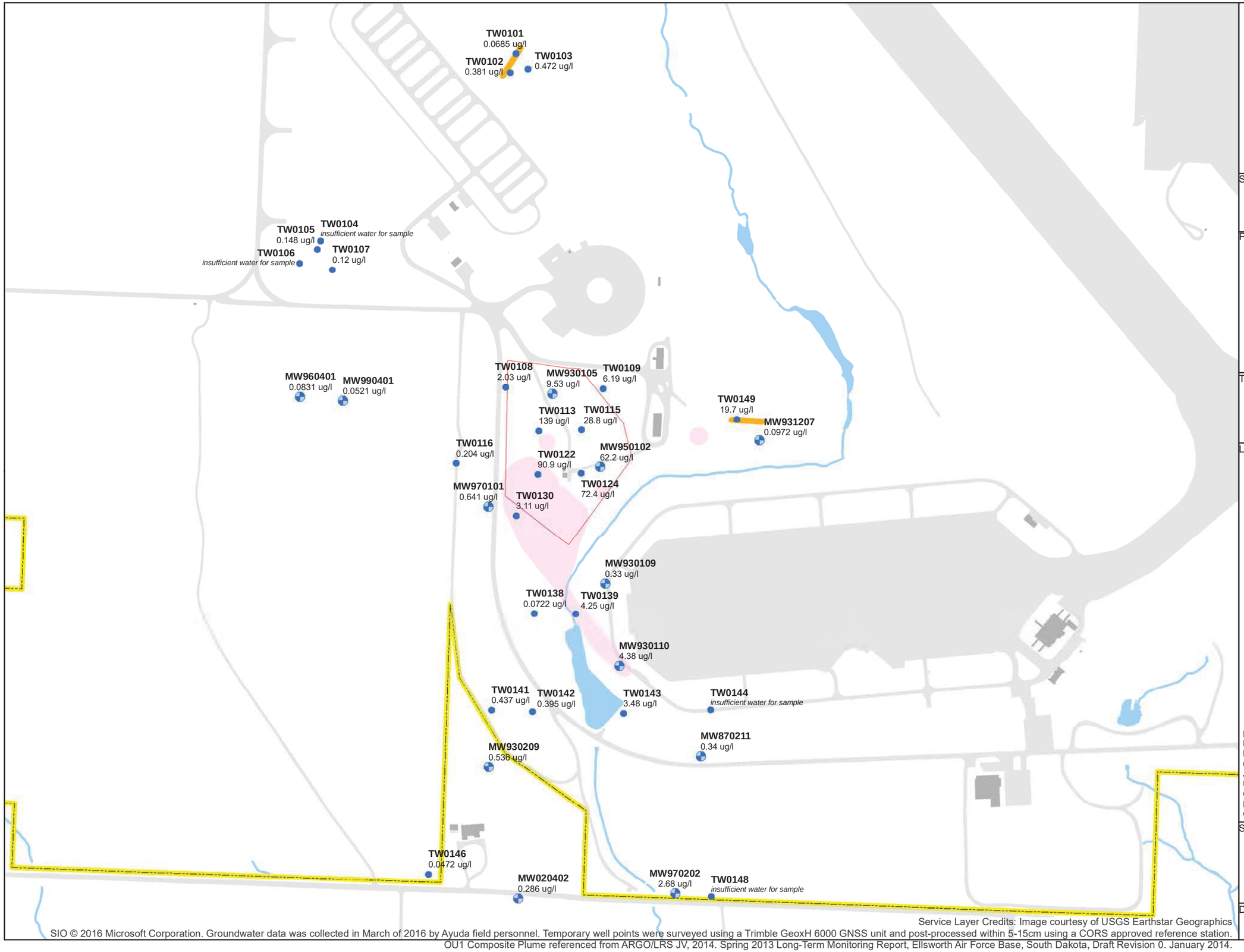
TITLE:
MARCH 2016
PERFLUORINATED COMPOUNDS CONCENTRATIONS IN GROUNDWATER

LEGEND:
- Monitoring Wells
  - South Dakota Administrative Rule 74:54:01:05 applied (see Tables 6-5 and 6-6)
  - Exceedance of Health Advisory Level
- Temporary Monitoring Well
  - No Exceedance
  - Exceedance of Health Advisory Level
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Ellsworth AFB Boundary
- Structures
- Paved Surface
- Surface Water

Note:
PFC = perfluorinated chemicals
SL = screening level
PFBS = perfluorobutanesulfonic acid [SL: 380 ug/l]
PFOA = perfluorooctanoic acid [SL: 0.07 ug/l]
PFOS = perfluorooctanesulfonic acid [SL: 0.07 ug/l]
COMB. = combined results for PFOA + PFOS [SL: 0.07 ug/l]
PFHxA = perfluorohexanoic acid [Laboratory Detection Limit]
PFHpA = perfluoroheptanoic acid [Laboratory Detection Limit]
PFHxS = perfluorohexanesulfonic acid [Laboratory Detection Limit]
ug/l = micrograms per liter
* = Wells in which PFCs exceeding the DL are not collocated with PFBS, PFOA, and/or PFOS SL exceedances
J = laboratory qualifier which indicates an estimated value
U = indicates results below laboratory limit of detection
Groundwater analytical results for PFCs are reported in ug/l and were collected in March of 2016. Results presented in red, indicate an exceedance in groundwater screening levels. Results presented in grey, indicate a non-detect.

SCALE: 1:5,000
N
0 200 400 800
Feet
NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 4	6-5



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OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
PERFLUOROBUTANESULFONIC ACID CONCENTRATIONS IN GROUNDWATER

LEGEND:

Monitoring Well
- Monitoring Well
- Temporary Monitoring Well

- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated chemicals
PFBS = perfluorobutanesulfonic acid [SL: 380 ug/l]
ug/l = micrograms per liter
J = estimated value
U = results below laboratory limit of detection
Groundwater samples were collected in March of 2016.
Results presented in red, indicate an exceedance in ground-water screening levels.

SCALE: 1:5,000

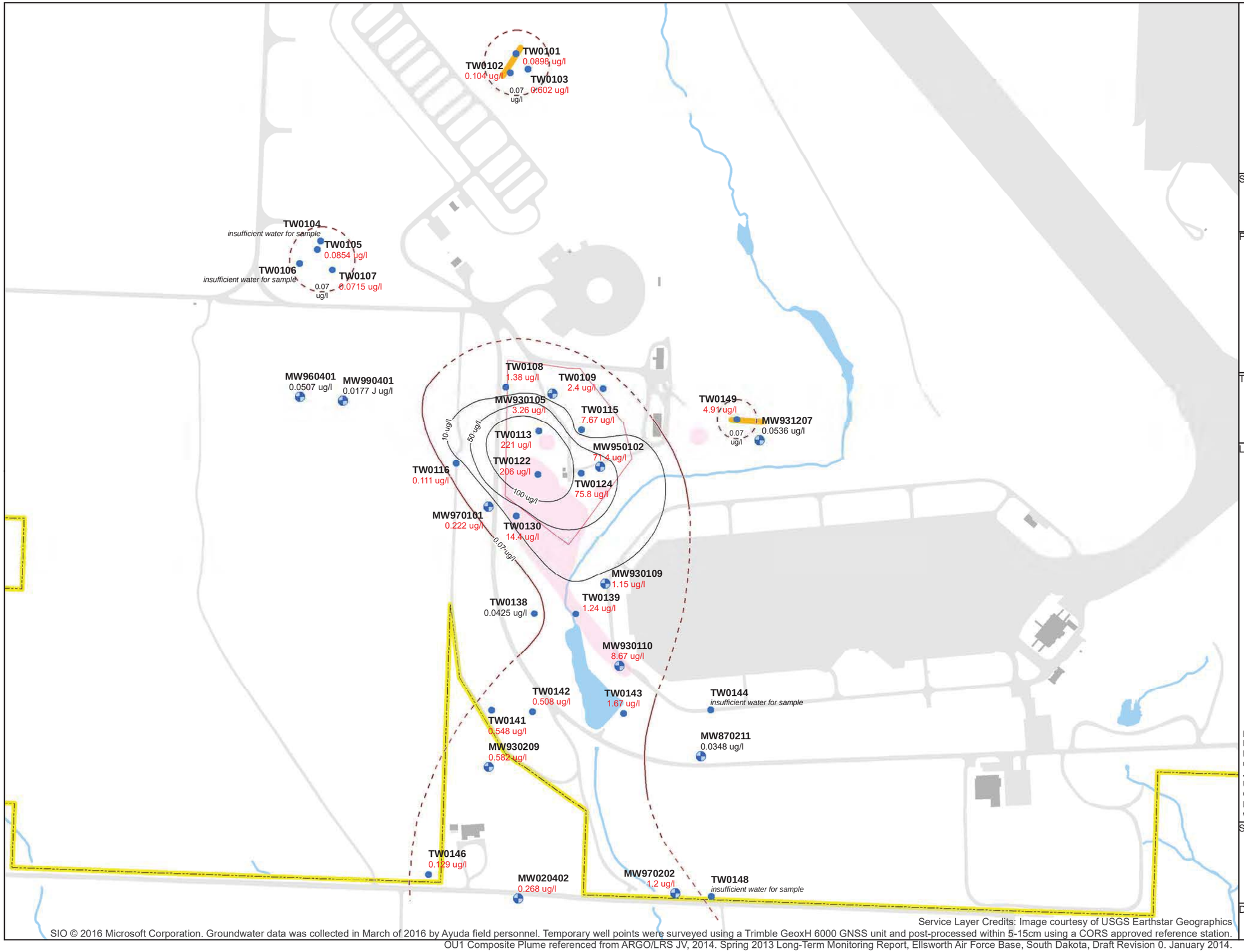
N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 4	6-6



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OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016 PERFLUOROOCTANOIC ACID CONCENTRATIONS IN GROUNDWATER

LEGEND:

Sampling Locations
- Monitoring Well
- Temporary Monitoring Well

PFOA Contamination Isopleths
- Delineated
- Delineated at Screening Level *0.07 ug/l*
- Inferred at Screening Level *0.07 ug/l*

- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated chemicals
PFOA = perfluorooctanoic acid [screening level: 0.07 ug/l]
ug/l = micrograms per liter
J = estimated value
U = results below laboratory limit of detection
Groundwater samples were collected in March of 2016.
Results presented in red, indicate an exceedance in groundwater screening levels.

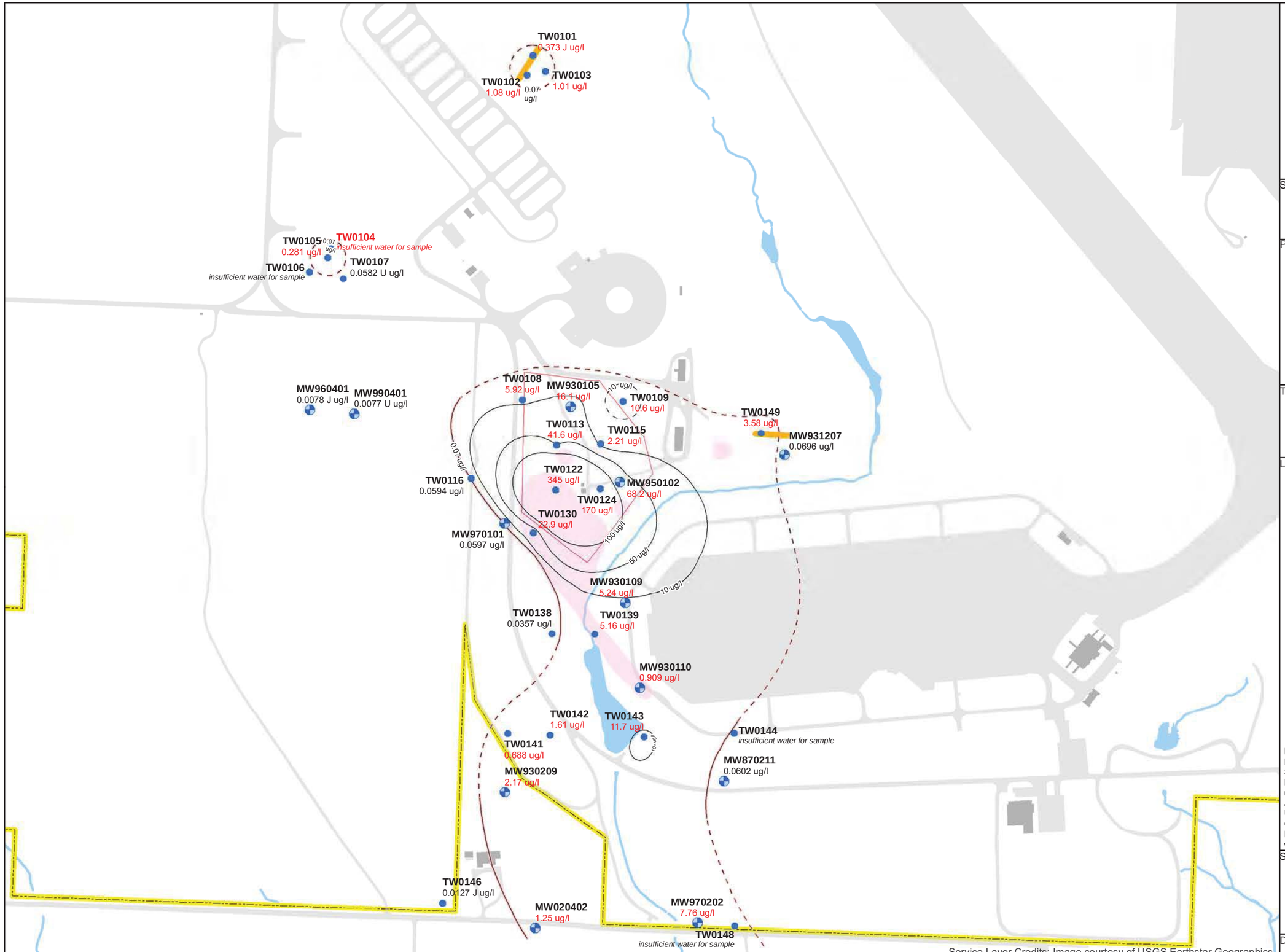
SCALE: 1:5,000

N

0 200 400 800
Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 3	6-7



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OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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PERFLUORINATED COMPOUND
DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
PERFLUOROOCTANESULFONIC ACID CONCENTRATIONS IN GROUNDWATER

LEGEND:

Sampling Locations
- Monitoring Well
- Temporary Monitoring Well

PFOS Contamination Isopleths
- Delineated
- Inferred
- Delineated at Screening Level *0.07 ug/l*
- Inferred at Screening Level *0.07 ug/l*

- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated chemicals
SL = screening level
PFOS = perfluorooctanesulfonic acid [SL: 0.07 ug/l]
ug/l = micrograms per liter
J = estimated value
U = results below laboratory limit of detection
Groundwater samples were collected in March of 2016.
Results presented in red, indicate an exceedance in groundwater screening levels.

SCALE: 1:5,000

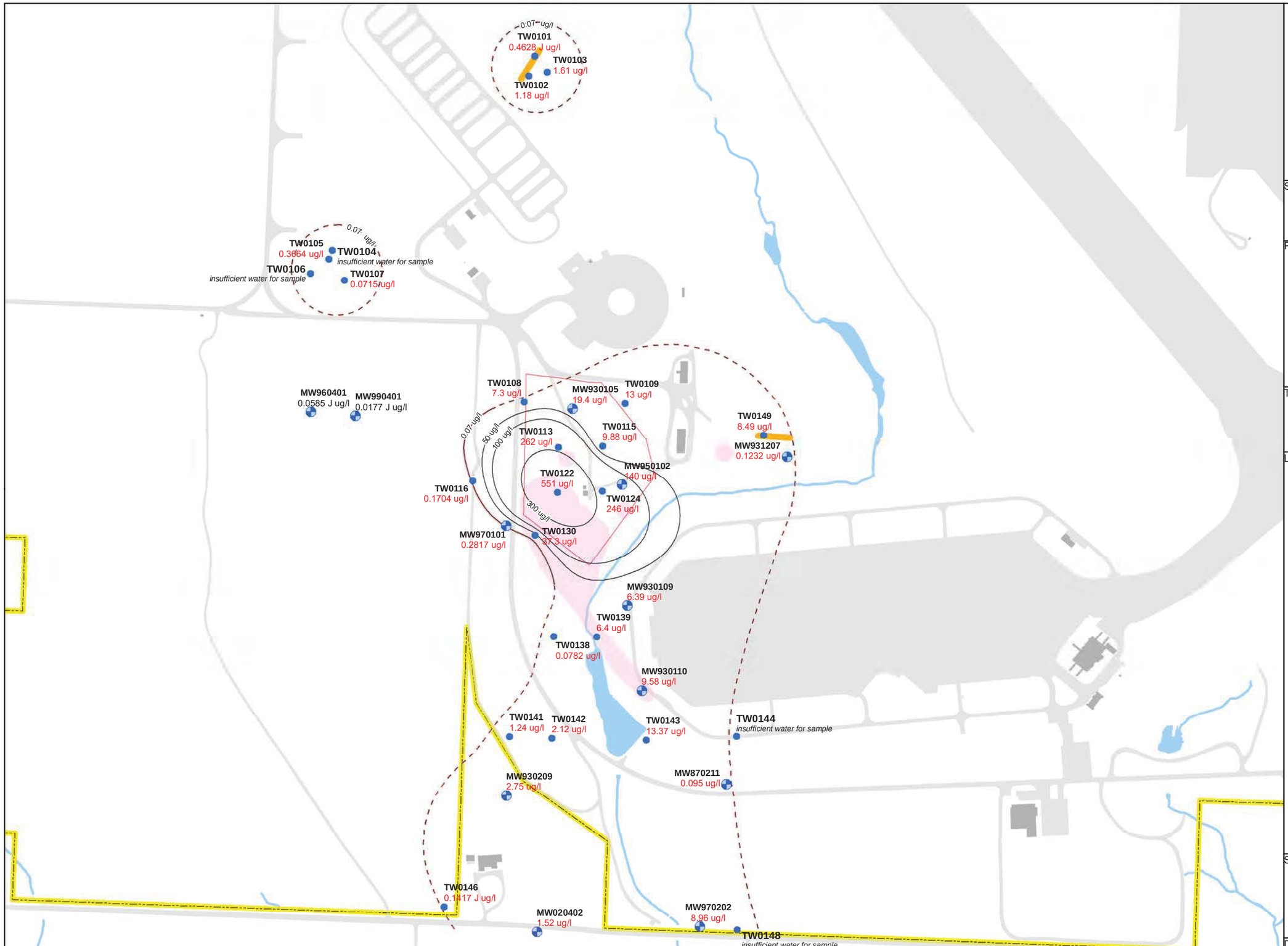
N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 1	**6-8**



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OU1 Composite Plume referenced from ARGO/LRS JV, 2014. Spring 2013 Long-Term Monitoring Report, Ellsworth Air Force Base, South Dakota, Draft Revision 0. January 2014.

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DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
COMBINED PFOS AND PFOA
CONCENTRATIONS IN GROUNDWATER

LEGEND:

Sampling Locations

Combined Results for PFOS and PFOA

- Monitoring Well
- Temporary Monitoring Well

Contamination Isopleths

Combined Results for PFOS and PFOA

- Delineated
- Inferred
- Delineated at Screening Level *0.07 ug/l*
- Inferred at Screening Level *0.07 ug/l*
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- OU1 Composite Plume - Spring 2013 LTM
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

PFC = perfluorinated chemicals
SL = screening level [combined: 0.07 ug/l]
PFOS = perfluorooctanesulfonic acid
PFOA = perfluorooctanoic acid
ug/l = micrograms per liter
J = laboratory qualifier that indicates an estimated value
U = results below laboratory limit of detection
Groundwater samples were collected in March of 2016.
Results presented in red, indicate an exceedance in ground-water screening levels.

SCALE: 1:5,000

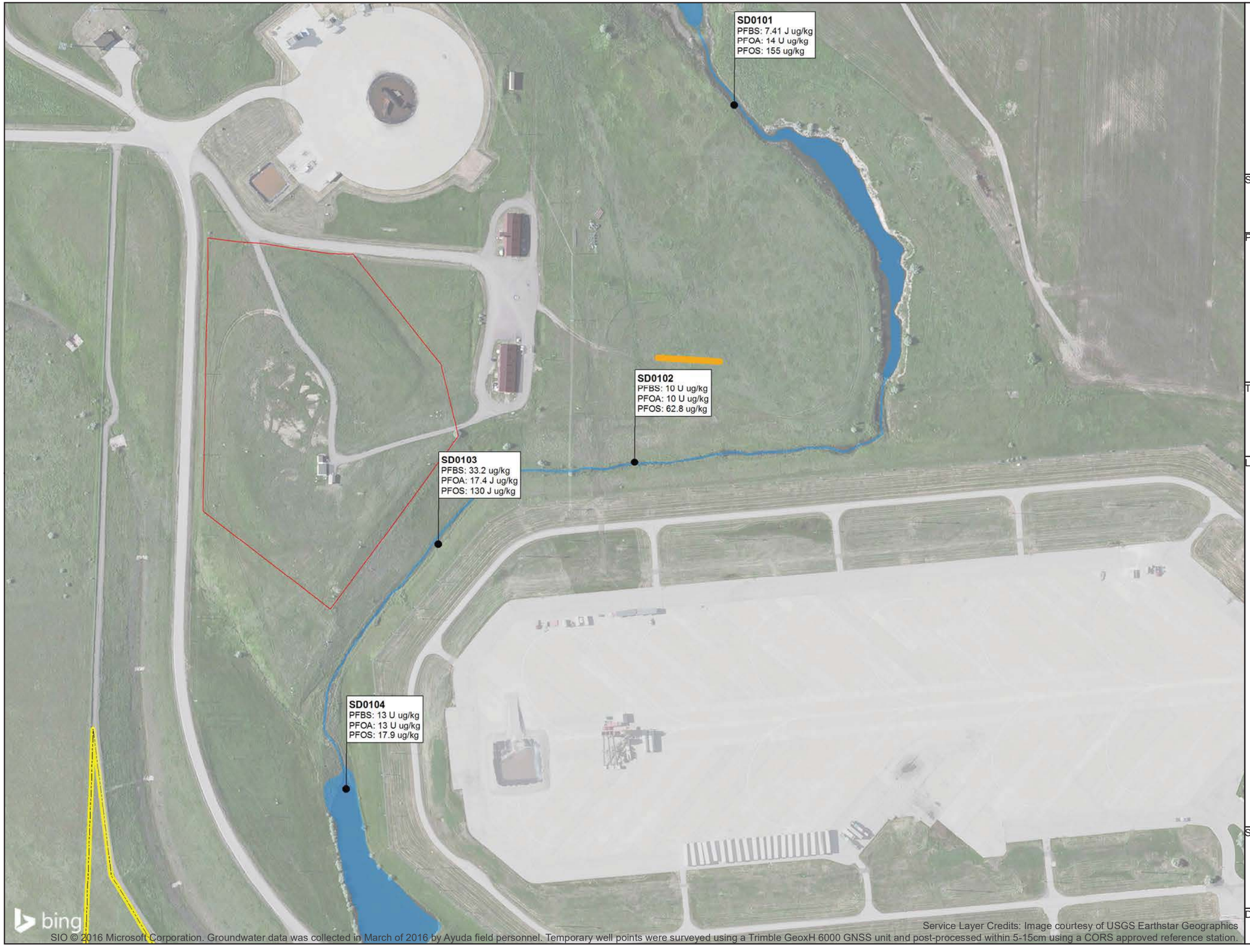
N

0 200 400 800

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/24/2017 REV: 1	**6-9**



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DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
PERFLUORINATED COMPOUNDS
CONCENTRATIONS IN
SEDIMENT

LEGEND:

- Stream Sediment Sample Location
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated chemicals
SL = screening level
PFBS = perfluorobutanesulfonic acid [SL: 1,600,000 ug/kg]
PFOA = perfluorooctanoic acid [SL: 16,000 ug/kg]
PFOS = perfluorooctanesulfonic acid [SL: 6,000 ug/kg]
ug/kg = micrograms per kilogram
J = estimated value
U = results below laboratory limit of detection
Stream sediment analytical results for PFCs are reported in ug/kg and were collected in March of 2016.
Results presented in red, indicate an exceedance of soil screening levels.

SCALE: 1:2,500

N

0 100 200 400

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	3/10/2017 REV: 2	**6-10**



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DELINEATION

STAGE 2 GROUNDWATER
MONITORING WELL LOCATIONS
TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
MARCH 2016
PERFLUORINATED COMPOUNDS
CONCENTRATIONS IN
SURFACE WATER

LEGEND:

- Surface Water Sample Location
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Structures
- Paved Surface
- Ellsworth AFB Boundary
- Surface Water

Note:
PFC = perfluorinated chemicals
SL = screening level
PFBS = perfluorobutanesulfonic acid [SL: 380 ug/l]
PFOA = perfluorooctanoic acid [SL: 0.07 ug/l]
PFOS = perfluorooctanesulfonic acid [SL: 0.07 ug/l]
ug/l = micrograms per liter
J = estimated value
U = results below laboratory limit of detection
Surface water analytical results for PFCs are reported in ug/l and were collected in March of 2016. Results presented in red, indicate an exceedance of screening levels.

SCALE: 1:2,500

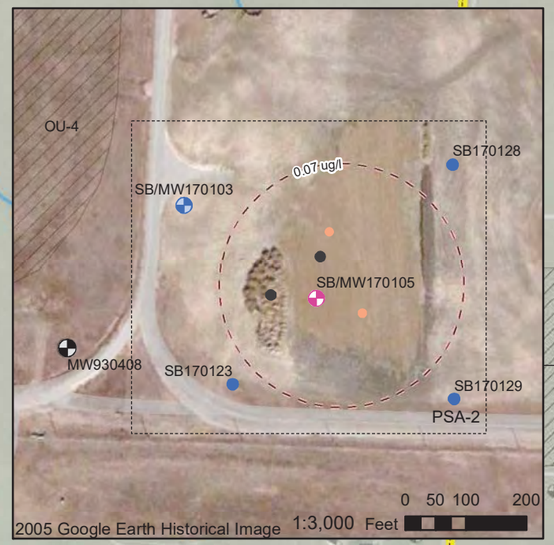
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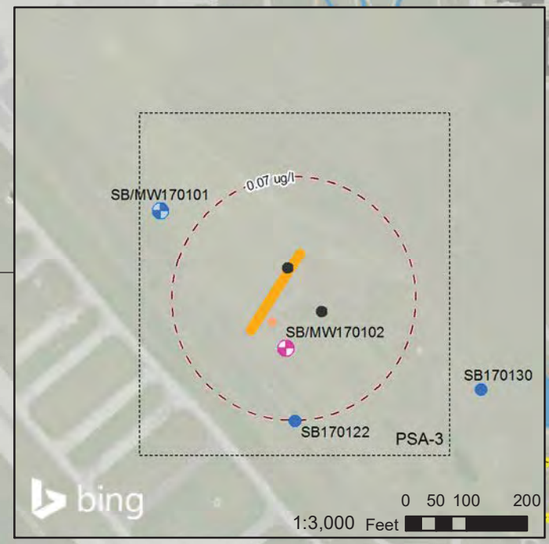
0 100 200 400

Feet

NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	1/16/2017 REV: 3	**6-11**





SEE FIGURE 8-2

THUNDERBIRD REALTY LLC

Don Newman

Tom Farrar

DW930412 (Sanders)

OU-4 OU-12 OU-2 OU-6

PSA-1 PSA-2 PSA-3 PSA-4

SB/MW170101 SB/MW170102 SB/MW170103 SB/MW170104 SB/MW170105 SB/MW170106 SB/MW170107 SB/MW170108 SB/MW170109 SB/MW170110 SB/MW170111 SB/MW170112 SB/MW170113 SB/MW170114 SB/MW170115 SB/MW170116 SB/MW170117 SB/MW170118 SB/MW170119

SB170120 SB170121 SB170122 SB170123 SB170124 SB170125 SB170126 SB170127 SB170128 SB170129 SB170130 SB170131 SB170132 SB170133

SD/SW0101 SD/SW0102 SD/SW0103 SD/SW0104 SD/SW0105 SD/SW0106 SD/SW0107 SD/SW0108 SD/SW0109 SD/SW0110

MW16OW52502 MW870101 MW870211 MW930102 MW930105 MW930109 MW930110 MW930209 MW930210 MW930408 MW930423 MW931201 MW931207 MW931209 MW940202 MW940203 MW960103 MW960401 MW960402 MW970101 MW970201 MW970202 MW990401 MW020402 MW040409 MW071201 MW080401 MW080402 MW970401

bing

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PROJECT:
AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
PROPOSED STAGE 2 INVESTIGATION FIELD ACTIVITIES

LEGEND:

Proposed Stage 2 Installations and Sampling
- Monitoring Well Installation for Groundwater Sample Collection
- Monitoring Well Installation for Soil and Groundwater Sample Collection
- Stream Sediment and Surface Water Sample Collectiong
- Soil Boring Installation and Soil Sample Collection

Existing Monitoring Wells
- Proposed for Stage 2 Sampling and Gauging
- No Action

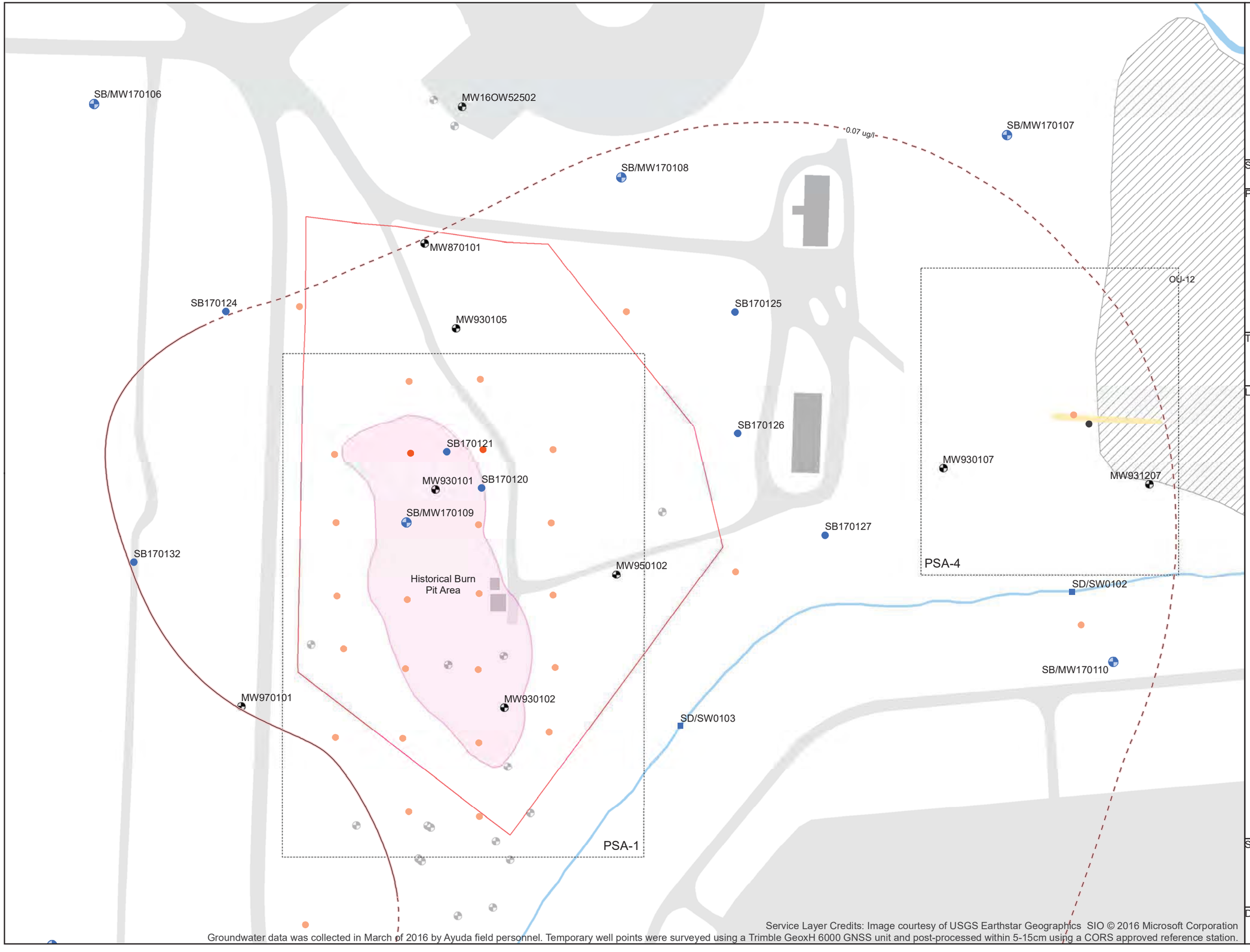
March 2016 Soil Borings
- PFC Exceedance
- PFC Detection
- PFC Non-detect

Combined PFOS and PFOA Contamination Extent in Groundwater
- Delineated at Screening Level *0.07 ug/l*
- Inferred at Screening Level *0.07 ug/l*

- Thunderbird Realty LLC Property
- Residential Wells for Stage 2 Sampling
- Potential Source Area (PSA)
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Ellsworth AFB Boundary
- Surface Water
- Landfill Covers
- Structures
- Paved Surface

SCALE: 1:10,000
N
0 375 750 1500
Feet
NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	9/12/2017 REV: 6	**8-1**



Groundwater data was collected in March of 2016 by Ayuda field personnel. Temporary well points were surveyed using a Trimble GeoxH 6000 GNSS unit and post-processed within 5-15cm using a CORS approved reference station.

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AOC PFC - 1
PERFLUORINATED COMPOUND DELINEATION

STAGE 2 GROUNDWATER MONITORING WELL LOCATIONS TECHNICAL MEMORANDUM

W912PP-13-D-0011, 0002

TITLE:
PROPOSED STAGE 2 INVESTIGATION PSA-1 AREA

LEGEND:

Proposed Stage 2 Installations and Sampling
- Monitoring Well Installation for Groundwater Sample Collection
- Monitoring Well Installation for Soil and Groundwater Sample Collection
- Stream Sediment and Surface Water Sample Collectiong
- Soil Boring Installation and Soil Sample Collection

March 2016 Soil Borings
- PFC Exceedance
- PFC Detection
- PFC Non-detect

Combined PFOS and PFOA Contamination Extent in Groundwater
- Delineated at Screening Level *0.07 ug/l*
- Inferred at Screening Level *0.07 ug/l*

Existing Monitoring Wells
- Proposed for Stage 2 Sampling and Gauging
- No Action

- Potential Source Area (PSA)
- Former Fire Protection Training Area
- Historical Groundwater Injection Trenches
- Ellsworth AFB Boundary
- Surface Water
- Landfill Covers
- Historical Burn Pit
- Structures
- Paved Surface

SCALE: 1:1,500
N
0 50 100 200
Feet
NAD 1983 StatePlane South Dakota South FIPS 4002 Feet

DRN/MOD BY:	DATE:	FIGURE:
ADS	8/22/2017 REV: 8	**8-2**

Tables

Table 5-0

Stage 1 Groundwater Quality Parameters

Well ID	Depth to Water (TOC)	Date	Sample Time	Volumes Removed (Gallon)	Temperature (C°)	Specific Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Hydrogen Potential (pH units)	Turbidity (NTU)	Comments
MW020402	21.12	3/15/2016	10:55	2.2	9.35	2050	9.96	141	6.74	2.1	
MW870211	17.96	3/16/2016	12:10	NM	NM	NM	NM	NM	NM	NM	Grab Sample
MW930109	15.97	3/16/2016	14:20	1.75	11.26	947	4.46	-16	6.63	28	
MW930209	31.65	3/15/2016	12:35	5.25	9.65	2650	10.22	127	6.73	122	3 Casing Volumes
MW990401	9.21	3/15/2016	14:25	1.25	7.02	1500	5.07	123	6.91	0	
MW960401	11.83	3/15/2016	15:20	1.75	10.57	1710	8.32	140	6.9	0	
MW930110	16.24	3/16/2016	13:30	2.4	12.08	1260	0.73	-58	5.24	0	
MW950102	18.26	3/16/2016	11:55	2.1	10.02	3390	0.9	71	6.5	21.6	
MW931207	21.31	3/15/2016	16:25	1.75	9.75	998	1.65	92	6.48	8	
MW970202	13.49	3/16/2016	9:25	2.4	9.97	1350	1.37	15	6.46	2.4	
MW930105	16.92	3/16/2016	15:25	1.5	10.04	3360	0.88	-76	6.38	8.4	
MW970101	9.05	3/16/2016	10:55	1.5	10.92	3220	1.77	103	6.47	27.3	

Notes:

NM = Not Measured

Table 6-0
Coordinate and Ground Surface Elevation Data for Stage 1 Sample Point Locations
Area of Concern PFC-1, Ellsworth Air Force Base

Soil Boring ID	Temporary Well ID	Soil Sample ID	Groundwater Sample ID	Soil Sample Date Collected	Groundwater Sample Date Collected	Soil Sample Depth	Easting	Northing	Ground Surface Elevation (ft. MSL)	Comments
DP0101	TW0101	DP0101-00-0316-0.5	TW0101-00-0316	3/18/2016	3/18/2016	0.5'	1242311.036755	669210.686028	3194.713	None
DP0101	TW0101	DP0101-00-0316-4-6	TW0101-00-0316	3/18/2016	3/18/2016	4-6'	1242311.036755	669210.686028	3194.713	None
DP0101	TW0101	DP0101-00-0316-13	TW0101-00-0316	3/18/2016	3/18/2016	13'	1242311.036755	669210.686028	3194.713	None
DP0102	TW0102	DP0102-00-0316-0.5	TW0102-00-0316	3/17/2016	3/18/2016	0.5'	1242284.516467	669122.464748	3197.157	None
DP0102	TW0102	DP0102-00-0316-6_8	TW0102-00-0316	3/17/2016	3/18/2016	6-8'	1242284.516467	669122.464748	3197.157	None
DP0102	TW0102	DP0102-00-0316-21	TW0102-00-0316	3/18/2016	3/18/2016	21'	1242284.516467	669122.464748	3197.157	None
DP0103	TW0103	DP0103-00-0316-0.5	TW0103-00-0316	3/18/2016	3/18/2016	0.5'	1242366.454295	669139.104150	3194.364	None
DP0103	TW0103	DP0103-00-0316-8-10	TW0103-00-0316	3/18/2016	3/18/2016	8-10'	1242366.454295	669139.104150	3194.364	None
DP0103	TW0103	DP0103-00-0316-13	TW0103-00-0316	3/18/2016	3/18/2016	13'	1242366.454295	669139.104150	3194.364	None
DP0104	NS	DP0104-00-0316-0.5	NS	3/17/2016	NS	0.5'	1241408.133377	668345.589661	3206.607	Insufficient water for sample collection
DP0104	NS	DP0104-00-0316-4_6	NS	3/17/2016	NS	4-6'	1241408.133377	668345.589661	3206.607	Insufficient water for sample collection
DP0104	NS	DP0104-00-0316-21	NS	3/17/2016	NS	21'	1241408.133377	668345.589661	3206.607	Insufficient water for sample collection
DP0105	TW0105	DP0105-00-0316-0.5	TW0105-00-0316	3/17/2016	3/18/2016	0.5'	1241393.294168	668305.467694	3204.593	None
DP0105	TW0105	DP0105-00-0316-6_8	TW0105-00-0316	3/17/2016	3/18/2016	6-8'	1241393.294168	668305.467694	3204.593	None
DP0105	TW0105	DP0105-00-0316-18	TW0105-00-0316	3/17/2016	3/18/2016	18'	1241393.294168	668305.467694	3204.593	None
DP0106	NS	DP0106-00-0316-0.5	NS	3/17/2016	NS	0.5'	1241311.195251	668241.577074	3205.219	Insufficient water for sample collection
DP0106	NS	DP0106-00-0316-2_10	NS	3/17/2016	NS	2-10'	1241311.195251	668241.577074	3205.219	Insufficient water for sample collection
DP0106	NS	DP0106-00-0316-2_10	NS	3/17/2016	NS	2-10'	1241311.195251	668241.577074	3205.219	Insufficient water for sample collection
DP0107	TW0107	DP0107-00-0316-0.5	TW0107-00-0316	3/17/2016	3/18/2016	0.5'	1241462.603412	668212.035795	3202.568	None
DP0107	TW0107	DP0107-00-0316-2_10	TW0107-00-0316	3/17/2016	3/18/2016	2-10'	1241462.603412	668212.035795	3202.568	None
DP0107	TW0107	DP0107-00-0316-19	TW0107-00-0316	3/17/2016	3/18/2016	19'	1241462.603412	668212.035795	3202.568	None
DP0108	TW0108	DP0108-00-0316-0.5	TW0108-00-0316	3/8/2016	3/11/2016	0.5'	1242262.827862	667668.885306	3191.666	None
DP0108	TW0108	DP0108-00-0316-2_10	TW0108-00-0316	3/8/2016	3/11/2016	2-10'	1242262.827862	667668.885306	3191.666	None
DP0108	TW0108	DP0108-00-0316-15	TW0108-00-0316	3/10/2016	3/11/2016	15'	1242262.827862	667668.885306	3191.666	None
DP0109	TW0109	DP0109-00-0316-0.5	TW0109-00-0316	3/8/2016	3/11/2016	0.5'	1242714.047760	667661.901396	3188.597	None
DP0109	TW0109	DP0109-00-0316-2_10	TW0109-00-0316	3/8/2016	3/11/2016	2-10'	1242714.047760	667661.901396	3188.597	None
DP0109	TW0109	DP0109-00-0316-19	TW0109-00-0316	3/10/2016	3/11/2016	19'	1242714.047760	667661.901396	3188.597	None
DP0110	NS	DP0110-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242414.164829	667565.633872	3193.661	Groundwater not observed
DP0111	NS	DP0111-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242512.464173	667568.253618	3193.394	Groundwater not observed
DP0112	NS	DP0112-00-0316-0.5	NS	3/14/2016	NS	0.5'	1242311.280193	667464.804349	3190.348	Groundwater not observed
DP0112	NS	DP0112-00-0316-4_6	NS	3/14/2016	NS	4-6'	1242311.280193	667464.804349	3190.348	Groundwater not observed
DP0113	TW0113	DP0113-00-0316-0.5	TW0113-00-0316	3/14/2016	3/19/2016	0.5'	1242416.049668	667466.307627	3193.215	None
DP0113	TW0113	DP0113-00-0316-8_10	TW0113-00-0316	3/14/2016	3/19/2016	8-10'	1242416.049668	667466.307627	3193.215	None
DP0113	TW0113	DP0113-00-0316-18	TW0113-00-0316	3/14/2016	3/19/2016	18'	1242416.049668	667466.307627	3193.215	None
DP0114	NS	DP0114-00-0316-0.5	NS	3/13/2016	NS	0.5'	1242516.226961	667471.266607	3192.966	Groundwater not observed
DP0114	NS	DP0114-00-0316-2-4	NS	3/13/2016	NS	2-4'	1242516.226961	667471.266607	3192.966	Groundwater not observed
DP0114	NS	DP0114-00-0316-16	NS	3/13/2016	NS	16'	1242516.226961	667471.266607	3192.966	Groundwater not observed
DP0115	TW0115	DP0115-00-0316-0.5	TW0115-00-0316	3/13/2016	3/19/2016	0.5'	1242612.976440	667471.302368	3191.907	None
DP0115	TW0115	DP0115-00-0316-6_8	TW0115-00-0316	3/13/2016	3/19/2016	6-8'	1242612.976440	667471.302368	3191.907	None
DP0115	TW0115	DP0115-00-0316-19	TW0115-00-0316	3/13/2016	3/19/2016	19'	1242612.976440	667471.302368	3191.907	None
DP0116	TW0116	DP0116-00-0316-0.5	TW0116-00-0316	3/8/2016	3/9/2016	0.5'	1242034.136390	667315.718690	3177.991	None

Table 6-0
Coordinate and Ground Surface Elevation Data for Stage 1 Sample Point Locations
Area of Concern PFC-1, Ellsworth Air Force Base

Soil Boring ID	Temporary Well ID	Soil Sample ID	Groundwater Sample ID	Soil Sample Date Collected	Groundwater Sample Date Collected	Soil Sample Depth	Easting	Northing	Ground Surface Elevation (ft. MSL)	Comments
DP0116	TW0116	DP0116-00-0316-2_10	TW0116-00-0316	3/8/2016	3/9/2016	2-10'	1242034.136390	667315.718690	3177.991	None
DP0117	TW0116	DP0117-00-0316-0.5	TW0116-00-0316	3/18/2016	3/9/2016	0.5'	1242313.434388	667370.439053	3191.373	None
DP0118	NS	DP0118-00-0316-0.5	NS	3/14/2016	NS	0.5'	1242410.175336	667370.556178	3192.448	Groundwater not observed
DP0118	NS	DP0118-00-0316-2_4	NS	3/14/2016	NS	2-4'	1242410.175336	667370.556178	3192.448	Groundwater not observed
DP0118	NS	DP0118-00-0316-16	NS	3/14/2016	NS	16'	1242410.175336	667370.556178	3192.448	Groundwater not observed
DP0119	NS	DP0119-00-0316-0.5	NS	3/14/2016	NS	0.5'	1242510.022577	667367.466289	3192.096	Groundwater not observed
DP0119	NS	DP0119-00-0316-8_10	NS	3/14/2016	NS	8-10'	1242510.022577	667367.466289	3192.096	Groundwater not observed
DP0119	NS	DP0119-00-0316-13	NS	3/14/2016	NS	13'	1242510.022577	667367.466289	3192.096	Groundwater not observed
DP0120	NS	DP0120-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242610.323230	667370.220221	3192.162	Groundwater not observed
DP0121	NS	DP0121-00-0316-0.5	NS	3/14/2016	NS	0.5'	1242314.559714	667269.147588	3184.741	Groundwater not observed
DP0121	NS	DP0121-00-0316-2_4	NS	3/14/2016	NS	2-4'	1242314.559714	667269.147588	3184.741	Groundwater not observed
DP0121	NS	DP0121-00-0316-21	NS	3/14/2016	NS	21'	1242314.559714	667269.147588	3184.741	Groundwater not observed
DP0122	TW0122	DP0122-00-0316-0.5	TW0122-00-0316	3/14/2016	3/16/2016	0.5'	1242411.645149	667264.329357	3191.135	None
DP0122	TW0122	DP0122-00-0316-6_8	TW0122-00-0316	3/14/2016	3/16/2016	6-8'	1242411.645149	667264.329357	3191.135	None
DP0122	TW0122	DP0122-00-0316-15	TW0122-00-0316	3/14/2016	3/16/2016	15'	1242411.645149	667264.329357	3191.135	None
DP0123	NS	DP0123-00-0316-0.5	NS	3/14/2016	NS	0.5'	1242510.868376	667272.485836	3192.8	Borehole Collapse
DP0123	NS	DP0123-00-0316-2_4	NS	3/14/2016	NS	2-4'	1242510.868376	667272.485836	3192.8	Borehole Collapse
DP0123	NS	DP0123-00-0316-17.5	NS	3/14/2016	NS	17.5'	1242510.868376	667272.485836	3192.8	Borehole Collapse
DP0124	TW0124	DP0124-00-0316-0.5	TW0124-00-0316	3/9/2016	3/16/2016	0.5'	1242612.682805	667270.308019	3190.979	None
DP0124	TW0124	DP0124-00-0316-8_10	TW0124-00-0316	3/9/2016	3/16/2016	8-10'	1242612.682805	667270.308019	3190.979	None
DP0124	TW0124	DP0124-00-0316-17	TW0124-00-0316	3/14/2016	3/16/2016	17'	1242612.682805	667270.308019	3190.979	None
DP0125	NS	DP0125-00-0316-0.5	NS	3/16/2016	NS	0.5'	1242865.053691	667302.442797	3183.322	Borehole Collapse
DP0125	NS	DP0125-00-0316-2_10	NS	3/16/2016	NS	2-10'	1242865.053691	667302.442797	3183.322	Borehole Collapse
DP0125	NS	DP0125-00-0316-10	NS	3/16/2016	NS	10'	1242865.053691	667302.442797	3183.322	Borehole Collapse
DP0126	NS	DP0126-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242323.831349	667196.261907	3181.482	Groundwater not observed
DP0127	NS	DP0127-00-0316-0.5	NS	3/15/2016	NS	0.5'	1242409.095614	667168.660913	3189.663	Groundwater not observed
DP0127	NS	DP0127-00-0316-4_6	NS	3/15/2016	NS	4-6'	1242409.095614	667168.660913	3189.663	Groundwater not observed
DP0127	NS	DP0127-00-0316-17	NS	3/15/2016	NS	17'	1242409.095614	667168.660913	3189.663	Groundwater not observed
DP0128	NS	DP0128-00-0316-0.5	NS	3/15/2016	NS	0.5'	1242509.738457	667167.753762	3190.641	Groundwater not observed
DP0128	NS	DP0128-00-0316-8_10	NS	3/15/2016	NS	8-10'	1242509.738457	667167.753762	3190.641	Groundwater not observed
DP0128	NS	DP0128-00-0316-15	NS	3/15/2016	NS	15'	1242509.738457	667167.753762	3190.641	Groundwater not observed
DP0129	NS	DP0129-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242615.660817	667170.551001	3191.413	Groundwater not observed
DP0130	TW0130	DP0130-00-0316-0.5	TW0130-00-0316	3/16/2016	3/19/2016	0.5'	1242312.351057	667073.660119	3173.493	None
DP0130	TW0130	DP0130-00-0316-2_4	TW0130-00-0316	3/16/2016	3/19/2016	2-4'	1242312.351057	667073.660119	3173.493	None
DP0130	TW0130	DP0130-00-0316-14	TW0130-00-0316	3/16/2016	3/19/2016	14'	1242312.351057	667073.660119	3173.493	None
DP0131	NS	DP0131-00-0316-0.5	NS	3/16/2016	NS	0.5'	1242405.231776	667072.637811	3180.609	Groundwater not observed
DP0131	NS	DP0131-00-0316-6_8	NS	3/16/2016	NS	6-8'	1242405.231776	667072.637811	3180.609	Groundwater not observed
DP0132	NS	DP0132-00-0316-0.5	NS	3/15/2016	NS	0.5'	1242510.207288	667066.347141	3187.23	Groundwater not observed
DP0132	NS	DP0132-00-0316-8_10	NS	3/15/2016	NS	8-10'	1242510.207288	667066.347141	3187.23	Groundwater not observed
DP0133	NS	DP0133-00-0316-0.5	NS	3/15/2016	NS	0.5'	1242607.279273	667081.148293	3188.86	Groundwater not observed
DP0133	NS	DP0133-00-0316-4_6	NS	3/15/2016	NS	4-6'	1242607.279273	667081.148293	3188.86	Groundwater not observed

Table 6-0
Coordinate and Ground Surface Elevation Data for Stage 1 Sample Point Locations
Area of Concern PFC-1, Ellsworth Air Force Base

Soil Boring ID	Temporary Well ID	Soil Sample ID	Groundwater Sample ID	Soil Sample Date Collected	Groundwater Sample Date Collected	Soil Sample Depth	Easting	Northing	Ground Surface Elevation (ft. MSL)	Comments
DP0133	NS	DP0133-00-0316-14	NS	3/15/2016	NS	14'	1242607.279273	667081.148293	3188.86	Groundwater not observed
DP0133	NS	DP0133-00-0316-16	NS	3/15/2016	NS	16'	1242607.279273	667081.148293	3188.86	Groundwater not observed
DP0134	NS	DP0134-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242413.720933	666971.317804	3173.925	Groundwater not observed
DP0135	NS	DP0135-00-0316-0.5	NS	3/18/2016	NS	0.5'	1242511.024872	666964.543539	3179.114	Groundwater not observed
DP0136	NS	DP0136-00-0316-20	NS	3/18/2016	NS	20'	1242270.997137	666815.124874	3172.283	Groundwater not observed
DP0136	NS	DP0136-00-0316-0.5	NS	3/12/2016	NS	0.5'	1242270.997137	666815.124874	3172.283	Groundwater not observed
DP0136	NS	DP0136-00-0316-2_10	NS	3/12/2016	NS	2-10'	1242270.997137	666815.124874	3172.283	Groundwater not observed
DP0137	NS	DP0137-00-0316-0.5	NS	3/13/2016	NS	0.5'	1241983.274287	666625.763377	3190.083	Groundwater not observed
DP0137	NS	DP0137-00-0316-2_10	NS	3/13/2016	NS	2-10'	1241983.274287	666625.763377	3190.083	Groundwater not observed
DP0138	TW0138	DP0138-00-0316-0.5	TW0138-00-0316	3/13/2016	3/14/2016	0.5'	1242395.613029	666621.750917	3165.428	None
DP0138	TW0138	DP0138-00-0316-2_10	TW0138-00-0316	3/13/2016	3/14/2016	2-10'	1242395.613029	666621.750917	3165.428	None
DP0138	TW0138	DP0138-00-0316-13	TW0138-00-0316	3/13/2016	3/14/2016	13'	1242395.613029	666621.750917	3165.428	None
DP0139	TW0139	DP0139-00-0316-0.5	TW0139-00-0316	3/19/2016	3/19/2016	0.5'	1242587.606412	666620.453020	3153.444	None
DP0139	TW0139	DP0139-00-0316-1.0	TW0139-00-0316	3/19/2016	3/19/2016	1'	1242587.606412	666620.453020	3153.444	None
DP0140	NS	DP0140-00-0316-0.5	NS	3/13/2016	NS	0.5'	1241980.069897	666171.502474	3161.429	Groundwater not observed
DP0140	NS	DP0140-00-0316-2_10	NS	3/13/2016	NS	2-10'	1241980.069897	666171.502474	3161.429	Groundwater not observed
DP0141	TW0141	DP0141-00-0316-0.5	TW0141-00-0316	3/8/2016	3/11/2016	0.5'	1242198.029107	666175.375170	3162.97	None
DP0141	TW0141	DP0141-00-0316-2_10	TW0141-00-0316	3/8/2016	3/11/2016	2-10'	1242198.029107	666175.375170	3162.97	None
DP0141	TW0141	DP0141-00-0316-31.8	TW0141-00-0316	3/10/2016	3/11/2016	31.8'	1242198.029107	666175.375170	3162.97	None
DP0142	TW0142	DP0142-00-0316-0.5	TW0142-00-0316	3/10/2016	3/11/2016	0.5'	1242386.627811	666168.227546	3162.591	None
DP0142	TW0142	DP0142-00-0316-2_10	TW0142-00-0316	3/10/2016	3/11/2016	2-10'	1242386.627811	666168.227546	3162.591	None
DP0142	TW0142	DP0142-00-0316-16.5	TW0142-00-0316	3/10/2016	3/11/2016	16.5'	1242386.627811	666168.227546	3162.591	None
DP0143	TW0143	DP0143-00-0316-0.5	TW0143-00-0316	3/10/2016	3/12/2016	0.5'	1242808.012139	666159.792196	3154.753	None
DP0143	TW0143	DP0143-00-0316-2_10	TW0143-00-0316	3/10/2016	3/12/2016	2-10'	1242808.012139	666159.792196	3154.753	None
DP0143	TW0143	DP0143-00-0316-18	TW0143-00-0316	3/11/2016	3/12/2016	18'	1242808.012139	666159.792196	3154.753	None
DP0144	NS	DP0144-00-0316-0.5	NS	3/11/2016	NS	0.5'	1243210.277410	666177.230481	3172.812	Insufficient water for sample collection
DP0144	NS	DP0144-00-0316-2_10	NS	3/11/2016	NS	2-10'	1243210.277410	666177.230481	3172.812	Insufficient water for sample collection
DP0145	NS	DP0145-00-0316-0.5	NS	3/10/2016	NS	0.5'	1242578.154659	665760.598768	3145.191	Groundwater not observed
DP0145	NS	DP0145-00-0316-2_10	NS	3/10/2016	NS	2-10'	1242578.154659	665760.598768	3145.191	Groundwater not observed
DP0145	NS	DP0145-00-0316-12	NS	3/10/2016	NS	12'	1242578.154659	665760.598768	3145.191	Groundwater not observed
DP0146	TW0146	DP0146-00-0316-0.5	TW0146-00-0316	3/12/2016	3/13/2016	0.5'	1241906.226213	665416.300572	3138.212	None
DP0146	TW0146	DP0146-00-0316-19	TW0146-00-0316	3/12/2016	3/13/2016	19'	1241906.226213	665416.300572	3138.212	None
DP0146	TW0146	DP0146-00-0316-2_10	TW0146-00-0316	3/12/2016	3/13/2016	2-10'	1241906.226213	665416.300572	3138.212	None
DP0147	NS	DP0147-00-0316-0.5	NS	3/11/2016	NS	0.5'	1242786.033180	665396.050941	3134.667	Groundwater not observed
DP0147	NS	DP0147-00-0316-2_10	NS	3/11/2016	NS	2-10'	1242786.033180	665396.050941	3134.667	Groundwater not observed
DP0147	NS	DP0147-00-0316-13	NS	3/11/2016	NS	13'	1242786.033180	665396.050941	3134.667	Groundwater not observed
DP0148	NS	DP0148-00-0316-0.5	NS	3/11/2016	NS	0.5'	1243213.533966	665313.276172	3133.748	Insufficient water for sample collection
DP0148	NS	DP0148-00-0316-13	NS	3/11/2016	NS	13'	1243213.533966	665313.276172	3133.748	Insufficient water for sample collection
DP0148	NS	DP0148-00-0316-2_10	NS	3/11/2016	NS	2-10'	1243213.533966	665313.276172	3133.748	Insufficient water for sample collection
DP0149	TW0149	DP0149-00-0316-0.5	TW0149-00-0316	3/17/2016	3/19/2016	0.5'	1243331.759123	667519.377075	3183.171	None
DP0149	TW0149	DP0149-00-0316-2_10	TW0149-00-0316	3/17/2016	3/19/2016	2-10'	1243331.759123	667519.377075	3183.171	None

Table 6-0
Coordinate and Ground Surface Elevation Data for Stage 1 Sample Point Locations
Area of Concern PFC-1, Ellsworth Air Force Base

Soil Boring ID	Temporary Well ID	Soil Sample ID	Groundwater Sample ID	Soil Sample Date Collected	Groundwater Sample Date Collected	Soil Sample Depth	Easting	Northing	Ground Surface Elevation (ft. MSL)	Comments
DP0149	TW0149	DP0149-00-0316-25	TW0149-00-0316	3/17/2016	3/19/2016	25'	1243331.759123	667519.377075	3183.171	None
DP0150	NS	DP0150-00-0316-0.5	NS	3/16/2016	NS	0.5'	1243352.866036	667506.684187	3183.22	Groundwater not observed
DP0150	NS	DP0150-00-0316-2_10	NS	3/16/2016	NS	2-10'	1243352.866036	667506.684187	3183.22	Groundwater not observed
DP0151	NS	DP0151-00-0316-0.5	NS	3/16/2016	NS	0.5'	1243342.239089	667229.291697	3171.343	Groundwater not observed
DP0151	NS	DP0151-00-0316-2_10	NS	3/16/2016	NS	2-10'	1243342.239089	667229.291697	3171.343	Groundwater not observed

Notes
ft. = feet
MSL = Mean Sea Level
NS = No Sample
Northing and Easting data collected in NAD83 South Dakota State Plane Coordinate System

Table 6-1
Surface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0101-00-0316-0.5		DP0102-00-0316-0.5		DP0102-01-0316-0.5		DP0103-00-0316-0.5		DP0103-01-0316-0.5		DP0109-00-0316-0.5		DP0104-00-0316-0.5	
Lab Sample ID:				FA32490-8		FA32423-11		FA32423-12		FA32490-2		FA32490-3		FA32234-1		FA32423-15	
Date Sampled:				3/18/2016		3/17/2016		3/17/2016		3/18/2016		3/18/2016		3/8/2016		3/17/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	8.3	U	9.9	U	9.2	U	10	U	9	U	*5.83*	J	9.6	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	*12*	UJ	9.6	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	8.3	U	9.9	U	9.2	U	10	U	9	U	*12*	UJ	9.6	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	8.3	U	9.9	U	9.2	U	10	U	9	U	12	U	9.6	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	8.3	U	9.9	U	9.2	U	*9.59*	J	*5.82*	J	*11.4*	J	9.6	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	8.3	U	9.9	U	*5.37*	J	10	U	9	U	51.1		*5.13*	J
General Chemistry																	
Solids, Percent	%			85.3		84.5		80.7		85.5		85.8		85.9		80.5	

Client Sample ID:				DP0105-00-0316-0.5		DP0105-01-0316-0.5		DP0106-00-0316-0.5		DP0107-00-0316-0.5		DP0108-00-0316-0.5		DP0110-00-0316-0.5		DP0110-01-0316-0.5	
Lab Sample ID:				FA32423-4		FA32423-5		FA32423-7		FA32448-22		FA32234-3		FA32490-13		FA32490-14	
Date Sampled:				3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/8/2016		3/18/2016		3/18/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*6.91*	J	*9.66*	J	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.3	U	*8.71*	J	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	9.3	U	*8.13*	J	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	*9.3*	UJ	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.3	U	12	U	9.1	U	8.9	U	8.6	U	11	U	8.3	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	9.3	U	45.8		9.1	U	8.9	U	*5.13*	J	*10*	J	*9.45*	J
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	9.3	U	*8.51*	J	9.1	U	8.9	U	192		106		159	
General Chemistry																	
Solids, Percent	%			85.8		81.3		85.1		78.9		83.4		85.3		85	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL Residential Soil (USEPA, 2016c).

NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.

Analytical information for these compounds will be obtained to inform the conceptual site model.

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-1
Surface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0104-01-0316-0.5		DP0112-00-0316-0.5		DP0113-00-0316-0.5		DP0114-00-0316-0.5		DP0115-00-0316-0.5		DP0116-00-0316-0.5		DP0117-00-0316-0.5	
Lab Sample ID:				FA32423-16		FA32390-26		FA32390-23		FA32270-4		FA32270-1		FA32234-5		FA32490-16	
Date Sampled:				3/17/2016		3/14/2016		3/14/2016		3/13/2016		3/13/2016		3/8/2016		3/18/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	9.1	U	8.4	U	32.1		1,460		7.8	U	12	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.1	U	8.4	U	*7.22*	J	220		7.8	U	12	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	9.1	U	8.4	U	70.4		7,220		7.8	U	12	U	*6.2*	J
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.1	U	*5.26*	J	*8.41*	J	*33.4*	J	*6.15*	J	12	U	16.1	
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.1	U	8.4	U	9	U	52	U	7.8	U	12	U	11	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.1	U	8.4	U	9	U	52	U	7.8	U	12	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.1	U	8.4	U	9	U	52	U	7.8	U	12	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.1	U	8.4	U	9	U	52	U	7.8	U	12	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.1	U	8.4	U	9	U	52	U	7.8	U	12	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.1	U	8.4	U	16.2		864		7.8	U	12	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	9.1	U	*5.8*	J	*422*	J	14,000		*8.23*	J	12	U	13.6	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	*5.52*	J	414		10,000		32,900		731		12	U	533	
General Chemistry																	
Solids, Percent	%			84.2		84.6		88.5		94.2		87		81.9		85.8	

Client Sample ID:				DP0111-00-0316-0.5		DP0120-00-0316-0.5		DP0120-01-0316-0.5		DP0121-00-0316-0.5		DP0122-00-0316-0.5		DP0123-00-0316-0.5		DP0124-00-0316-0.5	
Lab Sample ID:				FA32490-15		FA32490-17		FA32490-18		FA32390-20		FA32390-17		FA32390-14		FA32234-9	
Date Sampled:				3/18/2016		3/18/2016		3/18/2016		3/14/2016		3/14/2016		3/14/2016		3/9/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	9.2	U	9.6	U	8.3	U	9.6	U	*8.37*	J	10	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.2	U	9.6	U	8.3	U	9.6	U	*6.84*	J	10	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	*6.07*	J	9.6	U	*6.81*	J	*9.52*	J	18.5		*5.79*	J	*7.14*	J
Perfluorononanoic acid	ug/kg	375-95-1	NS	*6.01*	J	9.6	U	8.3	U	*5.63*	J	15.1		10	U	*5.97*	J
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.2	U	*5.75*	J	8.3	U	9.6	U	10	U	10	U	*10.3*	J
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.2	U	9.6	U	8.3	U	9.6	U	10	U	10	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.2	U	9.6	U	8.3	U	9.6	U	10	U	10	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.2	U	9.6	U	8.3	U	9.6	U	10	U	10	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.2	U	9.6	U	8.3	U	9.6	U	10	U	10	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.2	U	9.6	U	8.3	U	9.6	U	10	U	10	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	15.9		*7.53*	J	16.4		22.8		45		17.4		18.9	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	1,680		279		1,790		298		1,460		251		803	
General Chemistry																	
Solids, Percent	%			88.8		89.6		87.2		83		88.7		82.5		79.1	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL Residential Soil (USEPA, 2016c).

NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.

Analytical information for these compounds will be obtained to inform the conceptual site model.

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessm

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-1
Surface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0118-00-0316-0.5		DP0119-00-0316-0.5		DP0127-00-0316-0.5		DP0128-00-0316-0.5		DP0129-00-0316-0.5		DP0130-00-0316-0.5		DP0131-00-0316-0.5	
Lab Sample ID:				FA32390-28		FA32390-30		FA32390-1		FA32390-4		FA32490-19		FA32448-4		FA32448-2	
Date Sampled:				3/14/2016		3/14/2016		3/15/2016		3/15/2016		3/18/2016		3/16/2016		3/16/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	27.4		*5.77*	J	11	U	8.9	U	*4.66*	J	9.8	U	*5.19*	J
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	21	U	10	U	*6.79*	J	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	142		*6.72*	J	27.3		*9.11*	J	*7.58*	J	9.8	U	*5.73*	J
Perfluorononanoic acid	ug/kg	375-95-1	NS	52.1		10	U	*7.82*	J	*4.71*	J	8.6	U	*8.06*	J	*8.23*	J
Perfluorodecanoic acid	ug/kg	335-76-2	NS	21	U	10	U	11	U	*4.45*	J	8.6	U	9.8	U	9.5	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	21	U	10	U	11	U	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	21	U	10	U	11	U	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	21	U	10	U	11	U	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	21	U	10	U	11	U	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	*13.5*	J	10	U	11	U	8.9	U	8.6	U	9.8	U	9.5	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	771		30.5		57.3		21.4		16.1		24		*11.9*	J
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	38,300		588		3,150		189		757		504		475	
General Chemistry																	
Solids, Percent	%			88		87.2		81.4		84.7		86.2		87.6		92	

Client Sample ID:				DP0125-00-0316-0.5		DP0126-00-0316-0.5		DP0135-00-0316-0.5		DP0136-00-0316-0.5		DP0137-00-0316-0.5		DP0138-00-0316-0.5		DP0139-00-0316-0.5	
Lab Sample ID:				FA32448-6		FA32490-20		FA32490-22		FA32270-25		FA32270-12		FA32270-14		FA32490-39	
Date Sampled:				3/16/2016		3/18/2016		3/18/2016		3/12/2016		3/13/2016		3/13/2016		3/19/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	8.8	U	9.2	U	*6.09*	J	10	U	10	U	11	U	12	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	8.8	U	9.2	U	*9.57*	J	10	U	10	U	11	U	12	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	8.8	U	16.8		25.1		10	U	10	U	11	U	12	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	8.8	U	9.2	U	18.8		10	U	10	U	11	U	12	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	8.8	U	9.2	U	*5.73*	J	10	U	10	U	11	U	12	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	8.8	U	9.2	U	11	U	10	U	10	U	11	U	12	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	8.8	U	9.2	U	11	U	10	U	10	U	11	U	12	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	8.8	U	9.2	U	11	U	10	U	10	U	11	U	12	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	8.8	U	9.2	U	11	U	10	U	10	U	11	U	12	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	8.8	U	9.2	U	11	U	10	U	10	U	11	U	12	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	12.5		68.5		53.2		10	U	10	U	11	U	*11*	J
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	71		80.1		3,250		*12.8*	J	10	U	*5.75*	J	34.2	
General Chemistry																	
Solids, Percent	%			94.3		88.6		81.7		91.3		83.8		86.7		63.7	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL Residential Soil (USEPA, 2016c).

NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.

Analytical information for these compounds will be obtained to inform the conceptual site model.

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessm

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-1
Surface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0132-00-0316-0.5		DP0133-00-0316-0.5		DP0134-00-0316-0.5		DP0143-00-0316-0.5		DP0144-00-0316-0.5		DP0145-00-0316-0.5		DP0146-00-0316-0.5		DP0147-00-0316-0.5	
Lab Sample ID:				FA32390-11		FA32390-7		FA32490-21		FA32234-20		FA32270-23		FA32234-14		FA32270-7		FA32270-21	
Date Sampled:				3/15/2016		3/15/2016		3/18/2016		3/10/2016		3/11/2016		3/10/2016		3/12/2016		3/11/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)																
Perfluorohexanoic acid	ug/kg	307-24-4	NS	45.7		*5.01*	J	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	12.6		9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	39.3		*5.97*	J	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.1	U	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	*9.01*	J	9	U	11	U	12	U	9.5	U	9.2	U	9.9	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	141		23.3		*11.7*	J	*7.36*	J	9.5	U	9.2	U	9.9	U	11	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	186		58.6		77.8		179		*5.02*	J	85.7		9.9	U	74.1	
General Chemistry																			
Solids, Percent	%			91.2		91.6		83.1		72.3		84.4		80.9		72.4		85	

Client Sample ID:				DP0140-00-0316-0.5		DP0141-00-0316-0.5		DP0142-00-0316-0.5		DP0148-00-0316-0.5		DP0149-00-0316-0.5		DP0150-00-0316-0.5		DP0151-00-0316-0.5	
Lab Sample ID:				FA32270-10		FA32234-7		FA32234-17		FA32270-18		FA32448-14		FA32448-17		FA32448-9	
Date Sampled:				3/13/2016		3/8/2016		3/10/2016		3/11/2016		3/17/2016		3/16/2016		3/16/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	12	U	11	U	9.9	U	10	U	9.7	U	9.6	U	11	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	12	U	*11.8*	J	9.9	U	*8.05*	J	*8.46*	J	9.6	U	*13.6*	J
General Chemistry																	
Solids, Percent	%			81.4		84		84		82.2		82.9		81.7		83.3	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL Residential Soil (USEPA, 2016c).

NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.

Analytical information for these compounds will be obtained to inform the conceptual site model.

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessm

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0101-00-0316-4_6		DP0101-01-0316-4_6		DP0101-00-0316-13		DP0102-00-0316-6_8		DP0102-01-0316-6_8		DP0102-00-0316-21		DP0103-01-0316-8-10	
Lab Sample ID:				FA32490-9		FA32490-44		FA32490-10		FA32423-13		FA32423-14		FA32490-1		FA32490-5	
Date Sampled:				3/18/2016		3/18/2016		3/18/2016		3/17/2016		3/17/2016		3/18/2016		3/18/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	10	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	9.2	U	9.7	U	9.9	U	8.8	U	9.1	U	*6.72*	J	11	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	9.2	U	9.7	U	9.9	U	12.8		19.2		10	U	11	U
General Chemistry																	
Solids, Percent	%			89.4		84.7		79.8		93.9		94.4		77.8		80.2	

Client Sample ID:				DP0106-00-0316-2_10		DP0106-00-0316-2_10		DP0107-00-0316-2_10		DP0107-01-0316-2_10		DP0107-00-0316-19		DP0108-00-0316-2_10		DP0114-00-0316-16	
Lab Sample ID:				FA32423-8		FA32448-20		FA32423-1		FA32423-2		FA32423-3		FA32234-4		FA32270-6	
Date Sampled:				3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/8/2016		3/13/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	*6.59*	J
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	8.8	U	8.9	U	11	U	9.5	U	10	U	*7.14*	J	*7.7*	J
Perfluorononanoic acid	ug/kg	375-95-1	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	*6.46*	J	9.1	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	8.8	U	8.9	U	*11*	UJ	9.5	U	10	U	10	U	9.1	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	8.8	U	8.9	U	11	U	9.5	U	10	U	10	U	9.1	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	8.8	U	8.9	U	11	U	9.5	U	10	U	*11.2*	J	19.9	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	8.8	U	8.9	U	*8.47*	J	*6.72*	J	10	U	144		48.8	
General Chemistry																	
Solids, Percent	%			85.9		88.2		85.6		84.5		81.5		88.9		81.8	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0105-00-0316-18		DP0115-00-0316-19		DP0103-00-0316-13		DP0103-01-0316-13		DP0104-00-0316-4_6		DP0104-01-0316-4_6		DP0104-00-0316-21	
Lab Sample ID:				FA32423-6		FA32270-3		FA32490-6		FA32490-7		FA32423-17		FA32423-18		FA32423-19	
Date Sampled:				3/17/2016		3/13/2016		3/18/2016		3/18/2016		3/17/2016		3/17/2016		3/17/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	9.5	U	25.9		10	U	11	U	*6.88*	J	11	U	9.8	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	9.5	U	*7.01*	J	10	U	11	U	13	U	11	U	9.8	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.5	U	8.6	U	10	U	11	U	13	U	11	U	9.8	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.5	U	8.6	U	10	U	11	U	*13*	UJ	11	U	9.8	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.5	U	*8.37*	J	10	U	11	U	13	U	11	U	9.8	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	9.5	U	36		10	U	11	U	*10.3*	J	*7.95*	J	9.8	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	9.5	U	*10.8*	J	10	U	11	U	*44.9*	J	34.3		9.8	U
General Chemistry																	
Solids, Percent	%			82.8		80.9		79		76.3		78.2		78.6		84	

Client Sample ID:				DP0115-00-0316-6_8		DP0116-00-0316-2_10		DP0118-00-0316-2_4		DP0118-00-0316-16		DP0119-00-0316-8_10		DP0124-00-0316-8_10		DP0124-00-0316-17	
Lab Sample ID:				FA32270-2		FA32234-6		FA32390-29		FA32390-33		FA32390-31		FA32234-10		FA32390-13	
Date Sampled:				3/13/2016		3/8/2016		3/14/2016		3/14/2016		3/14/2016		3/9/2016		3/14/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	29.3		11	U	1,320		*14.7*	J	23.7		70.1		10.4	
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	10	U	11	U	144		12	U	12.8		29.4		8.1	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	10	U	11	U	1,130		12	U	129		657		*6.43*	J
Perfluorononanoic acid	ug/kg	375-95-1	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	10	U	11	U	9.9	U	12	U	8.7	U	8.6	U	8.1	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	*12.1*	J	11	U	463		*6.79*	J	*5.22*	J	12.3		8.1	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	*12.3*	J	11	U	3,010		*7.44*	J	383		1,500		28	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	10	U	11	U	584		12	U	1,750		1,350		49.7	
General Chemistry																	
Solids, Percent	%			89		86		86.3		81.5		93		83		91	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0105-00-0316-6_8		DP0105-01-0316-6_8		DP0109-00-0316-19		DP0112-00-0316-4_6		DP0113-00-0316-8_10		DP0113-00-0316-18		DP0125-00-0316-2_10	
Lab Sample ID:				FA32423-9		FA32423-10		FA32234-11		FA32390-27		FA32390-24		FA32390-25		FA32448-7	
Date Sampled:				3/17/2016		3/17/2016		3/10/2016		3/14/2016		3/14/2016		3/14/2016		3/16/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*5.1*	J	*4.84*	J	*7.3*	J	9.2	U	508		39.1		*4.83*	J
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	9.9	U	8.8	U	*14*	UJ	*8.17*	J	37.4		12	U	7.9	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	9.9	U	8.8	U	14	U	36.5		247		32.4		7.9	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	9.9	U	8.8	U	14	U	9.2	U	7.3	U	12	U	7.9	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	9.9	U	8.8	U	14	U	9.2	U	308		26.3		7.9	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	9.9	U	8.8	U	*9.79*	J	82		956		119		14	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	9.9	U	8.8	U	14	U	19.5		29.2		51		99	
General Chemistry																	
Solids, Percent	%			85.2		85.6		69.9		91.1		96.4		79.5		94.5	

Client Sample ID:				DP0108-00-0316-15		DP0109-00-0316-2_10		DP0128-00-0316-8_10		DP0133-00-0316-16		DP0114-00-0316-2-4		DP0119-00-0316-13		DP0121-00-0316-2_4	
Lab Sample ID:				FA32234-12		FA32234-2		FA32390-5		FA32390-10		FA32270-5		FA32390-32		FA32390-21	
Date Sampled:				3/10/2016		3/8/2016		3/15/2016		3/15/2016		3/13/2016		3/14/2016		3/14/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	11	U	*6.72*	J	30.2		8.2	U	1,740		27		7.6	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	11	U	9.9	U	11		8.2	U	167		9.8	U	7.6	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	11	U	9.9	U	179		8.2	U	802		12		16.3	
Perfluorononanoic acid	ug/kg	375-95-1	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	11	U	9.9	U	7.5	U	8.2	U	10	U	9.8	U	7.6	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	11	U	9.9	U	*7.13*	J	8.2	U	696		*9.3*	J	7.6	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	11	U	19		418		*7.23*	J	507		44.9		72.2	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	11	U	23		609		321		148		175		28.1	
General Chemistry																	
Solids, Percent	%			90.3		93.1		96.2		88.1		85.8		72.8		91	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0125-00-0316-10		DP0127-00-0316-4_6		DP0127-00-0316-17		DP0123-00-0316-2_4		DP0123-00-0316-17.5		DP0128-00-0316-15		DP0130-00-0316-2_4	
Lab Sample ID:				FA32448-8		FA32390-2		FA32390-3		FA32390-15		FA32390-16		FA32390-6		FA32448-5	
Date Sampled:				3/16/2016		3/15/2016		3/15/2016		3/14/2016		3/14/2016		3/15/2016		3/16/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*9.51*	J	299		30.3		45.8		29.9		*8.43*	J	*10.8*	J
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	10	U	62.4		11	U	17		*5.62*	J	10	U	*5.17*	J
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	10	U	459		25.7		224		*12.7*	J	*6.81*	J	105	
Perfluorononanoic acid	ug/kg	375-95-1	NS	10	U	8.7	U	11	U	*4.62*	J	11	U	10	U	9.8	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	10	U	8.7	U	11	U	8.9	U	11	U	10	U	9.8	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	10	U	8.7	U	11	U	8.9	U	11	U	10	U	9.8	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	10	U	8.7	U	11	U	8.9	U	11	U	10	U	9.8	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	10	U	8.7	U	11	U	8.9	U	11	U	10	U	9.8	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	10	U	8.7	U	11	U	8.9	U	11	U	10	U	9.8	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	10	U	54.4		*10.5*	J	15.8		13.7		10	U	9.8	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	22.5		1,910		69.9		654		54.2		20.6		334	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	23.3		2,630		117		3,840		25		122		641	
General Chemistry																	
Solids, Percent	%			90.6		93.9		82.8		93.3		80.3		86.2		94.9	

Client Sample ID:				DP0121-00-0316-21		DP0122-00-0316-6_8		DP0122-00-0316-15		DP0131-00-0316-6_8		DP0132-00-0316-8_10		DP0133-00-0316-4_6		DP0133-00-0316-14	
Lab Sample ID:				FA32390-22		FA32390-18		FA32390-19		FA32448-3		FA32390-12		FA32390-8		FA32390-9	
Date Sampled:				3/14/2016		3/14/2016		3/14/2016		3/16/2016		3/15/2016		3/15/2016		3/15/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*6.12*	J	273		27.3		34.4		12.9		*8.08*	J	37.5	
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	11	U	60.5		*6.05*	J	*6.25*	J	9.2	U	*7.67*	J	19.9	
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	11	U	656		28.8		25.6		*9.55*	J	20.1		82.2	
Perfluorononanoic acid	ug/kg	375-95-1	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	*12.8*	J	9.6	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	*12.3*	J	9.6	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	11	U	9.6	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	11	U	9.6	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	11	U	9.6	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	11	U	8.3	U	11	U	8.2	U	9.2	U	11	U	9.6	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	11	U	173		*11.5*	J	*8.03*	J	9.2	U	11	U	9.6	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	21.6		1,880		89		114		38.5		35.5		297	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	*8.14*	J	1,150		193		16.1		29.1		2,050		2,040	
General Chemistry																	
Solids, Percent	%			81.1		95		78.4		83.5		91.3		90.2		97	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0130-00-0316-14		DP0136-00-0316-2_10		DP0136-00-0316-20		DP0136-01-0316-20		DP0137-00-0316-2_10		DP0138-00-0316-2_10		DP0138-00-0316-13	
Lab Sample ID:				FA32448-13		FA32270-26		FA32490-11		FA32490-12		FA32270-13		FA32270-15		FA32270-16	
Date Sampled:				3/16/2016		3/12/2016		3/18/2016		3/18/2016		3/13/2016		3/13/2016		3/13/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	11	U	*9.6*	UJ	*12*	UJ	11	U	9.6	U	9.6	U	11	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	11	U	9.6	U	12	U	11	U	9.6	U	9.6	U	11	U
General Chemistry																	
Solids, Percent	%			79.4		81.7		75.9		71		92.2		84.5		77.8	

Client Sample ID:				DP0139-00-0316-1.0		DP0140-00-0316-2_10		DP0141-00-0316-2_10		DP0141-00-0316-31.8		DP0142-00-0316-2_10		DP0142-00-0316-16.5		DP0143-00-0316-2_10	
Lab Sample ID:				FA32490-39		FA32270-11		FA32234-8		FA32234-13		FA32234-18		FA32234-19		FA32234-21	
Date Sampled:				3/19/2016		3/13/2016		3/8/2016		3/10/2016		3/10/2016		3/10/2016		3/10/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	*5.3*	J
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	14	U	9.9	U	9.5	U	13	U	12	U	12	U	13.5	
Perfluorononanoic acid	ug/kg	375-95-1	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	14	U	9.9	U	9.5	U	13	U	12	U	12	U	8	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	*8.98*	J	9.9	U	9.5	U	13	U	12	U	12	U	65.1	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	23.1		9.9	U	9.5	U	13	U	12	U	12	U	14.6	
General Chemistry																	
Solids, Percent	%			63.8		89.8		83.9		79.5		81.3		78.5		86	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-2
Subsurface Soil Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				DP0143-00-0316-18		DP0144-00-0316-2_10		DP0145-00-0316-2_10		DP0145-00-0316-12		DP0146-00-0316-2_10		DP0146-00-0316-19		DP0147-00-0316-2_10		DP0103-00-0316-8-10	
Lab Sample ID:				FA32270-17		FA32270-24		FA32234-15		FA32234-16		FA32270-8		FA32270-9		FA32270-22		FA32490-4	
Date Sampled:				3/11/2016		3/11/2016		3/10/2016		3/10/2016		3/12/2016		3/12/2016		3/11/2016		3/18/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)																
Perfluorohexanoic acid	ug/kg	307-24-4	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	12	U	8.8	U	10	U	10	U	11	U	9.9	U	9.6	U	10	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	12	U	8.8	U	10	U	10	U	11	U	9.9	U	*5.17*	J	10	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	12	U	8.8	U	*7.31*	J	10	U	11	U	9.9	U	38.2		10	U
General Chemistry																			
Solids, Percent	%			75.8		85.7		78.7		86.2		69.4		86.7		90.2		79.6	

Client Sample ID:				DP0147-00-0316-13		DP0148-00-0316-2_10		DP0148-00-0316-13		DP0149-00-0316-2_10		DP0149-00-0316-25		DP0150-00-0316-2_10		DP0151-00-0316-2_10	
Lab Sample ID:				FA32270-27		FA32270-19		FA32270-20		FA32448-15		FA32448-16		FA32448-18		FA32448-10	
Date Sampled:				3/11/2016		3/11/2016		3/11/2016		3/17/2016		3/17/2016		3/16/2016		3/16/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)														
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*4.52*	J	9.9	U	8.8	U	11	U	*6.78*	J	8.7	U	9.1	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	8.9	U	*9.9*	UJ	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,000**	8.9	U	9.9	U	8.8	U	11	U	11	U	8.7	U	9.1	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	*5.77*	J	9.9	U	8.8	U	11	U	20.7		8.7	U	9.1	U
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	311		9.9	U	*5.87*	J	11	U	53.5		8.7	U	9.1	U
General Chemistry																	
Solids, Percent	%			88		81.1		79.7		88.4		82.7		88.9		83.5	

Detection above USEPA OSRTI & RSL

Detection

Non-Detects (U) Reported to LOD per DOD convention
Estimated Results (J) Reported in *italics*
*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).
**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).
NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.
Analytical information for these compounds will be obtained to inform the conceptual site model.
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-3a
Soil Analytical Results Depth Profile-Potential Source Area 1
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0108							DP0109							DP0112							DP0113							DP0114						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		8.6	U	8.6	U	192			12	U	*5.83*	J	51.1			8.4	U	8.4	U	414			16.2		70.4		10,000			864		7,220		32,900	
2_10		10	U	*7.14*	J	144			9.9	U	9.9	U	23																							
2_4																														696		802		148	
4_6																9.2	U	36.5		19.5															
6_8																																			
8_10																							308		247		29.2								
GW	15	11	U	11	U	11	U	19	14	U	14	U	14	U								18	26.3		32.4		51		16	9.1	U	*7.7*	J	48.8	

Depth	DP0115							DP0118							DP0119							DP0121							DP0122						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		7.8	U	7.8	U	731			*13.5*	J	142		38,300			10	U	*6.72*	J	588			9.6	U	*9.52*	J	298			10	U	18.5		1,460	
2_10																																			
2_4									463		1,130		584										7.6	U	16.3		28.1								
4_6																																			
6_8		*12.1*	J	10	U	10	U																							173		656		1,150	
8_10																*5.22*	J	129		1,750															
GW	19	*8.37*	J	*7.01*	J	*10.8*	J	16	*6.79*	J	12	U	12	U	13	*9.3*	J	12		175		21	11	U	11	U	*8.14*	J	15	*11.5*	J	28.8		193	

Depth	DP0123							DP0124							DP0125							DP0127							DP0128						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		10	U	*5.79*	J	251			11	U	*7.14*	J	803			8.8	U	8.8	U	71			11	U	27.3		3,150			8.9	U	*9.11*	J	189	
2_10																7.9	U	7.9	U	99															
2_4		15.8		224		3,840																													
4_6																							54.4		459		2,630								
6_8																																			
8_10									12.3		657		1,350																	*7.13*	J	179		609	
GW	17.5	13.7		*12.7*	J	25		17	8.1	U	*6.43*	J	49.7		10	10	U	10	U	23.3		17	*10.5*	J	25.7		117		15	10	U	*6.81*	J	122	

Table 6-3a
Soil Analytical Results Depth Profile-Potential Source Area 1
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0130							DP0131							DP0132							DP0133							DP0136						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		9.8	U	9.8	U	504			9.5	U	*5.73*	J	475			*9.01*	J	39.3		186			9	U	*5.97*	J	58.6			10	U	10	U	*12.8*	J
2_10																														9.6	U	9.6	U	9.6	U
2_4		9.8	U	105		641																													
4_6																							11	U	20.1		2,050								
6_8									*8.03*	J	25.6		16.1																						
8_10																9.2	U	*9.55*	J	29.1															
GW	14	11	U	11	U	11	U															14	9.6	U	82.2		2,040		20	12	U	12	U	12	U
																						16	8.2	U	8.2	U	321							

Depth	DP0137							DP0138							DP0139						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		10	U	10	U	10	U		11	U	11	U	*5.75*	J		12	U	12	U	34.2	
2_10		9.6	U	9.6	U	9.6	U		9.6	U	9.6	U	9.6	U							
2_4																					
4_6																					
6_8																					
8_10																					
GW								13	11	U	11	U	11	U	1	14	U	14	U	23.1	

Saturated Soil Sample Depth (ft BGS)

Screening Level	PFBS		PFOA		PFOS
ug/kg	1,600,000		16,000		6,000

Detection above USEPA OSRTI & RSL

Detection

PFBS = Perfluorobutanesulfonic Acid

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctanesulfonic Acid

Ft BGS = feet below ground surface

GW = sample collected below water table in saturated conditions

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-3b
Soil Analytical Results Depth Profile Potential Source Area 2
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0104							DP0105							DP0106							DP0107						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		9.6	U	9.6	U	*5.13*	J		9.3	U	9.3	U	9.3	U		9.1	U	9.1	U	9.1	U		8.9	U	8.9	U	8.9	U
2_10																8.8	U	8.9	U	8.8	U		11	U	11	U	*8.47*	J
2_4																												
4_6		13	U	13	U	*44.9*	J																					
6_8									9.9	U	9.9	U	9.9	U														
8_10																												
GW	21	9.8	U	9.8	U	9.8	U	18	9.5	U	9.5	U	9.5	U								19	10	U	10	U	10	U

Saturated Soil Sample Depth (ft BGS)

SL	PFBS		PFOA		PFOS
ug/kg	1,600,000		16,000		6,000

Detection above USEPA OSRTI & RSL

Detection

PFBS = Perfluorobutanesulfonic Acid

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctanesulfonic Acid

Ft BGS = feet below ground surface

GW = sample collected below water table in saturated conditions

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-3c
Soil Analytical Results Depth Profile Potential Source Area 3
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0101							DP0102							DP0103						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		8.3	U	8.3	U	8.3	U		9.9	U	9.9	U	9.9	U		10	U	10	U	10	U
2_10																					
2_4																					
4_6		9.2	U	9.2	U	9.2	U														
6_8									8.8	U	8.8	U	12.8								
8_10																10	U	10	U	10	U
GW	13	9.9	U	9.9	U	9.9	U	21	10	U	10	U	10	U	13	10	U	10	U	10	U

Saturated Soil Sample Depth (ft BGS)

SL	PFBS		PFOA		PFOS
ug/kg	1,600,000		16,000		6,000

Detection above USEPA OSRTI & RSL

Detection

PFBS = Perfluorobutanesulfonic Acid

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctanesulfonic Acid

Ft BGS = feet below ground surface

GW = sample collected below water table in saturated conditions

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-3d
Soil Analytical Results Depth Profile-Potential Source Area 4
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0149							DP0150							DP0151						
(ft BGS)		PFBS		PFOA		PFOS			PFBS		PFOA		PFOS			PFBS		PFOA		PFOS	
0.5		9.7	U	9.7	U	*8.46*	J		9.6	U	9.6	U	9.6	U		11	U	11	U	*13.6*	J
2_10		11	U	11	U	11	U		8.7	U	8.7	U	8.7	U		9.1	U	9.1	U	9.1	U
2_4																					
4_6																					
6_8																					
8_10																					
GW	25	11	U	11	U	53.5															

Saturated Soil Sample Depth (ft BGS)

SL	PFBS		PFOA		PFOS
ug/kg	1,600,000		16,000		6,000

Detection above USEPA OSRTI & RSL

Detection

PFBS = Perfluorobutanesulfonic Acid

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctanesulfonic Acid

Ft BGS = feet below ground surface

GW = sample collected below water table in saturated conditions

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-3e
Soil Analytical Results Depth Profile-Non-Source Area
Area of Concern PFC-1, Ellsworth Air Force Base

Depth	DP0116						DP0140						DP0141						DP0142						DP0143					
(ft BGS)	PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS	
0.5	12	U	12	U	12	U	12	U	12	U	12	U	11	U	11	U	*11.8*	J	9.9	U	9.9	U	9.9	U	12	U	12	U	179	
2_10	11	U	11	U	11	U	9.9	U	9.9	U	9.9	U	9.5	U	9.5	U	9.5	U	12	U	12	U	12	U	8	U	13.5		14.6	
2_4																														
4_6																														
6_8																														
8_10																														
GW													31.8	13	U	13	U	13	U	16.5	12	U	12	U	12	U	18	12	U	12	U	12	U

Depth	DP0144						DP0145						DP0146						DP0147						DP0148					
(ft BGS)	PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS		PFBS		PFOA		PFOS	
0.5	9.5	U	9.5	U	*5.02*	J	9.2	U	9.2	U	85.7		9.9	U	9.9	U	9.9	U	11	U	11	U	74.1		10	U	10	U	*8.05*	J
2_10	8.8	U	8.8	U	8.8	U	10	U	10	U	*7.31*	J	11	U	11	U	11	U	9.6	U	9.6	U	38.2		9.9	U	9.9	U	9.9	U
2_4																														
4_6																														
6_8																														
8_10																														
GW							12	10	U	10	U	10	U	19	9.9	U	9.9	U	9.9	U	13	8.9	U	8.9	U	311		13	8.8	U	8.8	U	*5.87*	J

Saturated Soil Sample Depth (ft BGS)

SL	PFBS		PFOA		PFOS
ug/kg	1,600,000		16,000		6,000

Detection above USEPA OSRTI & RSL

Detection

PFBS = Perfluorobutanesulfonic Acid

PFOA = Perfluorooctanoic Acid

PFOS = Perfluorooctanesulfonic Acid

Ft BGS = feet below ground surface

GW = sample collected below water table in saturated conditions

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-4
March 14, 2016 Groundwater Level Measurements
Area of Concern PFC-1, Ellsworth Air Force Base

Well Location	Top of Casing Elevation (ft amsl)	DTW (ft) (TOC)	GW Elevation (ft amsl)
MW020402	3132.10	18.20	3113.90
MW060101	3191.02	24.91	3166.11
MW070101	3190.83	22.46	3168.37
MW071201	3202.54	26.49	3176.05
MW080101	3152.46	0.39	3152.07
MW080401	3153.73	25.25	3128.48
MW080402	3146.18	28.21	3117.97
MW110401	3141.91	23.85	3118.06
MW111201	3202.54	25.62	3176.92
MW870101	3190.89	14.83	3176.06
MW870211	3152.38	15.47	3136.91
MW930101	3190.95	15.94	3175.01
MW930103	3166.39	10.75	3155.64
MW930105	3190.33	14.35	3175.98
MW930107	3185.41	29.70	3155.71
MW930109	3165.84	16.07	3149.77
MW930110	3164.41	16.19	3148.22
MW930209	3147.44	28.78	3118.66
MW930210	3147.32	24.23	3123.09
MW930423	3179.90	21.54	3158.36
MW931207	3178.83	18.75	3160.08
MW931209	3168.74	9.64	3159.10
MW950102	3189.05	15.38	3173.67
MW960102	3178.76	12.48	3166.28
MW960103	3158.75	4.33	3154.42
MW960401	3187.43	8.47	3178.96
MW960402	3188.74	10.60	3178.14
MW970101	3170.52	6.32	3164.20
MW970201	3132.35	19.22	3113.13
MW970202	3125.01	10.86	3114.15
MW970401	3132.35	18.43	3113.92
MW990401	3184.57	6.30	3178.27
TW0101	3194.71	9.36	3185.35
TW0102	3197.16	22.52	3174.64
TW0103	3194.36	7.50	3186.86
TW0105	3204.59	19.00	3185.59
TW0107	3202.57	18.18	3184.39
TW0108	3191.67	12.70	3178.97
TW0109	3188.60	10.80	3177.80
TW0113	3193.22	15.00	3178.22
TW0115	3191.91	28.60	3163.31
TW0116	3177.99	5.35	3172.64
TW0122	3191.14	14.40	3176.74
TW0124	3190.98	14.90	3176.08
TW0130	3173.49	15.94	3157.55
TW0139	3153.44	1.00	3152.44
TW0141	3162.97	28.55	3134.42
TW0142	3162.59	15.60	3146.99
TW0143	3154.75	9.90	3144.85
TW0144	3172.81	32.55	3140.26
TW0146	3138.21	19.00	3119.21
TW0148	3133.75	12.85	3120.90
TW0149	3183.17	30.00	3153.17

ft = feet
amsl = Above Mean Sea Level
TOC = Top of Casing
DTW = Depth to Water

Note: Temporary Well (TW) measurements were not used for creating the groundwater table surface map due to elevation measured using GPS.

Table 6-5
Permanent Well Groundwater Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				MW020402-00-0316		MW020402-01-0316		MW870211-00-0316		MW930105-00-0316		MW930109-00-0316		MW930110-00-0316		MW930209-00-0316	
Lab Sample ID:				FA32457-2		FA32457-3		FA32457-10		FA32457-16		FA32457-15		FA32457-14		FA32457-4	
Date Sampled:				3/15/2016		3/15/2016		3/16/2016		3/16/2016		3/16/2016		3/16/2016		3/15/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)														
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	0.628		0.602		0.957		34.2		1.19		9.28		1.1	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	0.162		0.157		0.0996		3.15		0.437		1.29		0.306	
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	0.268		0.267		0.0348		3.26		1.15		8.67		0.582	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.283		0.063	U	*0.013*	J
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.008	U	0.063	U	0.008	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.008	U	0.063	U	0.008	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.008	U	0.063	U	0.008	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.008	U	0.063	U	0.008	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	0.0083	U	0.008	U	0.0083	U	0.038	U	0.008	U	0.063	U	0.008	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	0.286		0.28		0.34		9.53		0.33		4.38		0.536	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	1.44		1.55		1.26		31.7		6.82		24.2		3.29	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	1.25		1.34		0.0602		16.1		5.24		0.909		2.17	
Combined PFOA & PFOS	ug/l		0.070	1.52		1.61		0.095		19.4		6.39		9.58		2.75	

Client Sample ID:				MW931207-00-0316		MW950102-00-0316		MW960401-00-0316		MW970101-00-0316		MW970101-01-0316		MW970202-00-0316		MW990401-00-0316	
Lab Sample ID:				FA32457-7		FA32457-13		FA32457-6		FA32457-11		FA32457-12		FA32457-9		FA32457-5	
Date Sampled:				3/15/2016		3/16/2016		3/15/2016		3/16/2016		3/16/2016		3/16/2016		3/15/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)														
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	0.174		186		0.198		1.24		1.22		5.38		0.0876	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	*0.0196*	J	23.1		0.0349		0.174		0.171		0.778		*0.0158*	J
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	0.0536		71.4		0.0507		0.222		0.218		1.2		*0.0177*	J
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0548		0.0077	U
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0219		0.0077	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0083	U	0.0077	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0083	U	0.0077	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0083	U	0.0077	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	0.008	U	0.83	U	0.0077	U	0.0077	U	0.0077	U	0.0083	U	0.0077	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	0.0972		62.2		0.0831		0.641		0.629		2.68		0.0521	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	0.286		348		0.441		3.77		3.69		13.6		0.229	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	0.0696		68.2		*0.0078*	J	0.0597		0.0556		7.76		0.0077	U
Combined PFOA & PFOS	ug/l		0.070	0.1232		140		*0.0585*	J	0.2817		0.2736		8.96		*0.0177*	J

Detection above USEPA PHA or RSL

Detection

Non-Detects (U) Reported to DL in order to facilitate comparison with Screening Level

Estimated Results (J) Reported in *italics*

*Lowest DL for all aqueous samples for this Analyte

*For PFCs other than PFOA, PFOS, and PFBS the South Dakota Administrative Rule 74:54:01:05 is applied. The DL shown represents performance goals prior to analyzing Site Samples. Actual detection limits for groundwater samples varied due to matrix, preparation, or other effects.

**USEPA Office of Water (OW) Provisional Health Advisory Level for PFOA and PFOS in drinking water (USEPA, 2016a).

***The groundwater screening level for PFBS is based on the USEPA May 2016 Regional RSL for Tapwater (USEPA, 2016b).

Duplicate samples denoted by 01 after the well name.

PALs for purposes of this document are intended to represent screening levels. These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment. Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-6
Temporary Well Groundwater Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				TW0101-00-0316		TW0102-00-0316		TW0103-00-0316		TW0105-00-0316		TW0107-00-0316		TW0107-01-0316	
Lab Sample ID:				FA32490-26		FA32490-27		FA32490-28		FA32490-23		FA32490-24		FA32490-25	
Date Sampled:				3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)												
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	0.143		0.826		1.43		0.234		0.232		0.395	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	0.044		0.0739		0.211		0.0403		*0.0326*	J	0.0536	
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	0.0898		0.104		0.602		0.0854		0.0715		0.179	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	0.016	U	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.016	U	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	*0.016*	UJ	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	*0.016*	UJ	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	*0.016*	UJ	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	*0.016*	UJ	0.015	U	0.0077	U	0.013	U	0.017	U	0.016	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	0.0685		0.381		0.472		0.148		0.12		0.2	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	*0.609*	J	0.507		3.42		0.959		0.835		1.31	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	*0.373*	J	1.08		1.01		0.281		0.0582	U	0.0733	U
Combined PFOA & PFOS	ug/l		0.070	*0.4628*	J	1.184		1.612		0.3664		0.0715		0.179	

Client Sample ID:				TW0108-00-0316		TW0109-00-0316		TW0113-00-0316		TW0113-00-0316		TW0115-00-0316		TW0116-00-0316	
Lab Sample ID:				FA32270-29		FA32270-28		FA32490-33		FA32390-34		FA32490-35		FA32234-22	
Date Sampled:				3/11/2016		3/11/2016		3/19/2016		3/15/2016		3/19/2016		3/9/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)												
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	6.17		13.9		309		367		96.4		0.256	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	1.04		1.41		27.6		42.8		10.1		0.0542	
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	1.38		2.4		221		321		7.67		0.111	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	0.039		0.04	U	*0.309*	J	4.2	U	0.083	U	0.008	U
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.008	U	0.04	U	0.17	U	4.2	U	0.083	U	0.008	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.008	U	0.04	U	0.17	U	4.2	U	0.083	U	0.008	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.008	U	0.04	U	0.17	U	4.2	U	0.083	U	0.008	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	*0.008*	UJ	*0.04*	UJ	0.17	U	*4.2*	UJ	0.083	U	*0.008*	UJ
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	*0.008*	UJ	*0.04*	UJ	0.17	U	*4.2*	UJ	0.083	U	*0.008*	UJ
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	2.03		6.19		139		217		28.8		0.204	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	10.1		22.3		763		1,480		70.8		1.33	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	5.92		10.6		41.6		48.9		2.21		0.0594	
Combined PFOA & PFOS	ug/l		0.070	7.3		13		262.6		369.9		9.88		0.1704	

Detection above USEPA PHA or RSL
Detection

Non-Detects (U) Reported to DL in order to facilitate comparison with Screening Level
Duplicate samples denoted by 01 after the well name.
Estimated Results (J) Reported in *italics*
*Lowest DL for all aqueous samples for this Analyte
*For PFCs other than PFOA, PFOS, and PFBS the South Dakota Administrative Rule 74:54:01:05 is applied.
The DL shown represents performance goals prior to analyzing Site Samples.
Actual detection limits for groundwater samples varied due to matrix, preparation, or other effects.
**USEPA Office of Water (OW) Provisional Health Advisory Level for PFOA and PFOS in drinking water (USEPA, 2016a).
***The groundwater screening level for PFBS is based on the USEPA May 2016 Regional RSL for Tapwater (USEPA, 2016b).
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-6
Temporary Well Groundwater Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				TW0122-00-0316		TW0124-00-0316		TW0130-00-0316		TW0138-00-0316		TW0138-00-0316		TW0138-01-0316	
Lab Sample ID:				FA32448-12		FA32448-11		FA32490-36		FA32390-35		FA32490-37		FA32490-38	
Date Sampled:				3/16/2016		3/16/2016		3/19/2016		3/14/2016		3/19/2016		3/19/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)												
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	207		205		9.43		0.0627		0.0726		0.0717	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	30.9		23.3		1.62		0.0257		0.0227		0.0222	
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	206		75.8		14.4		0.0425		0.0453		0.0407	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	1.59		0.697		0.141		0.0077	U	0.0077	U	0.0077	U
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.225		0.083	U	0.017	U	0.0077	U	0.0077	U	0.0077	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.083	U	0.083	U	0.017	U	0.0077	U	0.0077	U	0.0077	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.083	U	0.083	U	0.017	U	0.0077	U	0.0077	U	0.0077	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	0.083	U	0.083	U	0.017	U	*0.0077*	UJ	0.0077	U	0.0077	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	0.083	U	0.083	U	0.017	U	*0.0077*	UJ	0.0077	U	0.0077	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	90.9		72.4		3.11		0.0722		0.0675		0.0673	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	617		410		53.1		0.495		0.43		0.426	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	345		170		22.9		0.0357		0.0331		0.0351	
Combined PFOA & PFOS	ug/l		0.070	551		246		37.3		0.0782		0.0784		0.0758	

Client Sample ID:				TW0139-00-0316		TW0141-00-0316		TW0142-00-0316		TW0143-00-0316		TW0146-00-0316		TW0149-00-0316	
Lab Sample ID:				FA32490-41		FA32270-30		FA32270-31		FA32270-32		FA32270-33		FA32490-32	
Date Sampled:				3/19/2016		3/11/2016		3/11/2016		3/12/2016		3/13/2016		3/19/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)												
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	8.92		1.11		0.806		6.9		0.167		44.5	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	1.51		0.284		0.273		0.79		0.0562		5.09	
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070	1.24		0.548		0.508		1.67		0.129		4.91	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	0.0477		0.0083	U	*0.00985*	J	0.0332		0.01	U	0.14	U
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	0.0524		0.0083	U	0.0077	U	0.0234		0.01	U	0.14	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.008	U	0.0083	U	0.0077	U	0.008	U	0.01	U	0.14	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.008	U	0.0083	U	0.0077	U	0.008	U	0.01	U	0.14	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	0.008	U	*0.0083*	UJ	*0.0077*	UJ	*0.008*	UJ	*0.01*	UJ	0.14	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	0.008	U	*0.0083*	UJ	*0.0077*	UJ	*0.008*	UJ	*0.01*	UJ	0.14	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	4.25		0.437		0.395		3.48		0.0472		19.7	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	10.7		2.84		2.55		13.8		0.218		67.6	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070	5.16		0.688		1.61		11.7		*0.0127*	J	3.58	
Combined PFOA & PFOS	ug/l		0.070	6.4		1.236		2.118		13.37		*0.1417*	J	8.49	

Detection above USEPA PHA or RSL
Detection

Non-Detects (U) Reported to DL in order to facilitate comparison with Screening Level
Duplicate samples denoted by 01 after the well name.
Estimated Results (J) Reported in *italics*
*Lowest DL for all aqueous samples for this Analyte
*For PFCs other than PFOA, PFOS, and PFBS the South Dakota Administrative Rule 74:54:01:05 is applied.
The DL shown represents performance goals prior to analyzing Site Samples.
Actual detection limits for groundwater samples varied due to matrix, preparation, or other effects.
**USEPA Office of Water (OW) Provisional Health Advisory Level for PFOA and PFOS in drinking water (USEPA, 2016a).
***The groundwater screening level for PFBS is based on the USEPA May 2016 Regional RSL for Tapwater (USEPA, 2016b).
PALs for purposes of this document are intended to represent screening levels.
These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.
Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-7
Sediment Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				SD0101-00-0316		SD0102-00-0316		SD0102-01-0316		SD0103-00-0316		SD0104-00-0316	
Lab Sample ID:				FA32457-18		FA32457-20		FA32457-22		FA32457-24		FA32457-25	
Date Sampled:				3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/17/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/Kg)										
Perfluorohexanoic acid	ug/kg	307-24-4	NS	*15.6*	J	*7.01*	J	19		72.7		13	U
Perfluoroheptanoic acid	ug/kg	375-85-9	NS	14	U	10	U	11	U	24	U	13	U
Perfluorooctanoic acid (PFOA)	ug/kg	335-67-1	16,000*	14	U	10	U	*5.96*	J	*17.4*	J	13	U
Perfluorononanoic acid	ug/kg	375-95-1	NS	14	U	10	U	11	U	24	U	13	U
Perfluorodecanoic acid	ug/kg	335-76-2	NS	14	U	10	U	11	U	24	U	13	U
Perfluoroundecanoic acid	ug/kg	2058-94-8	NS	14	U	10	U	11	U	*24*	UJ	13	U
Perfluorododecanoic acid	ug/kg	307-55-1	NS	14	U	10	U	11	U	*24*	UJ	13	U
Perfluorotridecanoic acid	ug/kg	72629-94-8	NS	14	U	10	U	11	U	*24*	UJ	13	U
Perfluorotetradecanoic acid	ug/kg	376-06-7	NS	14	U	10	U	11	U	*24*	UJ	13	U
Perfluorobutanesulfonic acid (PFBS)	ug/kg	375-73-5	1,600,00**	*7.41*	J	10	U	*9.02*	J	33.2		13	U
Perfluorohexanesulfonic acid	ug/kg	355-46-4	NS	67.2		25.9		70.4		163		*13.6*	J
Perfluorooctanesulfonic acid (PFOS)	ug/kg	1763-23-1	6,000*	155		62.8		200		*130*	J	17.9	
General Chemistry													
Solids, Percent	%			64.0		77.8		67.6		31.9		59.8	

Detection

Non-Detects (U) Reported to LOD per DOD convention

Estimated Results (J) Reported in *italics*

*Soil screening levels for PFOA and PFOS are based on the USEPA OSRTI regional screening levels (USEPA, 2009).

**The soil screening level for PFBS is based on the USEPA May 2016 RSL for Residential Soil (USEPA, 2016c).

NS - No Standard; For PFCs other than PFOA, PFOS, and PFBS, as of the time of this writing there is no standard and therefore the soil screening and action limits are not applicable.

Analytical information for these compounds will be obtained to inform the conceptual site model.

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 6-8
Surface Water Analytical Results
Area of Concern PFC-1, Ellsworth Air Force Base

Client Sample ID:				SW0101-00-0316		SW0102-00-0316		SW0102-01-0316		SW0103-00-0316		SW0104-00-0316	
Lab Sample ID:				FA32457-19		FA32457-21		FA32457-23		FA32457-28		FA32457-26	
Date Sampled:				3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/17/2016	
LC/MS/MS EPA 537MOD	Units	CAS Number	Screening Level (ug/L)										
Perfluorohexanoic acid	ug/l	307-24-4	0.0077*	2.2		4.27		4.07		11.7		6.81	
Perfluoroheptanoic acid	ug/l	375-85-9	0.0076*	0.253		*0.458*	J	*0.49*	J	*0.669*	J	*0.705*	J
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.070**	0.394		0.808		0.746		1.34		1.4	
Perfluorononanoic acid	ug/l	375-95-1	0.0076*	*0.0103*	J	*0.0197*	J	*0.0214*	J	*0.0274*	J	*0.0332*	J
Perfluorodecanoic acid	ug/l	335-76-2	0.0076*	*0.0173*	J	*0.0289*	J	*0.0323*	J	*0.0298*	J	*0.0321*	J
Perfluoroundecanoic acid	ug/l	2058-94-8	0.0076*	0.008	U	0.0077	U	0.0077	U	0.0078	U	0.0076	U
Perfluorododecanoic acid	ug/l	307-55-1	0.0076*	0.008	U	0.0077	U	0.0077	U	0.0078	U	0.0076	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.0076*	0.008	U	0.0077	U	0.0077	U	0.0078	U	0.0076	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.0076*	0.008	U	0.0077	U	0.0077	U	0.0078	U	0.0076	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380***	1.27		2.42		2.33		5.55		3.56	
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.0077*	5.13		9.76		9.41		20.8		14.6	
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.070**	0.787		2.33		2.25		5.58		3.99	
Combined PFOA & PFOS	ug/l		0.070**	1.181		3.138		2.996		6.92		5.39	

Detection above USEPA PHA or RSL

Detection

Non-Detects (U) Reported to DL in order to facilitate comparison with Screening Level

Duplicate samples denoted by 01 after the well name.

Estimated Results (J) Reported in *italics*

*Lowest DL for all aqueous samples for this Analyte

the South Dakota Administrative Rule

**USEPA Office of Water (OW) Provisional Health Advisory Level for PFOA and PFOS in drinking water (USEPA, 2016a).

***The groundwater screening level for PFBS is based on the USEPA May 2016 Regional RSL for Tapwater (USEPA, 2016b).

PALs for purposes of this document are intended to represent screening levels.

These values will be used to identify whether a compound is a COPC to be evaluated in the Human Health Risk Assessment.

Final action limits will be derived from the risk assessment and may or may not correspond to the limits specified here.

Table 7-1
Field Quality Control Sample Summary
Area of Concern PFC-1, Ellsworth Air Force Base

	Proposed Investigative Samples	Actual Investigative Samples	Proposed MS/MSD Samples (5%)	Needed MS/MSD Samples	Actual MS/MSD Samples (5%)	Proposed Field Duplicate Samples (10%)	Needed Field Duplicate Samples	Actual Field Duplicate Samples (10%)	Proposed Equipment Blanks	Actual Equipment Blanks	QC Goals Met?
Stage 1, Surface Soil Samples	51	51	3	3	3	6	6	6	0	0	Yes
Stage 1, Subsurface Soil Samples	86	77	5	4	4	9	8	8	0	4*	Yes
Stage 1, Temporary Wells	43	22	3	2	2	5	2	2	0	2**	Yes
Stage 1 Sediment Samples	4	4	1	1	1	1	1	1	1	1**	Yes
Stage 1 Surface Water Samples	4	4	1	1	1	1	1	1	0	0	Yes
Existing Monitor Wells	12	12	1	1	1	2	2	2	0	3**	Yes

*Reusable stainless steel bowls and spoons or trowels were used for subsurface soil samples and sediment samples.
**Water Level Indicater used to measure depth to water.

