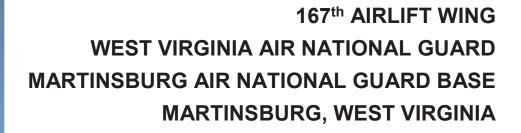
# FINAL REPORT FY16 PHASE I REGIONAL SITE INSPECTIONS FOR PERFLUORINATED COMPOUNDS



Contract #: W9133L-14-D-0002 Delivery Order 0006

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October 22, 2018



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### FY16 Phase I Regional Site Inspections For Perfluorinated Compounds

# West Virginia Air National Guard – 167<sup>th</sup> Airlift Wing Martinsburg Air National Guard Base Martinsburg, West Virginia

Prepared for: National Guard Bureau Operations Division, Restoration Branch Joint Base Andrews, MD 20762-5157

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#### **ACRONYMS & ABBREVIATIONS**

167 <sup>th</sup> AW	167 <sup>th</sup> Airlift Wing
A4OR	Operations Restoration Branch
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AMSL	Above Mean Sea Level
ANG	Air National Guard
AOC	Area of Concern
bgs	below ground surface
BB&E	BB&E, Incorporated
BW	Boundary Well
CE	Civil Engineering
°F	Degrees Fahrenheit
DoD	Department of Defense
EBS	Environmental Baseline Survey
EDR	Environmental Data Resources
FAA	Federal Aviation Administration
ft	feet/foot
FSP	Field Sampling Plan
FSS	Fire Suppression System
FTA	Fire Training Area
GW	Groundwater
HA	Health Advisory
HDPE	High-density Polyethylene
IRP	Installation Restoration Program
IDW	Investigation Derived Waste
MANGB mg/kg MSD μg/kg μg/L Mid-Atlantic mL/min	Martinsburg Air National Guard Base milligrams per kilogram Matrix Spike Matrix Spike Duplicate Micrograms per Kilogram Micrograms per Liter Mid-Atlantic Utility Locating, LLC of Ashburn, VA Milliliter per Minute
NFA	No Further Action
NGB	National Guard Bureau
NL	Not Listed

OWS	Oil/Water Separator
ORP	Oxidation Reduction Potential
PA	Preliminary Assessment
PFBS	Perfluorobutanesulfonic Acid
PFC	Perflourinated Compound
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
POC	Point of Contact
POTW	Publicly Owned Treatment Works
PRL	Potential Release Location
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RSL	Regional Screening Level
SB	Soil Boring (sample designation)
SD	Sediment (sample designation)
SI	Site Inspection
SHSP	Site Health and Safety Plan
SW	Surface Water
TCLP	Toxicity Characteristic Leaching Procedures
THQ	Target Hazard Quotient
TOC	Top of Casing
UCMR3	Third Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
Vista	Vista Analytical Laboratories, Inc.
WVDEP	West Virginia Department of Environmental Protection
WWTP	Wastewater Treatment Plant

#### EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau (NGB) Operations Restoration Branch (A4OR) under Contract #W9133L-14-D-0002, Delivery Order 0006 to conduct Phase I Regional Site Inspections (SIs) for Perfluorinated Compounds (PFCs) at multiple Air National Guard (ANG) Installations. This report has been prepared for SIs conducted at on-Base Potential Release Locations (PRLs) identified on the 167<sup>th</sup> Airlift Wing (167<sup>th</sup> AW), West Virginia Air National Guard, Martinsburg Air National Guard Base (MANGB), in the city of Martinsburg, West Virginia. This report presents the results and recommendations from the 2017 SI field activities conducted in October and November 2017 at MANGB. The objectives of the SI were to determine the presence or absence of PFCs at each PRL and the Base boundary, and based on the findings:

- 1) Determine if a PRL is eligible for a decision of No Further Action (NFA);
- 2) Assess if PFCs are migrating off-Base; and
- 3) Provide data which can be used for developing Data Quality Objectives if further investigations are recommended.

To meet the objectives, Amec Foster Wheeler performed SIs at the following ten PRLs:

- PRL 1: Former Fire Training Area (FTA) (IRP Site 4);
- PRL 2: Hangar 119;
- PRL 3: Former Hangar 128;
- PRL 4: Former Hangar 110;
- PRL 5: Building 139 Northeast Fire Department Equipment Testing Area
- PRL 6: Former Building 114 (Old Tower)
- PRL 7: Former Building 111 Former Fire Department
- PRL 8: Building 303 Current Fire Department
- PRL 9: Building 140 Former Fire Department
- PRL 10: Former Wastewater Treatment Plant (WWTP)

As part of the SI, groundwater at the Base boundary was also evaluated at six locations downgradient from the PRLs.

Based on recommendations from the Preliminary Assessment (PA) conducted by BB&E, Inc.

(BB&E) in August 2015, soil, groundwater, surface water, and sediment samples were collected and analyzed from eight PRLs. Collected samples were analyzed for the PFCs listed on the United States Environmental Protection Agency's (USEPA) Third Unregulated Contaminant Monitoring Rule (UCMR3) list (USEPA, 2012). The detected PFC concentrations were compared against screening criteria for perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutane sulfonate (PFBS) including: the USEPA lifetime drinking water Health Advisory (HA) for PFOS (USEPA, May 2016a) and HA for PFOA (USEPA, May 2016b); the USEPA Regional Screening Level (RSL) table for PFBS in residential soil (USEPA, 2017); the USEPA RSL for PFBS in tap water; and calculated screening levels using the USEPA screening level calculator for PFOA and PFBS in soil and sediment. These screening criteria are presented in **Table ES-1**.

Parameter	Chemical Abstract Number	USEPA R Screening L (Novembe Residential	evel Table	Air Force Guidance for Soils and Sediments <sup>b</sup>	USEPA Health Advisory Drinking Water (Surface Water or Groundwater) (µg/L) <sup>c</sup>	
		Soil (µg/kg)	Water (µg/L) <sup>f</sup>	(µg/kg)		
Perfluorobutane sulfonate (PFBS)	375-73-5	1,300,000 <sup>d</sup>	400 <sup>e</sup>	NL	NL	
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	1,260	0.07*	
Perfluorooctane sulfonate (PFOS)	1763-23- 1	NL	NL	1,260	0.01	

Table ES-1: USEPA and USAF S	SI Screening Criteria
------------------------------	-----------------------

Notes:

<sup>a</sup> USEPA Regional Screening Levels (USEPA, 2017a).

- <sup>b</sup> Screening levels calculated using the USEPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgibin/chemicals/csl\_search]. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 milligrams per kilogram per day (mg/kg/day) derived by USEPA in their Drinking Water Health Advisories for both PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b).
- <sup>c</sup> USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA) and USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).
- <sup>d</sup> PFBS RSL for Residential Soil (based on a target hazard quotient [THQ] of 1.0) concentration presented in the SI Work Plan (Amec Foster Wheeler, 2017) was 1,600,000 μg/kg based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in November 2017.
- <sup>e</sup> PFBS RSL for Tap Water (based on a THQ of 1.0) presented in the SI Work Plan (Amec Foster Wheeler, 2017) was 380 μg/L based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in November 2017.
- <sup>f</sup> Only groundwater and surface water were sampled during the SI, but analytical results have been compared to the tap water screening levels.
- \* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 μg/L health advisory value.

NL = not listed  $\mu g/kg$  = micrograms per kilogram  $\mu g/L$  = micrograms per liter

Based on comparison of analytical data to the screening criteria in the table above eight PRLs (PRL 1, PRL 2, PRL 3, PRL 4, PRL 5, PRL 7, PRL 9 and PRL 10), and a portion of the Base boundary had concentrations of PFCs exceeding guidance levels. However, PFCs were detected in groundwater and soil at each of PRLs investigated; therefore further investigations are recommended at all 10 PRLs. Amec Foster Wheeler also recommends that further investigations include analysis of additional compounds, including precursor compounds, to supplement the UCMR3 list. Precursor compounds have potential to result in increased concentrations downgradient and can serve as a lingering source. An overview of conclusions from SI activities and recommendations for future investigations are presented on **Table ES-2**.

	Screening Criteria Exceedance				
PRL Soil SW S <u>D</u> GW F		GW	Recommendations		
1	х			x	Soil and GW investigation to evaluate the extent of the confirmed PFC release. Soils in the saturated zone should be investigated as a potential contributing source to GW.
2				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
3		х		x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
4				х	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
5	х			х	Soil and GW investigation to evaluate the extent of the confirmed PFC release. Soils in the saturated zone should be investigated as a potential contributing source to GW.
6					GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
7				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
8					GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.

	Screening Criteria Exceedance					
PRL	Soil	SW	S <u>D</u>	GW	Recommendations	
9				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.	
10				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW. Sediment investigation to evaluate the extent of the PFC release.	
Base Boundary Wells				х	GW Investigation to evaluate the extent of the confirmed PFC release at BW-02. Surface water and sediment investigation to evaluate the stormwater retention basin as a potential source of PFCs to the environment. Evaluation of the presence of PFC contamination in groundwater off-Base both up and downgradient.	

Notes:

*GW* = *Groundwater SW* = *Surface Water*  X – Screening criteria exceedance PFC - Perfluorinated Compound THIS PAGE INTENTIONALLY LEFT BLANK.

#### 1.0 INTRODUCTION

Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau Operations Restoration Branch (NGB/A4OR) under Contract #W9133L-14-D-0002, Delivery Order 0006 to conduct Phase I Regional Site Inspections (SIs) for Perfluorinated Compounds (PFCs) at multiple Air National Guard (ANG) Installations. The scope of the Contract included performance of a SI at on-Base Potential Release Locations (PRLs) identified at the 167<sup>th</sup> Airlift Wing (167<sup>th</sup> AW), West Virginia Air National Guard, Martinsburg Air National Guide Base (MANGB), in the city of Martinsburg, West Virginia. This SI Report describes the objectives, procedures, and activities which were completed, and presents Amec Foster Wheeler's findings and recommendations. The Base location is shown in **Figure 1**, and the Base and area features are shown on **Figure 2**.

#### 1.1 Background

The Department of Defense (DoD) began investigations at military bases under the Installation Restoration Program (IRP) with the goal of identifying, evaluating, and remediating areas of contamination (the program is now referred to as the Environmental Restoration Program). Prior to the PFC Preliminary Assessment (PA) (BB&E, Inc. [BB&E], 2015), potential releases of PFCs from use and storage of aqueous film forming foam (AFFF) had not been evaluated at MANGB.

In 2015, BB&E conducted a PA to identify potential sites of historic environmental releases of PFC related to AFFF usage and storage. BB&E researched the potential existence of any documented Fire Training Area (FTA) in operation since 1970 or any other use or release of AFFF. BB&E interviewed available installation personnel as part of the PA.

Based on past use and storage of AFFF at MANGB, the PA identified 13 PRLs where releases of PFCs might have occurred, including FTAs, hangars, current and former fire departments, a former wastewater treatment plant (WWTP), storage buildings, etc. Ten of the 13 PRLs were recommended for further inspection, and three PRLs warranted No Further Action (NFA) (**Table 1**).

Location (AOC)	Use	Recommendation	
1. Former FTA (IRP Site 4)	Former Fire Training Area (FTA)	Soil and groundwater inspection	
2. Hangar 119	Hangar with AFFF Fire Suppression System (FSS)	Soil and groundwater inspection	
3. Former Hangar 128	Former Hangar with AFFF FSS	Soil and groundwater inspection	
4. Former Hangar 110	Former Hangar with AFFF FSS	Soil and groundwater inspection	
5. Building 139 -Northeast Fire Department Equipment Testing Area <sup>1</sup>	Fire Truck Equipment Testing	Soil, sediment, surface water, and groundwater inspection	
6. Former Building 114 - Old Tower	Other Building Type with AFFF storage near building	Groundwaterinspection	
7. Former Building 111 – Former Fire Department	Fire Station	Soil and groundwater inspection	
8. Building 303 - Current Fire Department	Fire Station	Soil and groundwater inspection	
9. Building 145 - Hazmart Pharmacy	Building with AFFF FSS	NFA	
10. Building 140 - Former Fire Department	Fire Station	Soil and groundwater inspection	
11. Former Building 106 - Former Base Supply Building	Building with AFFF storage	NFA	
12. Building 103 - CE Covered Storage	Building with AFFF storage	NFA	
13. Former Wastewater Treatment Plant (WWTP)	WWTP	Soil, sediment, surface water, and groundwater inspection (drainage area and downgradient)	

 Table 1

 Preliminary Assessment Recommendations

Notes:

1 - Although recommended in the PA, no surface water or sediment sampling was proposed in the SI work plan (Amec Foster Wheeler, 2017).