Table 8-1
Proposed Stage 2 Field Activities Summary and Rationale

Well Number	Elevation TOC (ft MSL)	Ground Elevation (ft MSL)	Approximate Well/Boring Depth (ft bgs)	Depth to Water March 2016 (ft bgs)	Proposed Boring or Monitoring Well Depth (ft bgs)	Proposed for Stage II Groundwater Sampling[1]	Proposed for Analytical Surface Soil Sampling[1]	Proposed for Analytical Subsurface Soil Sampling[1]	Proposed Surface Water and Sediment Sampling[1]	Proposed for Water Level Measurement	Rationale
MW870101	3192.98	3190.89	17	16.92	NA	x	NA	NA	NA	x	Location between current and former FTA. Well will be sampled if sufficient water is present. Insufficient water existed to sample this well in March 2016.
MW870211	3154.87	3152.38	30	17.96	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW930101	3193.54	3190.95	43	18.53	NA	x	NA	NA	NA	x	Source area well, refine conceptual site model.
MW930102	3188.53	3186.17	NA	NM	NA	x	NA	NA	NA	x	Evaluate groundwater contaminant concentrations between MW930101 and MW930109.
MW930105	3192.9	3190.33	29.5	16.92	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW930107	3188.33	3185.41	36.26	32.62	NA	x	NA	NA	NA	x	Evaluate easterly groundwater contaminant contribution from PSA-1, refine groundwater gradient.
MW930109	3165.74	3165.84	25	15.97	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW930110	3164.46	3165.84	25	15.97	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW930209	3150.31	3147.44	40	9.61	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW930210	3147.2	3147.32	35	24.11	NA	x	NA	NA	NA	x	Evaluate eastern extent of groundwater contamination.
MW930408	3201.9	3198.98	48	NM	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination in PSA-2.
MW930423	3182.77	3179.9	43	24.41	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination.
MW931201	3189.14	3187.54	NA	NA	NA	x	NA	NA	NA	x	Evaluate eastern (downgradient) extent of groundwater contamination at PSA-3, evaluate groundwater to surface water contaminant relationship.
MW931207	3181.39	3178.83	30	NM	NA	x	NA	NA	NA	x	Evaluate extent of groundwater plume downgradient of PSA-4.
MW931209	3168.74	3168.71	19.41	9.61	NA	x	NA	NA	NA	x	Evaluate extent of groundwater plume downgradient of PSA-4.
MW940202	3133.88	3131.19	31	NM	NA	x	NA	NA	NA	x	Evaluate eastern extent of off-base groundwater contamination.
MW940203	3137.86	3135.2	33	NM	NA	x	NA	NA	NA	x	Evaluate eastern extent of off-base groundwater contamination.
MW950102	3191.93	3189.05	28	18.26	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW960103	3161.87	3158.75	17	7.45	NA	x	NA	NA	NA	x	Middle of plume, refine conceptual site model.
MW960401	3190.79	3187.43	23	11.83	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis; evaluate western extent of contamination.
MW960402	3191.81	3188.74	19	13.67	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination.
MW970101	3173.25	3170.52	19.5	9.05	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW970201	3135.42	3132.35	28	22.29	NA	x	NA	NA	NA	x	Evaluate southeastern extent of groundwater contamination east of MW970202.
MW970202	3127.64	3125.01	24	13.49	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW970401	3135.3	3132.35	24	21.38	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination at the property boundary; confirm detection at TW0146.
MW990401	3187.48	3184.57	17	9.21	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis.
MW020402	3135.02	3132.1	30	21.12	NA	x	NA	NA	NA	x	Sampled March 2016, data trend and analysis, evaluate center of plume at property boundary.
MW040409	3142.03	3139.02	NA	NA	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination north of proposed monitoring well location MW170113.
MW071201	3202.54	3202.54	NA	NA	NA	x	NA	NA	NA	x	Evaluate eastern (downgradient) extent of groundwater contamination at PSA-3; evaluate groundwater to surface water contaminant relationship.

Table 8-1
Proposed Stage 2 Field Activities Summary and Rationale

Well Number	Elevation TOC (ft MSL)	Ground Elevation (ft MSL)	Approximate Well/Boring Depth (ft bgs)	Depth to Water March 2016 (ft bgs)	Proposed Boring or Monitoring Well Depth (ft bgs)	Proposed for Stage II Groundwater Sampling[1]	Proposed for Analytical Surface Soil Sampling[1]	Proposed for Analytical Subsurface Soil Sampling[1]	Proposed Surface Water and Sediment Sampling[1]	Proposed for Water Level Measurement	Rationale
MW080401	3156.23	3153.73	NA	NA	NA	x	NA	NA	NA	x	Evaluate western extent of groundwater contamination north of MW040409.
MW080402	3146.18	3146.18	33	28.21	NA	x	NA	NA	NA	x	Evaluate potential southwestern extent of groundwater contamination.
MW16OW52502[2]	3191.33	3191.7	22.3	14.45	NA	x	NA	NA	NA	x	Evaluate groundwater contamination north of of PSA-1 and adjacent to current FPTA.
SB/MW170101	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate potential northern/western extent of groundwater contamination at PSA-3, evaluate groundwater to surface water contaminant relationship.
SB/MW170102	TBD	TBD	TBD	TBD	17.5	x	L	L	NA	x	Confirm PSA-3 groundwater exceedance at TW0101, TW0102, and TW0103, evaluate groundwater to surface water contaminant relationship. Soil will be logged for lithology only because proposed boring location SB170122 will be used to evaluate soil impacts to the south of the historical reinjection trench.
SB/MW170103	TBD	TBD	TBD	TBD	18.4	x	x	x	NA	x	Evaluate potential groundwater contamination upgradient of PSA-2. Evaluate soil contamination northwest of PSA-2.
SB/MW170104	TBD	TBD	TBD	TBD	15.2	x	x	x	NA	x	Evaluate potential groundwater contamination north of the current FPTA, downgradient of PSA-3. Evaluate soil contamination north of PSA-1.
SB/MW170105	TBD	TBD	TBD	TBD	13.9	x	L	L	NA	x	Confirm PSA-2 groundwater exceedance at TW0105 and TW0107. Soil will be logged for lithology only because soil was sufficiently characterized within PSA-2 during Stage 1.
SB/MW170106	TBD	TBD	TBD	TBD	14.8	x	x	x	NA	x	Evaluate potential groundwater contamination northwest of the former FPTA, downgradient of PSA-2. Evaluate soil impacts between PSA-1 and PSA-2.
SB/MW170107	TBD	TBD	TBD	TBD	18.1	x	x	x	NA	x	Evaluate potential soil groundwater contamination downgradient of current FPTA, upgradient of PSA-4, evaluate groundwater to surface water contaminant relationship.
SB/MW170108	TBD	TBD	TBD	TBD	18.7	x	x	x	NA	x	Evaluate potential northern extent of PSA-1 groundwater contamination, evaluate soil and groundwater contamination between current and former FPTA.
SB/MW170109	TBD	TBD	TBD	TBD	12.9	x	x	x	NA	x	Provide complete vertical soil contaminant profile and obtain groundwater sample at location of complete vertical soil contaminant profile.
SB/MW170110	TBD	TBD	TBD	TBD	20.7	x	x	x	NA	x	Evaluate groundwater to surface water contaminant relationship downgradient of PSA-4. Characterize previous non-detect in DP0151 Stage 1 soil samples to groundwater protection SSLs.
SB/MW170111	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate potential western extent of PSA-1 groundwater contamination. Characterize previous non-detect in DP0137 Stage 1 soil samples to groundwater protection SSLs.
SB/MW170112	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate soil contamination observed at DP0144. Evaluate potential eastern extent of PSA-1 groundwater contamination and immediately upgradient of landfill.

Table 8-1
Proposed Stage 2 Field Activities Summary and Rationale

Well Number	Elevation TOC (ft MSL)	Ground Elevation (ft MSL)	Approximate Well/Boring Depth (ft bgs)	Depth to Water March 2016 (ft bgs)	Proposed Boring or Monitoring Well Depth (ft bgs)	Proposed for Stage II Groundwater Sampling[1]	Proposed for Analytical Surface Soil Sampling[1]	Proposed for Analytical Subsurface Soil Sampling[1]	Proposed Surface Water and Sediment Sampling[1]	Proposed for Water Level Measurement	Rationale
SB/MW170113	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate potential western extent of groundwater contamination at the base boundary. Evaluate soil contamination at the base boundary. TW0146 to the east of this location showed exceedances of PFCs in groundwater.
SB/MW170114	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate potential southeastern extent of off-base groundwater contamination. Evaluate soil contamination south of the base boundary.
SB/MW170115	TBD	TBD	TBD	TBD	TBD	x	x	x	NA	x	Evaluate potential western extent of off-base groundwater contamination. Evaluate soil contamination south of the base boundary.
SB/MW170116	NA	TBD	TBD	TBD	15.4	x	x	x	NA	NA	Evaluate potential eastern extent of off-base groundwater contamination. Evaluate soil contamination south of the base boundary.
SB/MW170117	NA	TBD	TBD	TBD	TBD	x	x	x	NA	NA	Evaluate potential southwestern extent of off-base groundwater contamination. Evaluate soil contamination south of the base boundary.
SB/MW170118	NA	TBD	TBD	TBD	TBD	x	x	x	NA	NA	Evaluate potential southern extent of off-base groundwater contamination. Evaluate soil contamination south of the base boundary.
SB/MW170119	NA	TBD	TBD	TBD	TBD	x	x	x	NA	NA	Evaluate potential southern extent of off-base groundwater contamination adjacent to surface water drainage, evaluate groundwater and surface water contaminant relationship. Evaluate soil contamination south of the base boundary.
SB170120	NA	TBD	TBD*	TBD	16.8	NA	x	x	NA	NA	Vertical contaminant profile at PSA-1.
SB170121	NA	TBD	TBD*	TBD	15.7	NA	x	x	NA	NA	Vertical contaminant profile at PSA-1.
SB170122	NA	TBD	TBD*	TBD	14.6	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0102, southern extent of PSA-3.
SB170123	NA	TBD	TBD*	TBD	17.2	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0107, southern extent of PSA-2.
SB170124	NA	TBD	TBD*	TBD	16.0	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0108, northwestern extent of PSA-1.
SB170125	NA	TBD	TBD*	TBD	16.0	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0109, northeastern extent of PSA-1.
SB170126	NA	TBD	TBD*	TBD	16.0	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0109, eastern extent of PSA-1.
SB170127	NA	TBD	TBD*	TBD	16.0	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0125, eastern extent of PSA-1.
SB170128	NA	TBD	TBD*	TBD	17.2	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0104, northeastern extent of PSA-2.
SB170129	NA	TBD	TBD*	TBD	17.2	NA	x	x	NA	NA	Evaluate soil contamination observed at DP0107, southeastern extent of PSA-2.
SB170130	NA	TBD	TBD*	TBD	14.6	NA	x	x	NA	NA	Characterize non-detect Stage 1 soil to Stage 2 SSLs. Southeastern extent of PSA-3.
SB170131	NA	TBD	TBD*	TBD	14.6	NA	x	x	NA	NA	Evaluate soil contamination south of Base boundary and soil contamination observed at DP0148.

Table 8-1
Proposed Stage 2 Field Activities Summary and Rationale

Well Number	Elevation TOC (ft MSL)	Ground Elevation (ft MSL)	Approximate Well/Boring Depth (ft bgs)	Depth to Water March 2016 (ft bgs)	Proposed Boring or Monitoring Well Depth (ft bgs)	Proposed for Stage II Groundwater Sampling[1]	Proposed for Analytical Surface Soil Sampling[1]	Proposed for Analytical Subsurface Soil Sampling[1]	Proposed Surface Water and Sediment Sampling[1]	Proposed for Water Level Measurement	Rationale
SB170132	NA	3177.99	TBD	5.35	6.0	NA	x	x	NA	NA	Evaluate soil at approximate location of Stage 1 boring where PFOA, PFOS, and PFBS were non-detect. Characterize extent of soil contamination to groundwater protection SSLs.
SB170133	NA	3161.42	TBD	TBD	TBD	NA	x	x	NA	NA	Evaluate soil at approximate Stage 1 soil boring location where PFOA, PFOS, and PFBS were non-detect. Characterize extent of soil contamination to groundwater protection SSLs.
SD/SW0101	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Sampled March 2016, data trend and analysis.
SD/SW0102	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Sampled March 2016, data trend and analysis.
SD/SW0103	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Sampled March 2016, data trend and analysis, resample in area where Stage 1 QC samples were outside of laboratory control limits.
SD/SW0104	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Sampled March 2016, data trend and analysis.
SD/SW0105	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate the extent of surface water contamination downgradient of PSA-1 at the property boundary.
SD/SW0106	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate potential southern extent of surface water contamination off-base.
SD/SW0107	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate potential southern extent of surface water contamination off-base.
SD/SW0108	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate potential northern extent of surface water contamination, Evaluate if concentrations are reduced between source areas.
SD/SW0109	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate potential surface water contamination adjacent to and downgradient of PSA-3, evaluate whether concentrations are reduced between source areas.
SD/SW0110	NA	NA	NA	NA	NA	NA	NA	NA	x	NA	Evaluate potential surface water contamination adjacent to and downgradient of PSA-4, evaluate whether concentrations are reduced between source areas.
Don Newman Residential Well	NA	NA	NA	NA	NA	x	NA	NA	NA	NA	Evaluate potential residential groundwater contamination.
Tom Farrar Residential Well	NA	NA	NA	NA	NA	x	NA	NA	NA	NA	Evaluate potential residential groundwater contamination.
DW930412 Sanders Residential Well	NA	NA	NA	NA	NA	x	NA	NA	NA	NA	Evaluate potential residential groundwater contamination.

Notes:

1 - In accordance with Project Decision Conditions defined in the UFP-QAPP, PFC contamination in soil, sediment, surface water, and groundwater will be characterized to the detection limit

2 - MW16OW52502 groundwater level measurement collected in July 2016

* - depth of soil borings will be dertermined by depth to water measured from ground surface in closest monitoring well

L = Boring logged for lithology only

FPTA =Fire Protection Training Area

TBD = to be evaluated

MSL = mean sea level

NA= Not Applicable/Not Available

ft = feet

PSA =Potential Source Area

Appendices

Appendix A – Daily Quality Control Reports

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/07/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 55, heavy wind – light rain.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 12:50PM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Coordination meetings with USAF site representatives and Gilbane. Project Health and Safety overview. Review Scope of Work with Contractor. Locate relevant landmarks, workspace. Oversight of one attempted direct push/geoprobe soil sample event. IDW sampling and waste collection.

HEALTH AND SAFETY: Tailgate safety meeting 11:00, reviewed work conditions during heavy wind and light rain.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Advanced 5 attempted soil core runs at location 45. Determined that additional fittings were required for acetate sleeves to retain soil samples.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Determined that additional fittings were required for acetate sleeves to retain soil samples. Clarified sampling procedure to optimize workflow and control decontamination needs.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
One IDW characterization sample collected – no/very low PID response. Supplemental/overriding sample to be collected during completion of location 45.

PREPARED BY:	SIGNATURE:
Robert Selover	

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/08/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 55, medium wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 11:00AM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Coordination meetings with Gilbane. Tailgate safety meeting. Oversight of four attempted direct push/geoprobe soil sample event. IDW sampling and waste collection.

HEALTH AND SAFETY: Tailgate safety meeting 09:00, reviewed work conditions during heavy wind.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Attempted Four Direct Push borings. Reached refusal at 7ft (DP0109), 8ft (DP0108), 11ft (DP0116) and 21ft (DP0141). Only DP0116 reached the GW table, but only after reconfiguring rig to push past refusal, resulting in no Soil sample collected at GW table. Sampling objectives not being met. Consult with subcontractor and Ayuda PM/Management.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Four geoprobe locations today, and one yesterday failed to advance into the water table (one location – trace moisture was observed at base of penetration). As such, recommend review project challenges with Project Manager, subcontractor, and client.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Headspace monitoring of IDW samples so far reveals no >0.0 readings.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/09/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 55, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 08:00AM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of one attempted direct push/geoprobe soil sample event. IDW sampling and waste collection.

HEALTH AND SAFETY: Tailgate safety meeting 07:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Attempted one Direct Push boring in OU1. Reached refusal at 13ft (DP0124)

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: One geoprobe location today failed to advance into the water table in OU1
Subcontractor not able to sample required media with current rig configuration. Reviewed previous work with Joe Odegaard to consider alternative rig configurations. Cascade/Vironex Mobilized additional supplies at 11:30 AM. Confirmed arrival of materials.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Headspace monitoring of IDW samples so far reveals no >0.0 readings.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/10/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 65, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 08:00AM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	
Zach Hilborn	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of five direct push/geoprobe soil sample events. IDW sampling and waste collection.

HEALTH AND SAFETY: Tailgate safety meeting 07:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Six Direct Push borings

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: During 6th Direct Push investigation, Dustin noticed hydraulic fluid dripping from rig. Closer inspection revealed damage to hydraulic liner – woven steel mesh visible. Damage patched with spill absorbent pad, absorbent pad and bucket placed under leak. Contractor will arrange repairs ASAP.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Headspace monitoring of IDW samples so far reveals no >0.0 readings.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/11/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 65, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 11:00AM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of five direct push/geoprobe soil sample events. IDW sampling and waste collection. Collection of water samples from temporary wells

HEALTH AND SAFETY: Tailgate safety meeting 11:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Five Direct Push Borings with temporary wells installed in each

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Rig repaired this AM. Began drilling at Noon. De-Con at end of day revealed that heating element on pressure washer not working. Still have materials for 2 borings, will proceed tomorrow while US Rentals replaces unit.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Headspace monitoring of IDW samples today: no >0.0 readings.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/12/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 65, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Levi Todd	PID – Calibrated 07:00AM	
Rob Selover		
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of two direct push borings. Sampling of five temporary wells. Resolved sample naming issue with analytical laboratory.

HEALTH AND SAFETY: Tailgate safety meeting 6:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Two Direct Push Borings with temporary wells installed in each

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Completed one direct push boring. Contractor sent Hot Water Power Washer out for repair. Completed additional boring. Power washer repaired. Contractor performed decontamination.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Headspace monitoring of IDW samples today: one high reading (>2000). Because of FedEx delivery limitations, will continue sampling. If reading in OU1 matches current reading, will supersede. If not, will re-sample location.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/13/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 65, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Rob Selover	PID – Calibrated 08:00AM	
Lyle Froehler		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of five direct push borings. Sampling of one temporary well.

HEALTH AND SAFETY: Tailgate safety meeting 8:00.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Five Direct Push Borings with temporary wells installed in two borings.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Not encountering water in OU1.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
Only high PID reading (8.6) was collected for PFC characterization, and so no sample was available for headspace analysis (remaining sample showed background readings). Will remain mindful of waste characterization.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/14/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 65, light wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Rob Selover	PID – Calibrated 11:00AM	
Lyle Froehler		
Adam		
Mateo Schimpf		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of four direct push borings (13,12,18,19). Sampling of two temporary wells (15 – no water) and 38.

HEALTH AND SAFETY: Tailgate safety meeting 8:00.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Four Direct Push Borings with temporary wells installed in two borings (13 and 18).

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Did not encounter water in 13, 18, or 19. Spoke with Levi Todd to confirm adjusted strategy of targeting soil samples at Fill/Clay interface

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
High PID reading recorded at DP018 – Headspace reading 538ppm did not exceed current observation of >2000ppm recorded at 36. Will continue monitoring.

PREPARED BY: Robert Selover	**SIGNATURE**: 

Date: 03/14/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	x					

On site Hours	9.5
Travel Time	0
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Sunny	Overcast	Wind + Rain		
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	50°	60°	60°		
Project Manager	Levi Todd	Wind	>25 mph			**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	70%			**1**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: None.

Visitors on site: None.

Equipment on site: Heron Water Level Meter

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes: Checked and reivewed	Chemical Hazards: Groundwater contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:
Arrive to EAFB at approximately 0830 and receive badges. Mobilize to AOC PFC-1 at approximately 0900. Begin monitoring well gauging activities at approximately 1030 after reviewing to-date Stage 1 field activities with Rob Selover (Ayuda). Gauge 32 monitoring wells, including 11 wells proposed for groundwater sampling. The field team could not locate monitoring well MW960101 (appears to be abandoned), which was proposed for Stage 1 groundwater sampling. Given its location immediately south of MW960101, it is proposed that monitoring well MW950102 be sampled instead. Pack up and leave site at 1800.

Comments: Could not locate monitoring well MW960101

Completed By: Mateo Schimpf	**Title: Staff Scientist**
	

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/15/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 40, wind. Afternoon Hail with heavy wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Rob Selover	PID – Calibrated 8:00AM	
Lyle Froehler		
Adam		
Mateo Schimpf		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of Eight direct push borings (24,23,22,21,27,28,33, & 32). Sampling of three temporary wells 13, 12 (no water) and 18 (no water).

HEALTH AND SAFETY: Tailgate safety meeting 8:00.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Eight Direct Push Borings with temporary wells.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Did not encounter water in 23, 22, 21, 27, 33, or 32 (6 of 8 drilled borings to one push past first encounter of expansive clay underneath fill)

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):
PID Headspace Monitoring

PREPARED BY: Robert Selover	**SIGNATURE**: 

Date: 03/15/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		X				

On site Hours	8.5
Travel Time	0
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Overcast	Wind + Hail			
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	40°	50°			
Project Manager	Levi Todd	Wind	>25 mph			**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	70%			**2**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: None.

Visitors on site: None.

Equipment on site: Heron Water Level Meter, Submersible Pump (Dedicated), Geopump Peristaltic Pump

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes	Chemical Hazards: Groundwater contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:
Arrive to AOC PFC-1 at approximately 0830. Begin groundwater sampling activities at approximately 0950. Total of five wells sampled on the day: MW020402, MW930209, MW990401, MW960401, and MW931207, which included one field duplicate (MW020402) and one matrix spike/matrix spike duplicate (MW930209). Conclude groundwater sampling activities at approximately 1630 due to inclement weather (high winds and hail). Pack up and leave site at 1700.

Comments: Total of five wells sampled.

Completed By: Mateo Schimpf	**Title: Staff Scientist**
	

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/16/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 40, wind.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Rob Selover	PID – Device determined to be defective	
Lyle Froehler		
Adam		
Mateo Schimpf		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of Five direct push borings (31, 30, 25, 51, &50). Sampling of five temporary wells 24, 22, 21 (no water), 27 (no water), and 28 (no water).

HEALTH AND SAFETY: Tailgate safety meeting 7:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Five Direct Push Borings with three temporary wells.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Did not encounter water in 30, 31, 51, and 50.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):

PREPARED BY:	SIGNATURE:
Robert Selover	

Date: 03/16/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			X			

On site Hours	10
Travel Time	0
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Sunny	Wind + Light Rain			
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	30°	35°			
Project Manager	Levi Todd	Wind	20 mph	25-30 mph		**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	40%			**3**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: None.

Visitors on site: None.

Equipment on site: Heron Water Level Meter, Submersible Pump (Dedicated), Geopump Peristaltic Pump

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes	Chemical Hazards: Groundwater contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:
Arrived to AOC PFC-1 at approximately 0730. Began groundwater sampling activities at approximately 0830. Total of seven wells sampled on the day: MW970202, MW870211, MW970101, MW950102, MW930110, MW930109, and MW930105, which included one field duplicate (MW970101). Monitoring well MW930105 was sampled as a substitute for MW870101, which was originally proposed for sampling but only contained 0.2 feet of water when gauged on Monday (3/14). Monitoring well MW930105 is the closest well to MW870101 at approximately 40 feet to the southeast. This concluded groundwater sampling activities from existing monitoring wells for Stage 1 field activities.

Began field reconnaissance of private wells at 1615. Three of the five wells identified by EAFB and a SDDENR database record search were located. Pack up and leave site at 1730.

Comments: Total of seven wells sampled; conclude groundwater sampling activities. Three of five private wells located during field reconnaissance.

Completed By: Mateo Schimpf	**Title: Staff Scientist**
	

Daily Quality Control Report

CONTRACT NO./ D.O. NO.:	PROJECT NO.:	DATE: 03/17/2016
W912PP-13-D-0011 TO# 0002	012.030.0011.0002	

WEATHER/TEMPERATURE: 35, wind, snow.

WORK LOCATION: Ellsworth AFB, SD

AYUDA PERSONNEL:	EQUIPMENT:	VISITORS (REPRESENTING):
Rob Selover	PID – Device determined to be defective	
Lyle Froehler		
Adam Stein		
Mateo Schimpf		

SUBCONTRACTOR:	TRADE/SERVICE:
Cascade/Vironex	Direct Push/ Geoprobe
Joey Sherman	
Dustin Powell	

WORK COMPLETED BY AYUDA: Tailgate safety meeting. Oversight of Six direct push borings (49, 6, 7, 5, 4, & 2). Sampling of five temporary wells 24, 22, 21 (no water), 27 (no water), and 28 (no water).

HEALTH AND SAFETY: Tailgate safety meeting 7:30.

MATERIALS DELIVERED (Amount, Condition, and Purpose):

WORK COMPLETED BY SUBCONTRACTORS): Six Direct Push Borings with three temporary wells.

AGREEMENTS MADE/PHONE CONVERSATIONS:

PROBLEMS/RESOLUTIONS: Did not encounter water in 49 – set 15ft of screen configured to nearby MW observations.

ANALYTICAL/INSPECTION DATA (List items here and results, attach appropriate data/information):

PREPARED BY:	SIGNATURE:
Robert Selover	

Date: 03/17/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				X		

On site Hours	9.75
Travel Time	0
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Sunny	Wind + Light Snow			
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	30°	25°			
Project Manager	Levi Todd	Wind	15 mph	20-25 mph		**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	50%			**4**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: Cascade drilling

Visitors on site: None.

Equipment on site: Horiba U-52

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds, Deep surface water
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes	Chemical Hazards: Soil, sediment, and surface water contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:
Arrive to AOC PFC-1 at approximately 0745. Work with Rob Selover (Ayuda) to begin transitioning drilling teams while Adam Stein (Ayuda) surveys existing direct push locations. Reconnect with Adam at 1125 to perform surface water and sediment sampling. Surface water and sediment samples collected from all four proposed locations, which include one field duplicate sample (SD0102) and one matrix spike/matrix spike duplicate sample (SD0103). Conclude surface water and sediment sampling at 1515. Attempt to collect groundwater grab sample from temporary well TW0150, but no water had recovered in the well. Pack up and leave site at 1730.

Comments: Surface water and sediment samples collected from all four proposed locations.

Completed By: Mateo Schimpf	**Title: Staff Scientist**
	

Date: 03/18/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					X	

On site Hours	11
Travel Time	0
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Overcast	Wind + Snow			
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	25°	25°			
Project Manager	Levi Todd	Wind	15 mph	25-30 mph		**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	50%			**5**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: Cascade Drilling

Visitors on site: None.

Equipment on site: Geoprobe, PID, PVC bailers

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds, Geoprobe
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes	Chemical Hazards: Soil, Groundwater contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:

Arrive to AOC PFC-1 at approximately 0800. Pack groundwater samples and complete drilling team transition with Rob Selover (Ayuda). Begin direct push boring advancement and sampling activities at approximately 0910. Complete borings DP0101 and DP0103 (field duplicate) to approximately 15 ft. bgs. In addition to primary borings, advance to the top of the groundwater table at a DP0102 offset in order to collect a discrete sample, and advance to a potentially petroleum-contaminated interval at a DP0136 (field duplicate and matrix spike/matrix spike duplicate) offset to collect a sample for waste characterization. Conclude direct push boring activities at approximately 1215.

Begin surface soil sampling activities at approximately 1300. Collect soil samples from all ten proposed surface sampling locations, which included field duplicate samples at locations DP0110 and DP0120, and one matrix spike/matrix spike duplicate sample at location DP0111. Conclude surface soil sampling activities at approximately 1350.

Begin groundwater grab sampling activities at approximately 1400. Grab samples collected from temporary well locations TW0105, TW0107, TW0101, TW0102, and TW0103, which include field duplicate samples at TW0107 and TW0103, a matrix spike duplicate sample at TW0101. Grab samples could not be collected due to insufficient groundwater recovery in temporary wells TW0123, TW0125, TW0106, and TW0104. All wells were abandoned after gauging and/or sampling. Pack up and leave site at 1900.

Comments: Complete direct push boring advancement at two locations. Complete surface soil sampling. Collect grab samples from five temporary monitoring wells.

Completed By: Mateo Schimpf	**Title: Staff Scientist**

Date: 03/19/16

DAILY FIELD REPORT

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						X

On site Hours	10.25
Travel Time	6.25
Office Hours	0

Site Name	EAFB AOC PFC-1	Weather	Overcast	Wind + Snow	Sunny		
Contract No.	W912PP-13-D-0011, TO 0002	Temp.	20°	25°	35°		
Project Manager	Levi Todd	Wind	15 mph	15 mph	<10 mph	**Report No.**	
Field Personnel	Mateo Schimpf, Adam Stein	Humidity	40%			**6**	

Ayuda personnel on site: Mateo Schimpf, Adam Stein

Subcontractors on site: Cascade Drilling

Visitors on site: None.

Equipment on site: PID, PVC bailers, Hand Auger

Health and Safety Briefing/Topic Discussed:	
Planned Site Activities	Physical Safety Hazards: Driving on site, High winds
Site Communication/Responsibilities	Biological Safety Hazards: Snakes and spiders
Emergency Procedures/Routes	Chemical Hazards: Soil, Groundwater contamination (PFCs)
First Aid Procedures	Respirator Use: None.
Level of PPE: Modified Level D	Exclusion Zone Procedures: N/A
Cold/Heat Stress	Spill Practices: N/A

Site Activities:
Arrive to AOC PFC-1 at approximately 0745. Begin temporary groundwater monitoring well sampling and abandonment activities at approximately 0825. In total, 16 temporary monitoring wells were gauged for groundwater. Of the 16 wells gauged, only five had sufficient groundwater to collect a sample. Samples were collected from temporary monitoring wells: TW0149, TW0113, TW0115, TW0130, and TW0138.

Following temporary monitoring well gauging and sampling, mobilize to collocated surface and subsurface soil sample location DP0139. Due to DP0139's proximity to Pond 1, the boring was advanced using a hand auger to a total depth of approximately 1.5 ft. bgs. Soil samples were collected from 0-6 inches and at the top of the water table. A groundwater grab sample was also collected.

Begin collecting groundwater samples for treatability study at approximately 1245. A total of roughly 30 gallons of groundwater were collected from three monitoring wells (MW070101, MW060101, and MW930102). Sample containers were filled until the monitoring well went dry.

Pack up and leave site at approximately 1800.

Comments: Complete final Stage 1 field activities, including temporary monitoring well sampling and abandonment, final boring advancement, and collection of groundwater treatability study samples.

Completed By: Mateo Schimpf	**Title: Staff Scientist**
	

Appendix B – Soil Boring Logs

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0101
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 3
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 669,210.7 North 1,242,311.0 East	
	9. SURFACE ELEVATION: 3194.7' NAVD 1929	
	10. DATE STARTED: 3/18/2016	11. DATE COMPLETED: 3/18/2016
12. OVERBURDEN THICKNESS: 15	15. DEPTH GROUNDWATER ENCOUNTERED: 13	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 9.36	
14. TOTAL DEPTH OF HOLE: 15.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.2' stickup	

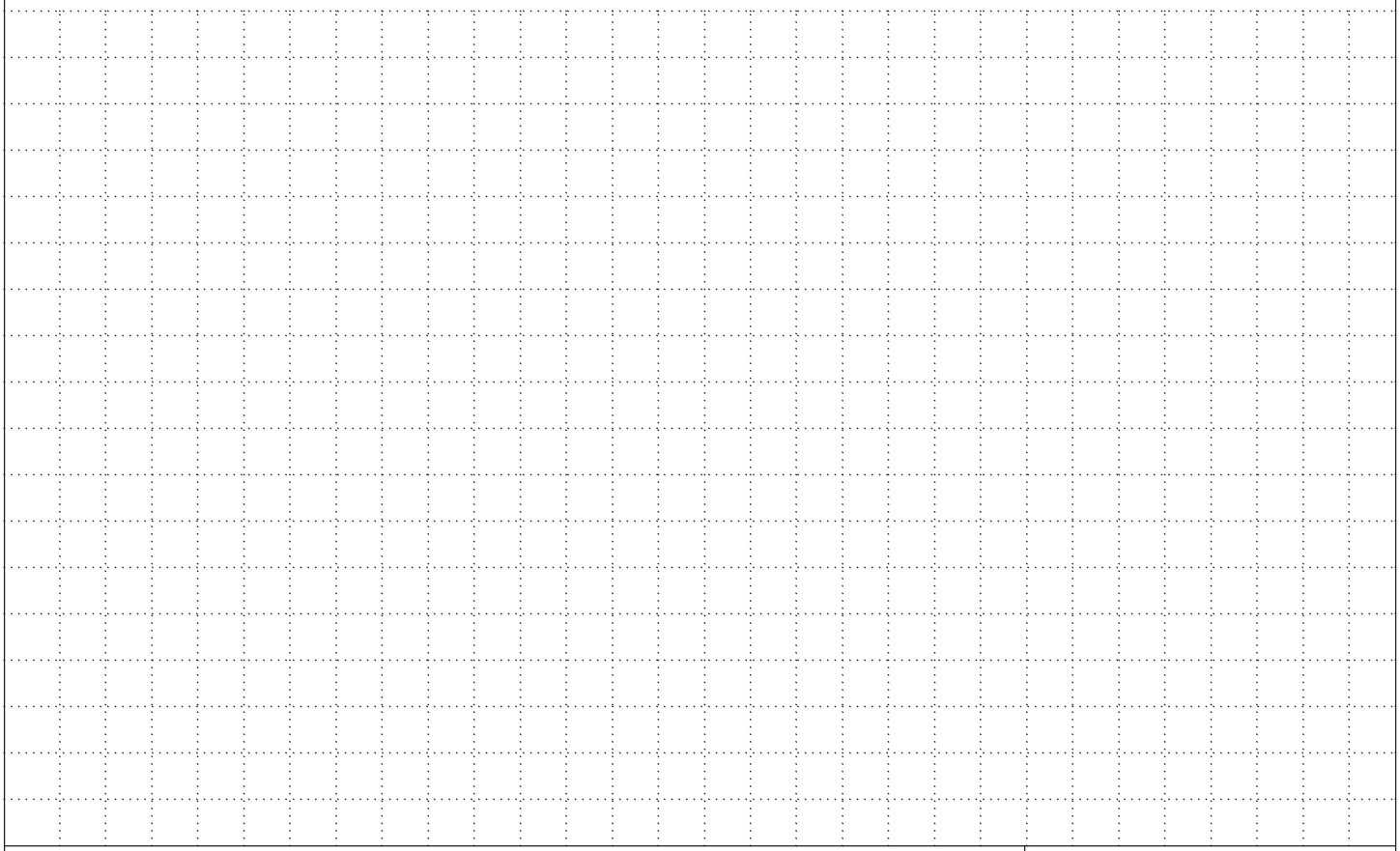
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
---	---	---	---

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0101

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0101

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3194.7	0	topsoil	0.0 ppm		DP0101-00-0316-0.5		
3193.7	1	non-plastic, clayey sand, gray to light brown, small gravel (SC)					
3192.7	2						
3191.7	3		0.0 ppm				
3190.7	4	no recovery					
3189.7	5						
3188.7	6						
3187.7	7						
3186.7	8	gravel fill	0.0 ppm		DP0101-00-0316-4-6		
3185.7	9	low plastic to non-plastic, silty sand, brown, moist (SM)					
3184.7	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0101

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0101

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3184.7	10	no recovery					
3183.7	11						
3182.7	12						
3181.7	13	low plastic, silty sand, brown w/ iron mottling, wet, small gravel (SM/SC)	0.0 ppm		DP0101-00-0316-13		Top of water table @ 13' bgs. Screen from 5-15'
3180.7	14						
3179.7	15	end of boring					
3178.7	16						
3177.7	17						
3176.7	18						
3175.7	19						
3174.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0101

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0102

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	669,122.5 North 1,242,284.5 East
	9. SURFACE ELEVATION
	3197.2' NAVD 1929
	10. DATE STARTED: 3/17/2016 / 11. DATE COMPLETED: 3/17/2016
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
24	21.5
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	22.52
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
24.0	1.2' stickup

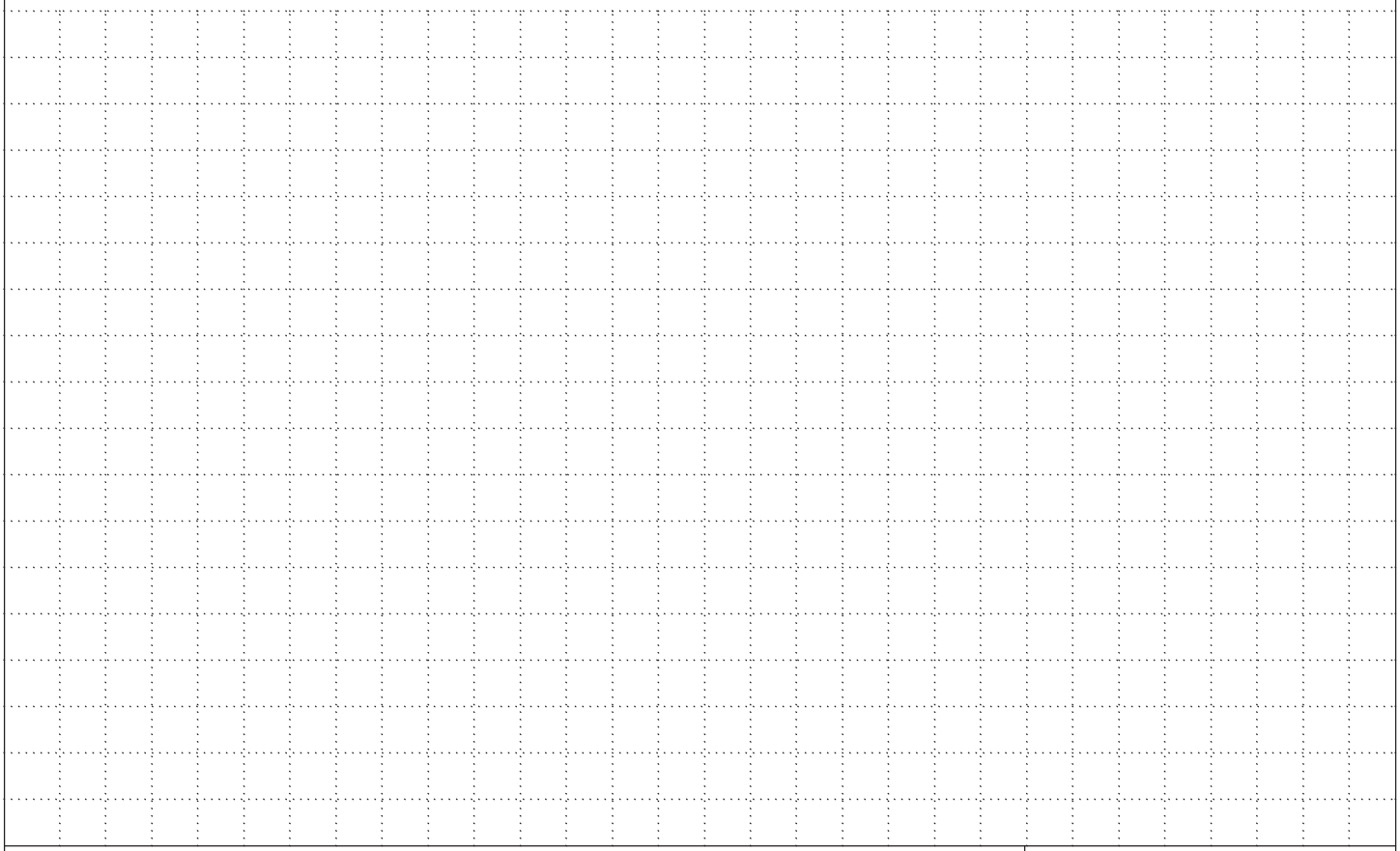
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
---	---	---	---

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0102

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0102

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3197.2	0	yellowish brown sandy silty clay with rootlets (CL)					
			0.0 ppm		DP0102-00-0316-0.5		Collected Field duplicate
3196.2	1						
3195.2	2	Yellowish brown sandy gravelly clay (CL)					
3194.2	3		0.0 ppm				
3193.2	4						
3192.2	5	Olive brown sandy gravelly clay (CL)					
3191.2	6		0.0 ppm		DP0102-00-0316-6-8		Collected Field duplicate
3190.2	7						
3189.2	8						
3188.2	9						
3187.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0102

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0102

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3187.2	10						
3186.2	11						
3185.2	12	Yellowish brown clay (CL)	0.0 ppm				
3184.2	13						
3183.2	14						
3182.2	15						
3181.2	16						
3180.2	17						
3179.2	18						
3178.2	19						
3177.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0102

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0102

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3177.2	20						
3176.2	21		0.0 ppm		DP0102-00-0316-21		Top of water table @ 21.5' bgs.
3175.2	22						
3174.2	23						
3173.2	24	End of boring					
3172.2	25						
3171.2	26						
3170.2	27						
3169.2	28						
3168.2	29						
3167.2	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0102

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0103
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 3
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 669,139.1 North 1,242,366.5 East	
	9. SURFACE ELEVATION: 3194.4' NAVD 1929	
	10. DATE STARTED: 3/18/2016	11. DATE COMPLETED: 3/18/2016
12. OVERBURDEN THICKNESS: 17	15. DEPTH GROUNDWATER ENCOUNTERED: 13	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 7.5	
14. TOTAL DEPTH OF HOLE: 17.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.2' stickup	

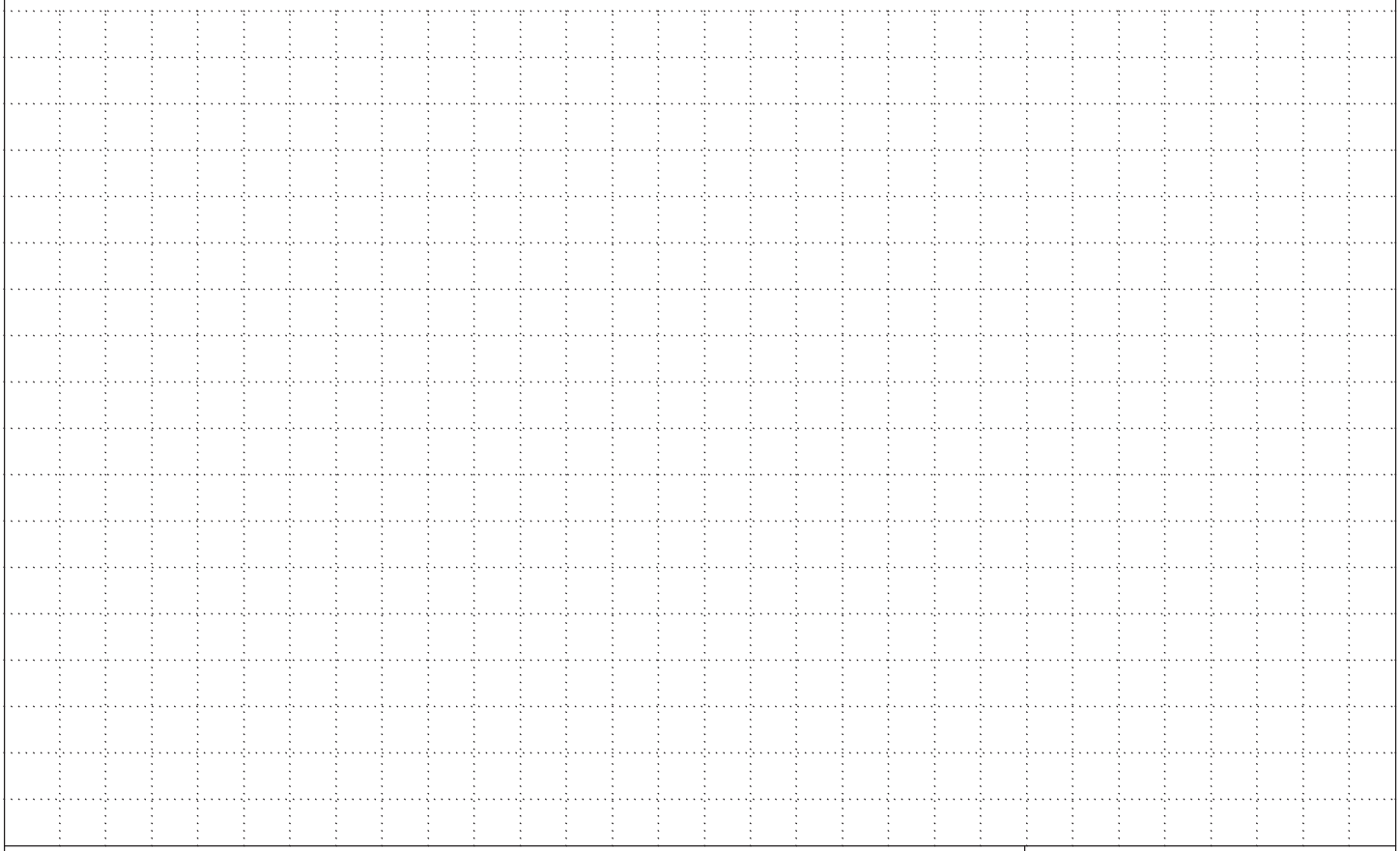
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0103

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0103

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3194.4	0	topsoil	0.0 ppm		DP0103-00-0316-0.5		
3193.4	1	Stiff, silty sand, dark brown (SM)					
3192.4	2						
		no recovery					
3191.4	3		0.0 ppm				
3190.4	4						
3189.4	5	gravel fill - large cobbles					
		non-plastic to low plastic clay, gray, small gravel (CL)					
3188.4	6		0.0 ppm				
3187.4	7						
3186.4	8						
		med-plastic, sandy clay, lt-med brown, intermittent sand, small gravel (CL)	0.0 ppm		DP0103-00-0316-8-10		
3185.4	9						
3184.4	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0103

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0103

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3184.4	10	med-plastic, sandy clay, lt-med brown, intermittent sand, small gravel, iron molding (CL)					
3183.4	11						
3182.4	12						
3181.4	13	med-plastic, sandy clay, lt-med brown, intermittent sand, small gravel (CL)	0.0 ppm		DP0103-00-0316-13		Top of water table @ 13' bgs. Screen from 5-15'
3180.4	14						
3179.4	15	Med plastic, silty clay, black with iron molding (CL)					
3178.4	16	no recovery					
3177.4	17	End of boring					
3176.4	18						
3175.4	19						
3174.4	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0103

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0104

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	668,345.6 North 1,241,408.1 East
	9. SURFACE ELEVATION
	3206.6' NAVD 1929
	10. DATE STARTED: 3/17/2016 / 11. DATE COMPLETED: 3/17/2016
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
21	21
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	Water not observed
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
21.0	4' stickup

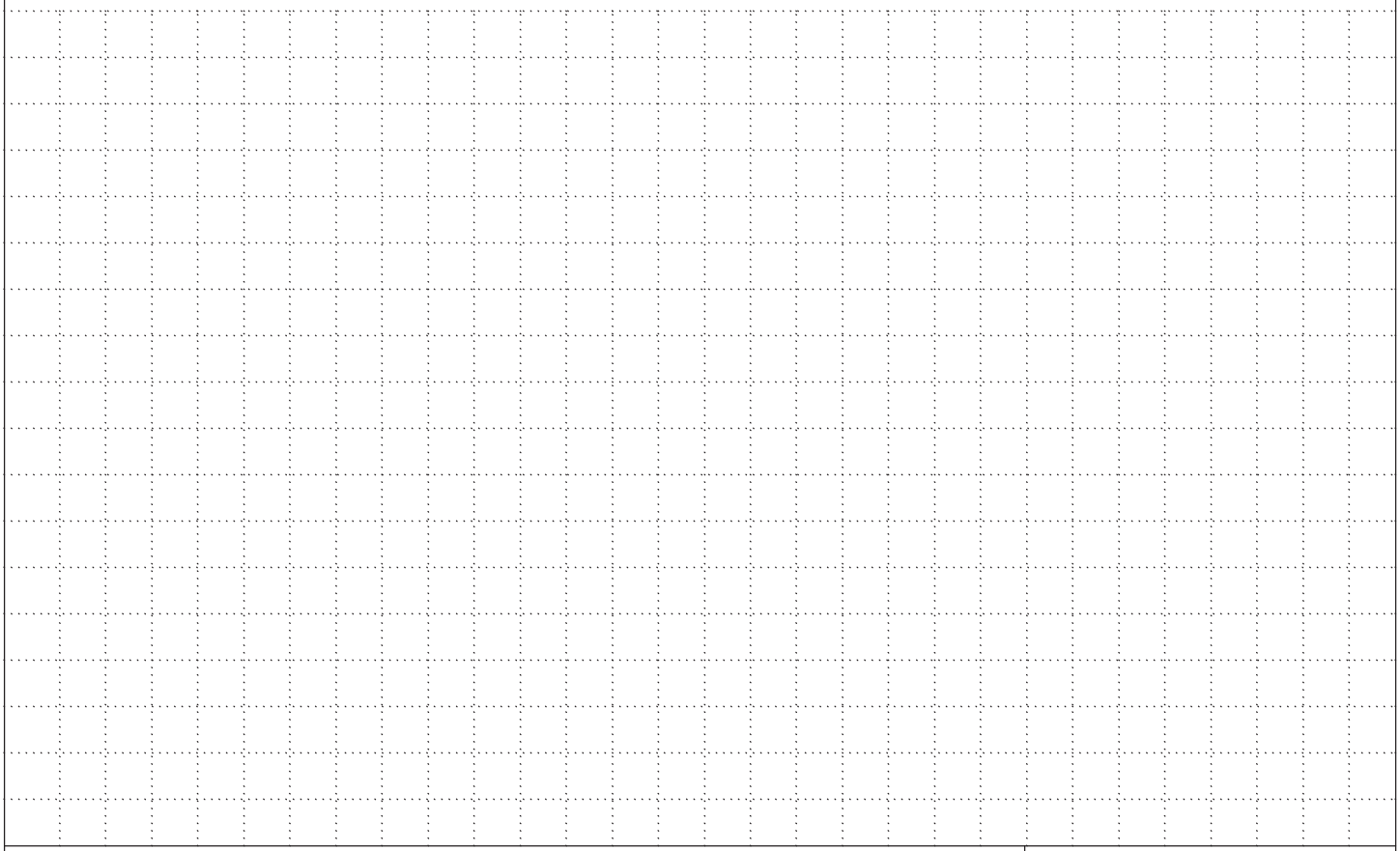
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0104

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0104

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3206.6	0	Yellowish brown sandy silty gravelly clay (CL)					
			0.0 ppm		DP0104-00-0316-0.5		Collected Field duplicate, MS/MSD
3205.6	1						
3204.6	2						
		no recovery					
3203.6	3						
3202.6	4		0.0 ppm		DP0104-00-0316-4-6		Collected Field duplicate, MS/MSD
3201.6	5	Yellowish brown clay (CL)					
3200.6	6		0.0 ppm				
3199.6	7						
3198.6	8		0.0 ppm				
3197.6	9						
3196.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0104

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0104

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3196.6	10	Yellowish Brown Clay (CL)					
3195.6	11						
3194.6	12						
3193.6	13		0.0 ppm				
3192.6	14						
3191.6	15	Yellowish brown clay (CL)					
3190.6	16						
3189.6	17						
3188.6	18						
3187.6	19						
3186.6	20						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0104

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3186.6	20	Yellowish brown gravelly medium sand (SP)					
3185.6	21	End of boring	0.0 ppm	DP0104-00-0316-21			Top of water table @ 21' bgs.
3184.6	22						
3183.6	23						
3182.6	24						
3181.6	25						
3180.6	26						
3179.6	27						
3178.6	28						
3177.6	29						
3176.6	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0104

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0105

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 668,305.5 North 1,241,393.3 East
	9. SURFACE ELEVATION: 3204.6' NAVD 1929
	10. DATE STARTED: 3/17/2016 / 11. DATE COMPLETED: 3/17/2016
12. OVERBURDEN THICKNESS: 21	15. DEPTH GROUNDWATER ENCOUNTERED: 18
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 19
14. TOTAL DEPTH OF HOLE: 21.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.15' stickup

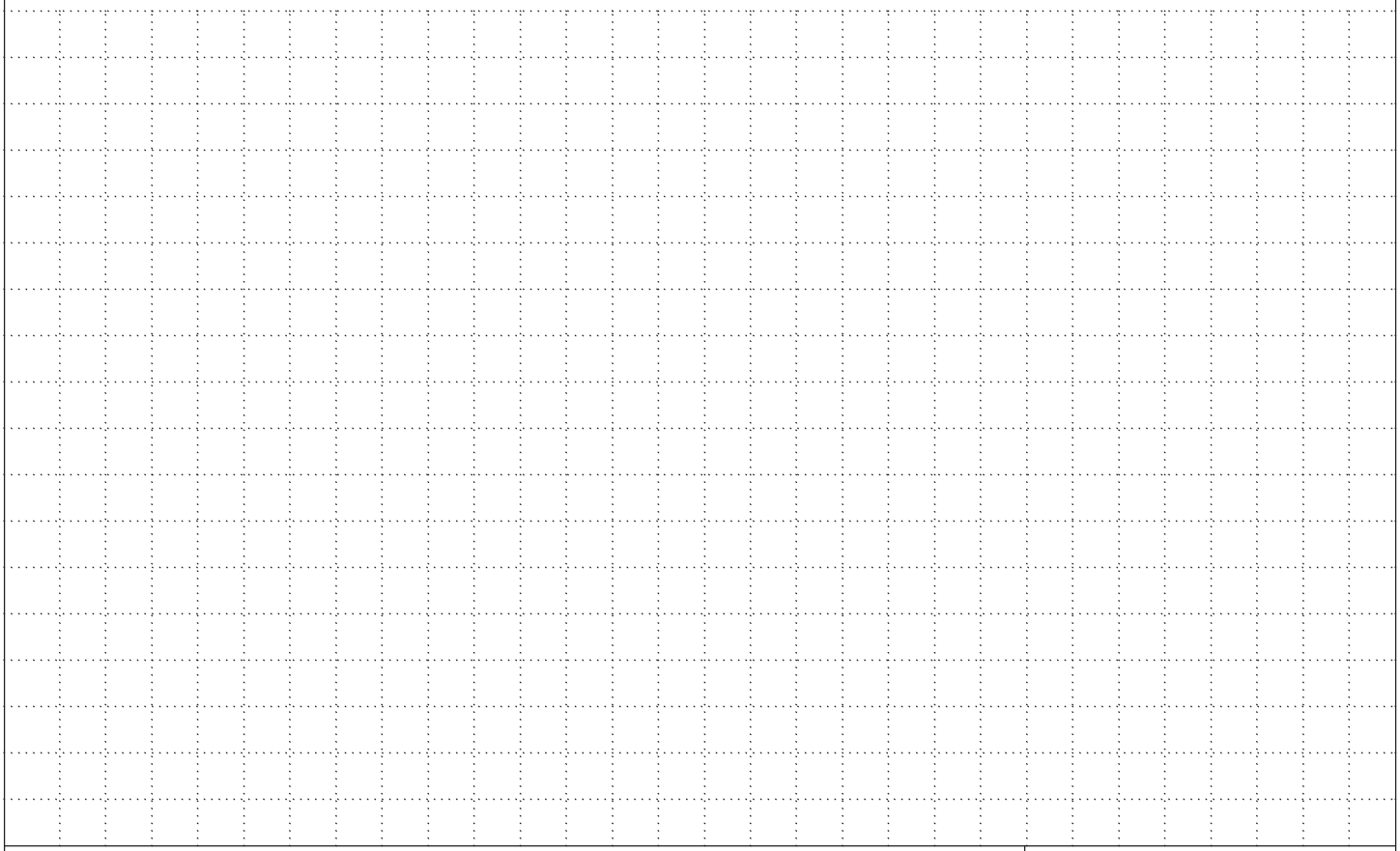
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0105