#### 1.2 Purpose and Scope

The purpose of the SI is to determine the presence or absence of PFCs in soil, sediment, surface water, and/or groundwater at the ten locations recommended for further investigation in the PA (BB&E, 2015), and at the Base boundary. The data collected during the SI has been used to develop recommendations for appropriate paths forward to either provide a NFA conclusion or recommendations for further investigations or remedial actions.

Based on locations where AFFF was potentially used or stored, thirteen Areas of Concern (AOCs) were evaluated at the Base during the PA. Due to findings of no known AFFF release at AOC 9 (Building 145 - Hazmart Pharmacy), AOC 11 (Former Building 106 - Former Base Supply Building), and AOC 12 (Building 103 - CE Covered Storage), NFA was recommended for these three areas. Ten AOCs were recommended for further investigations in the PA (BB&E, 2015) based on findings of a release, or suspected release of AFFF. The 10 AOCs recommended for further inspection are referenced as PRLs in this SI, which are illustrated on **Figure 3**, and summarized in the **Table 2** below:

Location	Preliminary Assessment AOC No.	Site Inspection PRL No.	
Former Fire Training Area (IRP Site 4)	1	1	
Hangar 119	2	2	
Former Hangar 128	3	3	
Former Hangar 110	4	4	
Building 139 -Northeast Fire Department Equipment Testing Area	5	5	
Former Building 114 - Old Tower	6	6	
Former Building 111 – Former Fire Department	7	7	
Building 303 - Current Fire Department	8	8	
Building 145 - Hazmart Pharmacy	9	N/A	
Building 140 - Former Fire Department	10	9	
Former Building 106 - Former Base Supply Building	11	N/A	
Building 103 – Civil Engineering Covered Storage	12	N/A	
Former Wastewater Treatment Plant	13	10	
Notes:			

#### Table 2: PRL Summary

AOC- Area of Concern

PRL – Potential Release Location

IRP – Installation Restoration Program

No. - Number

SI investigative tasks at these 10 PRLs are summarized on **Table 3**, and include:

- Advancement of 29 soil borings utilizing roto sonic drilling techniques to a maximum depth of 15 feet (ft) below ground surface (bgs), or first encountered groundwater, to facilitate collection of up to two soil samples from each boring (57 total soil samples);
- Installation of 16 temporary monitoring wells at locations downgradient of the PRLs and along the base boundary to facilitate collection of 16 groundwater samples;
- Collection of one surface water sample from PRL 3 in a drainage ditch northeast of Former Hangar 128 (although a surface water sample was planned for PRL 10, no water was present during the SI field activities; therefore, no sample was collected); and
- Collection of two sediment samples, one each from PRL 3 and PRL 10.

Field activities were conducted in accordance with the *Final SI Work Plan*, which included a Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Site Health and Safety Plan (SHSP) (Amec Foster Wheeler, 2017). The scope of the SI is detailed in the following sections.

### 2.0 INSTALLATION DESCRIPTION

**Section 2.1** describes the location and environs of MANGB. A brief history of MANGB is provided in **Section 2.2**.

#### 2.1 Location

The MANGB is located at the Eastern West Virginia Regional Airport in Berkeley County, West Virginia, approximately 2.5 miles south of Martinsburg, West Virginia (**Figures 1** and **2**). The Base occupies the northeastern portion of the airport and shares the runway facilities. The area designated for use by the 167<sup>th</sup> AW includes a total of 346 acres (EARTH TECH, 1996). Berkeley County lies within the Northern Appalachian Ridges and Valleys physiographic province. The major landforms consist of a series of parallel ridges and valleys that have a southwest-northeast orientation. The Martinsburg area is located within the Shenandoah Valley, which is part of the Great Valley of the Appalachians that extends from Georgia to New York. Elevations on the Base range from approximately 560 ft above mean sea level (AMSL) in the west to 520 ft AMSL in the east (AECOM, 2015). Each of the 10 PRLs are located in separate areas across the MANGB. The locations of each PRL are shown on **Figure 3**.

# 2.2 Organization and History

Originally titled Shepherd Field, the Base was first used in 1922 as a pubic airfield by the city of Martinsburg (AECOM, 2015). The field was used for flying encampments by Maryland National Guard flying units in 1928 and 1929. In October 1958, a new ANG facility was completed and the AW was installed. From that time to the present, various types of military aircraft have been based in the 167<sup>th</sup> AW, with the missions changing with each type of aircraft. These aircraft have included F-86s, T-33s, C-119s, and C-121s. As of 1994, twelve C-130 aircraft were assigned to the AW. The mission of the unit is to support the flying operations of the C-130 aircraft (ANG, 2013).

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#### 3.0 ENVIRONMENTAL SETTING

The following sections provide information on the environmental setting at MANGB. This information was summarized from the Regional Compliance Restoration Program Preliminary Assessment/Site Inspection (AECOM, 2015) and other sources cited below.

#### 3.1 Climate

The climate in Martinsburg is defined as moderate and is characterized by four highly variable seasons with warm summers and no dry season. The temperature typically varies from 23 degrees Fahrenheit (°F) to 88°F and is rarely below 0°F or above 91°F. The average cold season (1 December to 9 March) temperature is 32°F and average warm season (29 May to 16 September) temperature is 73°F. Average annual precipitation is 37.54 inches with an average annual snowfall of 25.3 inches. The typical number of days with measurable precipitation is 117. Prevailing winds are from the west-northwest at an average of 11 miles per hour.

### 3.2 Topography

Topography is characterized by nearly level to gently rolling terrain; however, the site is located on improved land with minor topographic variation. The natural topography has been altered or leveled in areas to accommodate development (AMEC, 2002). The Base overall is relatively flat.

#### 3.3 Geology

Berkeley County is located in the ridge and valley province of the Appalachian Mountains. Geology in the region consists of eroded limestone, shale, and sandstone formed during the mountain building episode of the late Paleozoic period, approximately 300 million years ago. Bedrock underlying a portion of the Base consists predominantly of fractured and faulted limestone. Previous geological studies have shown that areas with shallow depth (less than 10 ft) to bedrock are present in areas of the existing MANGB. A fault line runs north-south bisecting the Base east of the control tower. Shale bedrock also underlies the westernmost portions of the Base (AMEC, 2002).

#### 3.4 Soils

According to the National Resources Conservation Service Web Soil Survey (NRCS, 2018), soils in the vicinity of the Former FTA (PRL 1) are mapped as Carbo-Endcav silty clay loams (3 to 8

percent slopes). Soils in the vicinity of Building 139 – Northeast Fire Department Equipment Testing Area (PRL 5) are mapped as Carbo-Endcav silty clay loams (8 to 15 percent slopes) and Huntington silt loam. Soils in the vicinity of Building 303 – Current Fire Department (PRL 8) are mapped as Weikert-Berks channery silt loams (8 to 15 percent slopes). Soils at the other seven PRLs are mapped as Urban Land.

Soils observed during the SI activities generally consisted of fine silt and clays over layers of clay with sand or gravel. Occasional layers of finer material (silty sand) and coarser material (gravelly sand) were encountered. Soil boring logs are included in **Appendix A**.

# 3.5 Surface Water Hydrology

Surface water from the MANGB discharges to small intermittent and perennial streams located at the boundaries of the Base. Generally, surface water from the northern half of the Base, flows northward into Cold Spring Run, and surface water from the southern half, from the runway, flows eastward into Sulfur Spring Run. These streams flow eastward into Opequon Creek and ultimately northeast into the Potomac River. Runoff from impervious areas is transported off the property through overland flow or by storm drain systems that discharge toward the northeast corner of the Property. Drainage at the Base consists of unlined shallow swales, rip-rap lined ditches, culverts, and piping with catch basins and manholes. The majority of storm water runoff is conveyed via swales and piping to a drainage ditch that traverses the Base from the south of Building 134, past Building 121 and Building 131, to a point of discharge at the north boundary of the Base (AECOM, 2015). In addition, two storm water detention basins that were constructed in late 2006 to early 2007 are located along the western portion of the Base. Based on this date of construction, it is unlikely that these basins would have received waters impacted by AFFF (BB&E, 2015). Surface water from the Base apron and around the Current Fire Department (Building 303) are routed through the storm water system to the basins.

# 3.6 Hydrogeology

Groundwater in Berkeley County occurs in limestone and shale bedrock. Drilled wells commonly supply domestic water systems in rural areas. Groundwater supply obtained from limestone is generally abundant; however, the depth to good water-bearing strata varies and water levels are subject to a rapid and wide range of seasonal fluctuations. The average depth of wells in these areas is about 150 to 200 ft bgs. Groundwater yield from shale is generally less than that of limestone; however, the depth and yield is generally more dependable. Most wells in these areas

are 100 to 150 ft deep (AMEC, 2002).

The primary water-bearing stratum in the Martinsburg area is the Beekmantown Limestone. Wells in this formation are generally in the 200-ft range and have an average yield of 69 gallons per minute. Estimated depth to groundwater on the installation ranges from 25 to 40 ft and has been encountered during previous evaluations at 40 to 50 ft bgs. Groundwater flow is estimated to be toward the northern portion of the main runway. Groundwater flow in the area south of the runway generally flows eastward toward Opequon Creek, approximately 1 mile east of the installation (AMEC, 2002).

Groundwater samples for PFC analysis have not previously been collected at the MANGB. No groundwater monitoring wells currently exist on the main MANGB property; however, one well is reported to exist south of the firing range (Building 144) approximately 3,500 ft south of the main Base. The Base currently uses drinking water from the city of Martinsburg and use of the "firing range well" was discontinued in 2006 due to high arsenic concentrations (BB&E, 2015).

A limestone quarry is located approximately two miles north of MANBG. The quarry and city of Martinsburg pump water from the same aquifer at similar well depths (West Virginia Department of Environmental Protection [WVDEP], 2016). The city of Martinsburg's Big Springs Deep Well, the quarry, and MANGB are aligned along a geologic strike. Underground tunnels associated with historic limestone mining are also present at the quarry. These tunnels extend southwest from the existing open pit quarry area to within approximately 0.6 miles of the airport runway.

# 3.7 Critical Habitat and Threatened/Endangered Species

According to the United States Fish and Wildlife Service (USFWS), there are four endangered species found in Berkeley County: the red knot, northeastern bulrush, harperella, and the Indiana bat (USFWS, 2014). The red knot is a species of bird whose status is proposed threatened. Northeastern bulrush and harperella are species of flowering plants that are endangered. The Indiana bat is an endangered mammal species. However, since the general area of the Base is developed, these species are not likely to be found at the PRLs.

#### 3.8 City of Martinsburg Water Supply

The nearest public water supply (Big Spring Water Filtration Plant) is just over one mile hydraulically downgradient from the Base. Another public water supply (Kilmer Springs Water Filtration Plant) is located approximately four miles north of the Base, hydraulically downgradient.