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0105

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3204.6	0	Dark yellowish brown sandy silty clay (CL)					
			0.0 ppm		DP0105-00-0316-0.5		Collected Field duplicate, MS/MSD
3203.6	1						
3202.6	2	no recovery					
3201.6	3						
3200.6	4		0.0 ppm				
3199.6	5	Yellowish brown clay (CL)					
3198.6	6		0.0 ppm		DP0105-00-0316-6-8		Collected Field duplicate, MS/MSD
3197.6	7						
3196.6	8		0.0 ppm				
3195.6	9						
3194.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0105

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0105

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3194.6	10	Yellowish Brown Clay (CL)					
3193.6	11						
3192.6	12						
3191.6	13		0.0 ppm				
3190.6	14						
3189.6	15						
3188.6	16						
3187.6	17						
3186.6	18	Yellowish brown gravelly coarse sand (SP)	0.0 ppm		DP0105-00-0316-18		Top of water table @ 18' bgs.
3185.6	19						
3184.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0105

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0105

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3184.6	20						
3183.6	21	End of boring					
3182.6	22						
3181.6	23						
3180.6	24						
3179.6	25						
3178.6	26						
3177.6	27						
3176.6	28						
3175.6	29						
3174.6	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0105

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0106

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 668,241.6 North 1,241,311.2 East
	9. SURFACE ELEVATION: 3205.2' NAVD 1929
	10. DATE STARTED: 3/17/2016 / 11. DATE COMPLETED: 3/17/2016
12. OVERBURDEN THICKNESS: 18	15. DEPTH GROUNDWATER ENCOUNTERED: 15
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 18.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 5' stickup

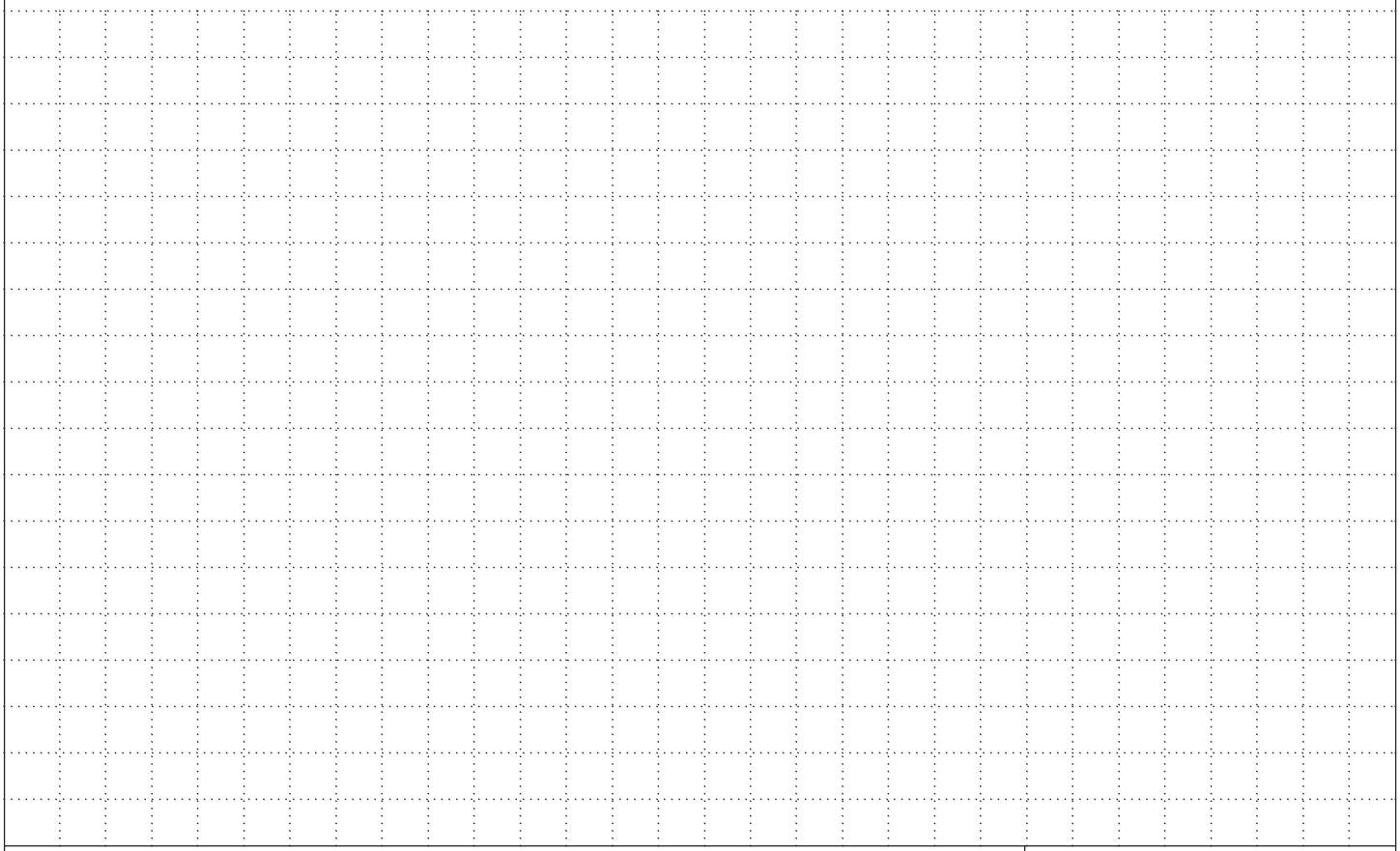
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0106

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0106

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3205.2	0	Yellowish brown sandy silty clay with rootlets (CL)					
			0.0 ppm		DP0106-00-0316-0.5		Collected Field duplicate, MS/MSD
3204.2	1						
3203.2	2	yellowish brown clay (CL)					
		no recovery					
3202.2	3						
3201.2	4		0.0 ppm		DP0106-00-0316-2-10		Collected Field duplicate, MS/MSD
3200.2	5	Yellowish Brown Clay (CL)					
3199.2	6		0.0 ppm				
3198.2	7						
3197.2	8		0.0 ppm				
3196.2	9						
3195.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0106

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0106

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3195.2	10	Yellowish Brown Clay (CL)					
3194.2	11						
3193.2	12						
3192.2	13						
3191.2	14						
		Yellowish brown sandy clay, plasticity (CL)					
3190.2	15		0.0 ppm				Top of water table @ 15' bgs.
3189.2	16						
3188.2	17						
3187.2	18						
		End of boring	0.0 ppm				
3186.2	19						
3185.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0106

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0107
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 3
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 668,212.0 North 1,241,462.6 East	
	9. SURFACE ELEVATION: 3202.6' NAVD 1929	
	10. DATE STARTED: 3/17/2016	11. DATE COMPLETED: 3/17/2016
12. OVERBURDEN THICKNESS: 19	15. DEPTH GROUNDWATER ENCOUNTERED: 19	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 18.18	
14. TOTAL DEPTH OF HOLE: 19.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.1' stickup	

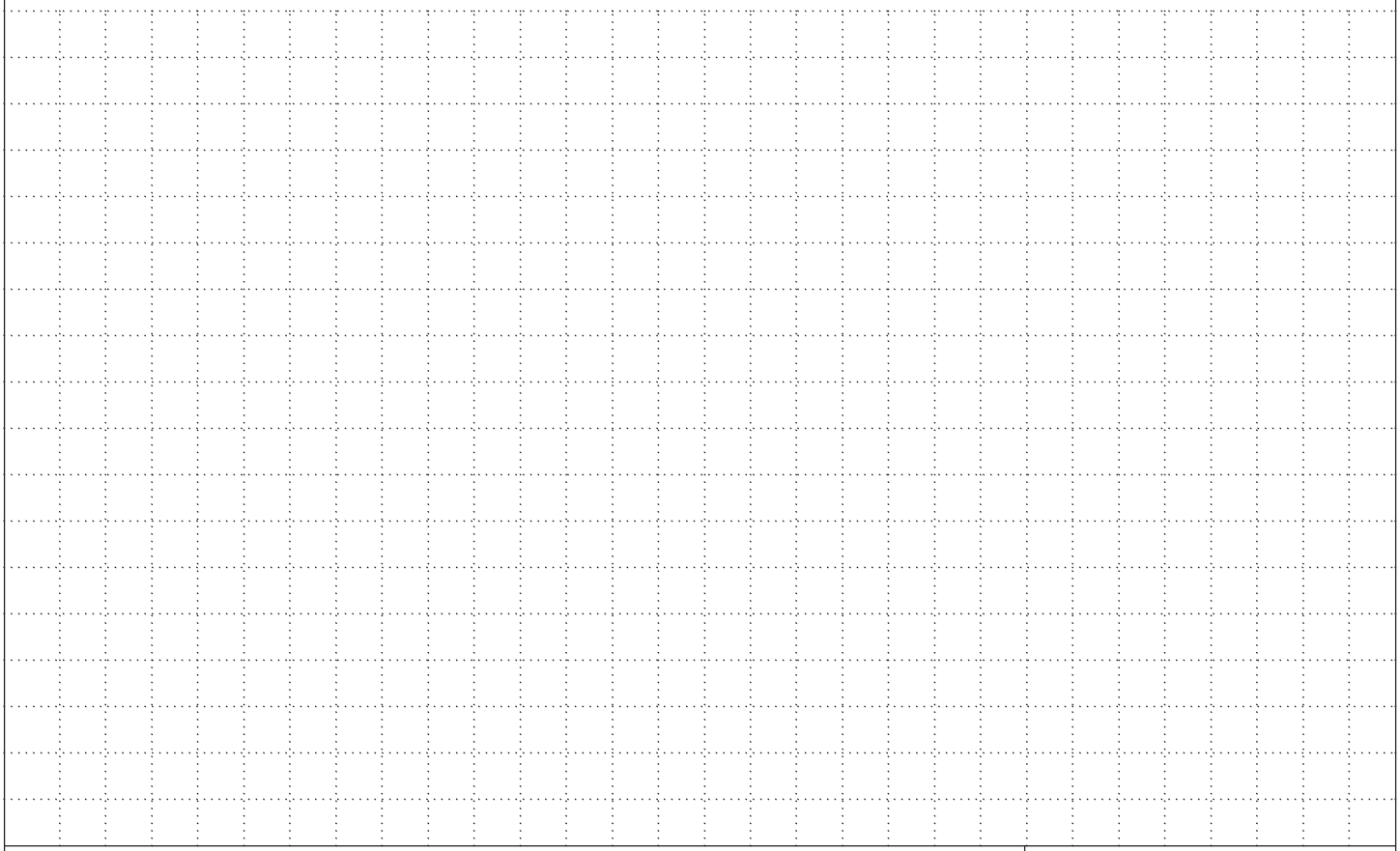
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0107

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0107

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3202.6	0	Dark yellowish brown sandy silty clay with rootlets (CL)					
		yellowish brown silty clay (CL)	0.0 ppm		DP0107-00-0316-0.5		Collected Field duplicate, MS/MSD
3201.6	1						
3200.6	2		0.0 ppm		DP0107-00-0316-2-10		
3199.6	3						
3198.6	4						
3197.6	5	yellowish brown silty clay (CL)					
3196.6	6		0.0 ppm				
3195.6	7						
3194.6	8		0.0 ppm				
3193.6	9						
3192.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0107

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0107

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3192.6	10	yellowish brown silty clay (CL)					
3191.6	11						
3190.6	12						
3189.6	13						
3188.6	14						
3187.6	15	Yellowish brown gravelly silty medium sand (SP)	0.0 ppm				
3186.6	16						
3185.6	17						
3184.6	18						
3183.6	19	End of boring	0.0 ppm		DP0107-00-0316-19		Top of water table @ 19' bgs.
3182.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0107

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0108

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,668.9 North 1,242,262.8 East
	9. SURFACE ELEVATION: 3191.7' NAVD 1929
	10. DATE STARTED: 3/08/16 / 11. DATE COMPLETED: 3/10/16
12. OVERBURDEN THICKNESS: 17	15. DEPTH GROUNDWATER ENCOUNTERED: 15
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 12.7
14. TOTAL DEPTH OF HOLE: 17.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.5' stickup

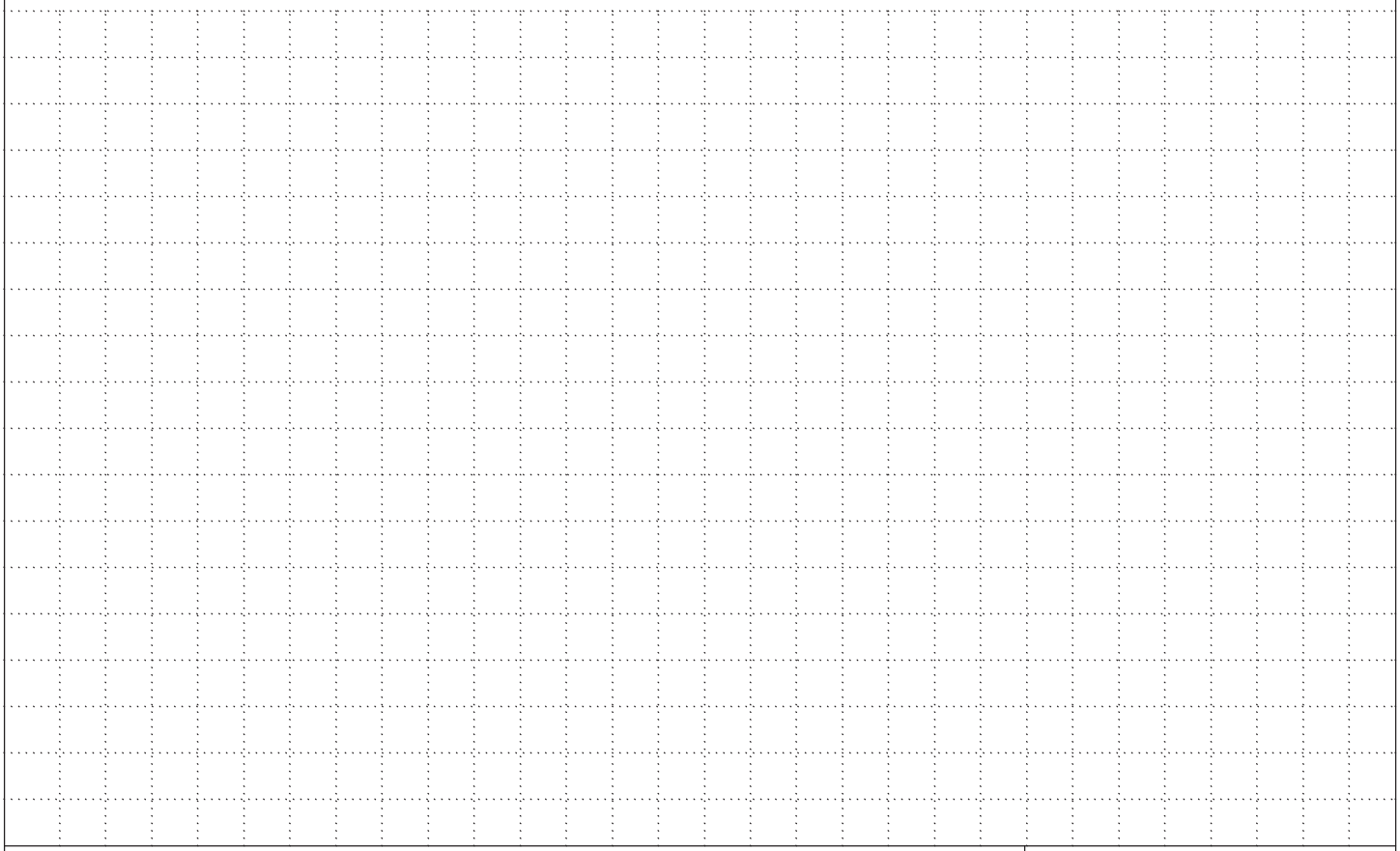
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0108

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0108

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3191.7	0	Dark yellowish brown very fine sandy silty clay with rootlets (CL)					
3190.7	1	Yellowish brown very fine sandy silty clay (CL)	0.0 ppm		DP0108-00-0316-0.5		*Sample taken from first boring attempt. Field duplicate, MS/MSD
3189.7	2	Light yellowish brown, very fine sandy silty clay, moist (CL)	0.0 ppm		DP0108-00-0316-2-10		*Sample taken from first boring attempt.
3188.7	3						
3187.7	4						
3186.7	5						
3185.7	6	Light yellowish brown, very fine sandy silty clay, moist (CL)	0.0 ppm				
3184.7	7						
3183.7	8						
3182.7	9	Light yellowish brown, very fine sandy silty clay, moist. With gray pebbles (CL)	0.0 ppm				
3181.7	10	Light yellowish brown, very fine sandy silty clay, moist. With gray pebbles (CL)					

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0108

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3181.7	10						
3180.7	11						
3179.7	12	Light gray sugary rock and pebbles (GP)					
3178.7	13	no recovery					
3177.7	14	Medium gray gravel (GP)					
3176.7	15	Yellowish brown gravel with medium sand (GP)	0.0 ppm		DP0108-00-0316-15		Top of water table @ 15' bgs.
		Light yellowish brown clay (CL)					
3175.7	16						
3174.7	17	End of boring	11.6 ppm				
3173.7	18						
3172.7	19						
3171.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0108

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0109

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,661.9 North 1,242,714.0 East
	9. SURFACE ELEVATION: 3188.6' NAVD 1929
	10. DATE STARTED: 3/08/16 / 11. DATE COMPLETED: 3/10/16
12. OVERBURDEN THICKNESS: 23	15. DEPTH GROUNDWATER ENCOUNTERED: 19
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 10.8
14. TOTAL DEPTH OF HOLE: 23.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.6' stickup

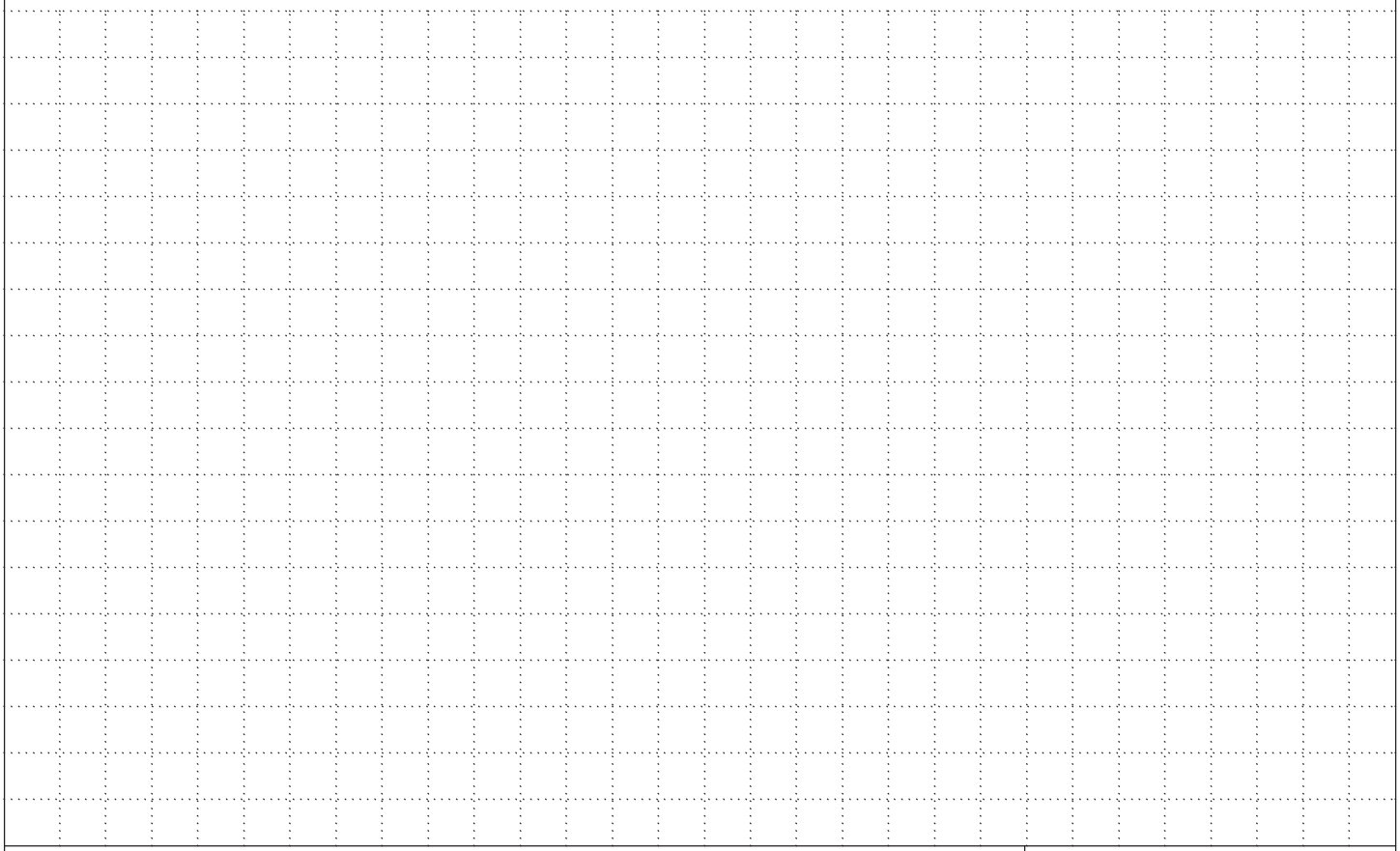
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0109

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0109

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3188.6	0	Yellowish brown very fine sandy silty clay with rootlets (CL)	0.0 ppm		DP0109-00-0316-0.5		*Sample taken from first boring attempt.
3187.6	1						
3186.6	2	Light yellowish brown very fine silty sandy clay with pebbles (CL)	0.0 ppm		DP0109-00-0316-2-10		*Sample taken from first boring attempt.
3185.6	3	Medium gray weathered shale (GP)					
3184.6	4						
3183.6	5	Light yellowish brown medium sand with light gray sugary gravel (SP)					
3182.6	6		0.0 ppm				
3181.6	7						
3180.6	8						
3179.6	9						
3178.6	10						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0109

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3178.6	10	Dark yellowish brown very fine sandy clay, moist (CL)	0.0 ppm				
3177.6	11						
3176.6	12						
3175.6	13						
3174.6	14						
3173.6	15						
		Dark yellowish brown very fine sandy clay, moist (CL)					
3172.6	16		2.6 ppm				
3171.6	17						
		Dark yellowish brown very fine sandy clay, moist (CL)					
3170.6	18						
3169.6	19		0.0 ppm		DP0109-00-0316-19		Top of water table @ 19' bgs.
3168.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0109

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0109

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3168.6	20						
3167.6	21						
3166.6	22						
3165.6	23	End of boring	0.0 ppm				
3164.6	24						
3163.6	25						
3162.6	26						
3161.6	27						
3160.6	28						
3159.6	29						
3158.6	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0109

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0112

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,464.8 North 1,242,311.3 East
	9. SURFACE ELEVATION: 3190.3' NAVD 1929
	10. DATE STARTED: 3/14/16 / 11. DATE COMPLETED: 3/14/16
12. OVERBURDEN THICKNESS: 26	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 26.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 3' stickup

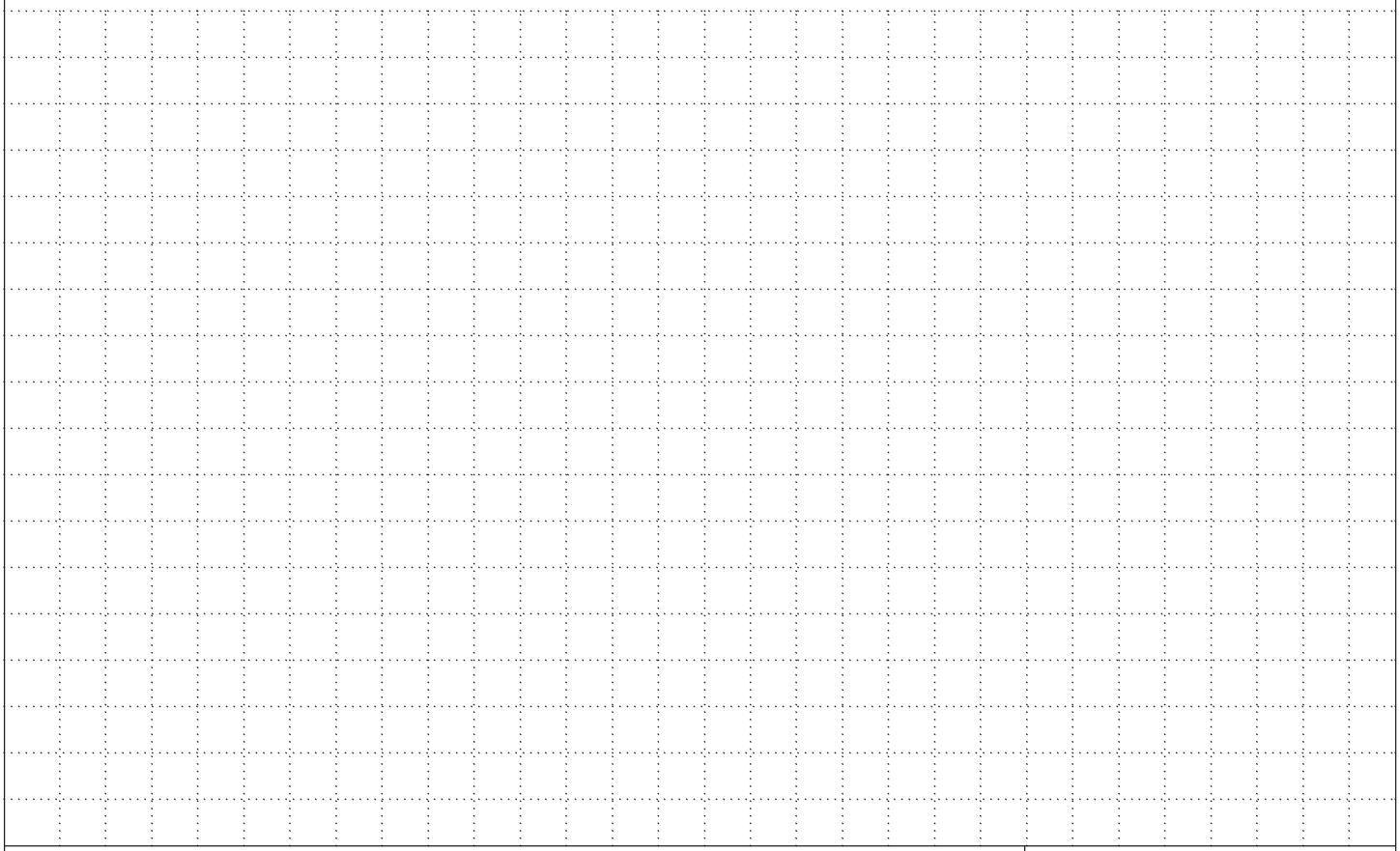
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0112

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0112

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3190.3	0	Yellowish brown sandy silty clay (CL)					
			0.0 ppm		DP0112-00-0316-0.5		
3189.3	1						
3188.3	2		0.0 ppm		DP0112-00-0316-4-6		
3187.3	3						
3186.3	4						
3185.3	5	Yellowish brown fill with white gravel, crushed gray rock (GP)					
3184.3	6		0.0 ppm				
3183.3	7						
3182.3	8						
3181.3	9	no recovery					
3180.3	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0112

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0112

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3180.3	10		0.0 ppm				
3179.3	11						
3178.3	12						
3177.3	13	Yellowish brown fill with white gravel, crushed gray rock (GP)					
3176.3	14	Yellowish brown medium sandy silty clay (CL)	5.4 ppm				Slight petroleum odor
3175.3	15						
3174.3	16						
3173.3	17						
3172.3	18						
3171.3	19	Yellowish brown medium sandy silty clay (CL)	0.0 ppm				
3170.3	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0112

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0112

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3170.3	20						
3169.3	21						
3168.3	22						
3167.3	23						
3166.3	24						
3165.3	25						
3164.3	26	End of boring	0.0 ppm				Groundwater not encountered
3163.3	27						
3162.3	28						
3161.3	29						
3160.3	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0112

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0113

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,466.3 North 1,242,416.1 East
	9. SURFACE ELEVATION: 3193.2' NAVD 1929
	10. DATE STARTED: 3/14/16 / 11. DATE COMPLETED: 3/14/16
12. OVERBURDEN THICKNESS: 18	15. DEPTH GROUNDWATER ENCOUNTERED: 18
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 15
14. TOTAL DEPTH OF HOLE: 18.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2' stickup

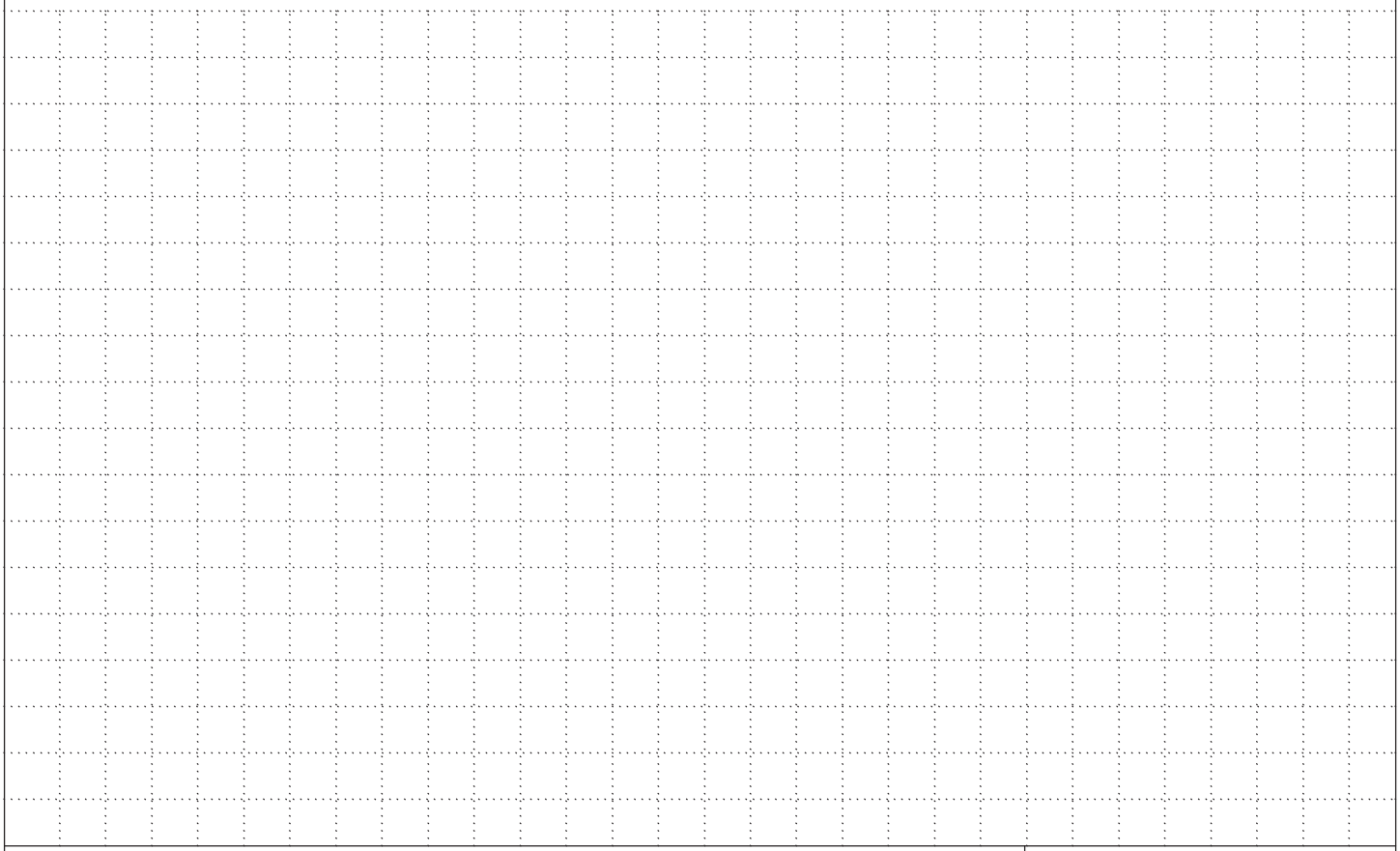
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0113

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0113

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3193.2	0	Olive brown sandy clay (CL)	0.0 ppm	DP0113-00-0316-0.5			*Sample taken from first boring attempt.
3192.2	1						
3191.2	2	Yellowish brown fill with white gravel, crushed rock, reddish brick (GP)	0.0 ppm				
3190.2	3						
3189.2	4						
3188.2	5	Yellowish brown fill with white gravel, crushed rock, reddish brick, assorted fill (GP)					
3187.2	6		0.0 ppm				
3186.2	7						
3185.2	8	Yellowish brown fill with white gravel, crushed rock, reddish brick, assorted fill (GP)	0.0 ppm	DP0113-00-0316-8-10			
3184.2	9						
3183.2	10						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0113

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3183.2	10						
3182.2	11						
3181.2	12						
3180.2	13						
3179.2	14		0.0 ppm				
3178.2	15						
3177.2	16						
3176.2	17	Yellowish brown clay with gravel/pebbles, wet yellowish brown clay (CL)					
3175.2	18	End of boring	0.0 ppm		DP0113-00-0316-18		Top of water table @18' bgs
3174.2	19						
3173.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0113

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0114

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

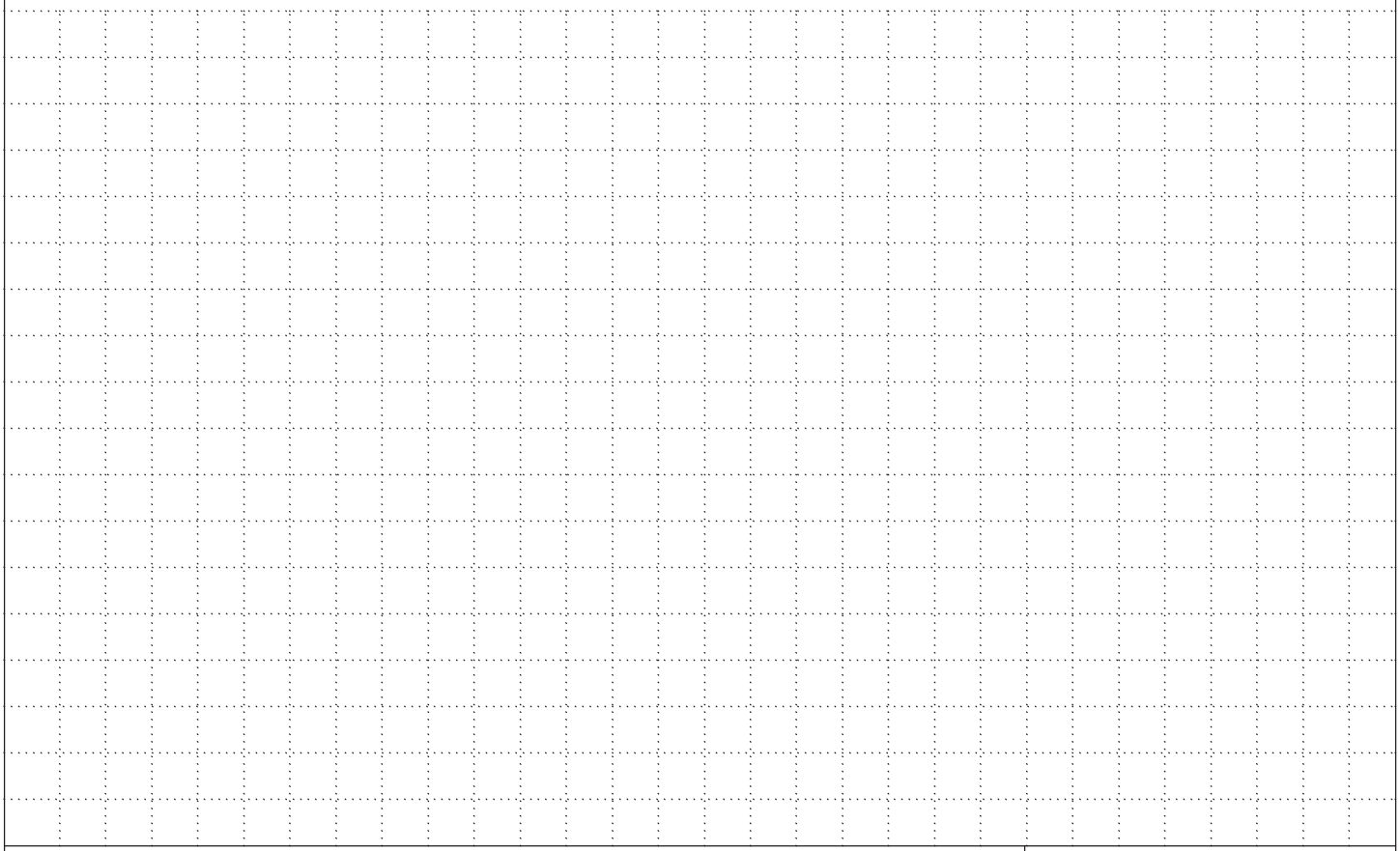
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	667,471.3 North 1,242,516.2 East
	9. SURFACE ELEVATION
	3193.0' NAVD 1929
	10. DATE STARTED: 3/13/16 / 11. DATE COMPLETED: 3/13/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
17	Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	Water not observed
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
17.0	No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0114

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0114

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3193.0	0	Yellowish brown to light gray sandy gravel (GP)	0.0 ppm		DP0114-00-0316-0.5		
3192.0	1						
3191.0	2	Yellowish brown very fine sandy silty clay (CL)	0.0 ppm		DP0114-00-0316-2-4		
3190.0	3						
3189.0	4						
3188.0	5	Assorted yellowish brown fill sand, gravel, broken stone (GP)					
3187.0	6		0.0 ppm				
3186.0	7						
3185.0	8						
3184.0	9						
3183.0	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0114

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0114

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3183.0	10	Assorted yellowish brown fill sand, gravel, broken stone, orange red and gold staining (GP)	0.0 ppm				
3182.0	11						
3181.0	12						
3180.0	13						
3179.0	14						
3178.0	15						
		Assorted yellowish brown fill sand, gravel, broken stone, orange red and gold staining (GP)					
3177.0	16						
3176.0	17						
		End of boring	8.6 ppm				
3175.0	18		0.0 ppm		DP0114-00-0316-18		Top of water table @18' bgs
3174.0	19						
3173.0	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0114

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0115

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

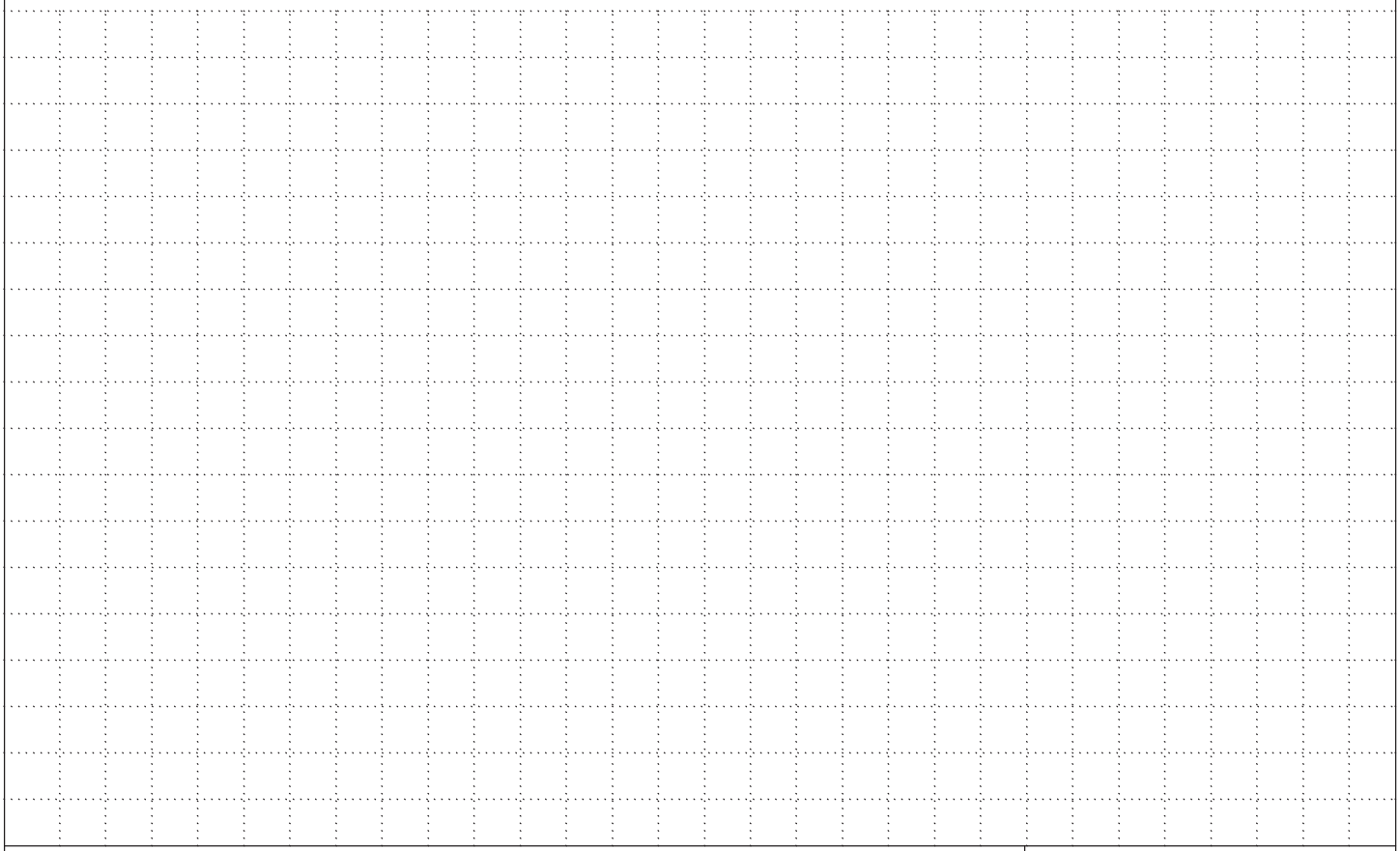
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	667,471.3 North 1,242,613.0 East
	9. SURFACE ELEVATION
	3191.9' NAVD 1929
	10. DATE STARTED: 3/13/16 / 11. DATE COMPLETED: 3/13/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
29	Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	28.6
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
29.0	1.2' stickup

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0115

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0115

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3191.9	0	Dark yellowish brown silty clay with rootlets (CL)					
			0.0 ppm		DP0115-00-0316-0.5		
3190.9	1						
		Yellowish brown sandy silty clay with olive gray stringers, dessicated (CL)					
3189.9	2		0.0 ppm				
3188.9	3						
3187.9	4						
3186.9	5						
		Yellowish brown sandy silty clay with olive gray stringers, dessicated (CL)					
3185.9	6		0.0 ppm		DP0115-00-0316-6-8		
3184.9	7						
3183.9	8		0.0 ppm				
3182.9	9						
3181.9	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0115

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0115

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3181.9	10	no recovery					
3180.9	11						
3179.9	12	Yellowish brown sandy silty clay with olive gray stringers, dessicated (CL)					
3178.9	13	Yellowish brown sandy clay with light gray gravel (CL)					
3177.9	14	no recovery	0.0 ppm				
3176.9	15						
3175.9	16						
3174.9	17	Yellowish brown medium sand, plastic texture, moist (SP)					
3173.9	18	Yellowish brown medium sandy clay, orange stain @ 18.5' (CL)					
3172.9	19	Yellowish brown to olive gray clay (CL)	0.0 ppm		DP0115-00-0316-19		Groundwater not encountered
3171.9	20						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0115

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3171.9	20						
3170.9	21						
3169.9	22						
3168.9	23						
3167.9	24	Yellowish brown to olive gray clay (CL)	0.0 ppm				
3166.9	25						
3165.9	26						
3164.9	27						
3163.9	28						
3162.9	29	End of boring	0.0 ppm				
3161.9	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0115

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0116
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF 2 SHEETS
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,315.7 North 1,242,034.1 East	
	9. SURFACE ELEVATION: 3178.0' NAVD 1929	
	10. DATE STARTED: 3/14/16	11. DATE COMPLETED: 3/14/16
12. OVERBURDEN THICKNESS: 11	15. DEPTH GROUNDWATER ENCOUNTERED: 11	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 5.35	
14. TOTAL DEPTH OF HOLE: 11.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.05' stickup	

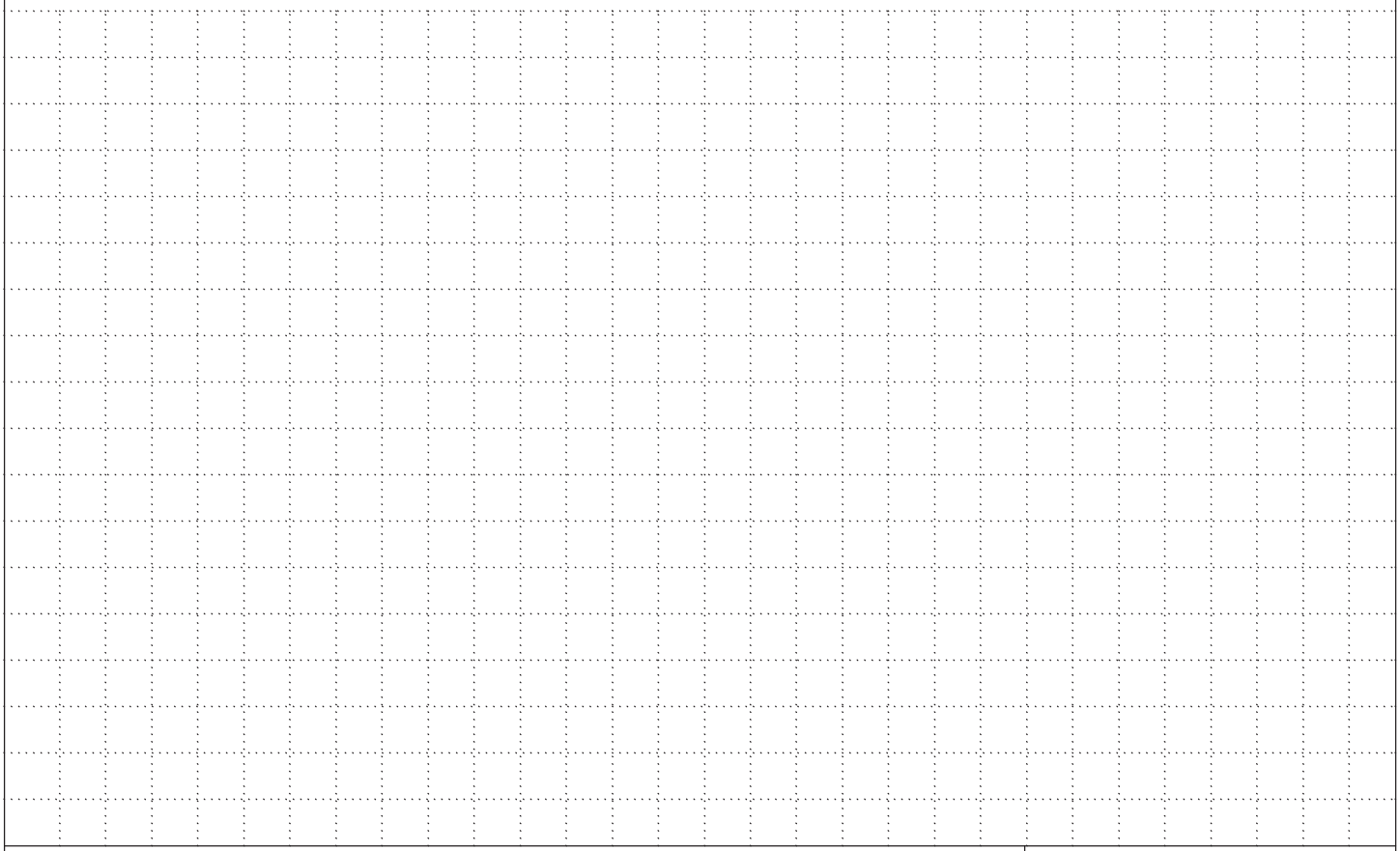
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0116

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0116

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3178.0	0	Dark yellowish brown silty clay with rootlets (CL)	0.0 ppm		DP0116-00-0316-0.5		
3177.0	1	Light yellowish brown very fine sandy clay (CL)					
3176.0	2		0.0 ppm		DP0116-00-0316-2-10		
3175.0	3						
3174.0	4						
3173.0	5	Light yellowish brown very fine sandy clay (CL)					
3172.0	6		0.0 ppm				Water measured after 24 hrs @ 5.35' bgs
3171.0	7						
3170.0	8						
3169.0	9	End of boring	0.0 ppm				
3168.0	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0116

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0118

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,370.6 North 1,242,410.2 East
	9. SURFACE ELEVATION: 3192.4' NAVD 1929
	10. DATE STARTED: 3/08/16 / 11. DATE COMPLETED: 3/08/16
12. OVERBURDEN THICKNESS: 21	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 21.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.7' stickup

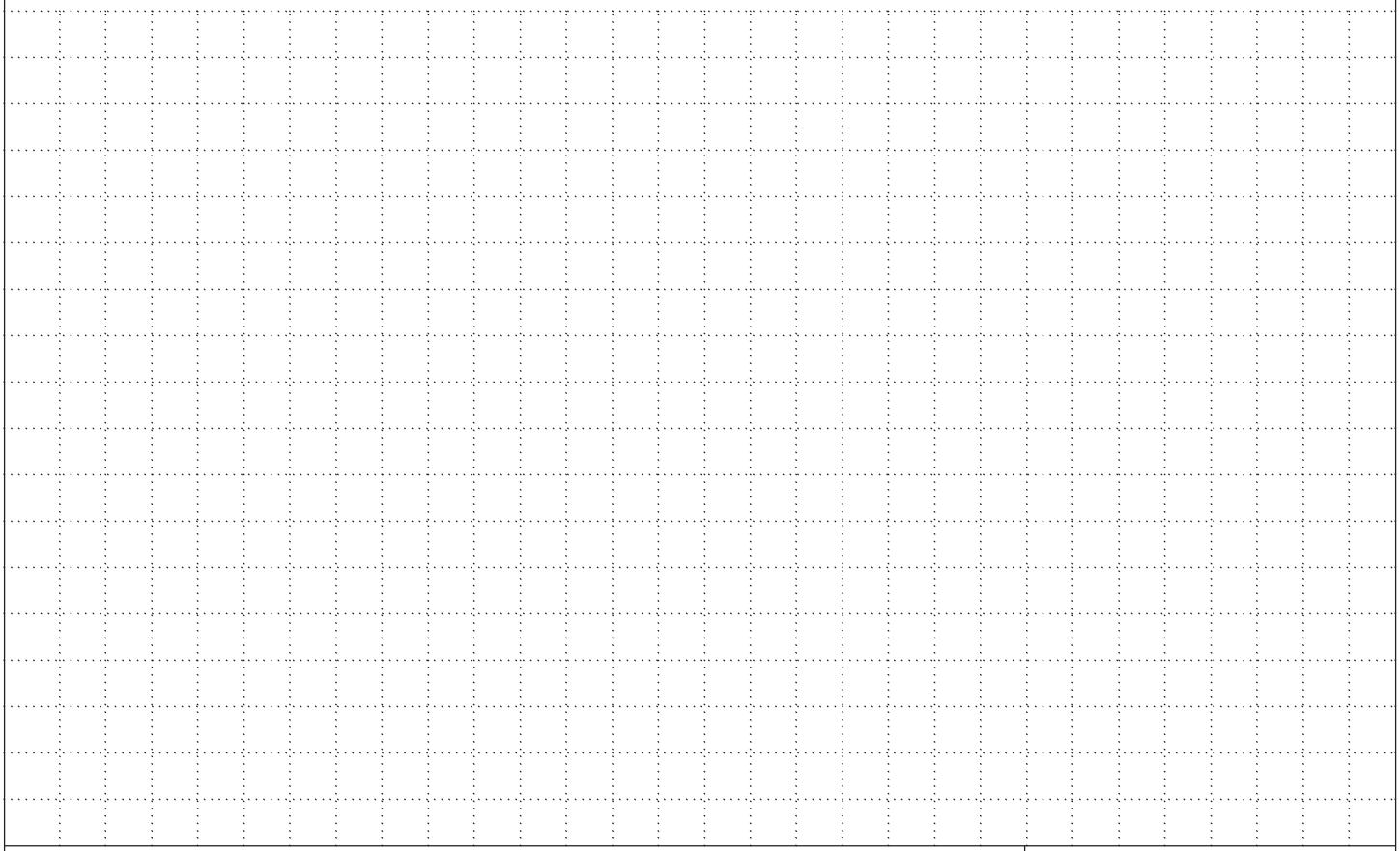
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0118

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0118

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3192.4	0	Yellowish brown sandy silty clay (CL)					
		Yellowish brown to medium gray fill (GP)	0.0 ppm		DP0118-00-0316-0.5		
3191.4	1						
3190.4	2	Yellowish brown silty clay (CL)	0.0 ppm		DP0118-00-0316-2-4		
3189.4	3						
3188.4	4	Yellowish brown to medium gray fill with green staining (GP)					
3187.4	5	Yellowish brown to medium gray fill (GP)					
3186.4	6		0.0 ppm				Water measured after 24 hrs @ 5.35' bgs
3185.4	7						
3184.4	8	Yellowish brown to medium gray fill (GP)					
3183.4	9		0.0 ppm				
3182.4	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0118

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0118

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3182.4	10						
3181.4	11						
3180.4	12		0.0 ppm				
3179.4	13	Yellowish brown to medium gray fill (GP)					
3178.4	14						
3177.4	15						
3176.4	16	Yellowish brown to medium gray fill (GP)	527 ppm		DP0118-00-0316-16		Petroleum odor, black staining observed
3175.4	17						
3174.4	18	Yellowish brown clay (CL)					
3173.4	19						
3172.4	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0118

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0118

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3172.4	20						
3171.4	21	End of boring	0.0 ppm				
3170.4	22						
3169.4	23						
3168.4	24						
3167.4	25						
3166.4	26						
3165.4	27						
3164.4	28						
3163.4	29						
3162.4	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0118

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0119

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

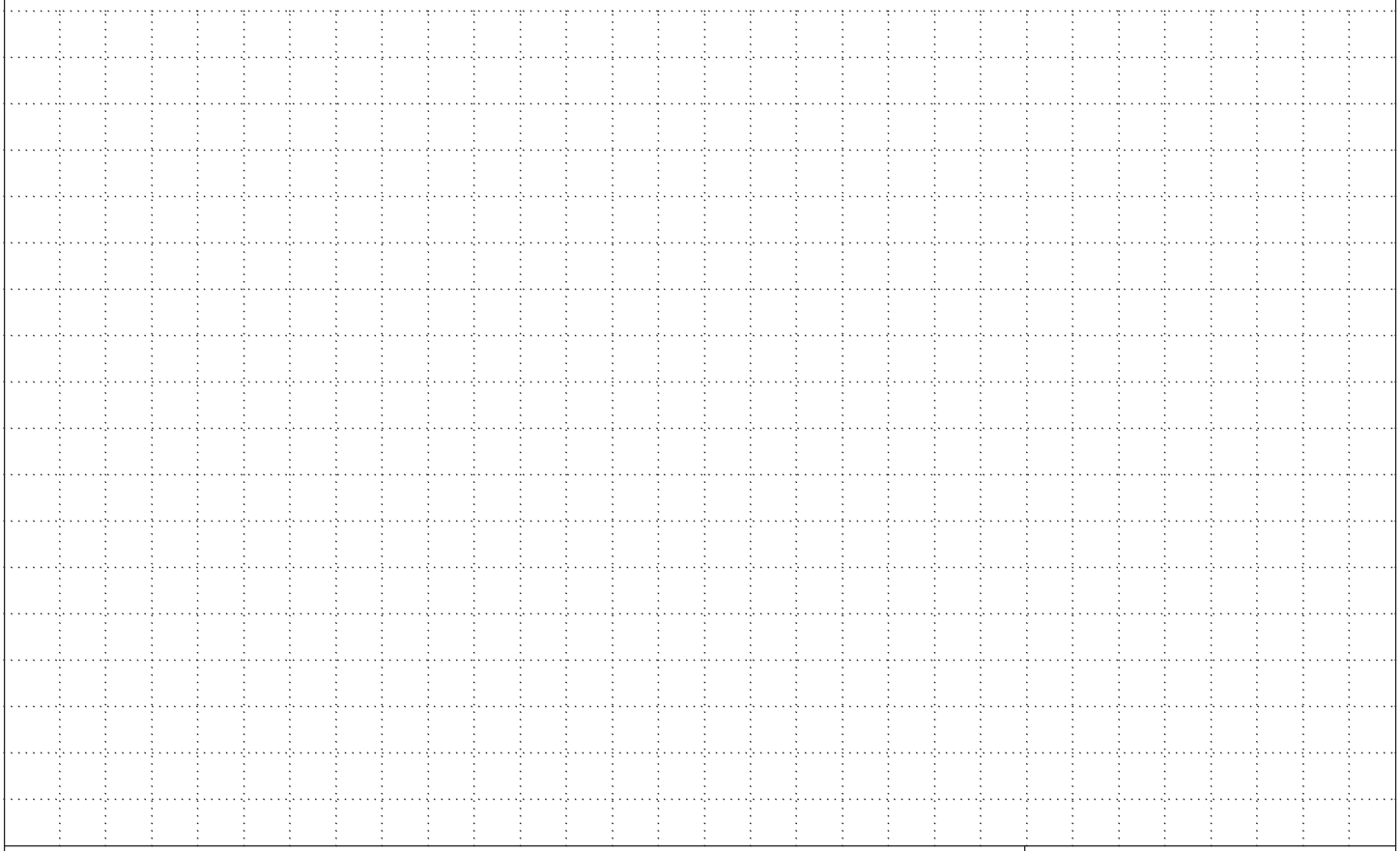
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,367.5 North 1,242,510.0 East
	9. SURFACE ELEVATION: 3192.1' NAVD 1929
	10. DATE STARTED: 3/14/16 / 11. DATE COMPLETED: 3/14/16
12. OVERBURDEN THICKNESS: 25	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 25.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0119