A review of the 2014 city of Martinsburg's Water Quality Report (city of Martinsburg, 2015) revealed detections of Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA), but at levels below the then-current United States Environmental Protection Agency (USEPA) recommended provisional health advisory levels of 0.2  $\mu$ g/L for PFOS and 0.4  $\mu$ g/L for PFOA (WVDEP, 2016). In an interview with Mr. Sam Blair of the city of Martinsburg's Water and Sewer Department, it was reported that the highest concentrations of PFOS and PFOA were 0.071  $\mu$ g/L and 0.079  $\mu$ g/L respectively. These concentrations reflected an average of both the Big Spring and Kilmer Spring Water Filtration Plants (BB&E, 2015).

When USEPA updated the PFOS/PFOA health advisory levels in May 2016, these prior detections exceeded the current Lifetime Health Advisories for PFOS/PFOA and the West Virginia Bureau for Public Health advised the Big Spring's deep well be discontinued. The WVDEPs Division of Water and Waste Management then began investigating the source of PFOS/PFOA impacts in Martinsburg's deep well (WVDEP, 2016). The Kilmer Springs Water Filtration Plant is currently used as the city's water supply while the Big Springs Deep Well remains closed.

According to the September 2002 Environmental Baseline Survey (EBS) (AMEC, 2002), there were two groundwater wells at the MANGB. The well located at Building 101 was approximately 100 ft deep and was abandoned in 2010. The well was previously investigated for potential drinking water use and was found to have a high bacteria content.

A second well, located south of the firing range (Building 144) approximately 3,500 ft south of the main Base, was used to supply potable water (AMEC, 2002). Use of this "firing range well" ceased in 2006 due to high arsenic concentrations. Further action was not required at this time, but it was recommended that the well be abandoned if no longer needed. There was no abandonment record noted for the well during the file review portion of the PA (BB&E, 2015).

A review of the Environmental Data Resources (EDR) Radius Map<sup>™</sup> Report with Geocheck® dated 21 July 2015, lists seven water wells within a one-mile radius of the MANGB (EDR, 2015). The seven wells appear on the United States Geological Survey database which usually lists monitoring or test wells. However, in a phone conversation with Mr. Steve Knipe of the city of Martinsburg's Water and Sewer Department, Mr. Knipe indicated there are multiple private potable water wells in the area. Based on this information, until the existence and status of nearby potable water wells can be confirmed, these wells should be treated as active potable water wells and potential receptors to any groundwater contamination (BB&E, 2015).

#### 4.0 PRELIMINARY ASSESSMENT

BB&E was contracted by the NGB to perform a PA at the Base with the objective of collecting and reviewing available information about any known or suspected releases of AFFF due to the use, handling, release or on-Base disposal at MANGB. The PA process included a review of documented FTAs in operation since 1970, and any other use or release of AFFF, and the completion of a Base reconnaissance. The Base reconnaissance included an inspection of potential sites of historical environmental releases, interviews with Base personnel, and a review of available on-Base documentation.

Based on past use and storage of AFFF at MANGB, the PA identified 13 AOCs where releases of PFC might have occurred, including FTAs, hangars, current and former fire departments, a former WWTP, storage buildings, etc. Ten of the 13 AOCs were recommended for further inspection, and three AOCs warranted NFA (AOCs 9, 11, and 12).

The findings of AFFF use and storage at each of the ten AOCs recommended for inclusion in the SI, as documented in the PA Site Visit Report, are summarized below. The PA recommended NFA at AOCs 9, 11, and 12, and these are not included in the ensuing text. The ten AOCs recommended for inclusion in the SI are referred to hereafter utilizing their respective PRL number (PRL 1 through PRL 10), as discussed in **Section 1.2**. The following sections provide a summary for each PRL which are reflective of the conditions at the time of the 2015 PA (BB&E. 2015).

# 4.1 PRL 1: Former FTA (IRP Site 4) – Fire Training Area

A historic FTA existed at the Base from 1960 and is referenced in a March 1986 Phase I Records Search prepared by the Hazardous Materials Technical Center (HMTC, 1986) and a September 2002 EBS prepared by AMEC (AMEC, 2002). However, these documents do not agree on the dates of usage. The March 1986 PA indicates the FTA was operational from 1960 until about 1975. The 2002 EBS indicates the FTA was operational from 1960 until about 1986. Base personnel interviewed in the PA acknowledge that some burning may have occurred up until 1979 but it was only for the burning of wood materials (no fuels or solvents). They were unaware of the FTA being used through 1986. In either case, the historic FTA did exist and was investigated and closed as IRP Site 4 (BB&E, 2015).

IRP Site 4 was an open, gravel-bottomed, elliptical bermed pit, located north of Taxiway A. Flammable liquids were poured into the pit and were ignited for fire-training exercises. The pit

measured approximately 20 by 30 ft and was lined with several layers of thick plastic sheeting that degraded over time. Approximately 75 ft north of the pit, the ground slopes steeply toward a man-made drainage ditch. Water that accumulated in the pit was sometimes drained from the pit into the nearby drainage ditch. The remedial action, including excavation, on-site thermal treatment of contamination and confirmation monitoring, was completed in 1996 and it was determined that contaminant levels at the site posed negligible risk to public health and the environment (BB&E, 2015). The WVDEP reviewed the sampling results which confirmed that all contaminant levels were below target clean up levels, and determined that NFA was required (AMEC, 2002). However, PFCs were not contaminants of concern during IRP investigations. As such, soil and/or groundwater samples were not analyzed for PFCs.

### 4.2 PRL 2: Hangar 119

Hangar 119 was constructed in the 1960s and was equipped with an AFFF fire suppression system (FSS) from approximately 1989 until 2007. The suppression system was designed to contain, store, and in the case of system engagement, ultimately discharge the AFFF inside the hangar. In 2007, Hangar 119 was converted to house various functions such as Civil Engineering (CE) and Environmental Management and the AFFF FSS was removed. AFFF from the 2007 removal was turned in to the Defense Reutilization and Marketing Office and sent to Battle Creek, Michigan (BB&E, 2015).