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0119

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3192.1	0	Yellowish brown gravelly clay (CL)					
			0.0 ppm		DP0119-00-0316-0.5		
3191.1	1						
3190.1	2						
		Yellowish brown gravelly clay, dessicated (CL)	0.0 ppm				
3189.1	3						
3188.1	4						
3187.1	5						
		Yellowish brown gravelly clay, dessicated (CL)					
3186.1	6						
			0.0 ppm				
3185.1	7						
		Yellowish brown medium to coarse sand (SP)					
3184.1	8						
			0.0 ppm		DP0119-00-0316-8-10		
3183.1	9						
3182.1	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0119

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0119

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3182.1	10	no recovery					
3181.1	11						
3180.1	12	Yellowish brown medium to coarse sand, reddish staining @ 13' (SP)					
3179.1	13	Olive gray silty clay (CL)	0.0 ppm		DP0119-00-0316-13		
3178.1	14	Yellowish brown gravelly sand (SP)					
		Olive gray clay (CL)					
3177.1	15						
3176.1	16	Olive gray clay (CL)					
3175.1	17						
3174.1	18		0.0 ppm				
3173.1	19						
3172.1	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0119

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0119

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3172.1	20	Olive gray clay (CL)					
3171.1	21						
3170.1	22						
3169.1	23						
3168.1	24						
3167.1	25	End of boring	0.0 ppm				Groundwater not encountered
3166.1	26						
3165.1	27						
3164.1	28						
3163.1	29						
3162.1	30						

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0121

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,269.1 North 1,242,314.6 East
	9. SURFACE ELEVATION: 3184.7' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 23	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 23.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 3.2' stickup

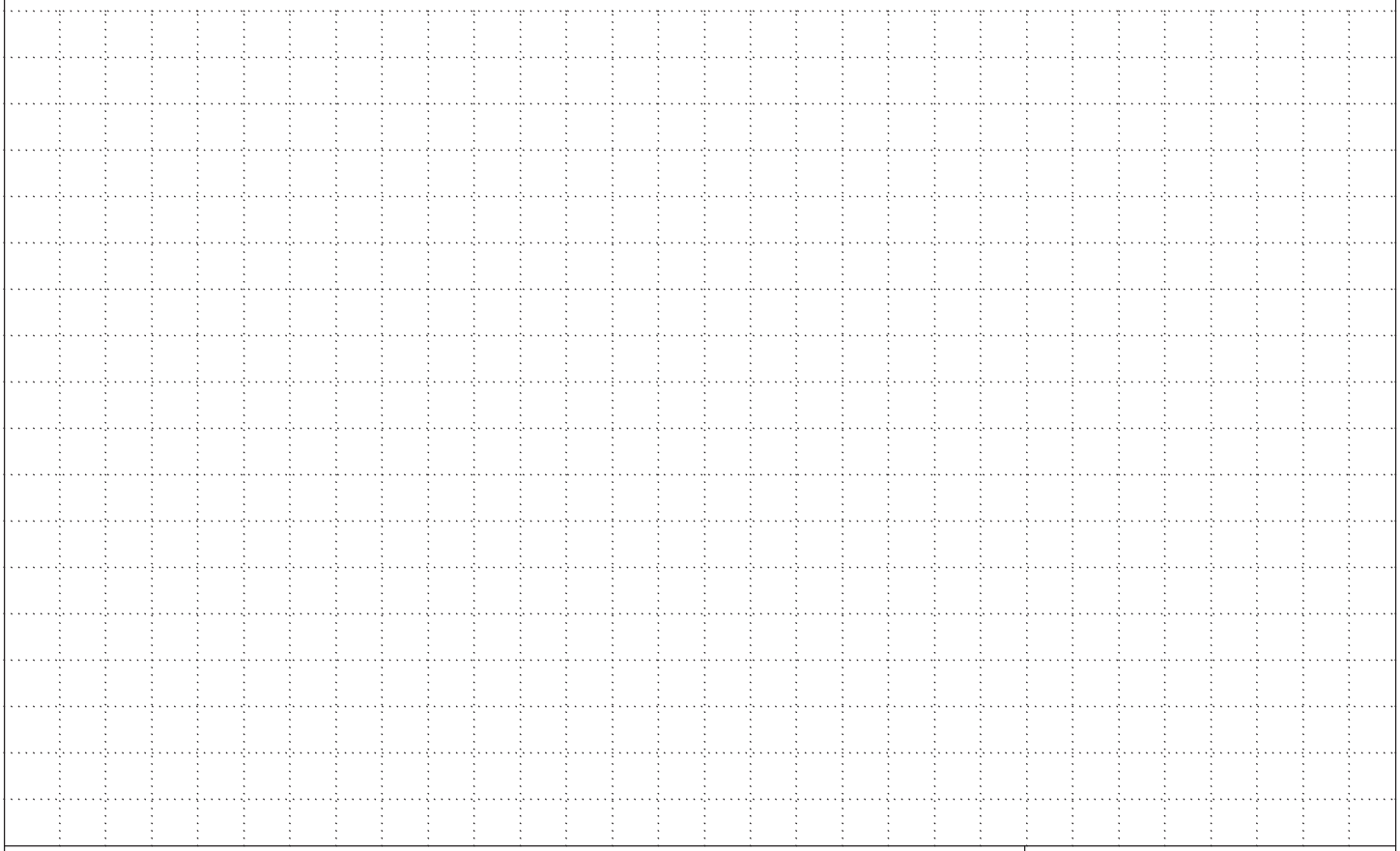
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0121

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0121

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3184.7	0	Yellowish brown sandy silty clay with rootlets (CL)					
		Yellowish brown medium gray sandy gravelly fill (GP)	0.0 ppm		DP0121-00-0316-0.5		
3183.7	1						
3182.7	2		0.0 ppm		DP0121-00-0316-2-4		
3181.7	3						
3180.7	4						
3179.7	5						
		no recovery					
3178.7	6		0.0 ppm				
3177.7	7						
3176.7	8						
		Yellowish brown medium gray sandy gravelly fill (GP)	0.0 ppm				
3175.7	9						
3174.7	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0121

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0121

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3174.7	10	Yellowish brown medium gray sandy gravelly fill (GP)					
3173.7	11						
3172.7	12		0.0 ppm				
3171.7	13						
3170.7	14						
3169.7	15	Yellowish brown clay (CL)					
3168.7	16						
3167.7	17		0.0 ppm				
3166.7	18						
3165.7	19						
3164.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0121

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0121

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3164.7	20	Yellowish brown medium to coarse sand (SP)					
3163.7	21	Olive gray clay (CL)	0.0 ppm		DP0121-00-0316-21		Groundwater not encountered
3162.7	22						
3161.7	23	End of boring					
3160.7	24						
3159.7	25						
3158.7	26						
3157.7	27						
3156.7	28						
3155.7	29						
3154.7	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0121

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0122

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,264.3 North 1,242,411.6 East
	9. SURFACE ELEVATION: 3191.1' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 20	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 14.4
14. TOTAL DEPTH OF HOLE: 20.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.1' stickup

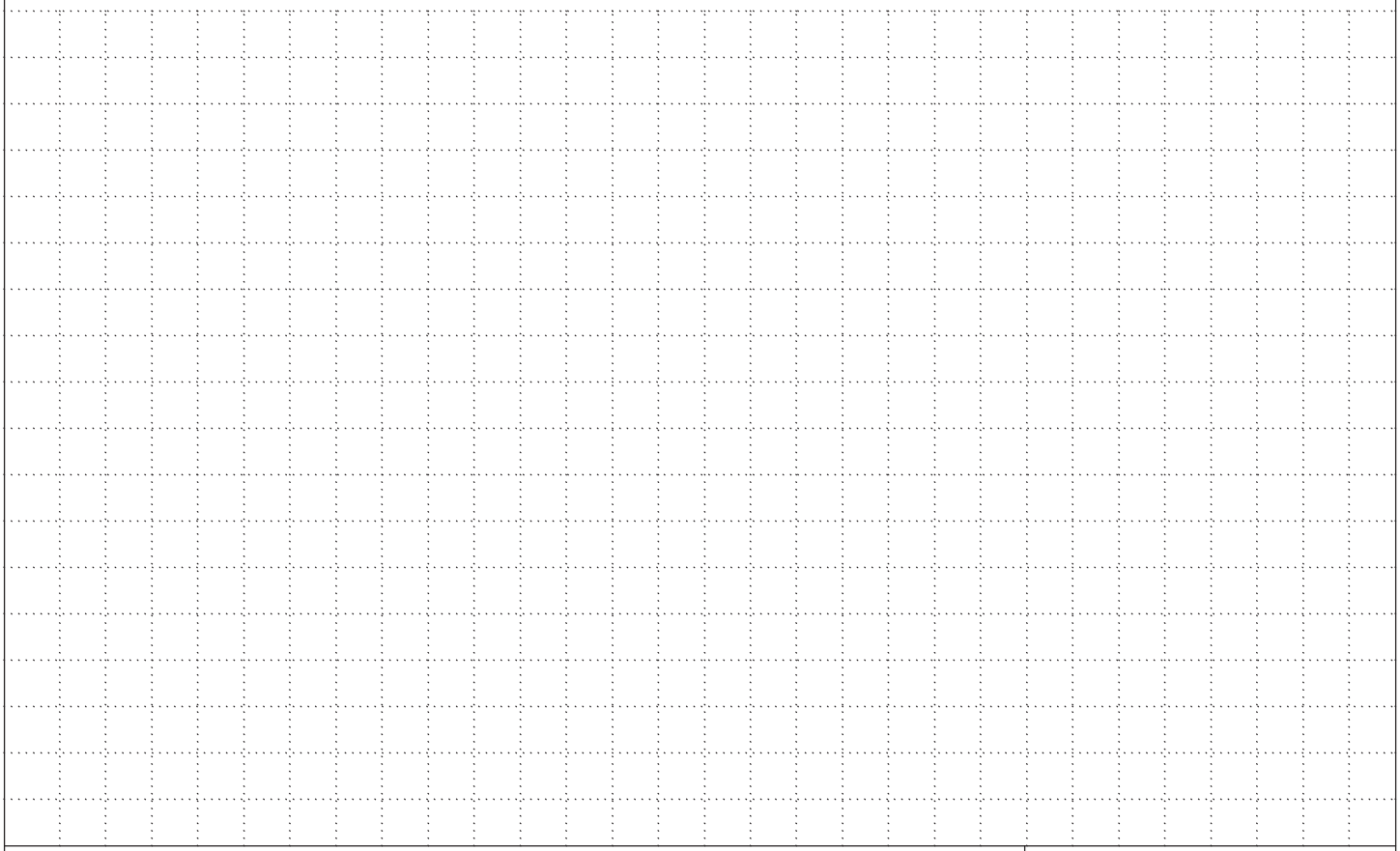
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0122

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0122

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3191.1	0	Yellowish brown very fine sandy silty clay (CL)	0.0 ppm		DP0122-00-0316-0.5		
3190.1	1	Yellowish brown to medium gray sandy gravelly fill (GP)					
3189.1	2		0.0 ppm				
3188.1	3						
3187.1	4						
3186.1	5	no recovery					
3185.1	6	Yellowish brown to medium gray sandy gravelly fill (GP)	0.0 ppm		DP0122-00-0316-6-8		
3184.1	7						
3183.1	8		0.0 ppm				
3182.1	9	no recovery					
3181.1	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0122

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0122

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3181.1	10	no recovery					
3180.1	11						
3179.1	12		0.0 ppm				
3178.1	13	Yellowish brown to medium gray sandy gravelly fill (GP)					
3177.1	14						
3176.1	15	no recovery	0.0 ppm		DP0122-00-0316-15		Petroleum odor, staining of soils down to 20' bgs. Top of water table observed at 14.4' bgs.
3175.1	16						
3174.1	17	Yellowish brown to medium gray sandy gravelly fill (GP)					
3173.1	18	Olive gray clay, petroleum odor, soil staining observed (CL)					
3172.1	19		191 ppm				
3171.1	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0122

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0122

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3171.1	20	End of boring					
3170.1	21						
3169.1	22						
3168.1	23						
3167.1	24						
3166.1	25						
3165.1	26						
3164.1	27						
3163.1	28						
3162.1	29						
3161.1	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0122

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0123

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,272.5 North 1,242,510.9 East
	9. SURFACE ELEVATION: 3192.8' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 19	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 19.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 0' stickup

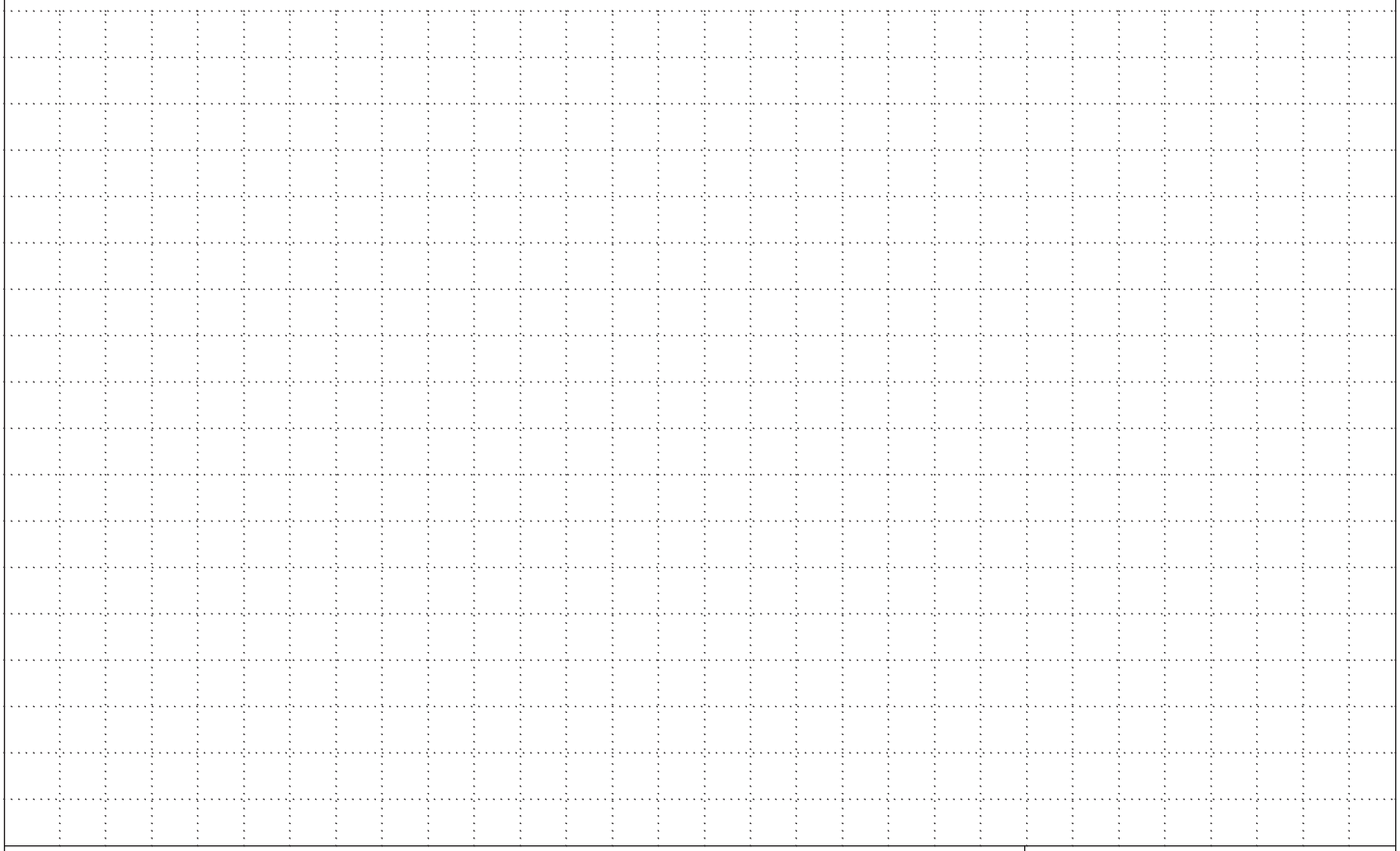
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0123

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0123

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3192.8	0	Yellowish brown silty clay with rootlets (CL)					
		Yellowish brown silty clay with gravel, dessicated (CL)	0.0 ppm		DP0123-00-0316-0.5		
3191.8	1						
3190.8	2		0.0 ppm		DP0123-00-0316-2-4		
3189.8	3						
3188.8	4						
3187.8	5						
		no recovery					
3186.8	6		0.0 ppm				
3185.8	7						
		Yellowish brown/ pinkish medium gray and yellowish gray sandy gravel, fill (GP)					
3184.8	8		0.0 ppm				
3183.8	9						
3182.8	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0123

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0123

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3182.8	10	no recovery					
3181.8	11						
3180.8	12		0.0 ppm				
3179.8	13	Yellowish brown/ pinkish medium gray and yellowish gray sandy gravel, fill (GP)					
3178.8	14						
3177.8	15	no recovery					
3176.8	16						
3175.8	17	Yellowish brown medium sand (SP)					
		Olive gray silty clay with very strong petroleum odor (CL)	15.4 ppm		DP0123-00-0316-17.5		Petroleum odor
3174.8	18		124 ppm				
3173.8	19	End of boring					Groundwater not encountered
3172.8	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0123

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0124

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,270.3 North 1,242,612.7 East
	9. SURFACE ELEVATION: 3191.0' NAVD 1929
	10. DATE STARTED: 3/09/16 / 11. DATE COMPLETED: 3/14/16
12. OVERBURDEN THICKNESS: 20	15. DEPTH GROUNDWATER ENCOUNTERED: 15
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 14.9
14. TOTAL DEPTH OF HOLE: 20.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 3.6' stickup

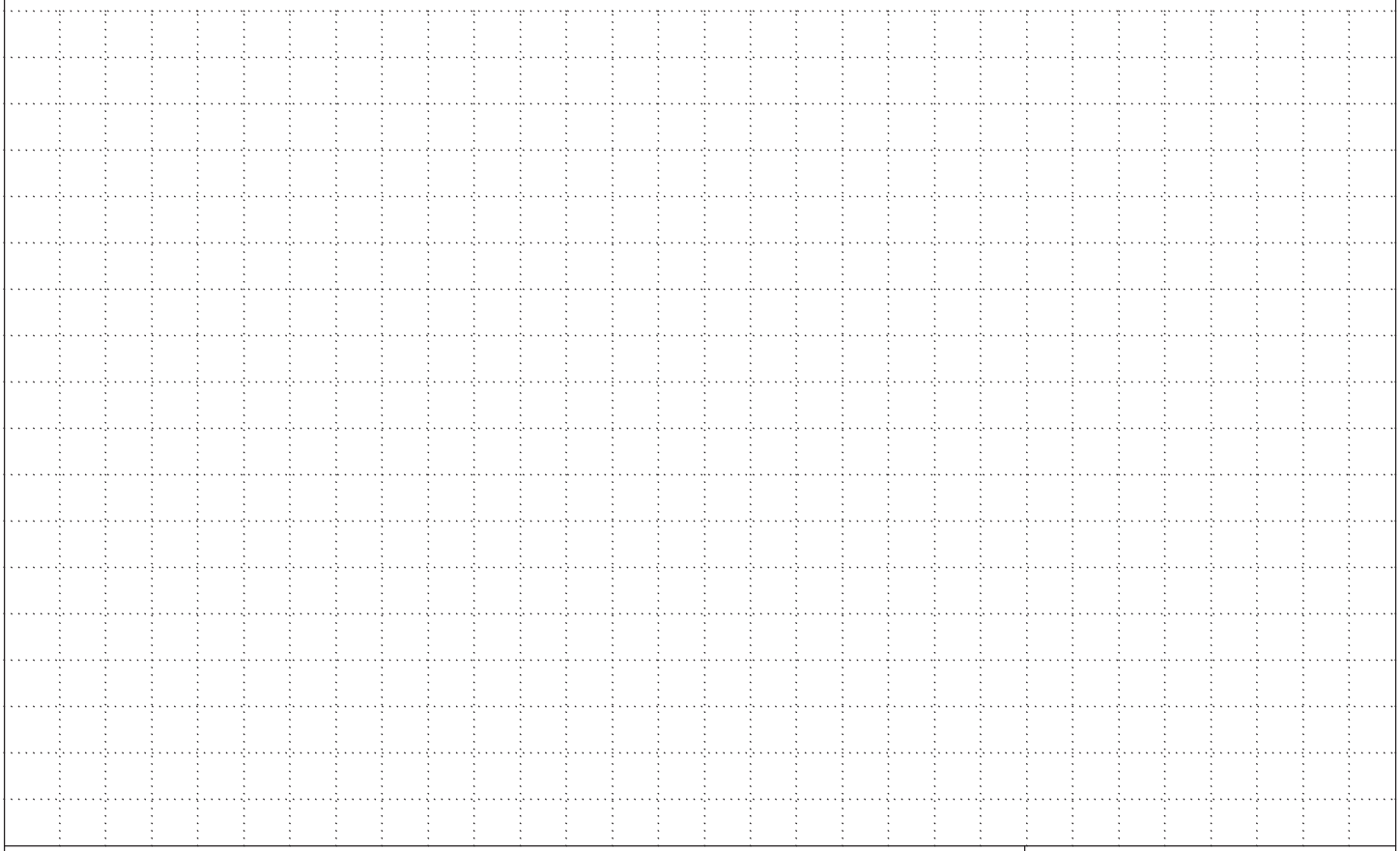
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0124

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0124

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3191.0	0	Reddish brown clay with rootlets & gravel (GP)					
		Light gray clay with gravel (CL)	0.0 ppm		DP0124-00-0316-0.5		*Sample taken from first boring attempt.
3190.0	1	Light gray clay (CL)					
3189.0	2		0.0 ppm				
3188.0	3	No recovery					
3187.0	4						
3186.0	5						
3185.0	6		0.0 ppm				
3184.0	7						
		Yellowish brown very fine sandy clay (CL)					
3183.0	8		0.0 ppm		DP0124-00-0316-8-10		*Sample taken from first boring attempt.
3182.0	9						
3181.0	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0124

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0124

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3181.0	10	no recovery. Unoriented sample in shoe - yellowish brown very fine clay with gravel (CL)					
3180.0	11						
3179.0	12		0.0 ppm				
3178.0	13						
		Yellowish brown sandy silty fill with Gravel (GP)					
3177.0	14						
3176.0	15						
		Yellowish brown medium sand, wet (SP)	0.0 ppm				Top of water table @ 15' bgs.
3175.0	16						
3174.0	17						
		Olive gray clay (CL)	0.0 ppm		DP0124-00-0316-17		Borehole collapse preventing screen to 17' bgs. Reemed and removed material 3x. Screen set to 14' bgs.
3173.0	18						
3172.0	19						
3171.0	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0124

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0124

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3171.0	20	End of boring	0.0 ppm				
3170.0	21						
3169.0	22						
3168.0	23						
3167.0	24						
3166.0	25						
3165.0	26						
3164.0	27						
3163.0	28						
3162.0	29						
3161.0	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0124

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0125

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	667,302.4 North 1,242,865.1 East
	9. SURFACE ELEVATION
	3183.3' NAVD 1929
	10. DATE STARTED: 3/16/16 / 11. DATE COMPLETED: 3/16/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
10	8
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	Water not observed
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
10.0	2' stickup

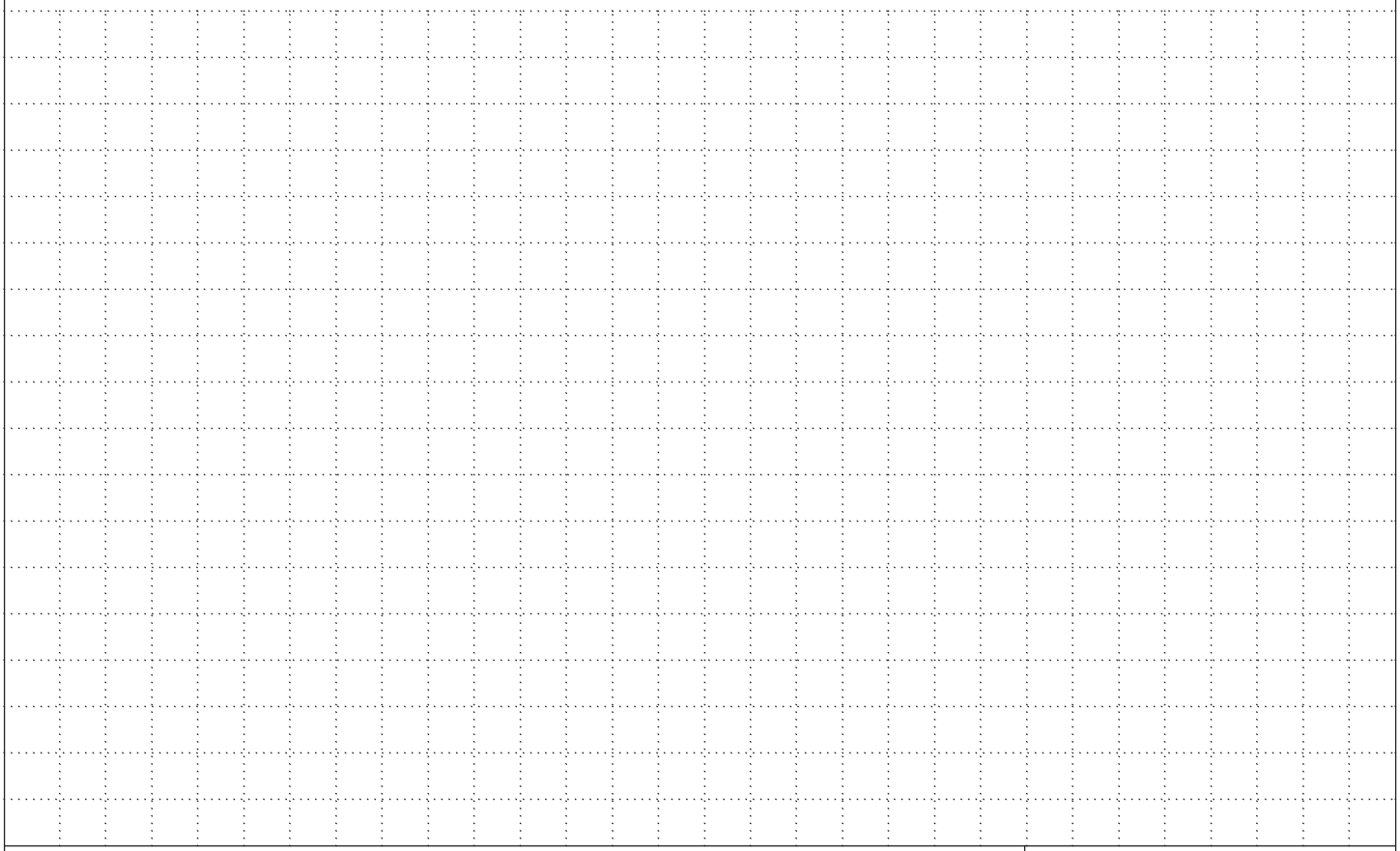
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0125

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0125

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3183.3	0	Yellowish brown sandy silty clay (CL)	0.0 ppm		DP0125-00-0316-0.5		
3182.3	1	Yellowish brown pinkish medium gray, sandy gravel (GP)					
3181.3	2		0.0 ppm		DP0125-00-0316-2-10		
3180.3	3						
3179.3	4						
3178.3	5	Yellowish brown pinkish medium gray, sandy gravel (GP)					
3177.3	6		0.0 ppm				
3176.3	7						
3175.3	8		0.0 ppm				Top of water table @ 8' bgs.
3174.3	9						
3173.3	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0125

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0125

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3173.3	10	End of boring	0.0 ppm	DP0125-00-0316-10			
3172.3	11						
3171.3	12						
3170.3	13						
3169.3	14						
3168.3	15						
3167.3	16						
3166.3	17						
3165.3	18						
3164.3	19						
3163.3	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0125

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

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DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0127

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,168.7 North 1,242,409.1 East
	9. SURFACE ELEVATION: 3189.7' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 20	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 20.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2' stickup

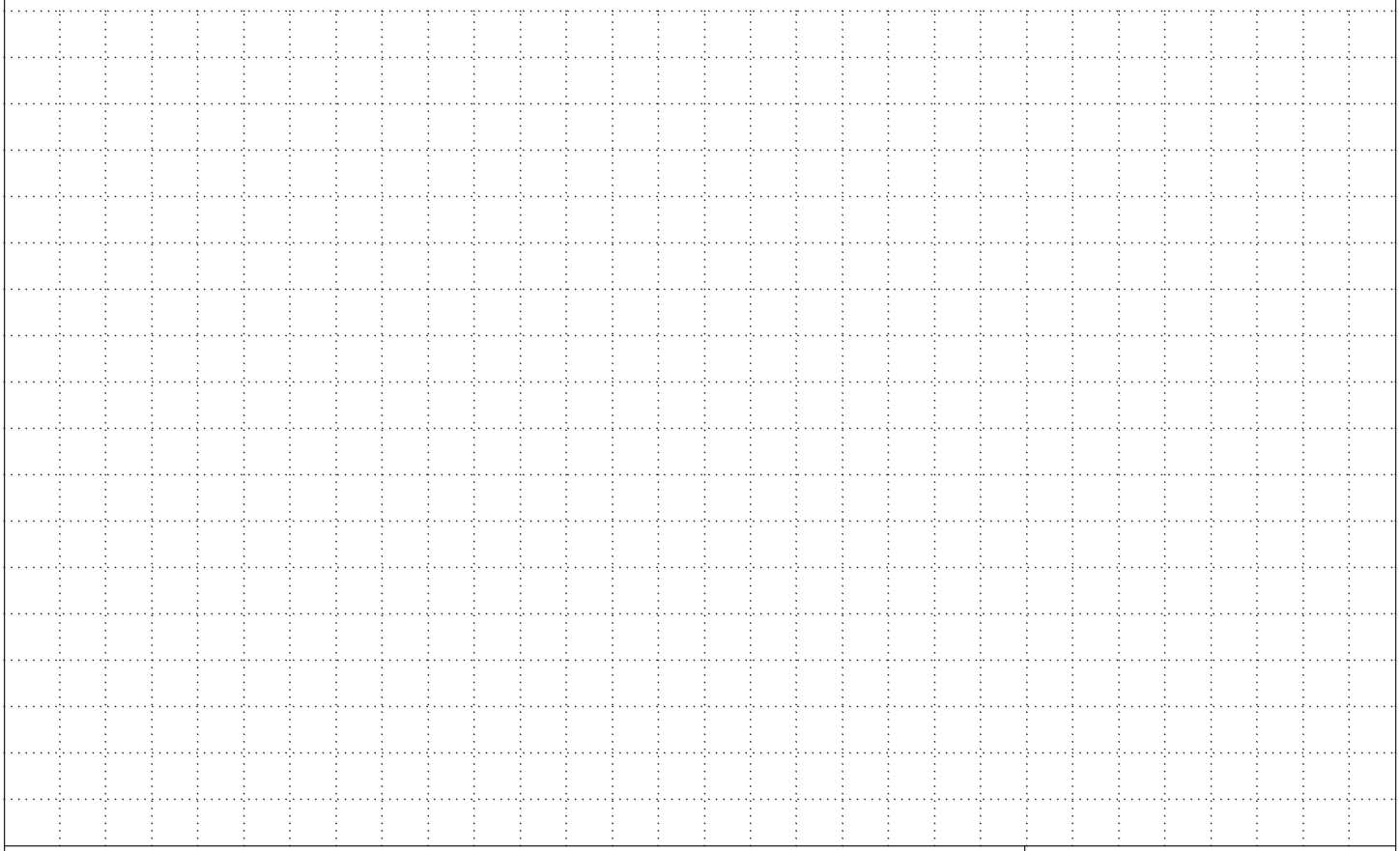
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0127

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0127

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3189.7	0	Yellowish brown silty clay (CL)					
			0.0 ppm		DP0127-00-0316-0.5		
3188.7	1						
		Yellowish brown medium gray pinkish fill (GP)					
3187.7	2		0.0 ppm		DP0127-00-0316-4-6		
3186.7	3						
3185.7	4						
3184.7	5						
		Yellowish brown medium gray pinkish fill (GP)					
3183.7	6		0.0 ppm				
3182.7	7						
3181.7	8		0.0 ppm				
3180.7	9						
3179.7	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0127

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0127

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3179.7	10	Yellowish brown medium gray pinkish fill (GP)	0.0 ppm				
3178.7	11						
3177.7	12						
3176.7	13		0.0 ppm				
3175.7	14						
3174.7	15						
		Yellowish brown medium gray pinkish fill (GP)					
3173.7	16						
3172.7	17		0.0 ppm		DP0127-00-0316-17		
3171.7	18						
		Yellowish brown to olive gray clay (CL)					
3170.7	19						
3169.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0127

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0127

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3169.7	20	End of boring	0.0 ppm				Groundwater not encountered
3168.7	21						
3167.7	22						
3166.7	23						
3165.7	24						
3164.7	25						
3163.7	26						
3162.7	27						
3161.7	28						
3160.7	29						
3159.7	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0127

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0128

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,167.8 North 1,242,509.7 East
	9. SURFACE ELEVATION: 3190.6' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 20	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 20.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 1.5' stickup

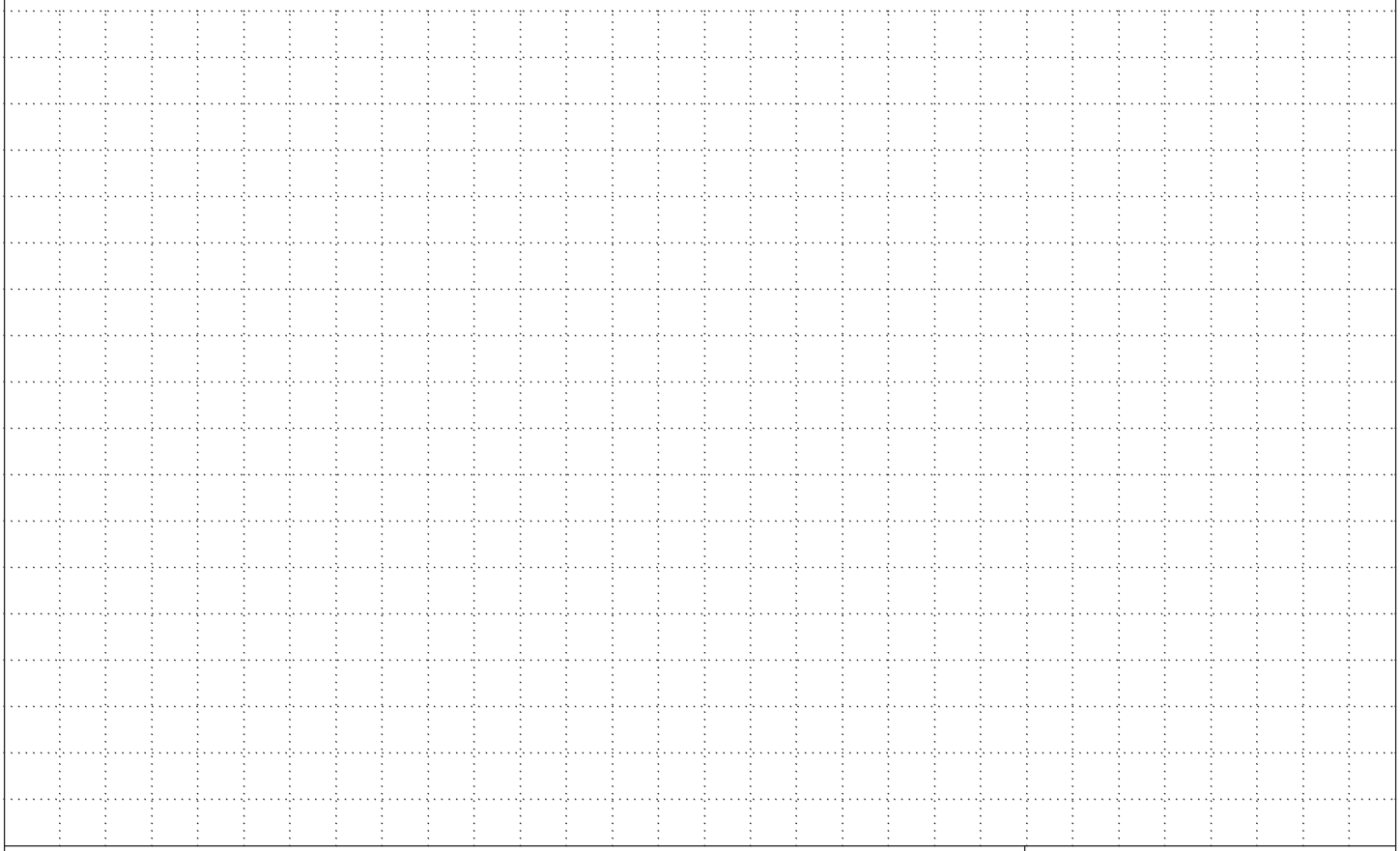
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0128

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0128

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3190.6	0	Dark yellowish brown sandy silty clay with rootlets (CL)					
			0.0 ppm		DP0128-00-0316-0.5		
3189.6	1						
3188.6	2		0.0 ppm				
		Yellowish brown medium sand (SP)					
3187.6	3						
3186.6	4						
3185.6	5						
		no recovery					
3184.6	6		0.0 ppm				
3183.6	7						
		Yellowish brown sandy silty clay (CL)					
3182.6	8		0.0 ppm		DP0128-00-0316-8-10		
3181.6	9						
3180.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0128

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0128

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3180.6	10	no recovery	0.0 ppm				
3179.6	11						
3178.6	12						
		Yellowish brown sandy gravelly fill (GP)					
3177.6	13		0.0 ppm				
3176.6	14						
3175.6	15						
		no recovery	0.0 ppm		DP0128-00-0316-15		Top of water table @ 15'bgs.
3174.6	16						
3173.6	17						
		Olive gray clay (CL)					
3172.6	18		0.0 ppm				
3171.6	19						
3170.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0128

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0128

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3170.6	20	End of boring	0.0 ppm				
3169.6	21						
3168.6	22						
3167.6	23						
3166.6	24						
3165.6	25						
3164.6	26						
3163.6	27						
3162.6	28						
3161.6	29						
3160.6	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0128

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0130

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,073.7 North 1,242,312.4 East
	9. SURFACE ELEVATION: 3173.5' NAVD 1929
	10. DATE STARTED: 3/16/16 / 11. DATE COMPLETED: 3/16/16
12. OVERBURDEN THICKNESS: 19	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 15.94
14. TOTAL DEPTH OF HOLE: 19.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.8' stickup

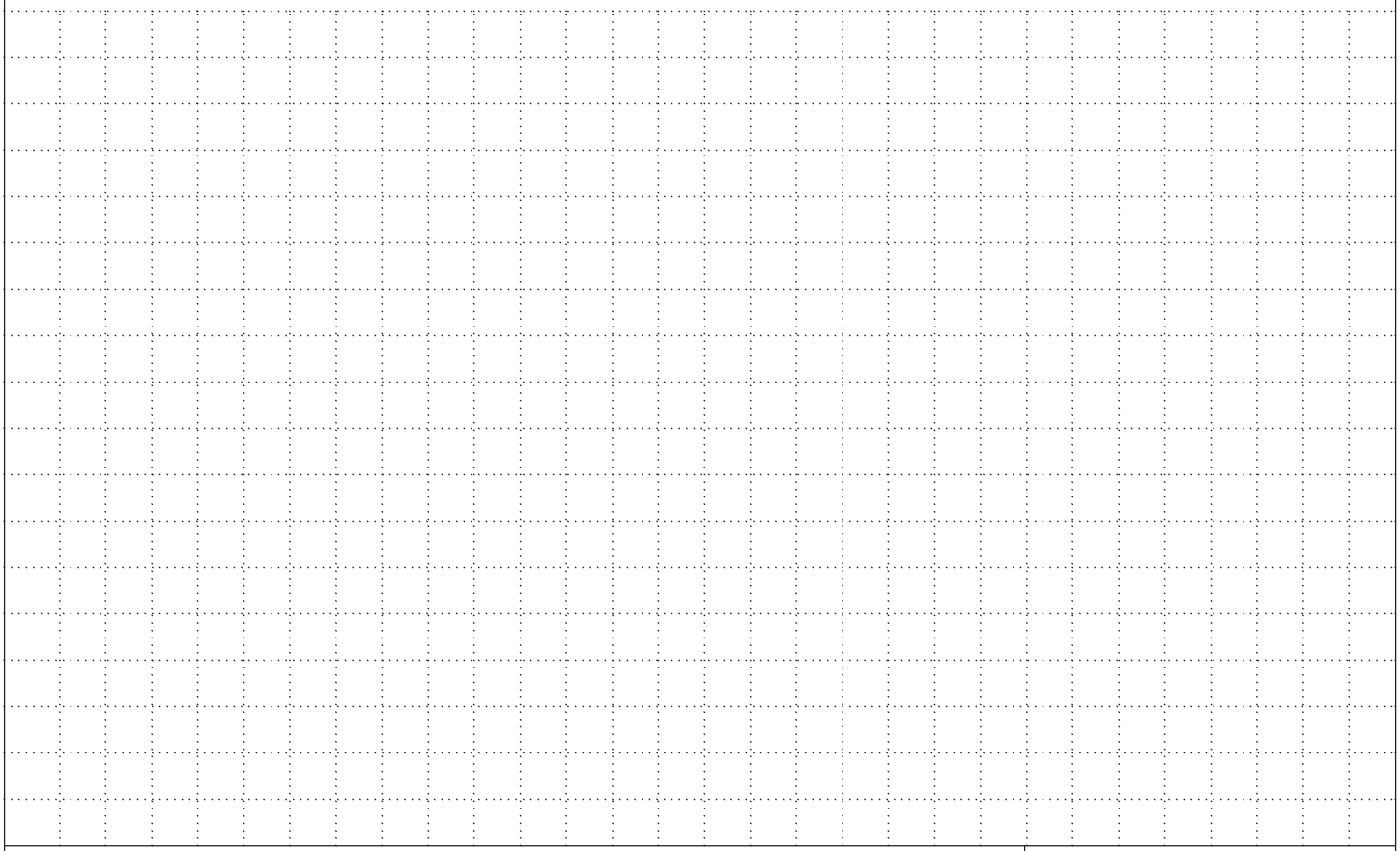
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0130

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0130

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3173.5	0	Yellowish brown sandy silty clay with rootlets (CL)	0.0 ppm		DP0130-00-0316-0.5		
3172.5	1						
3171.5	2	Yellowish brown to medium gray sand with gravel & rock fragments (SP)	0.0 ppm		DP0130-00-0316-2-4		
3170.5	3						
3169.5	4						
3168.5	5	no recovery					
3167.5	6		0.0 ppm				
3166.5	7	Yellowish brown to medium gray sand with gravel & rock fragments (SP)					
3165.5	8		0.0 ppm				
3164.5	9						
3163.5	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0130

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0130

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3163.5	10	Olive brown clay (CL)	133 ppm				Slight petroleum odor
3162.5	11						
3161.5	12						
3160.5	13						
3159.5	14						
		Olive brown clay (CL)	0.0 ppm		DP0130-00-0316-14		Depth to water measured @ 18.74' bgs.
3158.5	15						
3157.5	16		0.0 ppm				
3156.5	17						
3155.5	18						
3154.5	19						
		End of boring	0.0 ppm				
3153.5	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0130

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0131

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

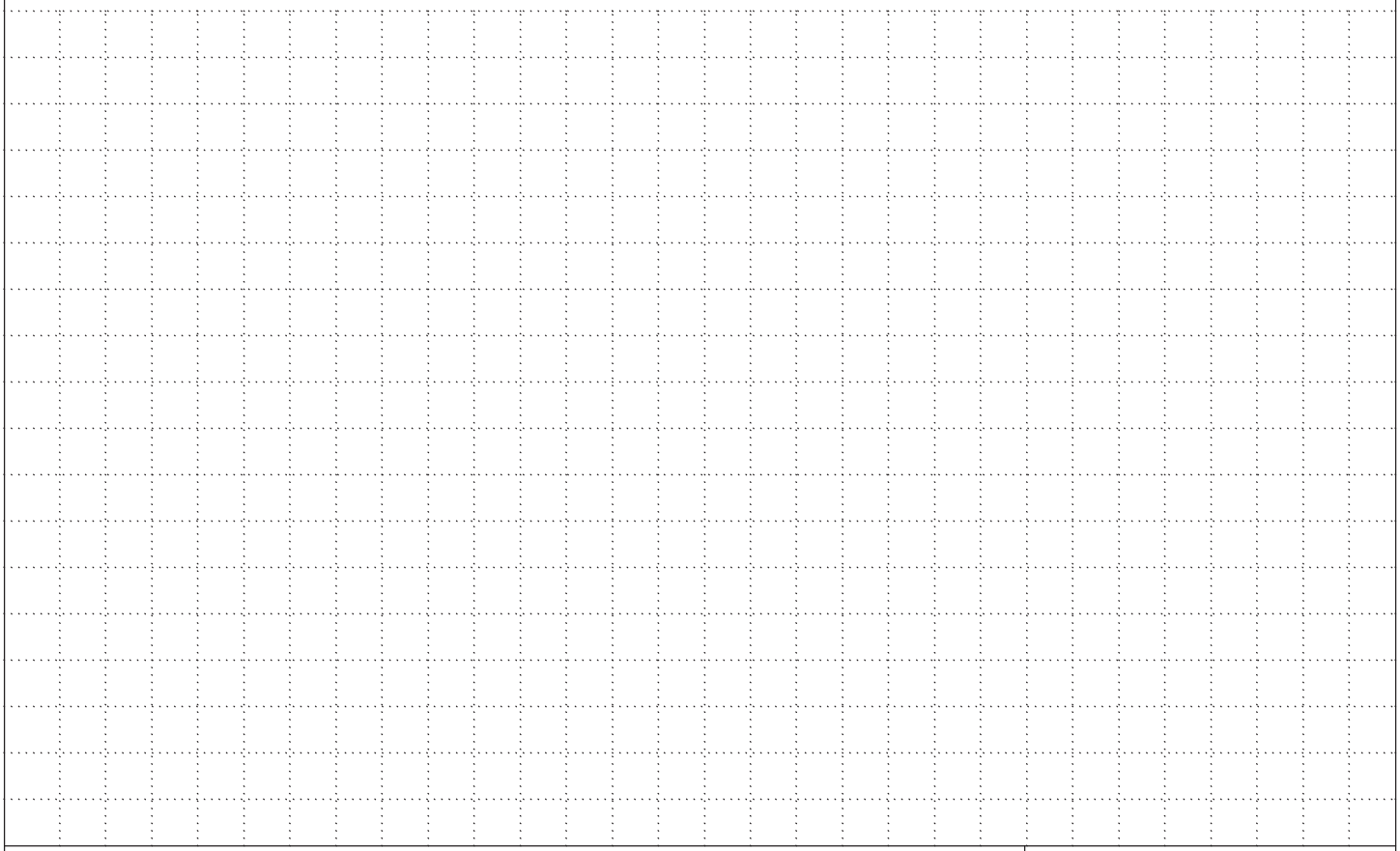
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,072.6 North 1,242,405.2 East
	9. SURFACE ELEVATION: 3180.6' NAVD 1929
	10. DATE STARTED: 3/16/16 / 11. DATE COMPLETED: 3/16/16
12. OVERBURDEN THICKNESS: 14	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 14.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0131

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0131

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3180.6	0	Yellowish brown sandy clay	0.0 ppm		DP0131-00-0316-0.5		
3179.6	1	Medium gray gravel & crushed rock (GP)					
3178.6	2	Yellowish brown sandy silty clay with gravel (SP)	0.0 ppm				
3177.6	3						
3176.6	4						
3175.6	5	Yellowish brown sandy silty clay with gravel (SP)					
3174.6	6	Pinkish gray gravel (GP)	0.0 ppm		DP0131-00-0316-6-8		
		Olive gray clay (CL)					
3173.6	7						
3172.6	8		0.0 ppm				
3171.6	9						
3170.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0131

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0131

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3170.6	10	Pinkish gray gravel - borehole collapse material (GP)	0.0 ppm				
3169.6	11						
3168.6	12	Olive gray clay, dessicated (CL)					
3167.6	13						
3166.6	14	End of boring	0.0 ppm				Groundwater not encountered
3165.6	15						
3164.6	16						
3163.6	17						
3162.6	18						
3161.6	19						
3160.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0131

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0132

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

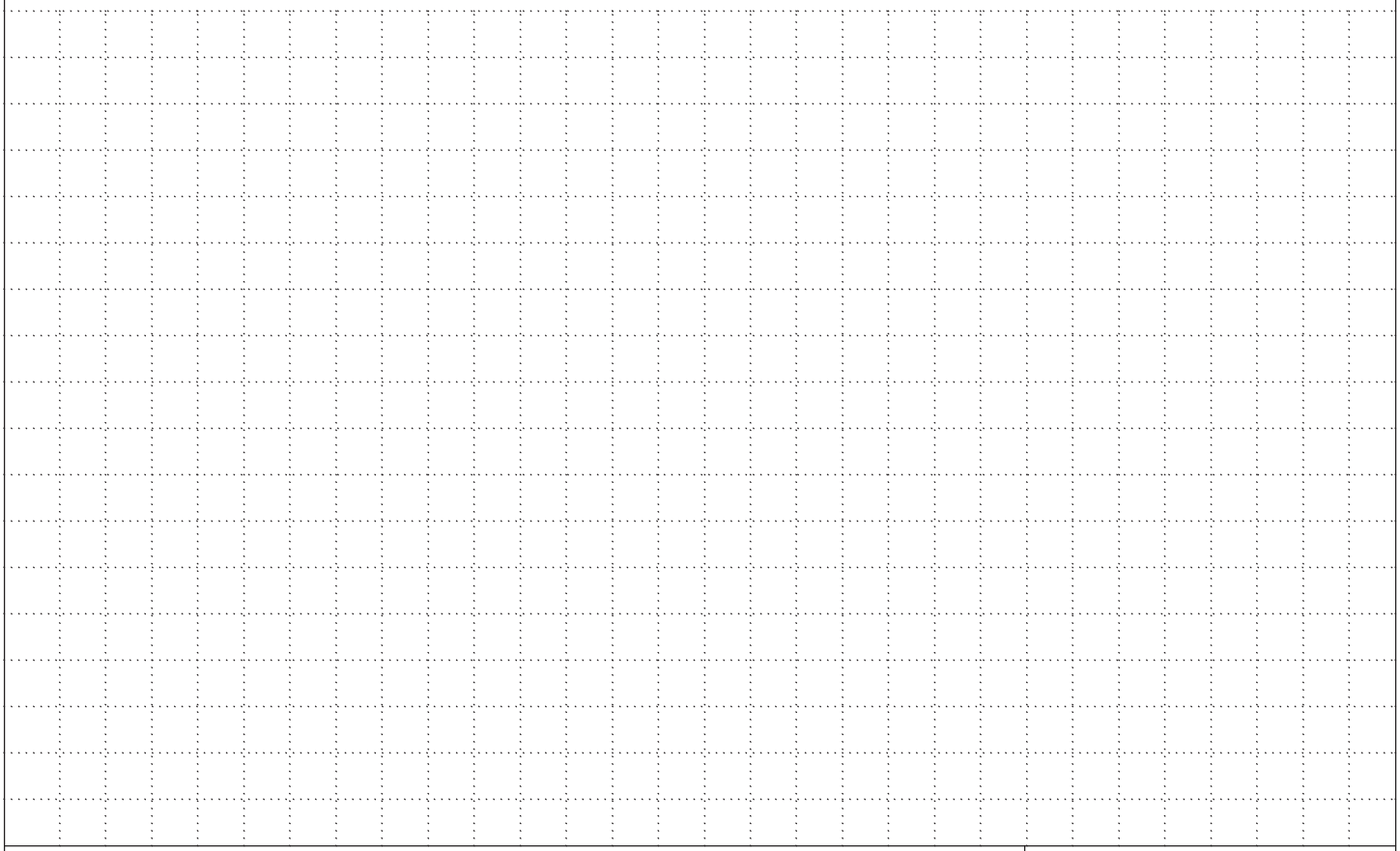
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,066.3 North 1,242,510.2 East
	9. SURFACE ELEVATION: 3187.2' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 25	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 25.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0132

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0132

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3187.2	0	Yellowish brown sandy silty clay with rootlets (CL)					
			0.0 ppm	DP0132-00-0316-0.5			
3186.2	1						
3185.2	2		0.0 ppm				
		Medium gray sandy silty clay (CL)					
3184.2	3						
3183.2	4						
3182.2	5						
		no recovery					
3181.2	6		0.0 ppm				
3180.2	7						
		Yellowish brown coarse sand with gravel & rock fragments (SP)					
3179.2	8						
			0.0 ppm	DP0132-00-0316-8-10			
3178.2	9						
3177.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0132

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0132

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3177.2	10	Yellowish brown coarse sand with gravel & rock fragments (SP)	0.0 ppm				
3176.2	11	Yellowish brown clay (CL)					
3175.2	12						
3174.2	13						
3173.2	14		0.0 ppm				
3172.2	15	Yellowish brown coarse sand with gravel (sloughed fill) (SP)					
3171.2	16						
3170.2	17	Yellowish brown clay (CL)	0.0 ppm				
3169.2	18						
3168.2	19						
3167.2	20						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0132

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3167.2	20	no recovery					
3166.2	21		0.0 ppm				
3165.2	22						
3164.2	23						
		Yellowish brown clay (CL)					
3163.2	24		0.0 ppm				Groundwater not encountered
3162.2	25						
		End of boring					
3161.2	26						
3160.2	27						
3159.2	28						
3158.2	29						
3157.2	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0132

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0133

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

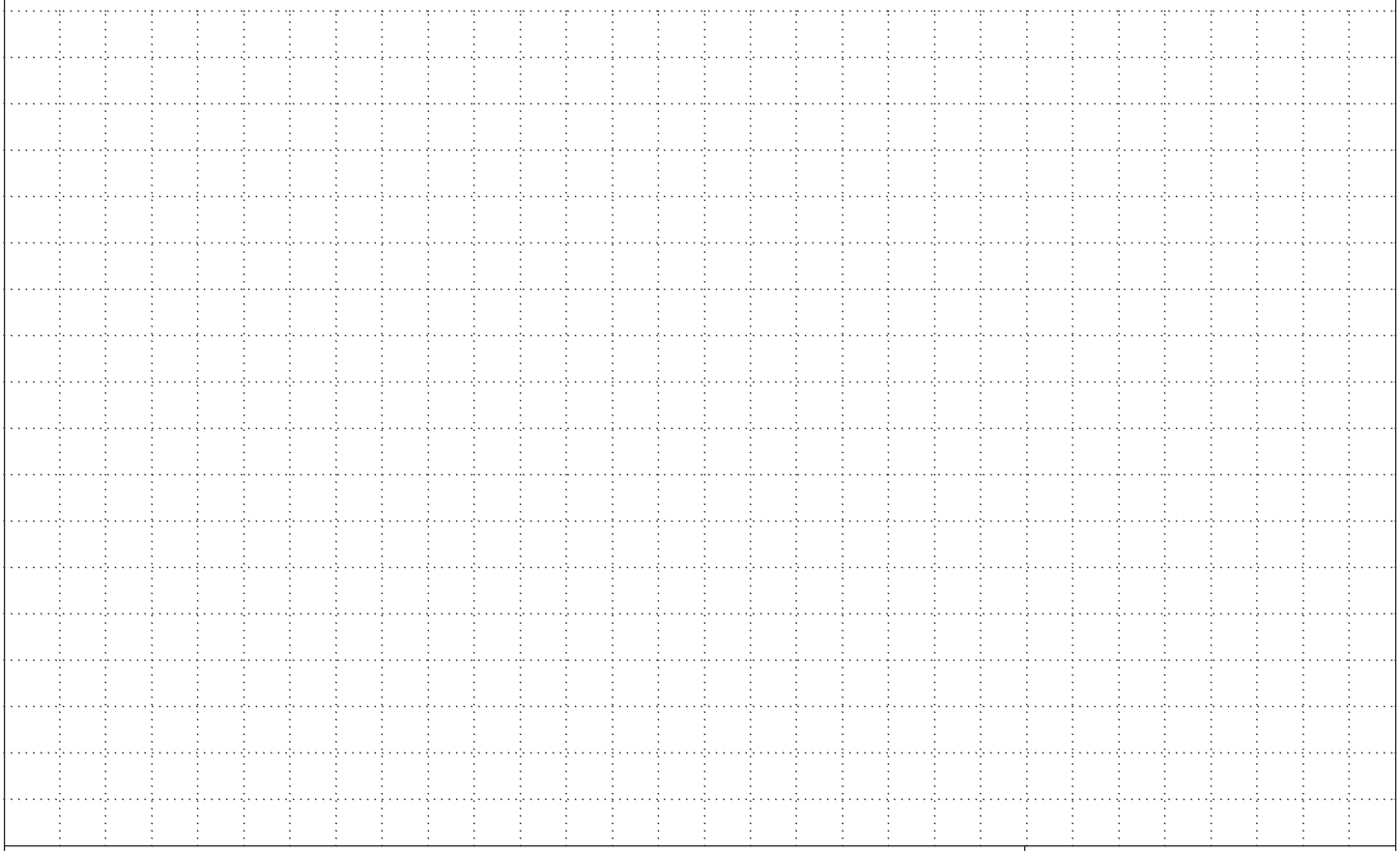
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,081.1 North 1,242,607.3 East
	9. SURFACE ELEVATION: 3188.9' NAVD 1929
	10. DATE STARTED: 3/15/16 / 11. DATE COMPLETED: 3/15/16
12. OVERBURDEN THICKNESS: 17	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 17.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0133

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0133

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3188.9	0	Yellowish brown sandy silty clay with rootlets (CL)					
			0.0 ppm		DP0133-00-0316-0.5		
3187.9	1						
3186.9	2	Yellowish brown to medium gray to pinkish gray gravel, sand, and rock fragments, fill (GP)	0.0 ppm				
3185.9	3						
3184.9	4		0.0 ppm		DP0133-00-0316-4-6		
3183.9	5	Yellowish brown to medium gray to pinkish gray gravel, sand, and rock fragments, fill (GP)					
3182.9	6						
3181.9	7						
		no recovery					
3180.9	8		0.0 ppm				
3179.9	9						
3178.9	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0133

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0133

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3178.9	10	Pinkish gray pebbles/gravel (GP)	0.0 ppm				
3177.9	11						
3176.9	12						
3175.9	13						
		Pinkish gray pebbles/gravel with yellowish & greenish staining(GP)					
3174.9	14		0.0 ppm		DP0133-00-0316-14		
3173.9	15						
		Olive brown clay with yellowish staining, reddish brown powdery texture to fine grains (CL)					
3172.9	16		0.0 ppm		DP0133-00-0316-16		Groundwater not encountered
3171.9	17						
		End of boring					
3170.9	18						
3169.9	19						
3168.9	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0133

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

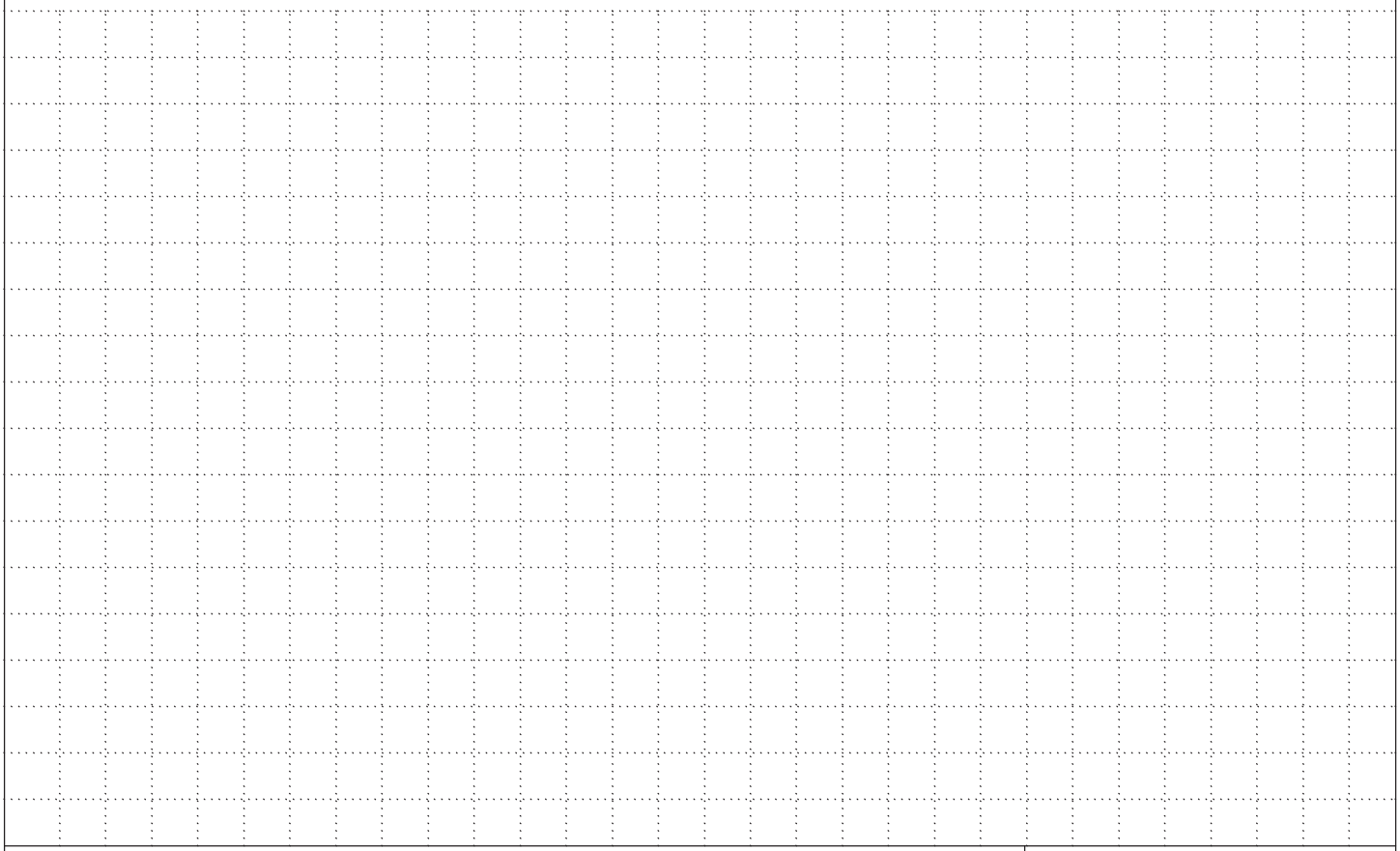
DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0136
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 4
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,815.1 North 1,242,271.0 East	
	9. SURFACE ELEVATION: 3172.3' NAVD 1929	
	10. DATE STARTED: 3/12/16	11. DATE COMPLETED: 3/12/16
12. OVERBURDEN THICKNESS: 21	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed	
14. TOTAL DEPTH OF HOLE: 21.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0136

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0136

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3172.3	0	Yellowish brown sandy gravel	3.0 ppm		DP0136-00-0316-0.5		
3171.3	1	Yellowish brownish gray gravel (GP)					
		Yellowish brown very fine sandy silty clay (CL)					
3170.3	2		3.0 ppm				
3169.3	3						
3168.3	4		3.0 ppm		DP0136-00-0316-2-10		
3167.3	5	Yellowish brown very fine sandy silty clay (CL)					
3166.3	6						
3165.3	7						
3164.3	8		3.0 ppm				
3163.3	9						
3162.3	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0136

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0136

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3162.3	10	Yellowish brown very fine sandy silty clay (CL)	3.0 ppm				
3161.3	11						
3160.3	12						
		Yellowish brown very fine sandy silty clay, moist (CL)					
3159.3	13						
3158.3	14		3.0 ppm				
3157.3	15						
3156.3	16		3.0 ppm				
3155.3	17						
		Yellowish brown very fine sandy silty clay, moist (CL)					
3154.3	18		3.3 ppm				Petroleum odor
3153.3	19						
3152.3	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0136

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0136

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3152.3	20						
3151.3	21	End of boring	3.3 ppm				Groundwater not encountered
3150.3	22						
3149.3	23						
3148.3	24						
3147.3	25						
3146.3	26						
3145.3	27						
3144.3	28						
3143.3	29						
3142.3	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0136

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0137

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 5

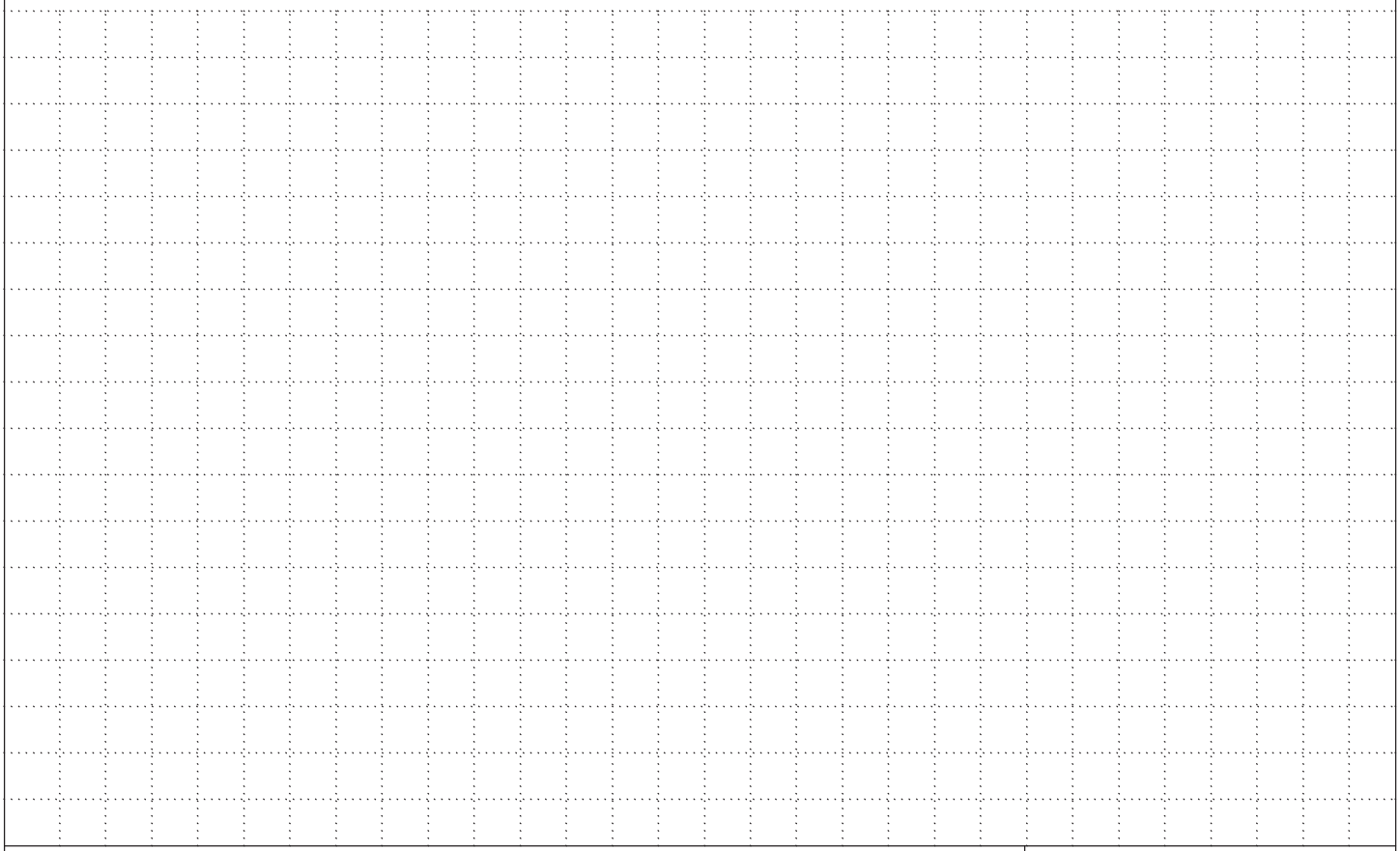
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,625.8 North 1,241,983.3 East
	9. SURFACE ELEVATION: 3190.1' NAVD 1929
	10. DATE STARTED: 3/13/16 / 11. DATE COMPLETED: 3/13/16
12. OVERBURDEN THICKNESS: 39	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 39.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0137

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0137

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3190.1	0	Yellowish brown silty clay with rootlets (CL)	0.0 ppm		DP0137-00-0316-0.5		
3189.1	1						
		Olive brown silty clay, dissicated (CL)					
3188.1	2		0.0 ppm		DP0137-00-0316-2-10		
3187.1	3						
		Yellowish brown silty clay, dessicated(CL)					
3186.1	4						
3185.1	5						
		Yellowish brown silty clay, dessicated(CL)					
3184.1	6		0.0 ppm				
3183.1	7						
		Yellowish brown gravel with silty clay (CL)					
3182.1	8						
		White calcified layer					
3181.1	9						
		Yellowish brown silty clay (CL)					
3180.1	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0137

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0137

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3180.1	10	Yellowish brown silty clay (CL)	0.0 ppm				
3179.1	11						
3178.1	12						
3177.1	13						
3176.1	14		0.0 ppm				
3175.1	15						
		Yellowish brown silty clay (CL)					
3174.1	16						
3173.1	17						
3172.1	18		0.0 ppm				
3171.1	19						
		Reddish brown medium to coarse sand with gravel (SP)					
3170.1	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0137

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0137

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3170.1	20						
3169.1	21						
3168.1	22	Medium gray gravel (GP)	0.0 ppm				
3167.1	23						
		Yellowish brown silty clay (CL)					
3166.1	24						
3165.1	25	Medium gray gravel (GP)					
3164.1	26	Yellowish brown silty clay (CL)	0.0 ppm				
3163.1	27						
3162.1	28	Reddish brown medium to coarse sand with gravel (SP)					
		Yellowish brown silty clay (CL)					
3161.1	29	Yellowish brown silty clay (CL)					
3160.1	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0137

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0137

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3160.1	30		0.0 ppm				
3159.1	31						
3158.1	32						
3157.1	33						
3156.1	34		0.0 ppm				
3155.1	35						
3154.1	36						
3153.1	37						
3152.1	38		0.0 ppm				Groundwater not encountered
3151.1	39	End of boring					
3150.1	40						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0137

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0138
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 3
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,621.8 North 1,242,395.6 East	
	9. SURFACE ELEVATION: 3165.4' NAVD 1929	
	10. DATE STARTED: 3/13/16	11. DATE COMPLETED: 3/13/16
12. OVERBURDEN THICKNESS: 15	15. DEPTH GROUNDWATER ENCOUNTERED: 13	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 9.5	
14. TOTAL DEPTH OF HOLE: 15.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 0' stickup	

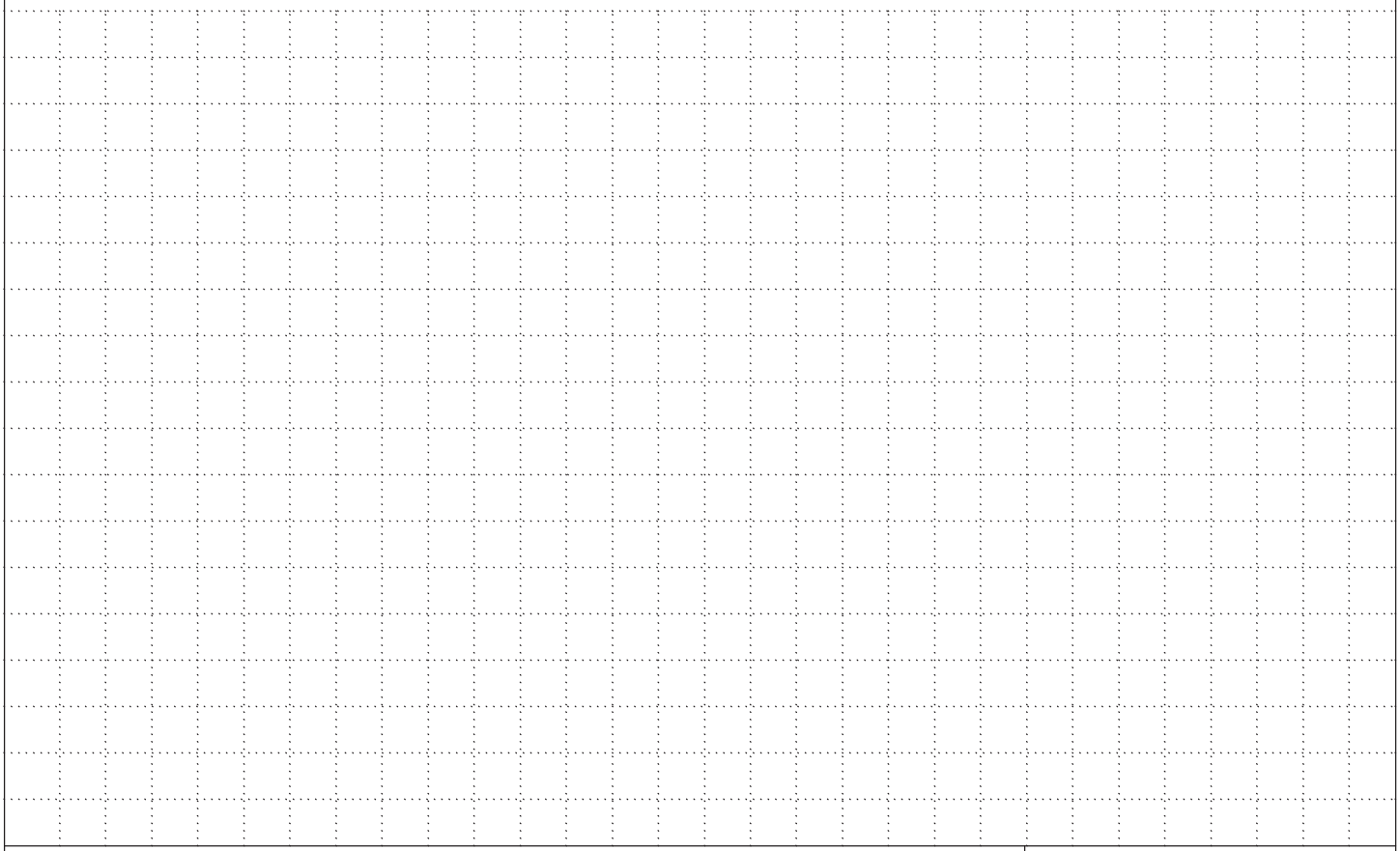
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0138

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0138

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3165.4	0	Yellowish brown silty clay with rootlets (CL)	0.0 ppm		DP0138-00-0316-0.5		
3164.4	1						
3163.4	2	Olive brown very fine sandy silty clay with light gray mottles, dessicated (CL)	0.0 ppm		DP0138-00-0316-2-10		
3162.4	3						
3161.4	4						
3160.4	5	Yellowish brown clay, red discoloration @ 8.5' (CL)					
3159.4	6		0.0 ppm				
3158.4	7						
3157.4	8		0.0 ppm				
3156.4	9						
3155.4	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0138

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0138

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3155.4	10	Yellowish brown clay (CL)	0.0 ppm				
3154.4	11						
3153.4	12						
3152.4	13						
		Reddish brown silty gravel (GP)	0.0 ppm				Top of water table @ 13' bgs.
		Yellowish brown clay (CL)					
3151.4	14						
3150.4	15						
		End of boring	0.0 ppm				
3149.4	16						
3148.4	17						
3147.4	18						
3146.4	19						
3145.4	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0138

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0139

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 2

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,620.5 North 1,242,587.6 East
	9. SURFACE ELEVATION: 3153.4' NAVD 1929
	10. DATE STARTED: 3/18/16 / 11. DATE COMPLETED: 3/18/16
12. OVERBURDEN THICKNESS: 2.5	15. DEPTH GROUNDWATER ENCOUNTERED: 1
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 1
14. TOTAL DEPTH OF HOLE: 2.5	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.5' stickup

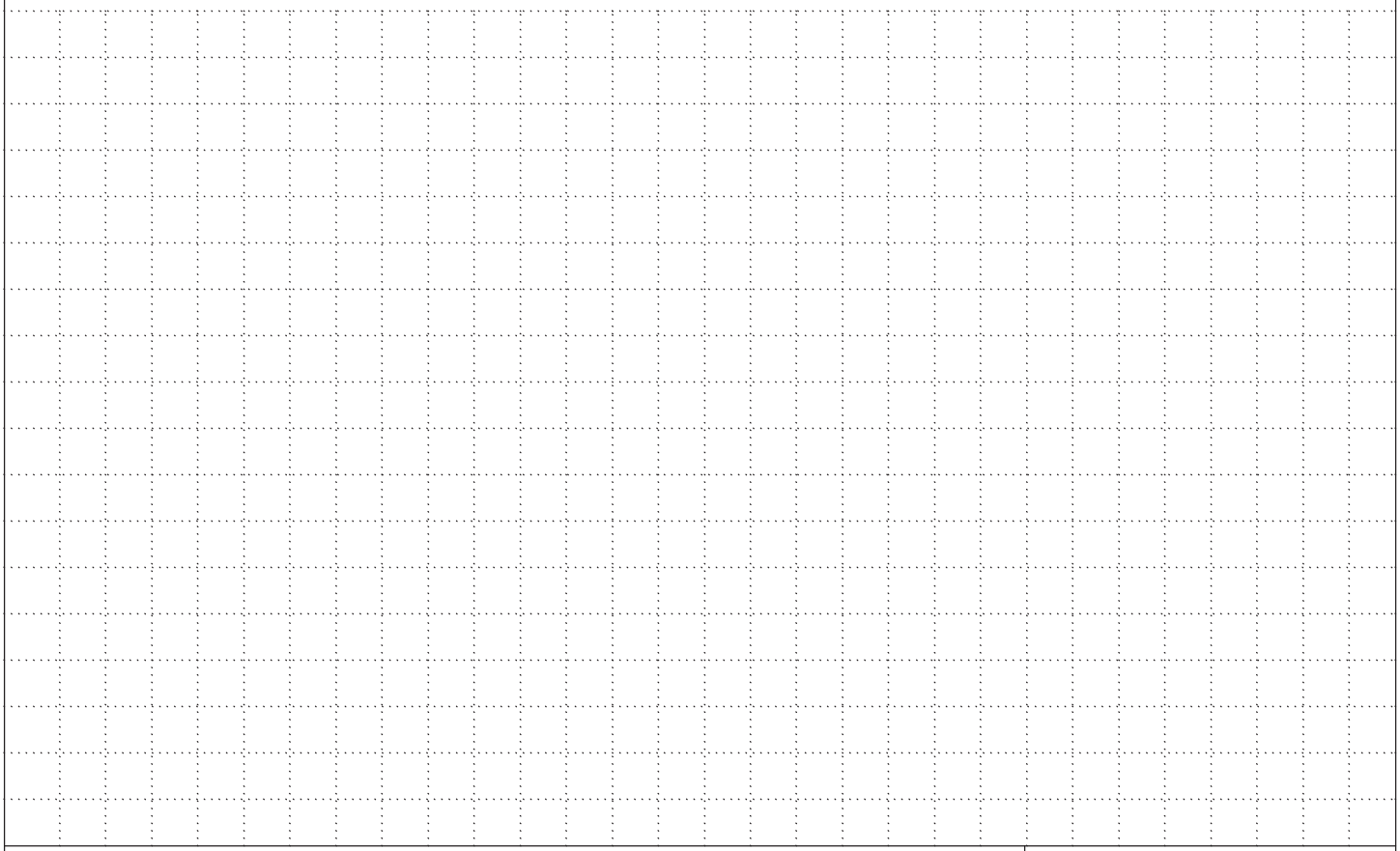
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0139

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0139

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3153.4	0	Topsoil					
		Plastic, silty clay, grey, moist (CL)	0.0 ppm		DP0139-00-0316-0.5		
3152.4	1		0.0 ppm		DP0139-00-0316-1		Top of water table @ 1' bgs.
3151.4	2		0.0 ppm				
		End of boring					
3150.4	3						
3149.4	4						
3148.4	5						
3147.4	6						
3146.4	7						
3145.4	8						
3144.4	9						
3143.4	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0139

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0140

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

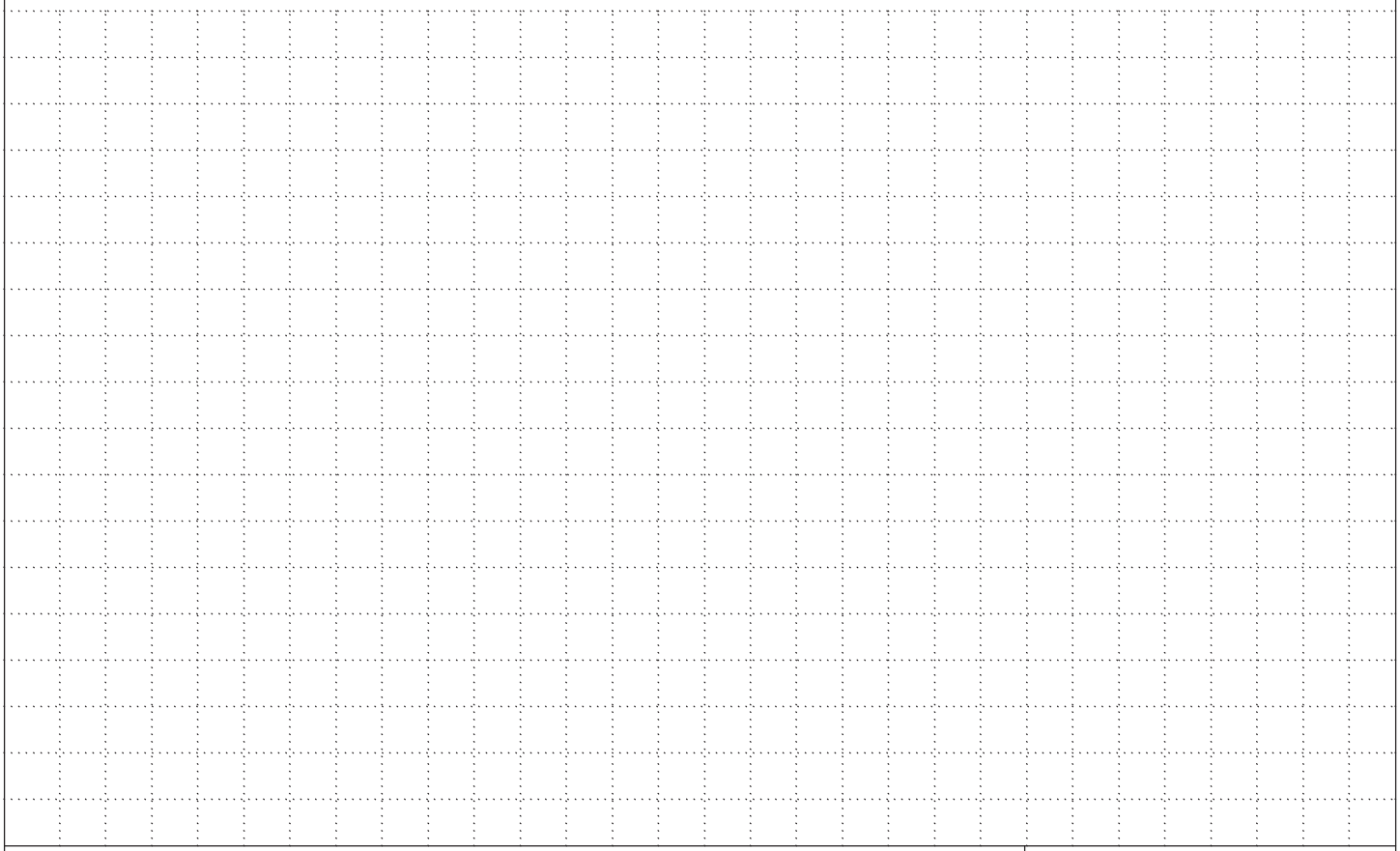
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,171.5 North 1,241,980.1 East
	9. SURFACE ELEVATION: 3161.4' NAVD 1929
	10. DATE STARTED: 3/13/16 / 11. DATE COMPLETED: 3/13/16
12. OVERBURDEN THICKNESS: 22	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 22.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0140

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0140

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3161.4	0	Yellowish brown silty clay with rootlets (CL)	0.0 ppm		DP0140-00-0316-0.5		
3160.4	1						
3159.4	2	Olive brown silty clay, dessicated (CL)	0.0 ppm		DP0140-00-0316-2-10		
3158.4	3						
3157.4	4		0.0 ppm				
3156.4	5	Yellowish brown silty clay (CL)					
3155.4	6		0.0 ppm				
3154.4	7						
3153.4	8		0.0 ppm				
3152.4	9						
3151.4	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0140

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0140

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3151.4	10	no recovery	0.0 ppm				
3150.4	11						
3149.4	12		0.0 ppm				
3148.4	13						
3147.4	14	Yellowish brown silty clay (CL)	0.0 ppm				
3146.4	15	no recovery					
3145.4	16		0.0 ppm				
3144.4	17						
		Yellowish brown silty clay, moist (CL)					
3143.4	18		0.0 ppm				
3142.4	19						
		Yellowish brown silty clay, moist (CL)					
3141.4	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0140

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0140

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3141.4	20		0.0 ppm				
3140.4	21						
3139.4	22	End of boring	0.0 ppm				Groundwater not encountered
3138.4	23						
3137.4	24						
3136.4	25						
3135.4	26						
3134.4	27						
3133.4	28						
3132.4	29						
3131.4	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0140

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0141

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 5

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,175.4 North 1,242,198.0 East
	9. SURFACE ELEVATION: 3163.0' NAVD 1929
	10. DATE STARTED: 3/08/16 / 11. DATE COMPLETED: 3/10/16
12. OVERBURDEN THICKNESS: 33	15. DEPTH GROUNDWATER ENCOUNTERED: 31.8
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 28.55
14. TOTAL DEPTH OF HOLE: 33.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.9' stickup

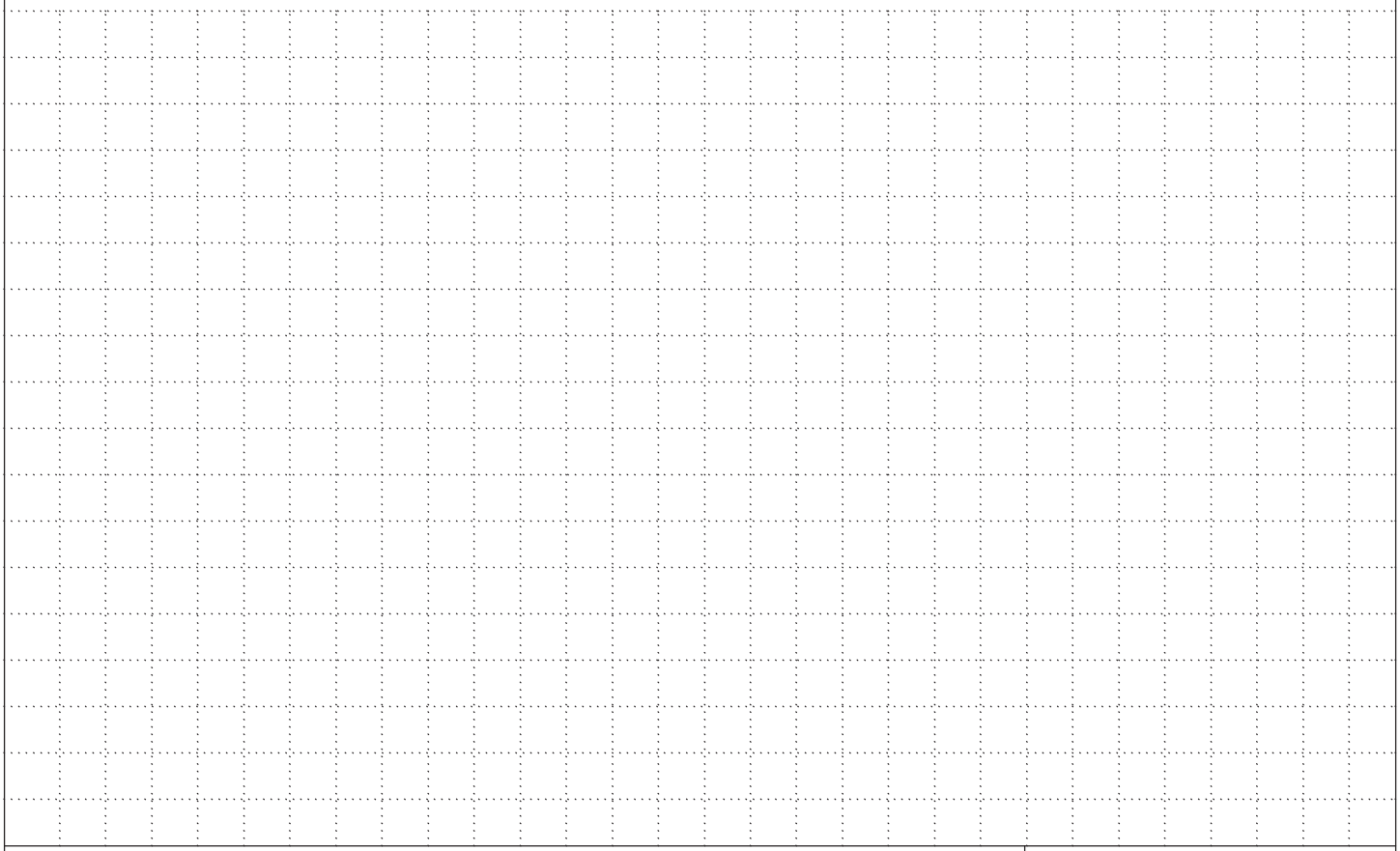
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0141

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0141

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3163.0	0	Olive brown very fine sandy & silty clay, rootlets, moist (CL)	0.0 ppm		DP0141-00-0316-0.5		*Sample taken from previous boring
3162.0	1						
3161.0	2		0.0 ppm		DP0141-00-0316-2-10		*Sample taken from previous boring
3160.0	3	Light yellowish brown, very fine sandy clay w/ pebbles (CL)					
3159.0	4		0.0 ppm				
3158.0	5	no recovery					
3157.0	6						
3156.0	7	Olive gray clay with natural openings, red crystallization (CL)					
3155.0	8		0.0 ppm				
3154.0	9						
3153.0	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0141

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0141

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3153.0	10	Olive gray clay (CL)					
3152.0	11						
3151.0	12		5.1 ppm				
3150.0	13						
3149.0	14						
3148.0	15						
		Olive gray clay, w/ white discoloration from 16-18' (CL)					
3147.0	16		0.0 ppm				
3146.0	17						
3145.0	18						
3144.0	19						
3143.0	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0141

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0141

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3143.0	20		0.0 ppm				
3142.0	21	Yellowish brown very fine sandy clay, w/ red discoloration (CL)					
3141.0	22						
3140.0	23						
3139.0	24	Yellowish brown very fine sandy clay, w/ red discoloration (CL)	0.0 ppm				
3138.0	25						
3137.0	26						
3136.0	27	Yellowish brown to olive brown clay (CL)					
3135.0	28		0.0 ppm				
3134.0	29						
3133.0	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0141

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0141

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3133.0	30	Orange brown very fine sandy clay (CL)	0.0 ppm				
3132.0	31						
3131.0	32		0.0 ppm		DP0141-00-0316-31.8		Top of water table @ 31.8' bgs.
		Yellowish brown to olive brown sandy clay (CL)					
3130.0	33	End of boring					
3129.0	34						
3128.0	35						
3127.0	36						
3126.0	37						
3125.0	38						
3124.0	39						
3123.0	40						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0141

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0142

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,168.2 North 1,242,386.6 East
	9. SURFACE ELEVATION: 3162.6' NAVD 1929
	10. DATE STARTED: 3/10/16 / 11. DATE COMPLETED: 3/10/16
12. OVERBURDEN THICKNESS: 20	15. DEPTH GROUNDWATER ENCOUNTERED: 16.5
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 15.6
14. TOTAL DEPTH OF HOLE: 20.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 0.35' stickup

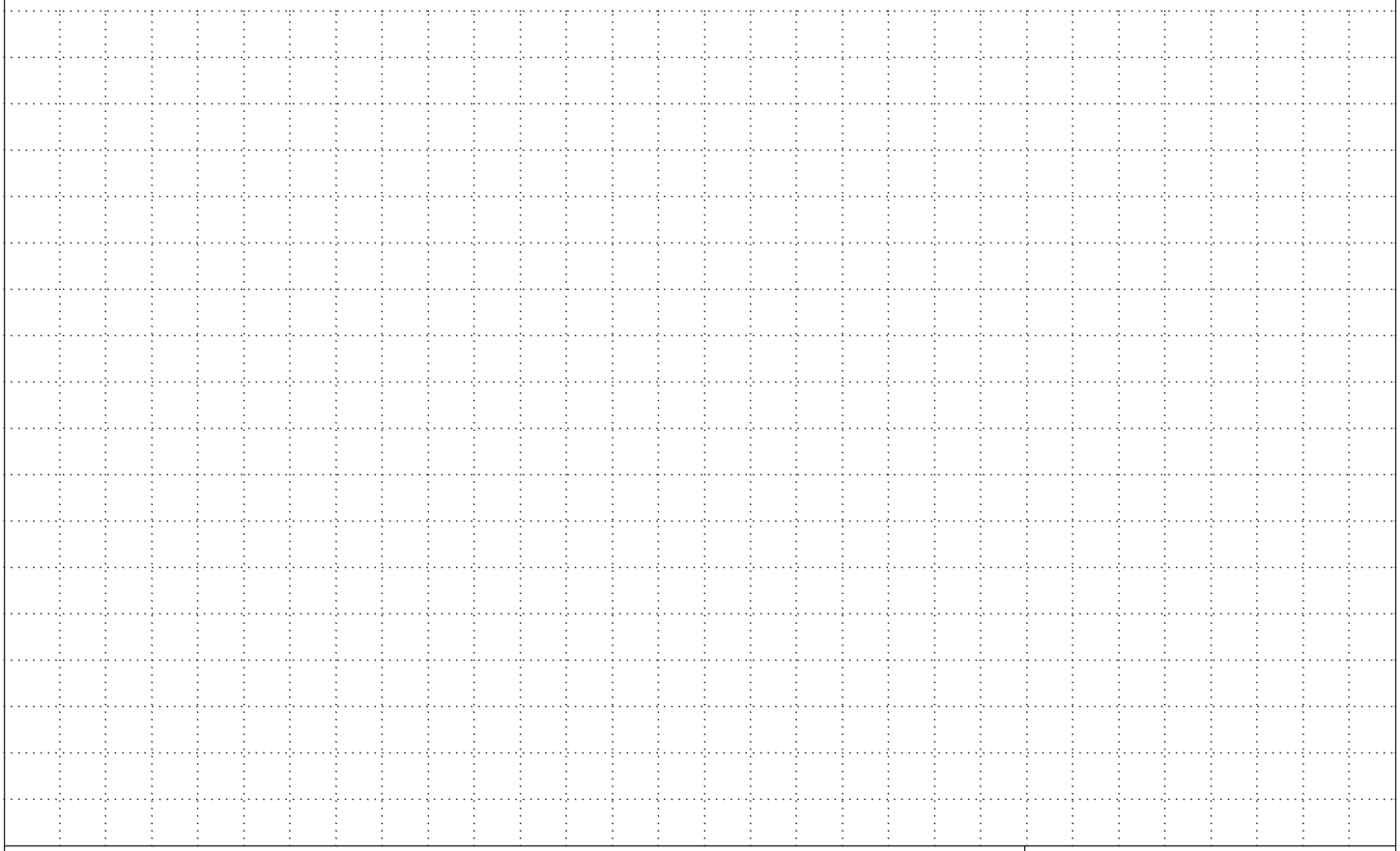
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0142

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0142

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3162.6	0	Olive brown very fine sandy silty clay (CL)					
		Yellowish brown very fine sandy silty clay (CL)	0.0 ppm		DP0142-00-0316-0.5		
3161.6	1						
		Pinkish yellowish brown sandy silty clay with pebbles (CL)					
3160.6	2	Yellowish brown sandy silty clay (CL)	0.0 ppm		DP0142-00-0316-2-10		
3159.6	3						
3158.6	4		0.0 ppm				
3157.6	5	Yellowish brown sandy silty clay with red stringers (CL)					
3156.6	6						
3155.6	7						
3154.6	8		0.0 ppm				
3153.6	9						
3152.6	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0142

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0142

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3152.6	10	Yellowish brown sandy silty clay with red stringers (CL)					
		Reddish brown sand (SP)					
3151.6	11						
3150.6	12	Yellowish brown very fine sandy silty clay (CL)	0.0 ppm				
3149.6	13						
3148.6	14						
3147.6	15	Yellowish brown very fine sandy silty clay (CL)					
3146.6	16						
		Reddish brown very fine silty clay with gravel (CL)	0.0 ppm		DP0142-00-0316-16.5		Top of water table @ 16.5' bgs.
3145.6	17	Yellowish brown very fine sandy silty clay (CL)					
3144.6	18						
3143.6	19						
3142.6	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0142

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0142

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3142.6	20	End of boring	0.0 ppm				
3141.6	21						
3140.6	22						
3139.6	23						
3138.6	24						
3137.6	25						
3136.6	26						
3135.6	27						
3134.6	28						
3133.6	29						
3132.6	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0142

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0143

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	666,159.8 North 1,242,808.0 East
	9. SURFACE ELEVATION
	3154.8' NAVD 1929
	10. DATE STARTED: 3/10/16 / 11. DATE COMPLETED: 3/11/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
20	18
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	9.9
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
20.0	0.4' stickup

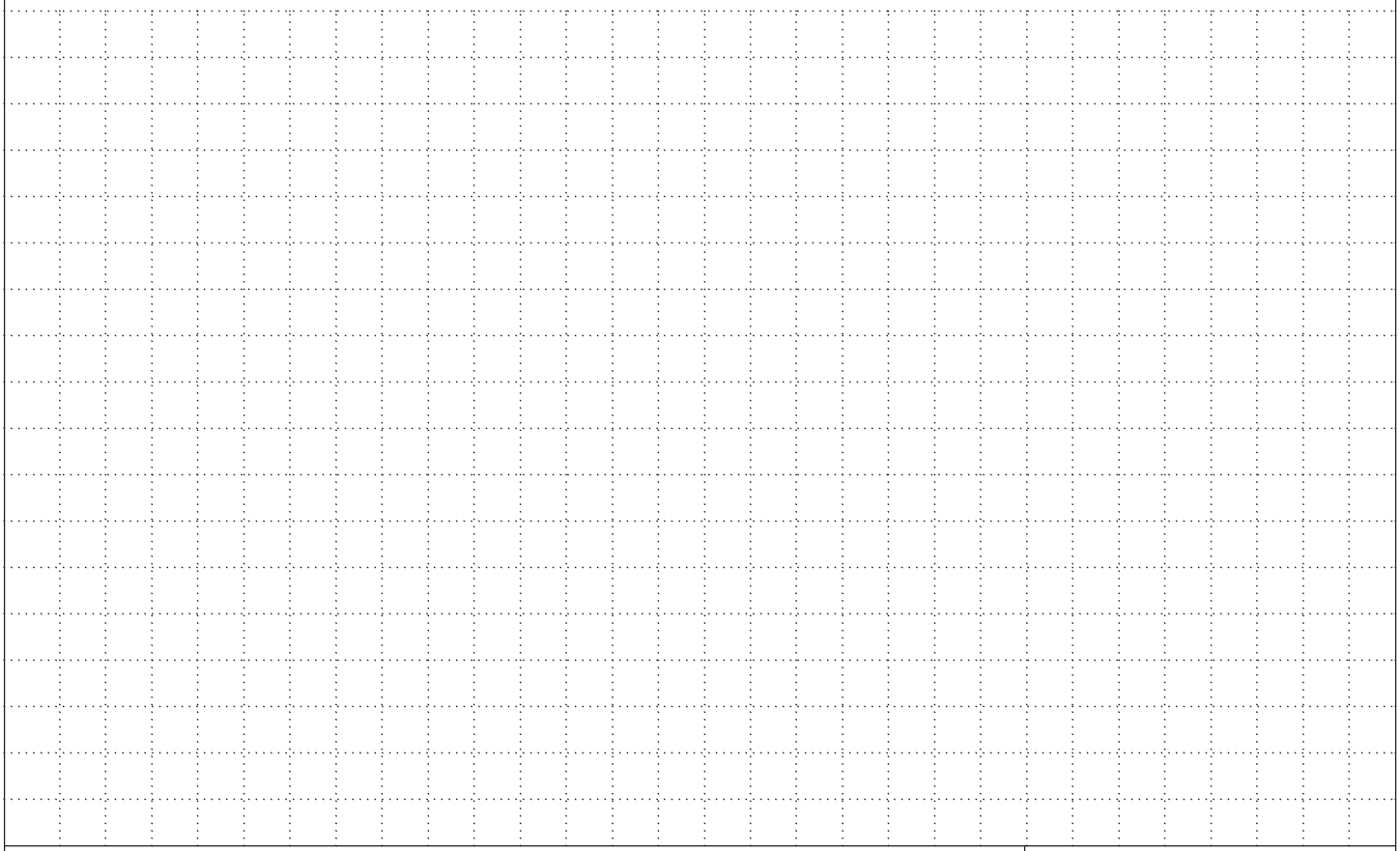
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0143

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0143

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3154.8	0	Dark yellowish brown sandy silty clay with rootlets (CL)					
		Yellowish brown very fine sandy silty clay (CL)	0.0 ppm		DP0143-00-0316-0.5		
3153.8	1						
3152.8	2		0.0 ppm		DP0143-00-0316-2-10		
		Light gray gravel (GP)					
3151.8	3	Olive brown very fine sandy silty clay (CL)					
3150.8	4		0.0 ppm				
3149.8	5	no recovery					
3148.8	6						
3147.8	7						
		Dark yellowish brown clay (CL)					
3146.8	8	Yellowish brown clay with gravel (CL)	0.0 ppm				
3145.8	9	Darl yellowish brown clay (CL)					
3144.8	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0143

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0143

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3144.8	10	no recovery					
3143.8	11						
3142.8	12		0.0 ppm				
		Olive brown clay					
3141.8	13						
3140.8	14						
3139.8	15	Olive brown clay					
3138.8	16		0.0 ppm				
3137.8	17						
3136.8	18		0.0 ppm				Top of water table @ approximately 18' bgs.
3135.8	19						
3134.8	20						

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0143

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3134.8	20	End of boring	0.0 ppm				
3133.8	21						
3132.8	22						
3131.8	23						
3130.8	24						
3129.8	25						
3128.8	26						
3127.8	27						
3126.8	28						
3125.8	29						
3124.8	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0143

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

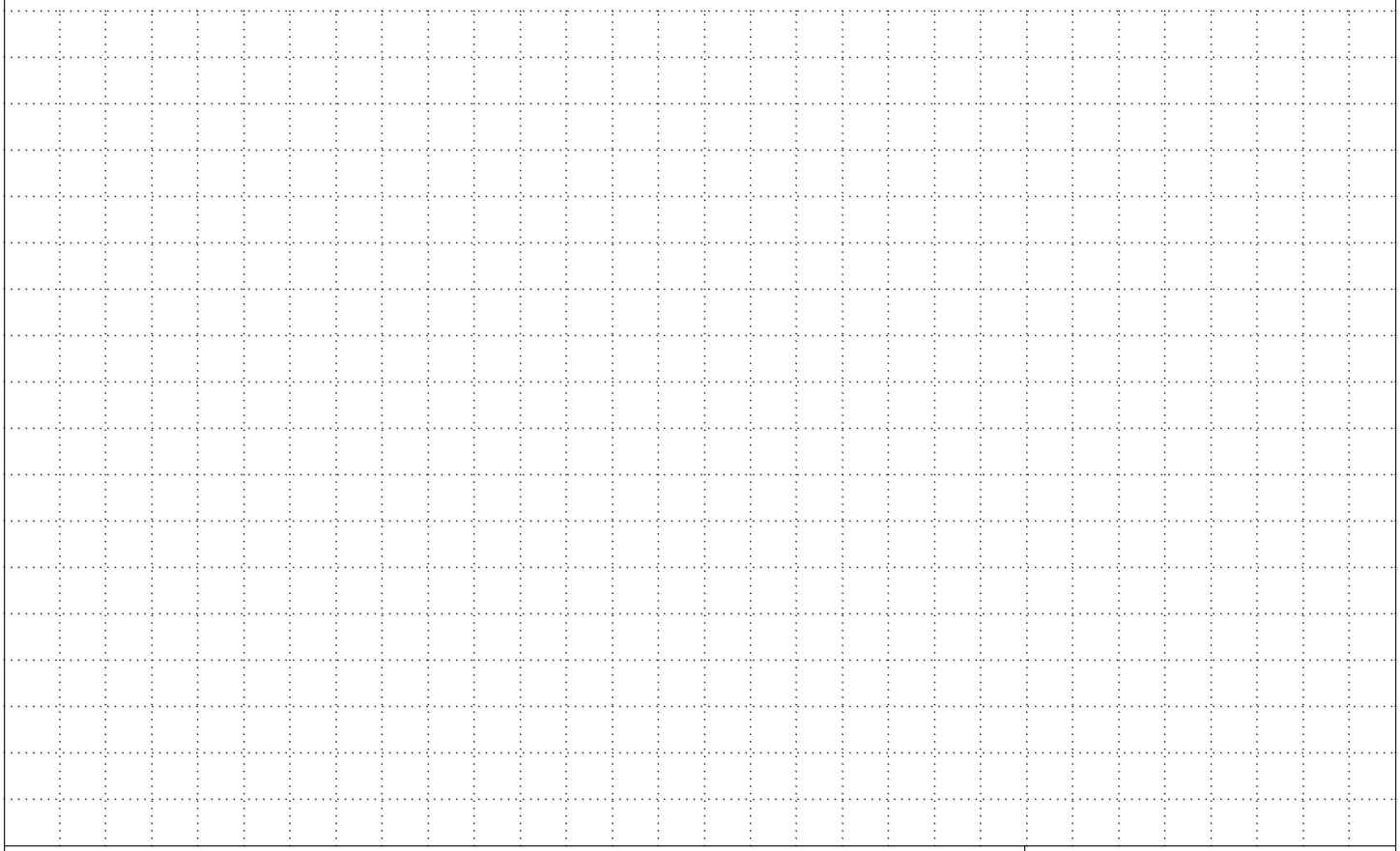
DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0144
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 5
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 666,177.2 North 1,243,210.3 East	
	9. SURFACE ELEVATION: 3172.8' NAVD 1929	
	10. DATE STARTED: 3/11//16	11. DATE COMPLETED: 3/11//16
12. OVERBURDEN THICKNESS: 27	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 32.55	
14. TOTAL DEPTH OF HOLE: 27.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 2.1' stickup	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0144

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0144

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3172.8	0	Medium gray gravel (GP)					
			0.0 ppm		DP0144-00-0316-0.5		
3171.8	1						
		Yellowish brown silty clay with medium gray gravel (CL)					
3170.8	2		0.0 ppm		DP0144-00-0316-2-10		
3169.8	3						
		Yellowish brown clay (CL)					
3168.8	4		0.0 ppm				
3167.8	5						
		Yellowish brown clay (CL)					
3166.8	6						
3165.8	7						
3164.8	8		0.0 ppm				
3163.8	9						
3162.8	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0144

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0144

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3162.8	10	Yellowish brown clay (CL)					
3161.8	11						
3160.8	12		0.0 ppm				
3159.8	13						
3158.8	14						
3157.8	15						
		Yellowish brown clay (CL)					
3156.8	16		0.0 ppm				
3155.8	17						
3154.8	18						
3153.8	19						
3152.8	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0144

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0144

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3152.8	20	Yellowish brown clay (CL)	0.0 ppm				
3151.8	21						
3150.8	22						
3149.8	23						
3148.8	24		0.0 ppm				
3147.8	25						
		Yellowish brown clay (CL)					
3146.8	26						
3145.8	27						
		No soil collection due to liners crumpling up during advancement					
3144.8	28		0.0 ppm				
3143.8	29						
3142.8	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0144

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0144

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3142.8	30						
3141.8	31						
3140.8	32						
3139.8	33	End of boring	0.0 ppm				Top of water table @ 32.55' bgs.
3138.8	34						
3137.8	35						
3136.8	36						
3135.8	37						
3134.8	38						
3133.8	39						
3132.8	40						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0144

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0145

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	665,760.6 North 1,242,578.2 East
	9. SURFACE ELEVATION
	3145.2' NAVD 1929
	10. DATE STARTED: 3/10/16 / 11. DATE COMPLETED: 3/10/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
19	Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	Water not observed
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
19.0	1.2' stickup

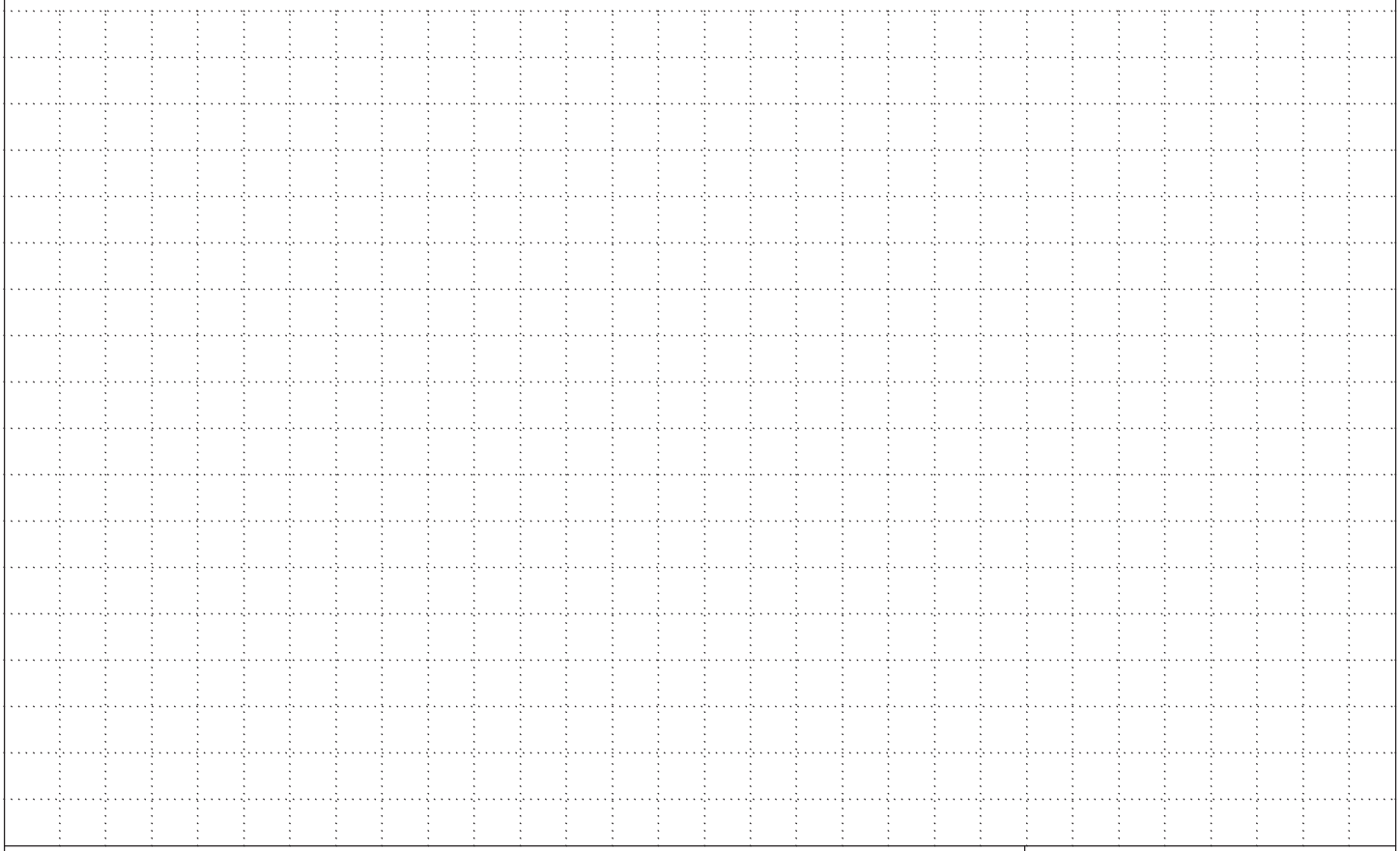
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0145