One spill was reported while the system was in place. The spill occurred in the 1990s and consisted of an approximate 500-gallon release to the hangar floor. The AFFF was hosed down the sanitary sewer drains which were connected to an oil/water separator (OWS) as was the case with all the hangars at that time. Prior to 2007, the sanitary drains inside Hangar 119 were connected to the Base's WWTP which discharged its effluent into the storm water drainage system which flows toward Cold Spring Run. According to Base personnel, sludge from the WWTP was sent off-site to a landfill for disposal and therefore not disposed on Base. The WWTP was demolished in 2007 and the sanitary sewer connected to the city of Martinsburg. Other Hangar 119 releases of AFFF occurred during FSS tests. It was estimated by Base personnel that an AFFF FSS test took place approximately every five years. Approximately 100 to 200 gallons of AFFF was released during each test. As indicated above, prior to 2007, AFFF from system tests was discharged to the Base WWTP (BB&E, 2015).

### 4.3 PRL 3: Former Hangar 128

The hangar was constructed in the 1980s and was demolished in 2008. Hangar 128 was equipped with an AFFF FSS until decommissioning prior to demolition. The suppression system was designed to contain, store, and in the case of system engagement, ultimately discharge the AFFF inside the hangar. According to CE drawings, the hangar drained to the sanitary sewer which, prior to 2007, was connected to the Base WWTP which discharged to the storm water drainage system. In the 1990s, approximately 500 gallons of AFFF was released to the hangar floor. The AFFF was hosed down the sanitary sewer drains which were connected to an OWS as was the case with all the hangars at that time. However, prior to 2007 the sanitary sewer drains inside Hangar 128 were connected to the Base's WWTP which discharged its effluent into the storm water drainage system which flows toward Cold Spring Run. The WWTP was demolished in 2007 and the sanitary sewer connected to the city of Martinsburg (BB&E, 2015).

Other Hangar 128 releases of AFFF occurred during FSS tests. It was estimated by Base personnel that an AFFF FSS test took place approximately every five years. Approximately 100-200 gallons of AFFF was released during each test. As indicated above, prior to 2007, AFFF from system tests was discharged to the Base WWTP (BB&E, 2015).

# 4.4 PRL 4: Former Hangar 110

Building 110 was constructed in the 1950s and demolished in 2011. The building was used as a hangar and was equipped with an AFFF FSS. The installation date for the AFFF FSS is not known; however, the system was decommissioned prior to demolition. As with other buildings at the Base, the floor drains in Hangar 110 discharged to the sanitary sewer system prior to 2007 when it was connected to the Base WWTP. Effluent from the Base WWTP was discharged to the storm water drainage system. The WWTP was demolished in 2007 and the sanitary sewer connected to the city of Martinsburg (BB&E, 2015).

According to the personnel interviewed during the PA, approximately 500 gallons of AFFF was released to the hangar floor in the 1990s. The AFFF was hosed down the sanitary sewer drains which were connected to an OWS as was the case with all the hangars at that time. However, prior to 2007 the sanitary sewer drains inside Hangar 110 were connected to the Base's WWTP which discharged its effluent into the storm water drainage system which flows toward Cold Spring Run. According to personnel interviewed during the PA, releases of AFFF may have occurred during FSS testing at Former Hangar 110. It was estimated by Base personnel that an AFFF FSS

test took place approximately every five years. Approximately 100-200 gallons of AFFF was released during each test. As indicated above, prior to 2007 AFFF from system tests was discharged to the Base WWTP (BB&E, 2015).

### 4.5 PRL 5: Building 139 – Northeast Fire Department Equipment Testing Area

This area consists of a low-lying vegetative area just northeast of Building 139. According to base personnel interviewed during the PA, nozzles were tested at this Fire Department Testing Area from at least 1990 to 2008. Nozzles were tested over a fence and onto the low-lying vegetative area. A storm water conveyance ditch nearby appears to flow toward Cold Spring Run. The frequency of the nozzle tests was targeted to be completed quarterly; however, Base personnel indicated that the testing was sporadic. Personnel interviewed were not aware of any other testing areas at Base (BB&E, 2015).

# 4.6 PRL 6: Former Building 114 (Old Tower)

According to personnel interviewed during the PA, bulk storage of AFFF existed near Building 114 (current Red Ramp) in the 1990s. Also, in the 1990s, there was a release of AFFF to the soil in this area from a storage container. It was estimated that less than 100 gallons was released. There was no special effort made to clean up the spill and it was allowed to naturally dissipate. When new hangars were constructed in the area from 2007 to 2010, this area was covered by approximately 2 ft of concrete (BB&E, 2015).

# 4.7 PRL 7: Former Building 111 – Former Fire Department

Building 111 was constructed in the 1950s and was demolished in 2011. After demolition, the area was regraded. From at least 2002 to 2008, the building was noted as a supply warehouse and sometime prior to 2002, it was the location of the former Base fire department. According to personnel interviewed during the PA, in the 1990s, a P-2 Fire Truck parked on the south side of Former Building 111 leaked approximately 50 gallons of AFFF to the soil in this area. The leak travelled into an open ditch and flowed toward Former Building 110. There was no special effort made to clean up the spill and it was allowed to naturally dissipate. Personnel interviewed were not aware of any other releases of AFFF at Former Building 111. However, fire trucks were historically power washed outside of Former Building 111 and it is possible that if any foam residue existed on the trucks, it could have been washed to the soil (BB&E, 2015).

### 4.8 PRL 8: Building 303 – Current Fire Department

Building 303 houses the current fire station and was constructed in 2009. This is the only building on Base that currently stores AFFF. In addition to the AFFF storage in the four fire department trucks, additional AFFF is stored in 5-gallon containers which are manually loaded into fire trucks equipped with a bayonet system that punctures the container within the fire truck's containment tank. There is no overhead fill system. A series of floor drains within the concrete floor lead to an OWS that appears to drain to an open ditch. While there have been no documented releases of AFFF from this new building, any potential release could flow toward the storm water drainage system (BB&E, 2015).

### 4.9 PRL 9: Building 140 – Former Fire Department

Building 140 was constructed in the 1990s and served as the former fire department building. There was no AFFF storage at Building 140, with the exception of what was stored on the fire department trucks. However, fire department vehicles were power-washed inside Building 140. Any foam on the vehicle would have flowed into a floor drain and then to an OWS which connected to the Base WWTP prior to 2007. The WWTP was demolished in 2007 and the sanitary sewer connected to the city of Martinsburg. Building 140 is currently used as the new aerospace ground equipment building (BB&E, 2015).

#### 4.10 PRL 10: Former Wastewater Treatment Plant

The former WWTP was constructed in the 1950s and demolished in 2007. Base sanitary sewer lines (including from hangars and fire stations) drained to the WWTP. The WWTP consisted of a wet well (underground pit), flow splitter box, clarifier, sand filters, chlorine contact tank, and a dechlorination tank before discharge. The effluent discharged to an open grass-lined ditch that drains toward Cold Spring Run. Any discharges of AFFF into the sanitary sewer prior to 2007 from hangars or fire stations would have been treated through this system and discharged to this open ditch (BB&E, 2015).

There is no documentation that AFFF discharged to the sanitary sewer had leaked out along the old sewer lines. However, the integrity of the sewer conveyance pipes at the time of the WWTP operation is unknown. After 2007, the sanitary sewer system at the Base was connected to the city of Martinsburg Publicly Owned Treatment Works (POTW). The effluent from the POTW is discharged to Tuscarora Creek which is a tributary of Opequon Creek (BB&E, 2015).

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### 5.0 FIELD PROGRAM METHODS

The following subsections summarize utility clearance and permitting activities; soil boring installation, sampling, and abandonment; temporary groundwater monitoring well construction, development, sampling, and abandonment; surface water sampling, and sediment sampling. SI activities were conducted in accordance with the Work Plan and the *ANG Investigation Guidance* (ANG, 2009). The SI field activities were conducted during 17 October through 30 November 2017. Photographs of field activities are included in **Appendix B**.

### 5.1 Utility Location and Clearance

Prior to commencement of SI activities, drilling locations were pre-marked, and the MANGB Point of Contact (POC) submitted an internal Base dig permit for the SI field activities on 29 September 2017.

On 17 October 2017, Mid-Atlantic Utility Locating, LLC of Ashburn, VA (Mid-Atlantic) cleared Base utilities at each of the 44-proposed soil boring and temporary monitoring well locations using geophysical techniques. Equipment employed by Mid-Atlantic included ground-penetrating radar and electro-magnetic induction locating equipment.

Utility clearance activities were performed at the direction and oversight of Amec Foster Wheeler, with the MANGB POC accompanying as an escort.

# 5.2 Permits

As described in **Section 5.1**, Amec Foster Wheeler obtained the internal Base dig permit from the MANGB POC. It was determined by the MANGB POC that Federal Aviation Administration (FAA) permits were required for performance of SI activities. An FAA permit was completed to obtain work clearance approval for each of the borings and temporary well locations. Amec Foster Wheeler obtained a Final Determination Letter dated 21 July 2017 from Mr. Matt Digiulian of the FAA providing work clearance approval. No other permits were required or obtained.

#### 5.3 Soil Boring Installation

Between 18 October and 21 November 2017, 43 soil borings were advanced with 16 temporary monitoring wells installed (two temporary monitoring wells were co-located with soil sample locations) to investigate potential PFC impacts in soil and groundwater at MANGB. It should be

noted that, there were 44 soil borings locations proposed in the Work Plan. However, per the Work Plan surface water was present at location 03SB01, therefore, it was converted from a soil boring to sediment sampling location. The borings were advanced by Cascade using roto sonic drilling techniques. Soil borings advanced solely for soil sample collection were completed at 15 ft bgs or first encountered boulder/bedrock. Soil borings advanced for installation of temporary monitoring wells were completed below the water table or at a maximum depth of approximately 40 ft bgs. Individual borehole depths are provided in the soil boring logs included in **Appendix A**.

Soil boring locations were selected based on PRL use and physical characteristics to target the most probable AFFF release areas. Forty-three soil borings were advanced in and around the ten PRLs using sonic drilling methods (27 borings for soil sampling only, 14 borings for temporary monitoring well installation, and two borings for combined temporary monitoring well installation and soil sampling). Soil cores were collected continuously for field screening at 5-ft intervals in decontaminated cores and new, dedicated high-density polyethylene (HDPE) plastic liner sleeves. Drilling rods/tools were decontaminated between borings in accordance with protocol described in the *Final Work Plan* (Amec Foster Wheeler, 2017).

## 5.4 Soil Sampling

Shallow soil samples were generally collected from the upper two ft of soil, directly beneath asphalt or pavement, if present. Deep soil samples were collected from the 2-ft interval above refusal (e.g. boulder/bedrock), or 15 ft bgs, whichever was encountered first.

Soil samples were collected from single-use HDPE sleeves. After retrieval from the core barrel, the sleeve was opened lengthwise and the soil was examined. Soil characteristics were logged in accordance with the Unified Soil Classification System. Soil was also visually inspected for other evidence of contamination. Shallow soil samples were collected from the upper two ft of soil, directly beneath asphalt or pavement, if present. Deep soil samples were collected from 13 to 15 ft bgs or the 2-ft interval above encountered boulder/bedrock, as the water table was not encountered in the upper 15 ft of each soil boring. Soil samples were collected in laboratory-provided, 6-ounce HDPE containers and immediately cooled with ice to less than 4°C.

# 5.5 Soil Boring Abandonment

Following the completion of drilling activities, each boring was backfilled with grout to ground surface and topped with bentonite chips.

# 5.6 Temporary Monitoring Well Installation and Development

Sixteen temporary monitoring wells were installed to investigate potential groundwater impacts at the ten MANGB PRLs and at the Base boundaries. The primary purpose of installing the temporary monitoring wells was to assess groundwater quality downgradient of the PRLs. Temporary monitoring well locations were determined based on historical groundwater data and topographic contours, historical indications of possible impact, and Base features such as buildings and the Base boundary. In general, temporary monitoring wells were installed at locations with the greatest potential to intercept PFCs dissolved in groundwater based on available data and might not represent the highest concentrations at each PRL.

Soil cores were collected continuously to verify soil lithology, then inspected, logged, and field screened in accordance with the FSP. Temporary monitoring wells were installed in accordance with Amec Foster Wheeler's PFC-specific Standard Operating Procedure for installation of monitoring wells (AFW-04).

The temporary monitoring well borings were advanced utilizing roto sonic drilling technique and tools. Temporary monitoring wells were constructed within borings using a two-inch diameter, schedule 40 polyvinyl chloride (PVC) riser with a 10-ft, 0.010-inch slot screened interval with the water table bisecting the well screen. New dedicated well materials were used at each temporary monitoring well location. The annulus surrounding each well screen and riser was backfilled with No.1 filter sand, which was placed from the bottom of the borehole to the bentonite seal. No annular seals were installed.

The temporary monitoring wells were developed using a pump to purge the screened interval and remove fine particles that had accumulated. Water quality parameters were monitored and recorded at periodic intervals. Monitoring wells were considered adequately developed when water quality parameters had stabilized and turbidity was low (i.e., <50 Nephelometric Turbidity Units where feasible). Where groundwater recharge was insufficient to allow stabilization, wells were pumped dry and allowed to recharge before sampling.

Well development water was containerized in steel 55-gallon drums and managed in accordance with **Section 5.13**. Equipment and pumps inserted into the well were decontaminated following each use in accordance with **Section 5.12**. Well development logs are included in **Appendix C**.

## 5.7 Water Level Measurements

Prior to well purging, static water level measurements were collected with an electronic water

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level meter. Water levels were measured as a distance below the top of the PVC riser and recorded on field data sheets.

## 5.8 Groundwater Sampling

Sixteen groundwater samples were collected from temporary monitoring wells with a submersible pump. Groundwater samples were not collected using USEPA Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Groundwater samples were collected using a ProActive Stainless Steel Mega-Monsoon XL submersible pump with ProActive Low Flow with Power Booster 3 XL LCD Controller. Although the low flow controller is designed to regulate low flow sampling as low as 40 milliliters per minute (mL/min), the submersible pump would shut off at low flow rates. Pumping speeds were kept as low as possible while maintaining constant pumping.

The initial water level was recorded using an electronic water level meter prior to purging and sampling activities. The submersible pump was inserted into the monitoring well to the depth recorded in the sampling logs, above the bottom of the well to prevent disturbances and resuspension of sediment present in the bottom of the well. In general, the pump intake was placed in the middle of the saturated interval. The pump discharge tubing was connected to a flow-through cell containing a multi-parameter Sonde Instrument to record water parameters. Except in cases of insufficient recharge, or where the pump shut off at low speeds, the pump rate during purging was maintained between 100 and 300 mL/min with a steady flow rate maintained. The following parameters were monitored during purging: temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen, turbidity, temperature, and specific conductivity on approximately five-minute intervals. The water level was monitored during this same time interval.

The well was considered stabilized after three consecutive readings as follows:

- +/-0.1 for pH,
- +/-3% for specific conductance (conductivity),
- +/-10 millivolts for ORP,
- +/-10% for dissolved oxygen, and
- +/-10% for turbidity.

Groundwater sampling logs and water quality instrument calibration logs are included in **Appendix D** and **Appendix E** respectively.

# 5.9 Temporary Monitoring Well Abandonment

Following the completion of sampling activities, each temporary well was pulled from the ground allowing the formation to collapse into the borehole. Subsequent boring abandonment was completed in accordance with **Section 5.5**.

# 5.10 Surface Water Sampling

One surface water sample was collected at PRL 3 (Former Hangar 128). Prior to sample collection, the following parameters were monitored as per the Work Plan: temperature, pH, ORP, dissolved oxygen, turbidity, and specific conductivity. The surface water sample was collected from mid-depth in the center of the water column. The surface water sample was collected using the sample container itself. After retrieval from the sampling device, the surface water samples were inspected for visual evidence of contamination. Surface water samples were immediately cooled with ice to less than 4°C. Surface water sampling logs are included in **Appendix F**.

# 5.11 Sediment Sampling

Two sediment samples were collected, one each from PRL 3 (Former Hangar 128) and PRL 10 (Former WWTP). Samples were collected from the upper 0.5 ft of sediment utilizing a clean stainless-steel hand auger. The hand auger was used to collect a 6-inch plug of sediment. After retrieval, sediment was transferred to a clean stainless-steel bowl, homogenized, and then placed in 6-ounce HDPE laboratory-supplied containers. Samples were immediately cooled with ice to less than 4°C. Re-usable sampling equipment was decontaminated in accordance with the *Final Work Plan* (Amec Foster Wheeler, 2017). Sediment sampling logs are included in **Appendix F**.

# 5.12 Decontamination

Field sampling equipment (e.g. water level indicators, pumps, bowls, trowels, hand augers, and other downhole equipment) was decontaminated prior to initial use, and between samples. Liquinox® soap diluted with PFC-free water was used to wash sampling equipment with a clean HDPE brush used to remove debris and particulates. PFC-free water was used to rinse soapy water from the sampling equipment. The PFC-free water was obtained from an onsite water source. Prior to use, a sample of the water was submitted to Vista Analytical Laboratories, Inc. (Vista) for analysis of the six PFC compounds on the Third Unregulated Contaminant Monitoring Rule (UCMR 3) list. Concentrations were reviewed to ensure Amec Foster Wheeler's internal PFC-free criteria were met. Decontamination fluids were containerized in steel 55-gallon drums

and managed in accordance with Section 5.13.

# 5.13 Investigation Derived Waste Management

Investigative Derived Waste (IDW) (including soil cuttings, abandoned monitoring wells, purge water, development water, and decontamination fluids) was collected and contained in labeled, secured, steel 55-gallon drums. Drums were staged on-site in an area designated by the MANGB POC. A total of 21 IDW soil drums, four IDW PVC pipe drums, and eight IDW liquid drums were generated as part of the SI activities. After the completion of field activities, representative composite samples were collected for both soil and liquid IDW. Soil IDW samples were collected using clean disposable gloves