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0145

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3145.2	0	Olive/yellowish brown very fine sandy silty clay with rootlets (CL)					
		Olive/yellowish brown very fine sandy silty clay(CL)	0.0 ppm		DP0145-00-0316-0.5		
3144.2	1						
3143.2	2		0.0 ppm		DP0145-00-0316-2-10		
3142.2	3						
3141.2	4		0.0 ppm				
3140.2	5	Olive/yellowish brown very fine sandy silty clay(CL)					
3139.2	6						
3138.2	7						
3137.2	8	Gray gravel (GP)	0.0 ppm				
		Sandy clay, yellowish brown fine sandy silty clay (CL)					
3136.2	9						
3135.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0145

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0145

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3135.2	10	Reddish yellowish brown very fine sandy silty clay, moist @ 12' bgs. (CL)					
3134.2	11						
3133.2	12		0.0 ppm		DP0145-00-0316-12		Top of water table @ 12' bgs.
3132.2	13						
3131.2	14						
3130.2	15	Yellowish brown very fine sandy silty clay (CL)					
3129.2	16		0.0 ppm				
3128.2	17						
3127.2	18						
3126.2	19	End of boring	0.0 ppm				
3125.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0145

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0146

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 4

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	665,416.3 North 1,241,906.2 East
	9. SURFACE ELEVATION
	3138.2' NAVD 1929
	10. DATE STARTED: 3/12/16 / 11. DATE COMPLETED: 3/12/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
22	19
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	19
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
22.0	0.15' stickup

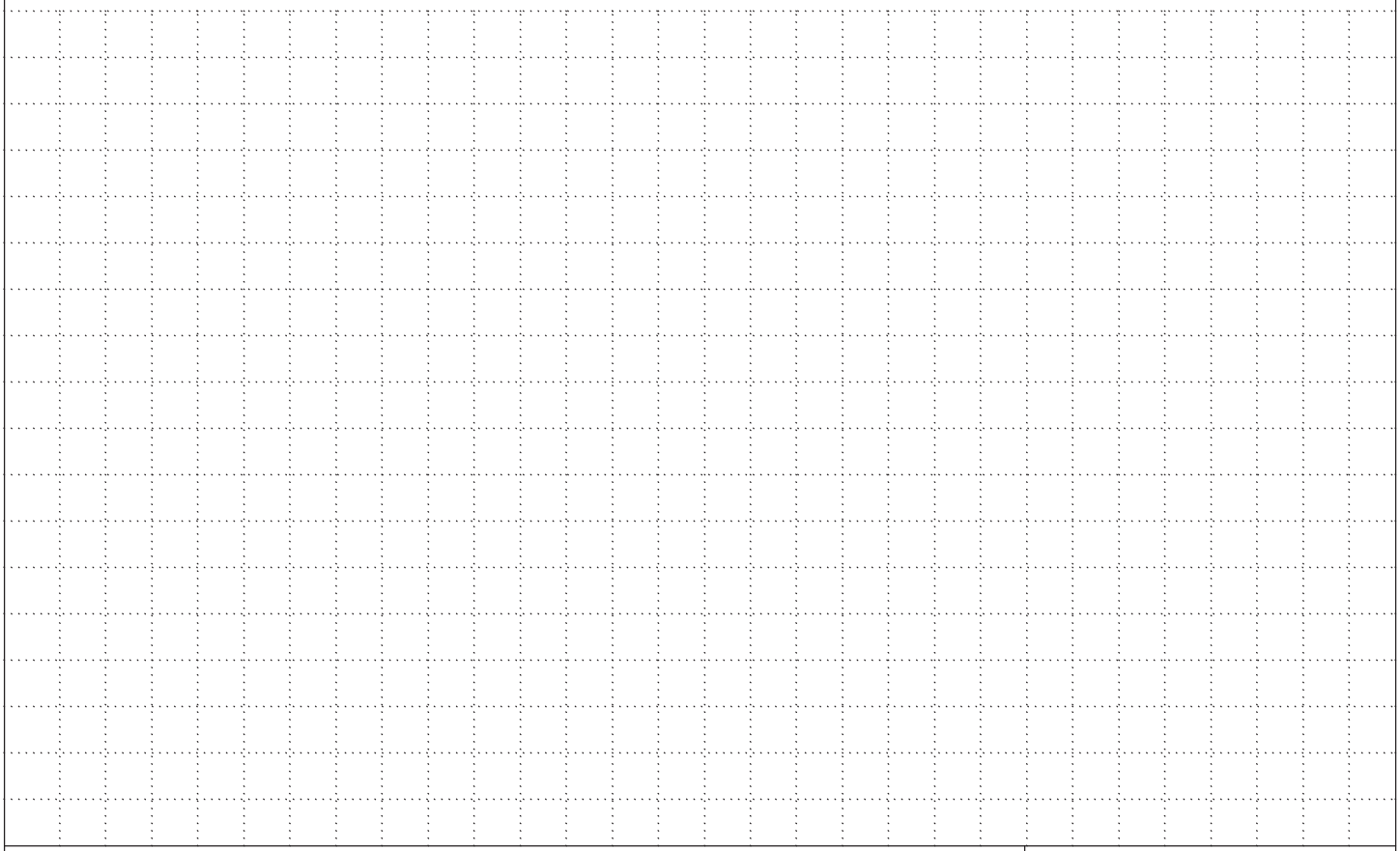
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0146

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0146

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3138.2	0	Dark yellowish brown very fine sandy silty clay, dessicated (CL)	0.0 ppm		DP0146-00-0316-0.5		
3137.2	1	Dark yellowish brown very fine sandy silty clay, dessicated (CL)					
3136.2	2		0.0 ppm		DP0146-00-0316-2-10		
3135.2	3						
3134.2	4						
3133.2	5						
3132.2	6		0.0 ppm				
3131.2	7						
3130.2	8	Yellowish brown medium to coarse sand (SP)					
3129.2	9						
3128.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0146

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0146

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 4

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3128.2	10	no recovery	0.0 ppm				
3127.2	11						
3126.2	12						
3125.2	13						
3124.2	14	Medium gravel with yellowish brown medium to coarse sand (GP)	0.0 ppm				
3123.2	15	Medium gravel with yellowish brown medium to coarse sand (GP)					
3122.2	16						
3121.2	17	Medium gravel with yellowish brown medium to coarse sand, moist (GP)					
3120.2	18	black wet muddy gravel (GP)					
3119.2	19		0.0 ppm		DP0146-00-0316-19		Top of water table @ 19' bgs.
3118.2	20	Yellowish brown medium sand (SP)					

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0146

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0146

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3118.2	20		0.0 ppm				Due to collapsed boring, Installed well to 20' bgs.
3117.2	21						
3116.2	22	End of boring	0.0 ppm				
3115.2	23						
3114.2	24						
3113.2	25						
3112.2	26						
3111.2	27						
3110.2	28						
3109.2	29						
3108.2	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0146

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0147

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 665,396.1 North 1,242,786.0 East
	9. SURFACE ELEVATION: 3134.7' NAVD 1929
	10. DATE STARTED: 3/11//16 / 11. DATE COMPLETED: 3/11//16
12. OVERBURDEN THICKNESS: 14	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed
14. TOTAL DEPTH OF HOLE: 14.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 1.8' stickup

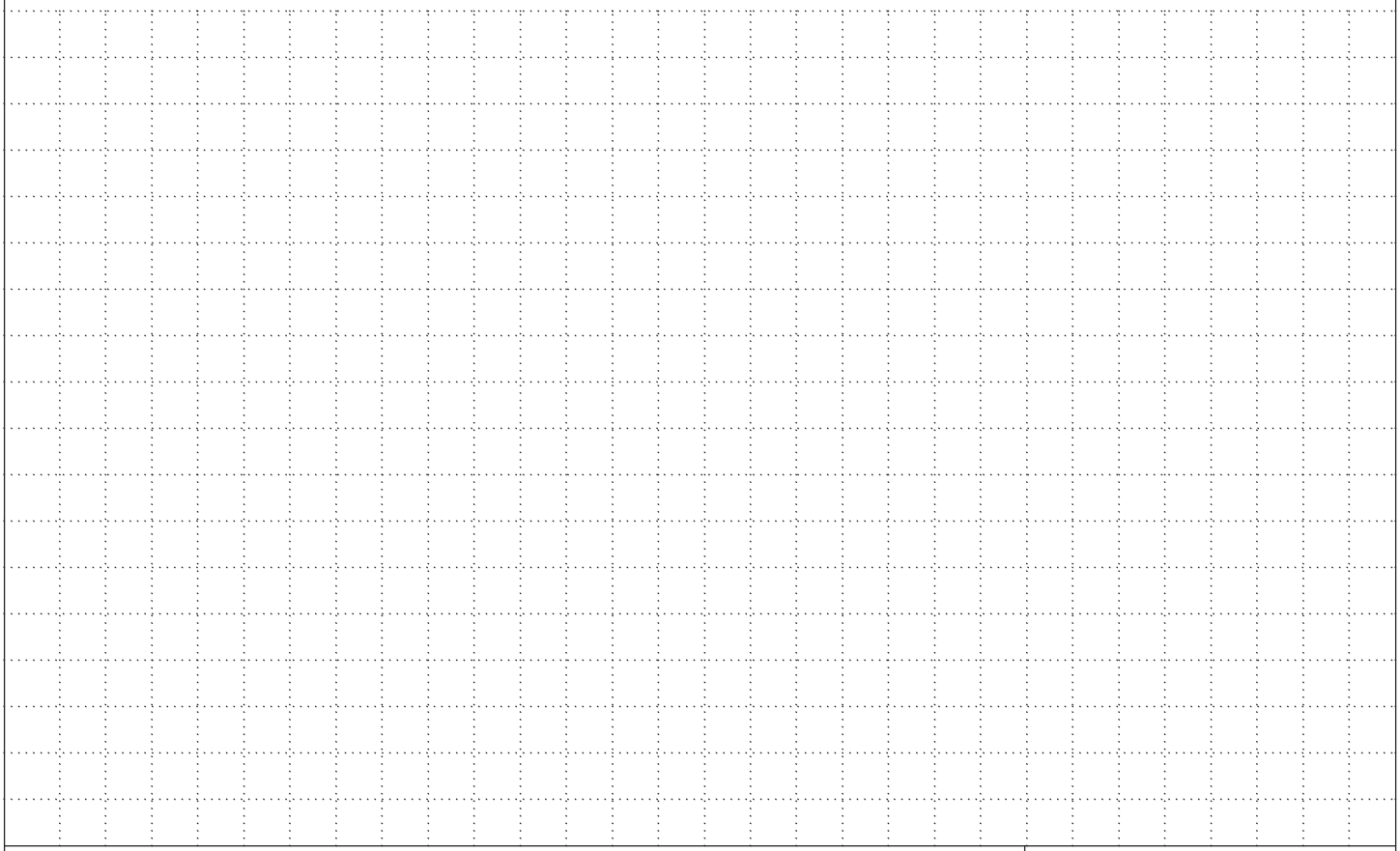
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0147

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0147

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3134.7	0	Light gray gravel & silt, road base (GP)					
			0.0 ppm		DP0147-00-0316-0.5		
3133.7	1						
3132.7	2	Yellowish brown very fine silty clay (CL)	0.0 ppm		DP0147-00-0316-2-10		
3131.7	3						
3130.7	4						
3129.7	5	Yellowish brown very fine silty clay (CL)					
3128.7	6		0.0 ppm				
3127.7	7						
3126.7	8						
3125.7	9	Dark gray gravel (GP)					
3124.7	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0147

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0147

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3124.7	10	no recovery	0.0 ppm				
3123.7	11						
3122.7	12						
3121.7	13						
3120.7	14	End of boring	0.0 ppm				Groundwater not encountered
3119.7	15						
3118.7	16						
3117.7	17						
3116.7	18						
3115.7	19						
3114.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0147

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0148

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET	SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF	3

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 665,313.3 North 1,243,213.5 East
	9. SURFACE ELEVATION: 3133.7' NAVD 1929
	10. DATE STARTED: 3/11//16 / 11. DATE COMPLETED: 3/11//16
12. OVERBURDEN THICKNESS: 14	15. DEPTH GROUNDWATER ENCOUNTERED: 8
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 12.85
14. TOTAL DEPTH OF HOLE: 14.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 1.9' stickup

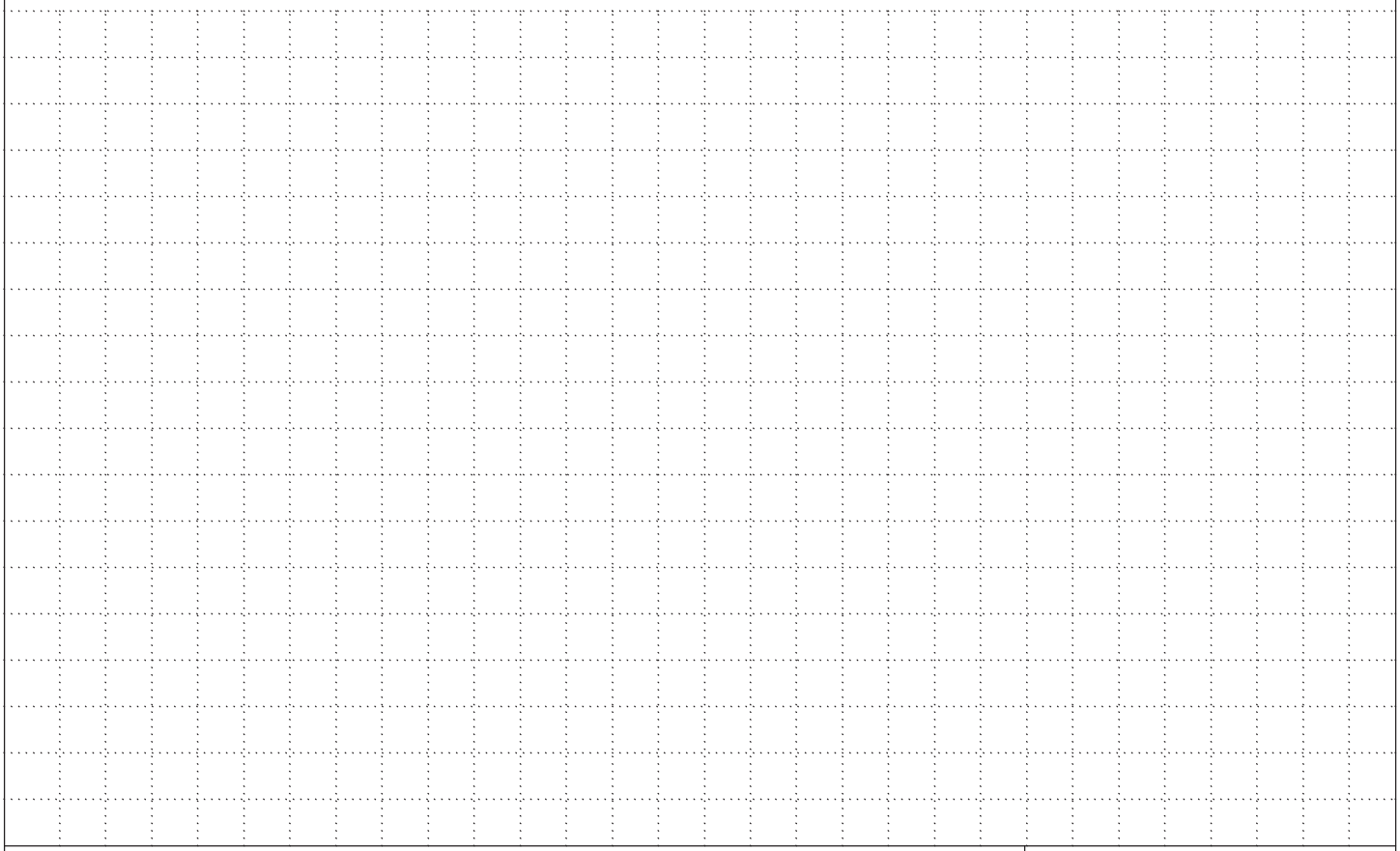
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0148

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0148

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3133.7	0	Dary yellowish brown silty clay (CL)	0.0 ppm		DP0148-00-0316-0.5		
3132.7	1	Gray rock fragments (GP)					
3131.7	2	Olive gray/ yellowish brown silty clay, dessicated (CL)	0.0 ppm		DP0148-00-0316-2-10		
3130.7	3						
3129.7	4						
3128.7	5	Olive gray/ yellowish brown silty clay, moist (CL)					
3127.7	6		0.0 ppm				
3126.7	7						
3125.7	8		0.0 ppm				Top of water table @ 8'bgs.
3124.7	9	Dark brown gravel (GP)					
3123.7	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0148

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0148

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3123.7	10	no recovery	0.0 ppm				
3122.7	11						
3121.7	12						
3120.7	13		0.0 ppm		DP0148-00-0316-13		
3119.7	14	End of boring	0.0 ppm				
3118.7	15						
3117.7	16						
3116.7	17						
3115.7	18						
3114.7	19						
3113.7	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0148

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0149

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 5

3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,519.4 North 1,243,331.8 East
	9. SURFACE ELEVATION: 3183.2' NAVD 1929
	10. DATE STARTED: 3/17/16 / 11. DATE COMPLETED: 3/17/16
12. OVERBURDEN THICKNESS: 30	15. DEPTH GROUNDWATER ENCOUNTERED: 25
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 30
14. TOTAL DEPTH OF HOLE: 30.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 4.2' stickup

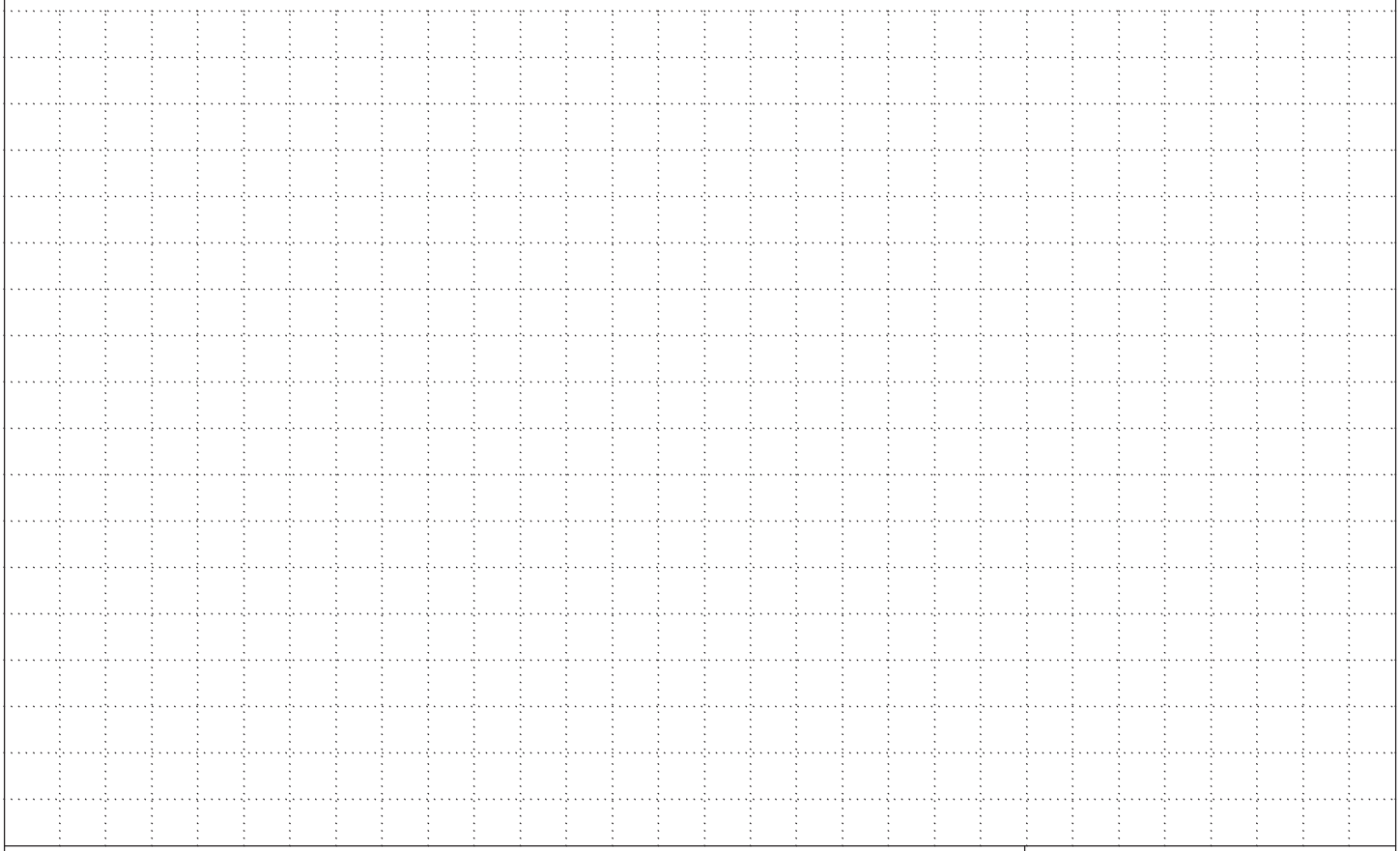
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
3	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0149

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0149

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3183.2	0	Yellowish brown sandy silty clay with rootlets (CL)					
		no recovery	0.0 ppm		DP0149-00-0316-0.5		
3182.2	1						
3181.2	2		0.0 ppm		DP0149-00-0316-2-10		
3180.2	3						
3179.2	4	Olive brown clay (CL)					
3178.2	5	Olive brown clay (CL)					
3177.2	6		0.0 ppm				
3176.2	7						
3175.2	8		0.0 ppm				
3174.2	9						
3173.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0149

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0149

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3173.2	10	Olive brown clay (CL)	0.0 ppm				
3172.2	11						
3171.2	12						
3170.2	13						
3169.2	14		0.0 ppm				
3168.2	15						
		Olive brown clay (CL)					
3167.2	16						
3166.2	17						
3165.2	18						
		Olive brown clay (CL)	0.0 ppm				
3164.2	19						
3163.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0149

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0149

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3163.2	20						
3162.2	21						
3161.2	22	Olive brown clay (CL)	0.0 ppm				
3160.2	23						
3159.2	24						
3158.2	25	Olive brown clay, moist @ 25' bgs. (CL)	0.0 ppm		DP0149-00-0316-25		Top of water table @ 25'bgs.
3157.2	26						
3156.2	27						
3155.2	28	Olive brown clay (CL)	0.0 ppm				
3154.2	29						
3153.2	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0149

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0149

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3153.2	30	End of boring	0.0 ppm				
3152.2	31						
3151.2	32						
3150.2	33						
3149.2	34						
3148.2	35						
3147.2	36						
3146.2	37						
3145.2	38						
3144.2	39						
3143.2	40						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0149

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

DISTRICT: USACE-Albuquerque District		HOLE NUMBER: DP0150
1. COMPANY NAME: Ayuda Joint Venture	2. DRILLING CONTRACTOR: Cascade/Vironex	SHEET 1 OF SHEETS 5
3. PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1	4. LOCATION: Ellsworth AFB, South Dakota	
5. NAME OF DRILLER: Dustin Powell	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 7800 Series	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION: 667,506.7 North 1,243,352.9 East	
	9. SURFACE ELEVATION: 3183.2' NAVD 1929	
	10. DATE STARTED: 3/16/16	11. DATE COMPLETED: 3/16/16
12. OVERBURDEN THICKNESS: 34	15. DEPTH GROUNDWATER ENCOUNTERED: Water not observed	
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: Water not observed	
14. TOTAL DEPTH OF HOLE: 34.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 1' stickup	

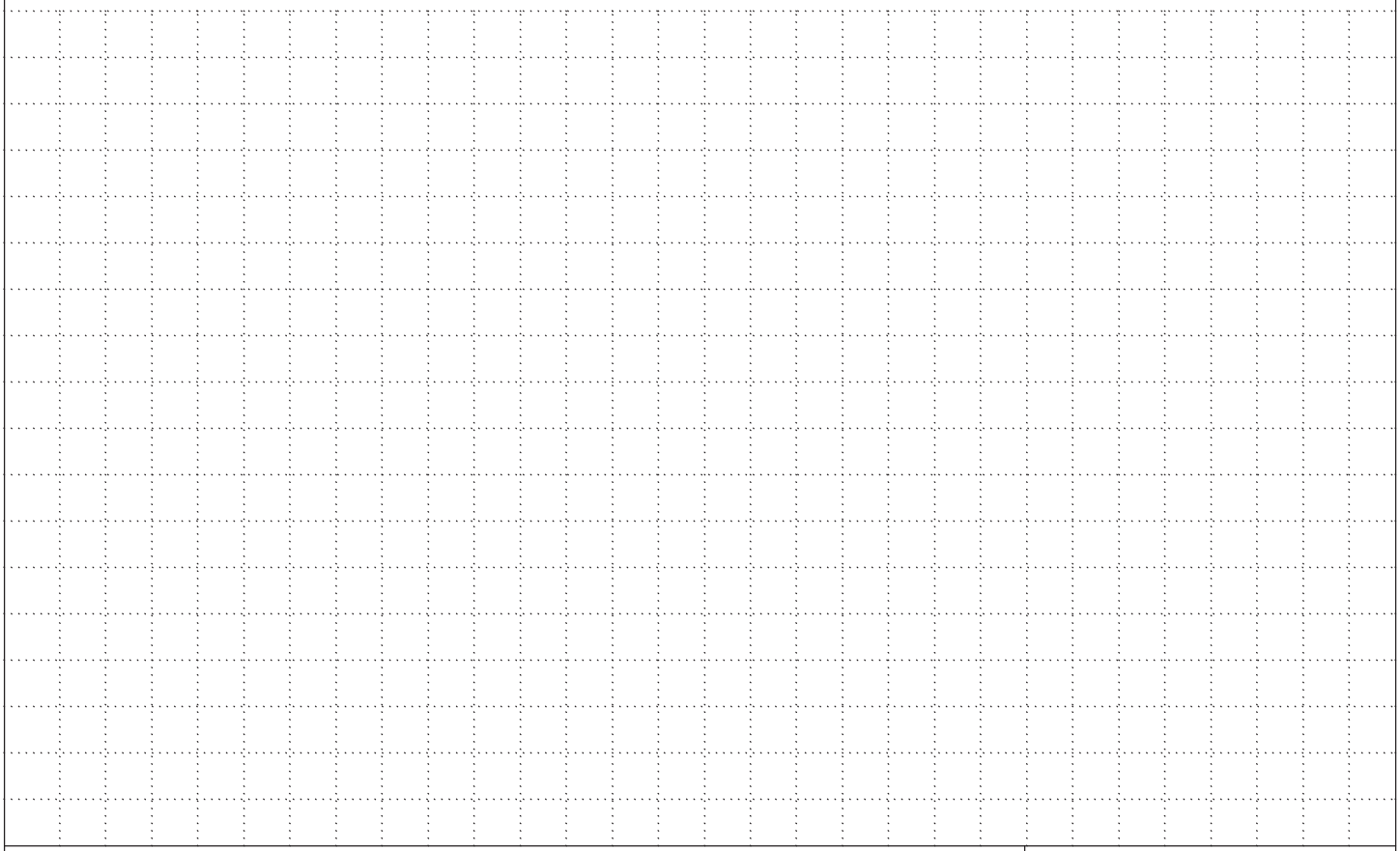
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Temporary Well			---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0150

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0150

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3183.2	0	Yellowish brown silty clay (CL)					
			0.0 ppm	DP0150-00-0316-0.5			
3182.2	1						
3181.2	2		0.0 ppm	DP0150-00-0316-2-10			
3180.2	3						
3179.2	4						
3178.2	5						
		Yellowish brown silty clay, dessicated (CL)					
3177.2	6		0.0 ppm				
3176.2	7						
3175.2	8		0.0 ppm				
3174.2	9						
3173.2	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0150

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0150

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 5

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3173.2	10	Yellowish brown silty clay, dessicated (CL)					
3172.2	11						
3171.2	12						
3170.2	13						
3169.2	14		0.0 ppm				
3168.2	15						
		Yellowish brown silty clay, dessicated (CL)					
3167.2	16		0.0 ppm				
3166.2	17						
3165.2	18						
		Yellowish brown silty clay, dessicated (CL)					
3164.2	19						
3163.2	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0150

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0150

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 4 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3163.2	20		0.0 ppm				
3162.2	21						
3161.2	22						
		Yellowish brown silty clay, dessicated (CL)					
3160.2	23						
3159.2	24		0.0 ppm				
3158.2	25						
3157.2	26						
3156.2	27		0.0 ppm				
3155.2	28						
		Yellowish brown silty clay, dessicated (CL)					
3154.2	29						
3153.2	30						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0150

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0150

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3153.2	30	Yellowish brown/olive gray silty clay, dessicated (CL)	0.0 ppm				
3152.2	31						
3151.2	32						
		Yellowish brown/olive gray silty clay, dessicated (CL)					
3150.2	33						
3149.2	34						
		End of boring	0.0 ppm				Groundwater not encountered
3148.2	35						
3147.2	36						
3146.2	37						
3145.2	38						
3144.2	39						
3143.2	40						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0150

DRILLING LOG

DISTRICT	HOLE NUMBER
USACE-Albuquerque District	DP0151

1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET / SHEETS
Ayuda Joint Venture	Cascade/Vironex	1 OF 3

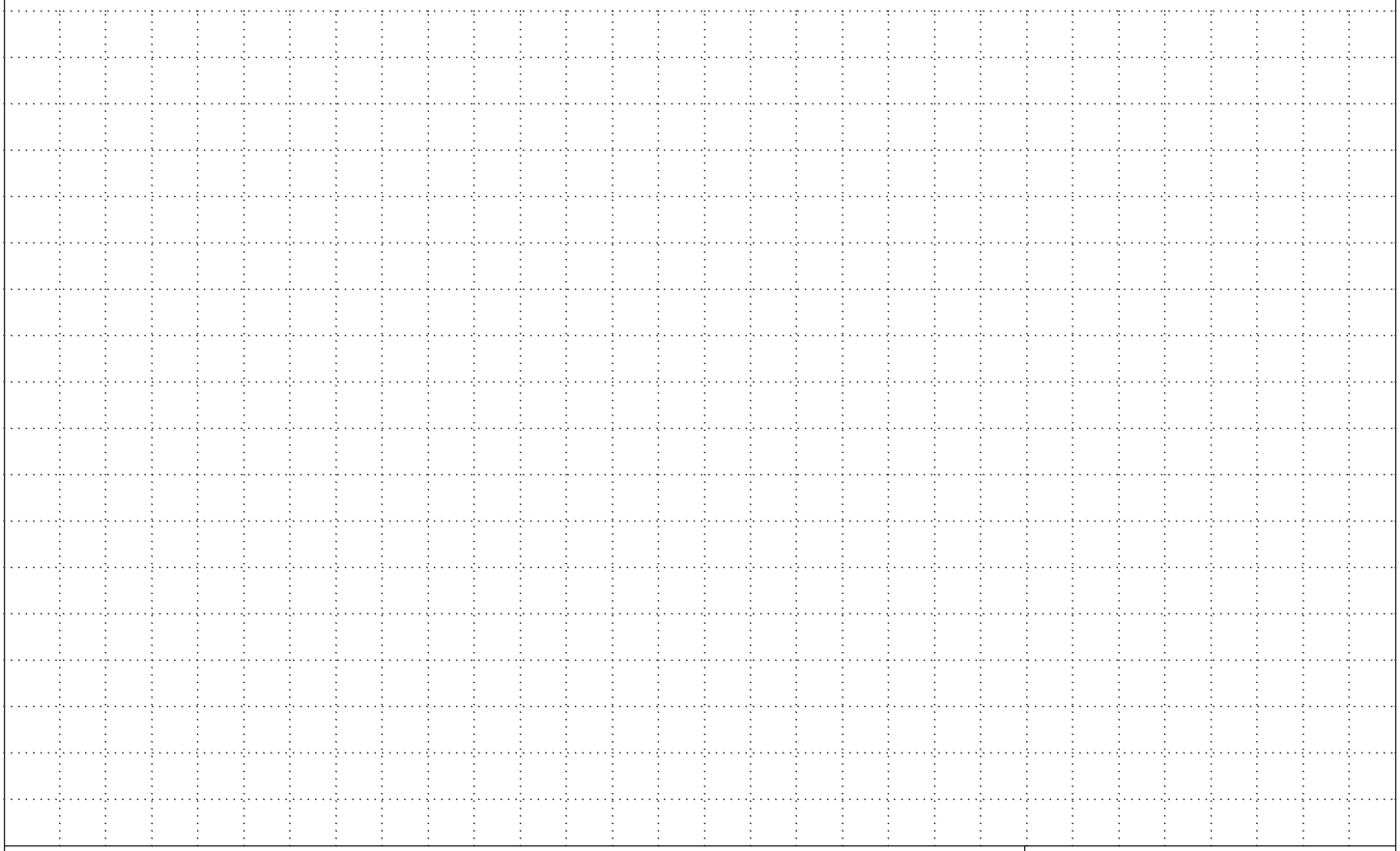
3. PROJECT	4. LOCATION
Ellsworth AFB - PFC Delineation at FTC 001, OU1	Ellsworth AFB, South Dakota
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
Dustin Powell	Geoprobe 7800 Series
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Macrocore	8. HOLE LOCATION
	667,229.3 North 1,243,342.2 East
	9. SURFACE ELEVATION
	3171.3' NAVD 1929
	10. DATE STARTED: 3/16/16 / 11. DATE COMPLETED: 3/16/16
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
15	Water not observed
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
	Water not observed
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)
15.0	No well installed

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
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20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
2	---	---	PFCs	---	---	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE: 1" = 1'



PROJECT	HOLE NO
Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota	DP0151

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0151

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 2 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3171.3	0	Yellowish brown clay (CL)					
			0.0 ppm		DP0151-00-0316-0.5		
3170.3	1						
3169.3	2		0.0 ppm		DP0151-00-0316-2-10		
3168.3	3						
3167.3	4						
3166.3	5	Yellowish brown clay (CL)					
3165.3	6		0.0 ppm				
3164.3	7						
3163.3	8		0.0 ppm				
3162.3	9	Yellowish brown clay, expansive (CL)					
3161.3	10						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0151

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DRILLING LOG

(CONTINUATION SHEET)

HOLE NUMBER: DP0151

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1
Ellsworth AFB, South Dakota

INSPECTOR: Robert Selover

SHEET 3 OF SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
3161.3	10						
3160.3	11						
3159.3	12	Yellowish brown clay, expansive (CL)	0.0 ppm				
3158.3	13						
3157.3	14						
3156.3	15	End of boring	0.0 ppm				Groundwater not encountered
3155.3	16						
3154.3	17						
3153.3	18						
3152.3	19						
3151.3	20						

PROJECT: Ellsworth AFB - PFC Delineation at FTC 001, OU1 Ellsworth AFB, South Dakota

HOLE NO: DP0151

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

Appendix C – Temporary Well Completion Details

Appendix C
Temporary Well Completion

Well Name	Material	Top	Bottom
TW0101	Grout	0	1.71
TW0101	Sand	1.71	12.71
TW0101	Stickup	2.29	0
TW0101	PVC	0	2.71
TW0101	Screen	2.71	12.21
TW0101	Foot	12.21	12.71
TW0102	Grout	0	12.73
TW0102	Sand	12.73	23.73
TW0102	Stickup	1.27	0
TW0102	PVC	0	13.73
TW0102	Screen	13.73	23.23
TW0102	Foot	23.23	23.73
TW0103	Grout	0	1.67
TW0103	Sand	1.67	12.67
TW0103	Stickup	2.33	0
TW0103	PVC	0	2.67
TW0103	Screen	2.67	12.17
TW0103	Foot	12.17	12.67
TW0105	Grout	0	9.75
TW0105	Sand	9.75	20.75
TW0105	Stickup	4.25	0
TW0105	PVC	0	10.75
TW0105	Screen	10.75	20.25
TW0105	Foot	20.25	20.75
TW0107	Grout	0	12.94
TW0107	Sand	12.94	25.44
TW0107	Stickup	2.1	0
TW0107	PVC	0	14.94
TW0107	Screen	14.94	24.94
TW0107	Foot	24.94	25.44
TW0108	Grout	0	9.2
TW0108	Sand	9.2	15.2
TW0108	Stickup	4.8	0
TW0108	PVC	0	10.2
TW0108	Screen	10.2	14.7
TW0108	Foot	14.7	15.2
TW0109	Grout	0	16.1
TW0109	Sand	16.1	22.1
TW0109	Stickup	2.9	0
TW0109	PVC	0	17.1
TW0109	Screen	17.1	21.6
TW0109	Foot	21.6	22.1

Appendix C
Temporary Well Completion

Well Name	Material	Top	Bottom
TW0113	Grout	0	11.8
TW0113	Sand	11.8	17.8
TW0113	Stickup	2.2	0
TW0113	PVC	0	12.8
TW0113	Screen	12.8	17.3
TW0113	Foot	17.3	17.8
TW0115	Grout	0	12.8
TW0115	Sand	12.8	28.8
TW0115	Stickup	1.2	0
TW0115	PVC	0	13.8
TW0115	Screen	13.8	28.3
TW0115	Foot	28.3	28.8
TW0116	Grout	0	4.95
TW0116	Sand	4.95	10.95
TW0116	Stickup	4.05	0
TW0116	PVC	0	5.95
TW0116	Screen	5.95	10.45
TW0116	Foot	10.45	10.95
TW0122	Grout	0	9.65
TW0122	Sand	9.65	15.65
TW0122	Stickup	4.35	0
TW0122	PVC	0	10.65
TW0122	Screen	10.65	15.15
TW0122	Foot	15.15	15.65
TW0124	Grout	0	5.2
TW0124	Sand	5.2	16.2
TW0124	Stickup	3.8	0
TW0124	PVC	0	6.2
TW0124	Screen	6.2	15.7
TW0124	Foot	15.7	16.2
TW0130	Grout	0	6
TW0130	Sand	6	17
TW0130	Stickup	3	0
TW0130	PVC	0	7
TW0130	Screen	7	16.5
TW0130	Foot	16.5	17
TW0138	Grout	0	8.85
TW0138	Sand	8.85	14.85
TW0138	Stickup	0.15	0
TW0138	PVC	0	9.85
TW0138	Screen	9.85	14.35
TW0138	Foot	14.35	14.85

Appendix C
Temporary Well Completion

Well Name	Material	Top	Bottom
TW0139	Grout	0	0.5
TW0139	Sand	0.5	2.5
TW0139	Stickup	2.5	0
TW0139	Screen	0	2
TW0139	Foot	2	2.5
TW0141	Grout	0	25.8
TW0141	Sand	25.8	31.8
TW0141	Stickup	3.2	0
TW0141	PVC	0	26.8
TW0141	Screen	26.8	31.3
TW0141	Foot	31.3	31.8
TW0142	Grout	0	13.65
TW0142	Sand	13.65	19.65
TW0142	Stickup	0.35	0
TW0142	PVC	0	14.65
TW0142	Screen	14.65	19.15
TW0142	Foot	19.15	19.65
TW0143	Grout	0	13.4
TW0143	Sand	13.4	19.4
TW0143	Stickup	0.6	0
TW0143	PVC	0	14.4
TW0143	Screen	14.4	18.9
TW0143	Foot	18.9	19.4
TW0146	Grout	0	13.85
TW0146	Sand	13.85	19.85
TW0146	Stickup	0.15	0
TW0146	PVC	0	14.85
TW0146	Screen	14.85	19.35
TW0146	Foot	19.35	19.85
TW0149	Grout	0	14.58
TW0149	Sand	14.58	30.58
TW0149	Stickup	4.42	0
TW0149	PVC	0	15.58
TW0149	Screen	15.58	30.08
TW0149	Foot	30.08	30.58

Appendix D – Equipment Blanks

Appendix D
Equipment Blanks
Area of Concern, PFC-1, Ellsworth Air Force Base

Client Sample ID: Lab Sample ID: Date Sampled:	Units	CAS Number	Screening Level (ug/L)	FB0101-00-0316 FA32234-23 3/9/2016		FB0102-03-0316 FA32270-34 3/14/2016		EB0116-03-0316 FA32457-1 3/14/2016		EB20116-03-0316 FA32457-8 3/15/2016		EB30116-03-0316 FA32457-17 3/16/2016	
Media Sampled				Subsurface Soil		Subsurface Soil		Groundwater		Groundwater		Groundwater	
GC/MS Semi-volatiles													
Perfluorohexanoic acid	ug/l	307-24-4	0.008	0.015	U	0.0117	J	0.017	U	0.016	U	0.015	U
Perfluoroheptanoic acid	ug/l	375-85-9	0.008	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.4	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluorononanoic acid	ug/l	375-95-1	0.008	0.0096	U	0.0096	U	0.01	U	0.01	U	0.0096	U
Perfluorodecanoic acid	ug/l	335-76-2	0.008	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluoroundecanoic acid	ug/l	2058-94-8	0.008	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluorododecanoic acid	ug/l	307-55-1	0.008	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluorotridecanoic acid	ug/l	72629-94-8	0.008	0.015	UJ	0.015	UJ	0.017	U	0.016	U	0.015	U
Perfluorotetradecanoic acid	ug/l	376-06-7	0.008	0.015	UJ	0.015	UJ	0.017	U	0.016	U	0.015	U
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	0.015	U	0.015	U	0.017	U	0.016	U	0.015	U
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.008	0.015	U	0.0309		0.017	U	0.016	U	0.015	U
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.2	0.0096	U	0.00823	J	0.01	U	0.01	U	0.0096	U

Client Sample ID: Lab Sample ID: Date Sampled:	Units	CAS Number	Screening Level (ug/L)	FB0103-03-0316 FA32448-1 3/16/2016		EB40116-03-0316 FA32457-27 3/17/2016		EB50116-03-0316 FA32490-30 3/18/2016		EB60116-03-0316 FA32490-31 3/18/2016		EB70116-03-0316 FA32490-42 3/19/2016	
Media Sampled				Subsurface Soil		Sediment		Subsurface Soil		Temporary Wells		Temporary Wells	
GC/MS Semi-volatiles													
Perfluorohexanoic acid	ug/l	307-24-4	0.008	0.015	U	0.015	U	0.015	U	0.0107	J	0.022	U
Perfluoroheptanoic acid	ug/l	375-85-9	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluorooctanoic acid (PFOA)	ug/l	335-67-1	0.4	0.015	U	0.015	U	0.015	U	0.018	U	0.022	U
Perfluorononanoic acid	ug/l	375-95-1	0.008	0.0096	U	0.0096	U	0.0096	UJ	0.011	UJ	0.014	UJ
Perfluorodecanoic acid	ug/l	335-76-2	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluoroundecanoic acid	ug/l	2058-94-8	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluorododecanoic acid	ug/l	307-55-1	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluorotridecanoic acid	ug/l	72629-94-8	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluorotetradecanoic acid	ug/l	376-06-7	0.008	0.015	U	0.015	U	0.015	UJ	0.018	UJ	0.022	UJ
Perfluorobutanesulfonic acid (PFBS)	ug/l	375-73-5	380	0.015	U	0.015	U	0.015	U	0.018	U	0.022	U
Perfluorohexanesulfonic acid	ug/l	355-46-4	0.008	0.015	U	0.015	U	0.015	U	0.0183	J	0.022	U
Perfluorooctanesulfonic acid (PFOS)	ug/l	1763-23-1	0.2	0.0096	U	0.0096	U	0.0096	U	0.0194	J	0.014	U

U = Non-detect
J = Estimated

Appendix E – Groundwater Sampling Logs

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW870211

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 17.96' feet	Sample Method: BAILER + PERISTALTIC PUMP	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 22.64' feet	Equipment: BAILER + PERISTALTIC PUMP	Location (Site): EAFB - AOC PFC-1	Begin Time: 0950
Water Column Thickness: 4.68 feet		Laboratory: SGS Accutest SE	Sample Depth: ~21'
Casing Diameter: 2 inches	Temperature (°F): 35°	Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Volume: 0.75 gallons (1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4)	Weather Conditions: SUNNY, WINDS @ 15MPH TO SW	Meters: Solinst W/L Meter; Horiba U-52	Serial numbers: 11230; YF1YV47F
Well Elevation (TOC): — feet		Well Condition: GOOD	Initial Observations: CLEAR
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
0955	0	11.28	3750	7.23	98	6.53	19	CLEAR
1000	0.3	11.22	3830	4.82	94	6.65	10	CLEAR
							→	W/L DROPS ~1 ft AFTER 5 MIN OF PURGING → SWITCH TO BAILER
1010	1.05	9.51	0	5.08	104	6.47	454	CLEAR TO CLOUDY / CONDUCTIVITY MEASUREMENT READING VERY LOW
1210							→	RETURN FOR GRAB SAMPLE

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
15	1.05	Y	WELL DRY @ 1012 AFTER BAILING

QA/QC Samples: N/A

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW930105

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 16.92' feet	Sample Method: LOW-FLOW PERISTALTIC	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 30.59' feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1450
Water Column Thickness: 13.67' feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~28
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 55°	Meters: Solinst W/L Meter	Serial numbers: 11080
		Horiba U-52	7F14V47F
Casing Volume: 2.2 gallons	Weather Conditions: SUNNY, WIND @ 25 mph to SW	Well Condition: GOOD	Initial Observations: CLEAR
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4			
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10% cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1455	0	10.69	3320	5.66	-35	6.37	51.9	CLEAR
1500	0.25	10.56	3408	2.77	-51	6.35	37.0	CLEAR
1505	0.5	10.11	3450	1.49	-59	6.36	17.5	CLEAR
1510	0.75	10.19	3430	1.08	-64	6.36	15.5	CLEAR
1515	1.0	10.19	3410	0.97	-67	6.35	13.3	CLEAR
1520	1.25	9.80	3410	0.90	-74	6.36	10.3	CLEAR
1525	1.5	10.04	3360	0.88	-76	6.38	8.9	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
30	1.5	N	None

QA/QC Samples: N/A

Signature

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW930109

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 15.97' feet	Sample Method: LOW-FLOW PERISTALTIC	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 23.74' feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1340
Water Column Thickness: 7.77 feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~22'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 35°	Meters: Solinst W/L Meter	Serial numbers: 11830
Casing Volume: 1.24 gallons		Horiba U-52	9F19V47F
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: PARTLY CLOUDY, WIND @ 20 mph N SW	Well Condition: GOOD	Initial Observations: CLEAR TO CLOUDY
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1345	0	11.38	1010	6.90	-63	6.11	218	CLEAR TO CLOUDY
1350	0.25	11.38	985	5.00	-59	6.29	114	CLEAR
1355	0.5	11.49	950	4.54	-53	6.42	42.9	CLEAR
1400	0.75	11.24	939	4.68	-44	6.51	45.9	CLEAR
1405	1.0	11.07	945	4.63	-35	6.56	39.5	CLEAR
1410	1.25	11.29	951	4.50	-26	6.60	29.6	CLEAR
1415	1.5	11.07	951	4.49	-18	6.63	28.9	CLEAR
1420	1.75	11.26	947	4.46	-10	6.63	28.0	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
35	1.75	N	None.

QA/QC Samples: N/A

Signature

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW930110

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 16.24' feet	Sample Method: LOW-FLOW SUBMERSIBLE	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 24.53 feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1245
Water Column Thickness: 8.29 feet	Equipment: SUBMERSIBLE PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~24'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 30°	Meters: Solinst W/L Meter	Serial numbers: 11930
Casing Volume: 1.3 gallons		Meters: Horiba U-52	Serial numbers: 4F19447F
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: OVERCAST, WINDS @ 20 MPH TO THE W	Well Condition: GOOD	Initial Observations: CLOUDY / MILKY
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1250	0	11.12	1370	3.06	-68	6.26	Ø	MILKY / CLOUDY
1255	0.3	10.99	1360	2.87	-55	5.70	Ø	MILKY / CLOUDY
1300	0.6	11.27	1310	2.01	-56	5.47	Ø	MILKY / CLOUDY
1305	0.9	11.59	1270	1.47	-59	5.37	Ø	MILKY / CLOUDY
1310	1.2	11.96	1330	1.03	-63	5.35	Ø	MILKY / CLOUDY
1315	1.5	11.80	1300	0.98	-59	5.26	Ø	MILKY / CLOUDY
1320	1.8	11.96	1260	0.81	-56	5.25	Ø	MILKY / CHALKY / CLOUDY
1325	2.1	12.02	1260	0.75	-57	5.24	Ø	MILKY / CLOUDY
1330	2.4	12.02	1260	0.73	-58	5.24		

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
40	2.4	N	NONE.

QA/QC Samples: N/A

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW 930209

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 31.65 feet	Sample Method: LOW-FLOW, THEN BAIL (3 CASING VOLUMES)	Sampler: Mateo Schimpf + Adam Stein	Date: 3/15/16
Well Depth (TOC): 42.00 feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1120
Water Column Thickness: 10.35 feet	Equipment: BAILER + SUBMERSIBLE PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~40'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 40	Meters: Solinst W/L Meter	Serial numbers: 11830
		Horiba U-52	Serial numbers: 11F19V697F
Casing Volume: 1.7 gallons (1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4)	Weather Conditions: OVERCAST, WINDS TO SW @ 15mph	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1125	0	9.64	2610	5.10	26	5.11	49.3	CLEAR
1130	0.25	9.81	2620	10.39	63	6.76	28.6	CLEAR
1135	0.5	9.79	2630	4.91	88	6.75	18.0	CLEAR
1140	0.75	10.40	2620	9.25	104	6.71	7.5	CLEAR
1145	—	—	—	—	—	—	→	PUMP COULD NOT MAINTAIN FLOW @ ~40' BGS — SWITCH TO BAILER
1215	1.75	10.04	2600	10.12	148	6.65	13.2	1 CASING VOLUME
1225	3.5	9.47	2640	10.95	128	6.65	12.4	2 CASING VOLUMES
1235	5.25	9.65	2650	10.22	127	6.73	12.2	3 CASING VOLUMES / SAMPLE

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
70	5.25	N	GW SAMPLE COLLECTED AFTER 3 CASING VOLUMES REMOVED * ORP > +/- 10 mV but w/in 10% ✓

QA/QC Samples: MS | MSD

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW931207

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 21.31 feet	Sample Method: LOW - FLOW SUBMERSIBLE	Sampler: Mateo Schimpf + Adam Stein	Date: 3/15/16
Well Depth (TOC): 30.34' feet	Equipment: SUBMERSIBLE PUMP	Location (Site): EAFB - AOC PFC-1	Begin Time: 1515
Water Column Thickness: 9.03 feet		Laboratory: SGS Accutest SE	Sample Depth: ~28
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 45	Meters: Solinst W/L Meter	Serial numbers: 11850
Casing Volume: 1.4 gallons		Horiba U-52	4F194478
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: OVERCAST, LT WINDS TO SW	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1550	0	10.46	972	10.72	48	7.30	45.8	CLEAR
1555	0.25	9.75	976	2.83	63	6.89	23.7	CLEAR
1600	0.5	10.12	986	2.91	100	6.77	18.3	CLEAR
1605	0.75	10.23	990	1.99	93	6.65	17.7	CLEAR
1610	1.0	10.21	992	1.61	89	6.58	11.0	CLEAR
1615	1.25	9.98	993	1.55	89	6.51	7.6	CLEAR
1620	1.5	9.85	996	1.65	90	6.50	8.5	CLEAR
1625	1.75	9.75	998	1.65	92	6.48	8.0	

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
35	1.75	N	NONE.

QA/QC Samples: N/A

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW950102

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 18.26 feet	Sample Method: LOW - FLOW PERISTALTIC	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 29.46' feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1115
Water Column Thickness: 11.17 feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~27'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 35°	Meters: Solinst W/L Meter	Serial numbers: 11830
		Horiba U-52	7F19V47F
Casing Volume: 1.8 gallons (1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4)	Weather Conditions: OVERCAST, WINDS @ 25 MPH TO SW	Well Condition: GOOD	Initial Observations: CLEAR TO CLOUDY
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1120	0	10.91	3320	4.62	115	6.74	123	CLEAR TO CLOUDY
1125	0.3	10.75	3350	1.74	100	6.55	45.0	CLEAR
1130	0.6	10.35	3350	1.30	94	6.51	28.9	CLEAR
1135	0.9	10.55	3360	1.19	86	6.49	28.8	CLEAR
1140	1.2	10.71	3360	1.08	77	6.50	23.5	CLEAR
1145	1.5	10.39	3360	0.96	75	6.56	22.1	CLEAR
1150	1.8	10.19	3370	0.94	73	6.50	22.5	CLEAR
1155	2.1	10.02	3390	0.90	71	6.50	21.6	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
35	2.1	N	NONE

QA/QC Samples: N/A

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW960401

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 11.83' feet	Sample Method: LOW - FLOW PERISTALTIC PUMP	Sampler: Mateo Schimpf + Adam Stein	Date: 3/15/16
Well Depth (TOC): 22.21 feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1440
Water Column Thickness: 10.38 feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~20'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 50	Meters: Solinst W/L Meter	Serial numbers: 1330
Casing Volume: 1.7 gallons		Horiba U-52	4F19V47F
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: OVERCAST, LT. WINDS TO SW	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10% cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1445	0	11.22	2370	5.33	130	6.87	7.6	CLEAR
1450	0.25	11.35	2020	4.56	112	6.80	1.5	CLEAR
1455	0.5	11.39	1770	6.51	122	6.87	0.5	CLEAR
1500	0.75	11.32	1680	7.27	129	6.92	Ø	CLEAR
1505	1.0	11.14	1650	8.18	133	6.94	Ø	CLEAR
1510	1.25	10.93	1710	8.51	136	6.93	Ø	CLEAR
1515	1.5	10.71	1710	8.32	138	6.91	Ø	CLEAR
1520	1.75	10.57	1710	8.32	140	6.90	Ø	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
35	1.75	N	NONE.

QA/QC Samples: N/A

Signature:

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW970101

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 9.05 feet	Sample Method: LOW - FLOW PERISTALTIC	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 20.83 feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1020
Water Column Thickness: 11.78 feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~18'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 35°	Meters: Solinst W/L Meter	Serial numbers: 11280
		Horiba U-52	9F19V475F
Casing Volume: 1.9 gallons (1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4)	Weather Conditions: SUNNY, WIND @ 20 mph to SW	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1025	0	11.96	3210	7.03	167	6.96	28.5	CLEAR
1030	0.25	11.54	3250	2.97	183	6.82	28.9	CLEAR
1035	0.5	11.20	3250	2.10	101	6.78	27.0	CLEAR
1040	0.75	11.00	3240	2.08	100	6.62	28.1	CLEAR
1045	1.0	10.75	3240	1.86	101	6.57	27.8	CLEAR
1050	1.25	10.90	3236	1.70	102	6.51	27.6	CLEAR
1055	1.5	10.92	3220	1.77	103	6.47	27.3	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
30	1.5	N	None.

QA/QC Samples: Field Duplicate

Signature

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW970202

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 13.49' feet	Sample Method: LOW - FLOW; PERISTALTIC PUMP	Sampler: Mateo Schimpf + Adam Stein	Date: 3/16/16
Well Depth (TOC): 24.81 feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 0840
Water Column Thickness: 11.32' feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~22'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 30	Meters: Solinst W/L Meter	Serial numbers: 11880
		Horiba U-52	Serial numbers: 1F19V97F
Casing Volume: 1.8 gallons	Weather Conditions: SUNNY, CLEAR	Well Condition: G.000	Initial Observations: CLEAR
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4			
Well Elevation (TOC): - feet			
Groundwater Elevation: - feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
0845	0	10.90	1360	7.03	105	5.46	38.8	CLEAR
0850	0.3	10.65	1340	2.65	72	6.15	15.4	CLEAR
0855	0.6	10.48	1340	2.17	52	6.29	11.5	CLEAR
0900	0.9	10.52	1340	1.91	44	6.32	7.3	CLEAR
0905	1.2	10.41	1330	1.71	37	6.33	4.3	CLEAR
0910	1.5	10.19	1340	1.64	30	6.34	5.4	CLEAR
0915	1.8	10.09	1340	1.92	22	6.39	2.6	CLEAR
0920	2.1	10.12	1340	1.36	14	6.49	3.2	CLEAR
0925	2.4	9.97	1350	1.37	15	6.46	2.4	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
40	2.4	N	None.

QA/QC Samples: N/A

Signature

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW990401

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 9.21' feet	Sample Method: LOW - FLOW PERISTALTIC	Sampler: Mateo Schimpf + Adam Stein	Date: 3/15/16
Well Depth (TOC): 18.68' feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1355
Water Column Thickness: 9.47 feet	Equipment: PERISTALTIC PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~17'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 50	Meters: Solinst W/L Meter	Serial numbers: 11830
Casing Volume: 1.5 gallons		Meters: Horiba U-52	Serial numbers: 1F19VG7F
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: PARTLY CLOUDY, WIND @ 10 mph TO SW	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1400	0	8.52	1380	4.71	124	7.14	8.7	CLEAR
1405	0.25	7.96	1890	5.14	117	7.12	1.3	CLEAR
1410	0.5	7.96	1610	5.32	116	7.07	Ø	CLEAR
1415	0.75	7.35	1540	4.95	117	7.01	Ø	CLEAR
1420	1.0	7.32	1520	5.11	119	6.96	Ø	CLEAR
1425	1.25	7.62	1580	5.07	123	6.91	Ø	CLEAR

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
25	1.25	N	None

QA/QC Samples: N/A

Signature

Ayuda Partners
Joint Venture

410 Acoma St. Suite A
Denver, CO

Station Name/Sample ID: MW020402

Project: EAFB - AOC PFC-1

Contract No.: W912PP-13-D-0011

GROUNDWATER SAMPLING LOG

Groundwater Depth (TOC): 21.12' feet	Sample Method: LOW - FLOW SUBMERSIBLE PUMP	Sampler: Mateo Schimpf + Adam Stein	Date: 3/15/16
Well Depth (TOC): 29.75' feet		Location (Site): EAFB - AOC PFC-1	Begin Time: 1000
Water Column Thickness: 8.63' feet	Equipment: SUBMERSIBLE PUMP	Laboratory: SGS Accutest SE	Sample Depth: ~ 28'
		Sample Suite: Perfluorinated Compounds - USEPA 537MOD	
Casing Diameter: 2 inches	Temperature (°F): 40°	Meters: Solinst W/L Meter	Serial numbers: 11830
Casing Volume: 1.3 gallons		Horiba U-52	4F19V97F
1"=x0.04 2"=x0.16 4"=x0.65 6"=x1.47 8"=x10.4	Weather Conditions: OVERCAST, LT WINDS	Well Condition: GOOD	Initial Observations: CLEAR
Well Elevation (TOC): — feet			
Groundwater Elevation: — feet	Parameter Stabilization: temp +/- 1° DO +/- 10% Turbidity +/- 10%; cond +/- 3% ORP +/- 10mV pH +/- 0.1 unit		

Time	Volume removed (gallon)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	ORP (mV)	pH	Turbidity (NTU)	Description (e.g. odor, clarity, color)
1005	0	9.50	2120	9.41	234	5.51	28.1	CLEAR
1010	0.3	9.66	2100	8.80	153	6.26	22.0	CLEAR
1015							→	STOP PUMP. FLOW CONTROL ROT MAL-FUNCTION (1030 RESTART)
1035	1.0	9.47	2080	8.92	147	6.73	8.0	CLEAR
1040	1.3	9.66	2060	10.31	140	6.73	3.0	CLEAR
1045	1.6	9.51	2060	10.22	139	6.80	1.4	CLEAR
1050	1.9	9.41	2050	10.07	143	6.74	2.1	CLEAR
1055	2.2	9.35	2050	9.96	141	6.74	2.1	SAMPLE

Total Time (min.)	Total Volume Removed	Well pumped dry (yes/no)	Notes
50	2.2 gal	N	NONE

QA/QC Samples: FIELD DUPLICATE

Signature:

Appendix F – Analytical Laboratory Reports

Appendix G – Data Validation Reports

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Ayuda Companies
410 Acoma Street
Denver, CO 80204
ATTN: Mr. Robert Selover

June 16, 2016

SUBJECT: Revised Ellsworth AFB, South Dakota, Data Validation

Dear Mr. Selover,

Enclosed is the revised validation report for the fraction listed below. Please replace the previously submitted report with the enclosed revised report.

LDC Project #36189:

SDG #	Fraction
FA32457	Perfluorooctane Sulfonate & Perfluorooctanoic Acid

- Revision: MS/MSD qualifiers removed from client samples MW930209-00-0316 & SW0103-00-0316 in SDG FA32457 due to sample dilutions.

Please feel free to contact us if you have any questions.

Sincerely,

Shauna McKellar
Project Manager/Chemist

LABORATORY DATA CONSULTANTS, INC.
1701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Ayuda Companies
410 Acoma Street
Denver, CO 80204
ATTN: Mr. Robert Selover

May 19, 2016

SUBJECT: Revised Ellsworth AFB, South Dakota, Data Validation

Dear Mr. Selover,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on April 15th & May 5th, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #36189:

SDG #	Fraction
FA32159, FA32234 FA32270, FA32390 FA32410, FA32423 FA32448, FA32457 FA32490	Volatiles, Metals, Total Petroleum Hydrocarbons as Gasoline, Total Petroleum Hydrocarbons as Extractables, Perfluorooctane Sulfonate & Perfluorooctanoic Acid

- Revision: An additional four samples in SDG FA32270 were validated at Level IV to meet the 10% requirement

Please feel free to contact us if you have any questions.

Sincerely,

Shauna McKellar
Project Manager/Chemist

6,371 pages-SF

Attachment 1

ERPIMS 90/10 Stage 2B/4

LDC #36189 (Ayuda Management - Broomfield, CO / Ellsworth AFB, South Dakota)

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260B)		Metals (6010C /7000)		TPH-G (8015C)		TPH-E (8015C)		PFOS/ PFOAs (537M)																							
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	FA32159	04/15/16	05/05/16	0	1	0	1	0	1	0	1	-	-																				
B	FA32234	04/15/16	05/05/16	-	-	-	-	-	-	-	-	2	21																				
C	FA32270	04/15/16	05/05/16	-	-	-	-	-	-	-	-	1	12																				
C	FA32270	04/15/16	05/05/16	-	-	-	-	-	-	-	-	6	15																				
D	FA32390	04/15/16	05/05/16	-	-	-	-	-	-	-	-	2	33																				
E	FA32410	04/15/16	05/05/16	0	4	0	3	0	3	0	3	-	-																				
F	FA32423	04/15/16	05/05/16	-	-	-	-	-	-	-	-	0	19																				
G	FA32448	04/15/16	05/05/16	-	-	-	-	-	-	-	-	3	17																				
H	FA32457	04/15/16	05/05/16	-	-	-	-	-	-	-	-	23	5																				
I	FA32490	05/05/16	05/26/16	-	-	-	-	-	-	-	-	16	25																				
Total	T/SM			0	5	0	4	0	4	0	4	53	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B review). Sample counts do not include MS, MSD, or DUP's.

V:\LOGIN\Ayuda\Ellsworth\36189ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: April 27, 2016

Parameters: Volatiles

Validation Level: Stage 4

Laboratory: SGS North America, Inc./Accutest Laboratories

Sample Delivery Group (SDG): FA32159

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WS0101-00-0316	FA32159-1	Soil	03/10/16
WS0101-00-0316MS	FA32159-1MS	Soil	03/10/16
WS0101-00-0316MSD	FA32159-1MSD	Soil	03/10/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria.

XIII. Target Compound Identifications

All target compound identifications met validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Volatiles - Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Volatiles - Laboratory Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Volatiles - Field Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

LDC #: 36189A1 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/22/16

SDG #: FA32159 Stage 4 Page: 1 of 1

Laboratory: Accutest Laboratories (SGS) Reviewer: TM

2nd Reviewer: SM

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	≤15 ICV ≤20
IV.	Continuing calibration	SW	≤20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WS0101-00-0316	FA32159-1	Soil	03/10/16
2	WS0101-00-0316MS	FA32159-1MS	Soil	03/10/16
3	WS0101-00-0316MSD	FA32159-1MSD	Soil	03/10/16
4				
5				
6				
7				
8				
9				

Notes:

	VY1104-MB						

LDC #: 36189A1

VALIDATION FINDINGS CHECKLIST

Reviewer: CM
2nd Reviewer: SM

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 36189A1

VALIDATION FINDINGS CHECKLIST

Reviewer: 9r
2nd Reviewer: Sm

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	(/)	X		
Was a MS/MSD analyzed every 20 samples of each matrix?	(/)		X	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	(/)		X	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within ± 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: ON
2nd Reviewer: SM

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?
(Y) N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
(Y) N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
		No ending CCV analyzed per DoD 5.0 QSM					text

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: 9m
2nd Reviewer: SM

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

RRF = $(A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs
X = Mean of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (4 std)	Recalculated RRF (4 std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	031116AA09-Y.M	03/11/16	Benzene (1st internal standard)	1.513	1.513	1.466	1.466	7.36	7.37
			Chlorobenzene (2nd internal standard)	1.324	1.324	1.285	1.285	5.58	5.59
			1,4-DCB (3rd internal standard)	2.038	2.038	2.003	2.002	6.10	6.10
			NA (4th internal standard)						
2			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
			(4th internal standard)						
3			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
			(4th internal standard)						
4			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
			(4th internal standard)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: 9m
2nd Reviewer: SM

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	Y2726z.D	03/11/16	Benzene (1st internal standard)	1.466	1.493	1.493	~~0.5~~ 1.8	1.9
			Chlorobenzene (2nd internal standard)	1.285	1.346	1.346	4.7	4.7
			1,4-DCB (3rd internal standard)	2.003	2.162	2.162	7.9	7.9
			(4th internal standard)					
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: CK
2nd reviewer: SK

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: |

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	50.000	48.55	97	97	Ø
1,2-Dichloroethane-d4	↓	52.92	106	106	Ø
Toluene-d8		50.45	101	101	Ø
Bromofluorobenzene	↓	53.12	106	106	Ø

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = | MSC - MSC | * 2/(MSC + MSDC) MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD sample: 2/3

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD		MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	72.6	73.4	ND	65.6	66.2	90	90	90	90	1	1
Trichloroethene	↓	↓	ND	65.0	62.3	90	89	85	85	4	4
Benzene	↓	↓	ND	67.0	64.4	92	92	88	88	4	4
Toluene	NA	NA									
Chlorobenzene	72.6	73.4	ND	65.7	63.4	91	91	86	86	4	4

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration; SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: VY1104-BS

Compound	Spike Added (ug/kg)		Spiked Sample Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	50	NA	49.7	NA	99	99				
Trichloroethene			49.5		99	99				
Benzene			49.8		100	100				
Toluene			NA							
Chlorobenzene			50.6		101	101				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: On
2nd reviewer: On

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?

(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

(Sample ND)

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 2(MS) 1,1-DCE

Conc. = $\frac{(674973)(50.00)(1)}{(117785)(0.634)(4.27)(0.807)}$

= 65.57607016 ≃ 65.6 MG/KG

#	Sample ID	Compound	Reported Concentration ( )	Calculated Concentration ( )	Qualification

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: April 28, 2016

Parameters: Metals

Validation Level: Stage 4

Laboratory: SGS North America, Inc./Accutest Laboratories

Sample Delivery Group (SDG): FA32159

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WS0101-00-0316	FA32159-1	Soil	03/10/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver by Environmental Protection Agency (EPA) SW 846 Method 6010C
Mercury by EPA SW 846 Method 7471A

All sample results were subjected to Stage 4 evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
WS0136-00-0316MS/MSD (All samples in SDG FA32159)	Chromium	-	127.2 (85-113)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met with the following exceptions:

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
WS0136-00-0316	Barium Chromium	12.9 (≤10) 12.7 (≤10)	All samples in SDG F32159	J (all detects) J (all detects)	A

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and serial dilution %D, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Metals - Data Qualification Summary - SDG FA32159

Sample	Analyte	Flag	A or P	Reason
WS0101-00-0316	Chromium	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
WS0101-00-0316	Barium Chromium	J (all detects) J (all detects)	A	Serial dilution (%D)

Ellsworth AFB, South Dakota
Metals - Laboratory Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Metals - Field Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

LDC #: 36189A4b

SDG #: FA32159

Laboratory: Accutest Laboratories

METHOD: Metals (EPA SW 846 Method 6010B/7471A)

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 4/26/16

Page: 1 of 1

Reviewer: JD

2nd Reviewer: SM

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	3/10/16
II.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	A	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS/D = WS0136-00-0316 MS/D (SDG: FA32410)
VII.	Duplicate sample analysis	A	DUP = WS0136-00-0316 DUP (SDG: FA32410)
VIII.	Serial Dilution	SW	SER = WS0136-00-0316 (SDG: FA32410)
IX.	Laboratory control samples	A	LCS
X.	Field Duplicates	N	
XI.	Sample Result Verification	A	
XII.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WS0101-00-0316	FA32159-1	Soil	03/10/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes:

LDC #: 36189A46

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: JD
2nd Reviewer: SM

Method: Metals (EPA SW 846 Method 6010B/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.		✓		
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?		✓		
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 36858A46

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: JD
2nd reviewer: JM

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1	S	Al, Sb, (As), Ba, Be, (Cd), Ca, (Cr), Co, Cu, Fe, (Pb), Mg, Mn, (Hg), Ni, K, (Se), (Ag), Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
Analysis Method		
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, _____

Comments: Mercury by CVAA if performed

LDC #: 36189A4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JD
2nd Reviewer: [illegible]

METHOD: Trace metals (EPA SW 846 Method 6010/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	WS0136-00-0316 MS/D (SDG: FA32410)	S	Cr		127.2 (85-113)		All	Jdet/A (det)

Comments: _____

LDC #: 36189A4b

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: JD
2nd Reviewer:

METHOD: Trace Metals (EPA SW 846 Method 6010C/6020A/7471B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y (N) N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y (N) N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

(Y) N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	%D (Limits)	Associated Samples	Qualifications
	WS0136-00-0316 (SDG: FA32159)	S	Ba	12.9	All	J/UJ/A (det)
			Cr	12.7		J/UJ/A (det)

Comments:

LDC #: 36189A46

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: JD
2nd Reviewer: M

METHOD: Trace Metals (See cover)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found x 100 / True

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
ICV 9:44	ICP (Initial calibration)	As	1998 ug/L	2000 ug/L	99.9%R	100.0%R	y*
	ICP/MS (Initial calibration)						
ICV 9:10	CVAA (Initial calibration)	Hg	3.0 ug/L	3 ug/L	100.0%R	100.0%R	y
CCV (3) 12:06	ICP (Continuing calibration)	Ba	2034 ug/L	2000 ug/L	101.7%R	101.5%R	y*
	ICP/MS (Continuing calibration)						
CCV 9:51	CVAA (Contining calibration)	Hg	3.0 ug/L	3 ug/L	100.0%R	100.0%R	y
	GFAA (Initial calibration)						
	GFAA (Continuing calibation)						

Comments: *Rounding

LDC #: 36189C46

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: JO
2nd Reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

%R = Found / True x 100 Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = |S-D| / (S+D)/2 x 100 Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

%D = |I-SDR| / I x 100 Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
ICS AB 10:09	ICP interference check	Se	1020 ug/L	1000 ug/L	102.0%R	102.0%R	Y
LCS 9:20	Laboratory control sample	Hg	0.256 mg/kg	0.25 mg/kg	102.4%R	104.0%R	Y*
MS 11:18	Matrix spike	Cd	(SSR-SR) 2.73 mg/kg	2.88 mg/kg	94.8%R	95.5%R	Y*
DUP 11:14	Duplicate	Ag	0.92 mg/kg	0.89 mg/kg	3.3%RPD	3.3%RPD	Y
SER 11:38	ICP serial dilution	Cr	0.494 mg/L	0.5120 mg/L	12.7%D	12.7%D	Y

Comments: *Ranging

LDC #: 36289C46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JO
2nd reviewer: SM

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for (1) As were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)(\%solids)}$

Recalculation: $\frac{(0.1985 mg/L)(50 ml)}{(1.07 g)(0.807)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

%solids = 0.807
RD = 0.1985 mg/L
FV = 50 ml
In. W = 1.07 g

#	Sample ID	Analyte	Reported Concentration (mg/kg)	Calculated Concentration (mg/kg)	Acceptable (Y/N)
	1	As	11.5	11.5	Y
		Ba	58.2	58.2	
		Cd	0.23	0.23	
		Cr	23.8	23.8	
		Pb	21.3	21.3	
		Hg	0.064	0.064	
		Ag	1.1	1.1	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: April 28, 2016

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Stage 4

Laboratory: SGS North America, Inc./Accutest Laboratories

Sample Delivery Group (SDG): FA32159

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WS0101-00-0316	FA32159-1	Soil	03/10/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Petroleum Hydrocarbons (TPH) as Gasoline by Environmental Protection Agency (EPA) SW 846 Method 8015C

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

LDC #: 36189A7 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/22/16

SDG #: FA32159 Stage 4 Page: 1 of 1

Laboratory: Accutest Laboratories (SGS) Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: GC TPH as Gasoline (EPA SW 846 Method 8015C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	~~≤20~~ r2 ≤20 ICV ≤20
III.	Continuing calibration	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	C.S.
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WS0101-00-0316	FA32159-1	Soil	03/10/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

	GW3942-MB						

LDC #: 36189A7

VALIDATION FINDINGS CHECKLIST

Reviewer: Om
2nd Reviewer: SM

Method: X GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Was a linear fit used for evaluation? If yes, were all percent relative standard deviations (%RSD) < 20%?	X	⊘		
Was a curve fit used for evaluation? If Yes, what was the acceptance criteria used?	✓			
Did the initial calibration meet the curve fit acceptance criteria?	✓			
Were the RT windows properly established?	✓			
IV. Initial calibration verification				
What type of initial calibration verification calculation was performed? X %D or ___ %R				
Was an initial calibration verification standard analyzed after each ICAL for each instrument?	✓			
Were all percent differences (%D) ≤ 20%.0 or percent recoveries 80-120%?	✓			
V. Continuing calibration				
What type of continuing calibration calculation was performed? X %D or ___ %R				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) < 20%.0 or percent recoveries 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
VI. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VII. Surrogate spikes				
Were all surrogate %R within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 36189A7

VALIDATION FINDINGS CHECKLIST

Reviewer: QN
2nd Reviewer: SM

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XII. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XVI. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XVII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target compounds were detected in the field blanks.			✓	

LDC #: 36189A7

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JM
2nd Reviewer: BM

METHOD: GC X HPLC ____

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated using the following calculations:

CF = A/C
Average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where: A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported (CF_{std4})	Recalculated (CF_{std4})	Reported CF (initial)	Recalculated CF (intial)	Reported %RSD	Recalculated %RSD
1	GRO5012I.M	01/21/16	GRO	1.446e4	1.446e4	1.535e4	1.5355e4	7.52	7.52
						{ - see attached for linear -			
2									
3									
4									

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

Method: GC TPH as Gasoline (EPA SW 846 Method 8015C)

Calibration Date	GC	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
1/21/2016	GC18420 RTX-502.2	Pentachlorophenol	1	1756632	100
			2	3119262	200
			3	6019559	400
			4	8674424	600
			5	11853937	800
			6	14628195	1000

Regression Output	*Calculated*	*Reported*
Constant	*260983.964384*	*260983.621310*
Std Err of Y Est		
R Squared	*0.999554*	*0.999600*
Degrees of Freedom		
X Coefficient(s)	*14350.356521*	*14350.357400*
Std Err of Coef.		
Correlation Coefficient	*0.9997772*	
Coefficient of Determination (r^2)	*0.9995544*	

LDC #: 36189A7

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC X HPLC _____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration CF were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. CF -CF)/ave.CF

Where: ave. CF = initial calibration average CF
CF = continuing calibration CF
A = Area of compound
C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV (Conc.)	Reported CF/(Conc.) CCV	Recalculated CF/(Conc.) CCV	Reported %D	Recalculated %D
1	UV074045.D	03/16/16	GRO	400.000	366.182	366.182	8.5	8.5
2	UV074056.D	03/16/16	GRO	400.000	362.080	362.080	9.5	9.5
3								
4								

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A7

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: X GC __ HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
B		50.000	41.977	84	84	Ø
C		↓	49.179	98	98	Ø

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 36489A7

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: X GC ___HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: GW3942-BS

Compound		Spike Added (mg/kg)		Spike Sample Concentration (mg/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)	20	NA	17.4	NA	87	87				
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)										
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										
Aroclor 1260	(8082)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A7

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: X GC __ HPLC

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds within 10% of the reported results? (Sample ND)

Concentration = linear (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. LCS Compound Name GRO

$$\text{Concentration} = \frac{\left[\frac{(5249076 - 260983.6213)}{1435035740}\right](5)(1)}{(100)} =$$

$17.37967996 \approx 17.4 \text{ mg/kg}$

#	Sample ID	Compound	Reported Concentrations ( )	Recalculated Results Concentrations ( )	Qualifications

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: April 28, 2016

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Stage 4

Laboratory: SGS North America, Inc./Accutest Laboratories

Sample Delivery Group (SDG): FA32159

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WS0101-00-0316	FA32159-1	Soil	03/10/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Petroleum Hydrocarbons (TPH) as Extractables by Environmental Protection Agency (EPA) SW 846 Method 8015C

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

All compound quantitations were within validation criteria.

XI. Target Compound Identifications

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification Summary - SDG FA32159

No Sample Data Qualified in this SDG

LDC #: 36189A8 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/22/16

SDG #: FA32159 Stage 4 Page: 1 of 1

Laboratory: Accutest Laboratories SGS Reviewer: TW

2nd Reviewer: SM

METHOD: GC TPH as Extractables (EPA SW 846 Method 8015C)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	≤20 ICV≤20
III.	Continuing calibration	A	≤20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	C.S.
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WS0101-00-0316	FA32159-1	Soil	03/10/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

	OP59769-MB						

LDC #: 36189A8

VALIDATION FINDINGS CHECKLIST

Reviewer: Om
2nd Reviewer: SM

Method: X GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Was a linear fit used for evaluation? If yes, were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If Yes, what was the acceptance criteria used?		✓		
Did the initial calibration meet the curve fit acceptance criteria?			✓	
Were the RT windows properly established?	✓			
IV. Initial calibration verification				
What type of initial calibration verification calculation was performed? X %D or ___ %R				
Was an initial calibration verification standard analyzed after each ICAL for each instrument?	✓			
Were all percent differences (%D) ≤ 20%.0 or percent recoveries 80-120%?	✓			
V. Continuing calibration				
What type of continuing calibration calculation was performed? X %D or ___ %R				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%.0 or percent recoveries 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
VI. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VII. Surrogate spikes				
Were all surrogate %R within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 36189A8

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XII. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. System performance				
System performance was found to be acceptable.	✓			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XVI. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XVII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target compounds were detected in the field blanks.			✓	

LDC #: 36189A8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC X HPLC ____

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated using the following calculations:

CF = A/C
Average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where: A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (2000 std)	Recalculated CF (2000 std)	Reported CF (initial)	Recalculated CF (intial)	Reported %RSD	Recalculated %RSD
1	GSS517 - ICC517	03/03/16	DRO	1.063e6	1.063e6	1.045e6	1.045e6	3.38	3.38
2									
3									
4									

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A8

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: GC X HPLC _____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration CF were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. CF -CF)/ave.CF

Where: ave. CF = initial calibration average CF
CF = continuing calibration CF
A = Area of compound
C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV (Conc.)	Reported CF/(Conc.) CCV	Recalculated CF/(Conc.) CCV	Reported %D	Recalculated %D
1	SS012179.d	03/22/16	DRO	2000.000	1916.237	1916.743	4.2	4.2
2								
3								
4								

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A8

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: 9m
2nd reviewer: 9m

METHOD: X GC ___ HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
H	/	50.000	55.116	110	110	0

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 36189A8

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: X GC ___HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: GJ5525

Compound		Spike Added (mg/Kg)		Spike Sample Concentration (mg/Kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)	50	NA	41.6	NA	83	83				
Benzene	(8021B)										
Methane	(RSK-175)										
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										
Aroclor 1260	(8082)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189A8

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: Qm
2nd Reviewer: SM

METHOD: X GC __ HPLC

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

(Sample ND)

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. LCS Compound Name DRO

Concentration = $\frac{(86876789)(1)(1)}{(1.045e6)(20)}$ =

41.56784191 ≈ 41.6 mg/kg

#	Sample ID	Compound	Reported Concentrations ( )	Recalculated Results Concentrations ( )	Qualifications

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: April 28, 2016

Parameters: Perfluorooctane Sulfonate & Perfluorooctanoic Acid

Validation Level: Stage 2B

Laboratory: Accutest Laboratories

Sample Delivery Group (SDG): FA32234

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
DP0109-00-0316-0.5	FA32234-1	Soil	03/08/16
DP0109-00-0316-2_10	FA32234-2	Soil	03/08/16
DP0108-00-0316-0.5	FA32234-3	Soil	03/08/16
DP0108-00-0316-2_10	FA32234-4	Soil	03/08/16
DP0116-00-0316-0.5	FA32234-5	Soil	03/08/16
DP0116-00-0316-2_10	FA32234-6	Soil	03/08/16
DP0141-00-0316-0.5	FA32234-7	Soil	03/08/16
DP0141-00-0316-2_10	FA32234-8	Soil	03/08/16
DP0124-00-0316-0.5	FA32234-9	Soil	03/09/16
DP0124-00-0316-8_10	FA32234-10	Soil	03/09/16
DP0109-00-0316-19	FA32234-11	Soil	03/10/16
DP0108-00-0316-15	FA32234-12	Soil	03/10/16
DP0141-00-0316-31.8	FA32234-13	Soil	03/10/16
DP0145-00-0316-0.5	FA32234-14	Soil	03/10/16
DP0145-00-0316-2_10	FA32234-15	Soil	03/10/16
DP0145-00-0316-12	FA32234-16	Soil	03/10/16
DP0142-00-0316-0.5	FA32234-17	Soil	03/10/16
DP0142-00-0316-2_10	FA32234-18	Soil	03/10/16
DP0142-00-0316-16.5	FA32234-19	Soil	03/10/16
DP0143-00-0316-0.5	FA32234-20	Soil	03/10/16
DP0143-00-0316-2_10	FA32234-21	Soil	03/10/16
TW0116-00-0316	FA32234-22	Water	03/09/16
FB0101-00-0316	FA32234-23	Water	03/09/16
DP0109-00-0316-0.5MS	FA32234-1MS	Soil	03/08/16
DP0109-00-0316-0.5MSD	FA32234-1MSD	Soil	03/08/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) by Environmental Protection Agency (EPA) method 537M

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was not checked in this SDG.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 25.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 25.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
03/16/16	Perfluoroheptanoic acid	25.1	DP0109-00-0316-19	UJ (all non-detects)	A

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample FB0101-00-0316 was identified as an equipment blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
DP0109-00-0316-0.5MS/MSD (DP0109-00-0316-0.5)	Perfluorotridecanoic acid Perfluorotetradecanoic acid	64 (70-130) 44 (70-130)	- 68 (70-130)	UJ (all non-detects) UJ (all non-detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
DP0109-00-0316-0.5MS/MSD (DP0109-00-0316-0.5)	Perfluorohexanoic acid Perfluoroheptanoic acid Perfluorononanoic acid Perfluorodecanoic acid Perfluoroundecanoic acid Perfluorododecanoic acid Perfluorotridecanoic acid Perfluorotetradecanoic acid Perfluorobutanesulfonic acid Perfluorooctanesulfonic acid	35 (≤30) 36 (≤30) 37 (≤30) 37 (≤30) 39 (≤30) 45 (≤30) 50 (≤30) 77 (≤30) 36 (≤30) 42 (≤30)	NA	-
DP0109-00-0316-0.5MS/MSD (DP0109-00-0316-0.5)	Perfluorooctanoic acid Perfluorohexanesulfonic acid	35 (≤30) 32 (≤30)	J (all detects) J (all detects)	A

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	%R (Limits)	Flag	A or P
OP59771-BS (All water samples in SDG FA32234)	Perfluorotridecanoic acid Perfluorotetradecanoic acid	60 (70-130) 57 (70-130)	UJ (all non-detects) UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration %D, MS/MSD %R and RPD, and LCS %R, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Data Qualification Summary - SDG FA32234

Sample	Compound	Flag	A or P	Reason
DP0109-00-0316-19	Perfluoroheptanoic acid	UJ (all non-detects)	A	Continuing calibration (%D)
DP0109-00-0316-0.5	Perfluorotridecanoic acid Perfluorotetradecanoic acid	UJ (all non-detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
DP0109-00-0316-0.5	Perfluorooctanoic acid Perfluorohexanesulfonic acid	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
TW0116-00-0316 FB0101-00-0316	Perfluorotridecanoic acid Perfluorotetradecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (%R)

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Laboratory Blank Data Qualification Summary - SDG FA32234

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Field Blank Data Qualification Summary - SDG FA32234

No Sample Data Qualified in this SDG

LDC #: 36189B96 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/23/16
SDG #: FA32234 Stage 2B Page: 1 of 2
Laboratory: Accutest Laboratories Reviewer: TM
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	N	
III.	Initial calibration/ICV	A / A	r2 ICV ≤25
IV.	Continuing calibration	SW	≤25
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	FB>23
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	DP0109-00-0316-0.5	FA32234-1	Soil	03/08/16
2	DP0109-00-0316-2_10	FA32234-2	Soil	03/08/16
3	DP0108-00-0316-0.5	FA32234-3	Soil	03/08/16
4	DP0108-00-0316-2_10	FA32234-4	Soil	03/08/16
5	DP0116-00-0316-0.5	FA32234-5	Soil	03/08/16
6	DP0116-00-0316-2_10	FA32234-6	Soil	03/08/16
7	DP0141-00-0316-0.5	FA32234-7	Soil	03/08/16
8	DP0141-00-0316-2_10	FA32234-8	Soil	03/08/16
9	DP0124-00-0316-0.5	FA32234-9	Soil	03/09/16
10	DP0124-00-0316-8_10	FA32234-10	Soil	03/09/16
11	DP0109-00-0316-19	FA32234-11	Soil	03/10/16
12	DP0108-00-0316-15	FA32234-12	Soil	03/10/16
13	DP0141-00-0316-31.8	FA32234-13	Soil	03/10/16

LDC #: 36189B96 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/23/16

SDG #: FA32234 Stage 2B Page: 2 of 2

Laboratory: Accutest Laboratories Reviewer: JW

2nd Reviewer: JM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

	Client ID	Lab ID	Matrix	Date
14	1 DP0145-00-0316-0.5	FA32234-14	Soil	03/10/16
15	1 DP0145-00-0316-2_10	FA32234-15	Soil	03/10/16
16	1 DP0145-00-0316-12	FA32234-16	Soil	03/10/16
17	1 DP0142-00-0316-0.5	FA32234-17	Soil	03/10/16
18	1 DP0142-00-0316-2_10	FA32234-18	Soil	03/10/16
19	1 DP0142-00-0316-16.5	FA32234-19	Soil	03/10/16
20	1 DP0143-00-0316-0.5	FA32234-20	Soil	03/10/16
21	2 DP0143-00-0316-2_10	FA32234-21	Soil	03/10/16
22	3 TW0116-00-0316	FA32234-22	Water	03/09/16
23	3 FB0101-00-0316	FA32234-23	Water	03/09/16
24	1 DP0109-00-0316-0.5MS	FA32234-1MS	Soil	03/08/16
25	1 DP0109-00-0316-0.5MSD	FA32234-1MSD	Soil	03/08/16
26				
27				
28				
29				
30				

Notes:

1	OP59714-MB							
2	OP59733-MB							
3	OP59771-MB							

TARGET COMPOUND WORKSHEET

METHOD: PFOS/PFOAs

A. Perfluorohexanoic acid				
B. Perfluoroheptanoic acid				
C. Perfluorooctanoic acid				
D. Perfluorononanoic acid				
E. Perfluorodecanoic acid				
F. Perfluoroundecanoic acid				
G. Perfluorododecanoic acid				
H. Perfluorotridecanoic acid				
I. Perfluorotetradecanoic acid				
J. Perfluorobutanesulfonic acid				
K. Perfluorohexanesulfonic acid				
L. Perfluorooctanesulfonic acid				

LDC #: 36189B96

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed after every 10 injections for each instrument?

Y N N/A Were all continuing calibration percent differences (%D) ≤25 %?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤25.0%)	Finding RRF (Limit:)	Associated Samples	Qualifications
	03/16/16	Q19289	B	25.1		11	J/UJ/A (ND)

LDC #: 36189B96

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates/Duplicates

Page: 1 of 1
Reviewer: TM
2nd Reviewer: [signature]

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) or duplicate sample analyzed for each matrix in this SDG?
(Y) N N/A Was a MS/MSD analyzed every 20 samples of each matrix?
Y (N) N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?
Y N (N/A) Were all duplicate sample relative percent differences (RPD) or differences within QC limits?

#	Date	MS/MSD/DUP ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		24/25	H	64 (70-130)			1	J/UJ/A (ND)
			I	44 ↓	68 (70-130)			↓
			A			35 (30)		Jdets/A
			B			36		
			C			35		(det)
			D			37		(ND)
			E			37		
			F			39		
			G			45		
			H			50		
			I			77		
			J			36		
			K			32		(det)
			L			42		(ND)

Privileged and Confidential

LDC #: 36189B9

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?

Y N N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		OP59771-BS	H	60 (70-130)	( )	( )	all waters	J/UJ/P (NA)
		↓	I	57 (70-130)	( )	( )	↓	↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ellsworth AFB, South Dakota

LDC Report Date: May 19, 2016

Parameters: Perfluorooctane Sulfonate & Perfluorooctanoic Acid

Validation Level: Stage 2B & 4

Laboratory: Accutest Laboratories

Sample Delivery Group (SDG): FA32270

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
DP0115-00-0316-0.5**	FA32270-1**	Soil	03/13/16
DP0115-00-0316-6_8**	FA32270-2**	Soil	03/13/16
DP0115-00-0316-19**	FA32270-3**	Soil	03/13/16
DP0114-00-0316-0.5**	FA32270-4**	Soil	03/13/16
DP0114-00-0316-2-4**	FA32270-5**	Soil	03/13/16
DP0114-00-0316-16**	FA32270-6**	Soil	03/13/16
DP0146-00-0316-0.5**	FA32270-7**	Soil	03/12/16
DP0146-00-0316-2_10**	FA32270-8**	Soil	03/12/16
DP0146-00-0316-19**	FA32270-9**	Soil	03/12/16
DP0140-00-0316-0.5**	FA32270-10**	Soil	03/13/16
DP0140-00-0316-3_10**	FA32270-11**	Soil	03/13/16
DP0137-00-0316-0.5**	FA32270-12**	Soil	03/13/16
DP0137-00-0316-2_10**	FA32270-13**	Soil	03/13/16
DP0138-00-0316-0.5**	FA32270-14**	Soil	03/13/16
DP0138-00-0316-2_10**	FA32270-15**	Soil	03/13/16
DP0138-00-0316-13	FA32270-16	Soil	03/13/16
DP0143-00-0316-18	FA32270-17	Soil	03/11/16
DP0148-00-0316-0.5	FA32270-18	Soil	03/11/16
DP0148-00-0316-2_10	FA32270-19	Soil	03/11/16
DP0148-00-0316-13	FA32270-20	Soil	03/11/16
DP0147-00-0316-0.5	FA32270-21	Soil	03/11/16
DP0147-00-0316-2_10	FA32270-22	Soil	03/11/16
DP0144-00-0316-0.5	FA32270-23	Soil	03/11/16
DP0144-00-0316-2_10	FA32270-24	Soil	03/11/16
DP0136-00-0316-0.5	FA32270-25	Soil	03/12/16
DP0136-00-0316-2_10	FA32270-26	Soil	03/12/16

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
DP0147-00-0316-13	FA32270-27	Soil	03/11/16
TW0109-00-0316**	FA32270-28**	Water	03/11/16
TW0108-00-0316**	FA32270-29**	Water	03/11/16
TW0141-00-0316**	FA32270-30**	Water	03/11/16
TW0142-00-0316**	FA32270-31**	Water	03/11/16
TW0143-00-0316**	FA32270-32**	Water	03/12/16
TW0146-00-0316**	FA32270-33**	Water	03/13/16
FB0102-03-0316	FA32270-34	Water	03/14/16
DP0148-00-0316-2_10MS	FA32270-19MS	Soil	03/11/16
DP0148-00-0316-2_10MSD	FA32270-19MSD	Soil	03/11/16
DP0136-00-0316-2_10MS	FA32270-26MS	Soil	03/12/16
DP0136-00-0316-2_10MSD	FA32270-26MSD	Soil	03/12/16

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Appendix A, Final Uniform Federal Policy - Quality Assurance Project Plan, Perfluorinated Compound Delineation at Area of Concern Perfluorinated Compound-1, Ellsworth Air Force Base, South Dakota (December 2015), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience. The analyses were performed by the following method:

Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) by Environmental Protection Agency (EPA) method 537M

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was not checked in this SDG.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 25.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 25.0% for all compounds.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Samples FB0101-00-0316 (from SDG FA32234) and FB0102-03-0316 were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
FB0102-03-0316	03/14/16	Perfluorohexanoic acid Perfluorohexanesulfonic acid Perfluorooctanesulfonic acid	0.0117 ug/L 0.0309 ug/L 0.00823 ug/L	No associated samples in this SDG

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for several samples. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
DP0148-00-0316-2_10MS/MSD (DP0148-00-0316-2_10)	Perfluorotetradecanoic acid	44 (70-130)	48 (70-130)	UJ (all non-detects)	A
DP0136-00-0316-2_10MS/MSD (DP0136-00-0316-2_10)	Perfluorotetradecanoic acid	69 (70-130)	-	UJ (all non-detects)	A

Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	%R (Limits)	Flag	A or P
OP59771-BS (All water samples in SDG FA32270)	Perfluorotridecanoic acid Perfluorotetradecanoic acid	60 (70-130) 57 (70-130)	UJ (all non-detects) UJ (all non-detects)	P

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to MS/MSD %R and LCS %R, data were qualified as estimated in nine samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Data Qualification Summary - SDG FA32270

Sample	Compound	Flag	A or P	Reason
DP0148-00-0316-2_10 DP0136-00-0316-2_10	Perfluorotetradecanoic acid	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
TW0109-00-0316** TW0108-00-0316** TW0141-00-0316** TW0142-00-0316** TW0143-00-0316** TW0146-00-0316** FB0102-03-0316	Perfluorotridecanoic acid Perfluorotetradecanoic acid	UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (%R)

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Laboratory Blank Data Qualification Summary - SDG FA32270

No Sample Data Qualified in this SDG

Ellsworth AFB, South Dakota
Perfluorooctane Sulfonate & Perfluorooctanoic Acid - Field Blank Data Qualification Summary - SDG FA32270

No Sample Data Qualified in this SDG

LDC #: 36189C96 **VALIDATION COMPLETENESS WORKSHEET** Date: 4/25/16
SDG #: FA32270 Stage 2B/4 Page: 1 of 2
Laboratory: Accutest Laboratories Reviewer: JM
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	N	
III.	Initial calibration/ICV	A / A	r2 ICV ≤25
IV.	Continuing calibration	A	≤25
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	EB=34, EB0101-00-0316(FA32234)*
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Stage 2B validation.
XIII.	Target compound identification	A	Not reviewed for Stage 2B validation.
XIV.	System performance	A	Not reviewed for Stage 2B validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	DP0115-00-0316-0.5**	FA32270-1**	Soil	03/13/16
2	DP0115-00-0316-6_8**	FA32270-2**	Soil	03/13/16
3	DP0115-00-0316-19**	FA32270-3**	Soil	03/13/16
4	DP0114-00-0316-0.5**	FA32270-4**	Soil	03/13/16
5	DP0114-00-0316-2-4**	FA32270-5**	Soil	03/13/16
6	DP0114-00-0316-16**	FA32270-6**	Soil	03/13/16
7	DP0146-00-0316-0.5**	FA32270-7**	Soil	03/12/16
8	DP0146-00-0316-2_10**	FA32270-8**	Soil	03/12/16
9	DP0146-00-0316-19**	FA32270-9**	Soil	03/12/16
10	DP0140-00-0316-0.5**	FA32270-10**	Soil	03/13/16
11	DP0140-00-0316-3_10**	FA32270-11**	Soil	03/13/16
12	DP0137-00-0316-0.5**	FA32270-12**	Soil	03/13/16
13	DP0137-00-0316-2_10**	FA32270-13**	Soil	03/13/16

LDC #: 36189C96 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/25/16
SDG #: FA32270 Stage 2B/4 Page: 2 of 2
Laboratory: Accutest Laboratories Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

	Client ID	Lab ID	Matrix	Date
14	DP0138-00-0316-0.5**	FA32270-14	Soil	03/13/16
15	DP0138-00-0316-2_10**	FA32270-15	Soil	03/13/16
16	DP0138-00-0316-13	FA32270-16	Soil	03/13/16
17	DP0143-00-0316-18	FA32270-17	Soil	03/11/16
18	DP0148-00-0316-0.5	FA32270-18	Soil	03/11/16
19	DP0148-00-0316-2_10	FA32270-19	Soil	03/11/16
20 2	DP0148-00-0316-13	FA32270-20	Soil	03/11/16
21 2	DP0147-00-0316-0.5	FA32270-21	Soil	03/11/16
22 2	DP0147-00-0316-2_10	FA32270-22	Soil	03/11/16
23 2	DP0144-00-0316-0.5	FA32270-23	Soil	03/11/16
24 2	DP0144-00-0316-2_10	FA32270-24	Soil	03/11/16
25 2	DP0136-00-0316-0.5	FA32270-25	Soil	03/12/16
26 2	DP0136-00-0316-2_10	FA32270-26	Soil	03/12/16
27 2	DP0147-00-0316-13	FA32270-27	Soil	03/11/16
28 3	TW0109-00-0316**	FA32270-28**	Water	03/11/16
29 3	TW0108-00-0316**	FA32270-29**	Water	03/11/16
30 3	TW0141-00-0316**	FA32270-30**	Water	03/11/16
31 3	TW0142-00-0316**	FA32270-31**	Water	03/11/16
32 3	TW0143-00-0316**	FA32270-32	Water	03/12/16
33 3	TW0146-00-0316**	FA32270-33	Water	03/13/16
34 3	FB0102-03-0316	FA32270-34	Water	03/14/16
35 1	DP0148-00-0316-2_10MS	FA32270-19MS	Soil	03/11/16
36 1	DP0148-00-0316-2_10MSD	FA32270-19MSD	Soil	03/11/16
37 2	DP0136-00-0316-2_10MS	FA32270-26MS	Soil	03/12/16
38 2	DP0136-00-0316-2_10MSD	FA32270-26MSD	Soil	03/12/16
39				
40				
41				
42				

Notes:

1	OP59733-MB						
2	OP59748-MB						
3	OP59771-MB						

LDC #: 36189C96

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: SM
2nd Reviewer: SM

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 25%?			✓	
Was a curve fit used for evaluation?	✓			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IV.Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 25%	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 25%	✓			
Were all the retention times within the acceptance windows?	✓			
V. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Surrogate spikes				
Were all surrogate %R within the QC limits?		✓		
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?	✓			
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		

LDC #: 36189C96

VALIDATION FINDINGS CHECKLIST

Reviewer: 9m
2nd Reviewer: SM

Validation Area	Yes	No	NA	Findings/Comments
IX. Internal standards				
Were internal standard area counts within acceptance limits?	✓			
X. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XI. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XII. System performance				
System performance was found to be acceptable.	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XIV. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XV. Field blanks				
Field blanks were identified in this SDG.	✓			
Target compounds were detected in the field blanks.	✓			

TARGET COMPOUND WORKSHEET

METHOD: PFOS/PFOAs

A. Perfluorohexanoic acid				
B. Perfluoroheptanoic acid				
C. Perfluorooctanoic acid				
D. Perfluorononanoic acid				
E. Perfluorodecanoic acid				
F. Perfluoroundecanoic acid				
G. Perfluorododecanoic acid				
H. Perfluorotridecanoic acid				
I. Perfluorotetradecanoic acid				
J. Perfluorobutanesulfonic acid				
K. Perfluorohexanesulfonic acid				
L. Perfluorooctanesulfonic acid				

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: 9th
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

(Y) N /N/A Were field blanks identified in this SDG?
(Y) N N/A Were target compounds detected in the field blanks?

Blank units: ng/L **Associated sample units:** ng/Kg & ng/L
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: _____ Associated Samples: None

Compound	Blank ID 37	Blank ID	Sample Identification							
Sampling Date	03/14/16									
A	0.0117									
K	0.0309									
L	0.00823									

Blank units: _____ **Associated sample units:** _____
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: _____ Associated Samples: _____

Compound	Blank ID	Blank ID	Sample Identification							
Sampling Date										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as Methylene chloride, Acetone, 2-Butanone and Carbon disulfide that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Surrogate Spikes

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all surrogate %R within QC limits?

Y (N) N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Date	Sample ID	Surrogate	%Recovery (Limits)	Qualifications
		4, 28, 29, 30, 31, 32	13C2-PFHxA	Ø (70-130)	Noqual - ≥ 20x Dilution
		↓	13C2-PFDA	Ø (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	

(13C2-PFHxA) = 13C2-Perfluorohexanoic acid
(13C2-PFDA) = 13C2-Perfluorodecanoic acid

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates/Duplicates

Reviewer: 9m
2nd Reviewer: [illegible]

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) or duplicate sample analyzed for each matrix in this SDG?
Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?
Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?
Y N N/A Were all duplicate sample relative percent differences (RPD) or differences within QC limits?

#	Date	MS/MSD/DUP ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		35/36	I	44 (70-130)	48 (70-130)		19	J/UJ/A (ND)
		37/38	I	69 (70-130)			26	J/UJ/A (ND)

Privileged and Confidential

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: 9m
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a LCS required?

Y (N) N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		OP59771-BS	H	60 (70-130)	( )	( )	all waters	J/UJ/P (ND)
		↓	I	57 (↓)	( )	( )	↓	↓ ↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )	

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: 9r
2nd Reviewer: fm

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
$\%RSD = 100 * (S/X)$

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs
X = Mean of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (4 std)	Recalculated RRF (4 std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	0316-PFC-SQ586	03/16/16	PFTrDA (1st internal standard)	0.7607	0.7607	See attached			
			PFHxA (2nd internal standard)	0.2381	0.2380				
			PFOS (3rd internal standard)	1.0154	1.0155				
2	0322-PFC-SQ590	03/22/16	PFTeDA (1st internal standard)	0.5431	0.5432	See attached			
			PFOA (2nd internal standard)	0.9233	0.9233				
			PFHxS (3rd internal standard)	0.4717	0.4717				
3			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
4			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC#: 36189C96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Calibration Date	MS	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
3/16/2016	Hunter	PFTrDA	1	0.098986824	0.1250
			2	0.19115807	0.2500
			3	0.38581567	0.5000
			4	0.7607245	1.0000
			5	1.128806929	1.5000
			6	1.955802389	2.5000
			7	3.792002536	5.0000

Regression Output	***Calculated***	***Reported***
Constant	*0.0058499*	Ø forced
Std Err of Y Est		
R Squared	*0.9997*	*0.9997*
Degrees of Freedom		
X Coefficient(s)	*0.7606757*	0.762496
Std Err of Coef.		
Correlation Coefficient	*0.9999*	
Coefficient of Determination (r^2)	*0.9997*	

Copy of linear fit _voa

LDC#: 36189C96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Calibration Date	MS	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
3/16/2016	Hunter	PFHxA	1	0.031510934	0.1250
			2	0.060193424	0.2500
			3	0.122751551	0.5000
			4	0.23804474	1.0000
			5	0.354451098	1.5000
			6	0.608646143	2.5000
			7	1.173338163	5.0000

Regression Output	*Calculated*	*Reported*
Constant	*0.0045829*	Ø
Std Err of Y Est		
R Squared	*0.9997*	*0.9996*
Degrees of Freedom		
X Coefficient(s)	*0.2351132*	0.236547
Std Err of Coef.		
Correlation Coefficient	*0.9998*	
Coefficient of Determination (r^2)	*0.9997*	

forced

Copy of linear fit _voa

LDC#: 36189C96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: TM
2nd Reviewer: SM

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Calibration Date	MS	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
3/16/2016	Hunter	PFOS	1	0.134829394	0.1250
			2	0.253133282	0.2500
			3	0.508207811	0.5000
			4	1.015477452	1.0000
			5	1.496776553	1.5000
			6	2.597473588	2.5000
			7	5.097886179	5.0000

Regression Output	***Calculated***	***Reported***
Constant	*-0.0014876*	0 forced
Std Err of Y Est		
R Squared	*0.9998*	*0.9998*
Degrees of Freedom		
X Coefficient(s)	*1.0219952*	1.021542
Std Err of Coef.		
Correlation Coefficient	*0.9999*	
Coefficient of Determination (r^2)	*0.9998*	

Copy of linear fit _voa

Validation Findings Worksheet
Initial Calibration Calculation Verification

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

The correlation coefficient (r) for the calibration of PFTeDA was recalculated.Calibration date: 03/22/16

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found X 100 / True **Where,** **Found = concentration of each analyte measured in the analysis of the ICV or CCV solution**

True = concentration of each analyte in the ICV or CCV source

Type of analysis	Standard	(Y) Response	(X) Conc.	(X^2) Conc.
Quadratic	s1	0.077936747	0.1250	0.015625
	s2	0.148607469	0.2500	0.0625
	s3	0.301835776	0.5000	0.25
	s4	0.543156857	1.0000	1
	s5	0.883941094	1.5000	2.25
	s6	1.71156282	2.5000	6.25
	s7	3.345641026	5.0000	25

Regression Output

			Reported (forced)	
Constant	*c*	*-0.0333*	*0.00E+00*	
Std Err of Y Est				
R Squared		*0.998*	*0.997400*	
Degrees of Freedom				
	a	*b*	*b*	*a*
X Coefficient(s)	*6.44E-01*	*6.86E-03*	6.12E-01	*1.22E-02*
Std Err of Coef.				
Correlation Coefficient		*0.998808*		
Coefficient of Determination (r^2)		*0.997617*	*0.9974*	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC#: 36189C96

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JM
2nd Reviewer: SM

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Calibration Date	MS	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
3/22/2016	Hunter	PFOA	1	0.136956095	0.1250
			2	0.235425777	0.2500
			3	0.472264991	0.5000
			4	0.923343995	1.0000
			5	1.481585982	1.5000
			6	2.392760085	2.5000
			7	4.721888538	5.0000

Regression Output	*Calculated*	*Reported*
Constant	*0.0124014*	Ø forced
Std Err of Y Est		
R Squared	*0.9997*	*0.9997*
Degrees of Freedom		
X Coefficient(s)	*0.9450497*	0.948916
Std Err of Coef.		
Correlation Coefficient	*0.9999*	
Coefficient of Determination (r^2)	*0.9997*	

Method: LC/MS PFOS/PFOAs (EPA Method 537M)

Calibration Date	MS	Compound	Standard	(X) Response ratio	(Y) Concentration ratio
3/22/2016	Hunter	PFHxS	1	0.069907669	0.1250
			2	0.120266608	0.2500
			3	0.242865116	0.5000
			4	0.471662229	1.0000
			5	0.743561498	1.5000
			6	1.191378656	2.5000
			7	2.287599045	5.0000

Regression Output	*Calculated*	*Reported*	
Constant	*0.0222424*	0	forced
Std Err of Y Est			
R Squared	*0.9992*	*0.9988*	
Degrees of Freedom			
X Coefficient(s)	*0.4571535*	0.464101	
Std Err of Coef.			
Correlation Coefficient	*0.9996*		
Coefficient of Determination (r^2)	*0.9992*		

Copy of linear fit _voa

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 3
Reviewer: 9th
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)		Spiked Conc. ~~Average RRF (initial)~~	Reported Conc. ~~RRF~~ (CC)	Recalculated Conc. ~~RRF~~ (CC)	Reported %D	Recalculated %D
1	Q19305	03/16/16	PFTrDA	(1st internal standard)	20.000	23.096	23.144	15.5	15.7
			PFHxA	(2nd internal standard)		22.833	22.953	14.2	14.8
			PFOS	(3rd internalstandard)		22.142	22.133	10.7	10.7
2	Q19317	03/16/16	PFTrDA	(1st internal standard)		19.714	19.753	1.4	1.2
			PFHxA	(2nd internal standard)		19.248	19.346	3.8	3.3
			PFOS	(3rd internalstandard)		19.722	19.714	1.4	1.4
3	Q19329	03/17/16	PFTrDA	(1st internal standard)		19.523	19.563	2.4	2.2
			PFHxA	(2nd internal standard)		19.002	19.099	5.0	4.5
			PFOS	(3rd internalstandard)		19.703	19.696	1.5	1.5
4	Q19490	03/22/16	PFTeDA	(1st internal standard)		21.154	21.153	5.8	5.8
			PFOA	(2nd internal standard)		21.276	21.101	6.4	5.5
			PFHxS	(3rd internalstandard)		22.027	21.389	10.1	6.9

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results

discrepancies due to recalculation from raw data vs. lab ~~use~~ provided linear equations

Privileged and Confidential

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: AM
2nd Reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)		Spiked conc. ~~Average RRF (initial)~~	Reported conc. ~~RRF~~ (CC)	Recalculated conc. ~~RRF~~ (CC)	Reported %D	Recalculated %D
1	Q19498	03/22/16	PFTeDA	(1st internal standard)	20.000	18.383	18.383	8.1	8.1
			PFOA	(2nd internal standard)		19.158	18.974	4.2	5.1
			PFHxS	(3rd internalstandard)		20.565	19.904	2.8	0.5
2	Q19508	03/22/16	PFTeDA	(1st internal standard)		18.317	18.316	8.4	8.4
			PFOA	(2nd internal standard)		19.476	19.294	2.6	3.5
			PFHxS	(3rd internalstandard)		20.835	20.178	4.2	0.9
3	Q19536	03/23/16	PFTeDA	(1st internal standard)		17.424	17.424	12.9	12.9
			PFOA	(2nd internal standard)		20.145	19.964	0.7	0.2
			PFHxS	(3rd internalstandard)	↓	19.668	18.993	1.7	5.0
4	Q19520	03/23/16	PFTeDA	(1st internal standard)	20.000	16.614	16.614	16.9	16.9
			PFOA	(2nd internal standard)		19.098	19.098	4.5	4.5
			PFHxS	(3rd internalstandard)	↓	21.055	21.055	5.3	5.3

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results

Privileged and Confidential

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: 4th
2nd Reviewer: _____

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	~~Average RRF~~ Spiked Conc (initial)	~~RRF~~ Conc Reported (CC)	~~RRF~~ Conc Recalculated (CC)	Reported %D	Recalculated %D
1	Q19547	03/23/16	PFTeDA (1st internal standard)	20.000	17.120	17.121	14.4	14.4
			PFOA (2nd internal standard)	↓	20.122	20.122	0.6	0.6
			PFHxS (3rd internal standard)	↓	20.233	20.233	1.2	1.2
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
5			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 36189C96

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: QL
2nd reviewer: SM

METHOD: LC/MS PFOS/PFOAs (EPA Method 537M)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
13C2-PFHxA	20.000	19.13	96	96	Ø
13C2-PFDA	↓	17.21	86	86	Ø

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference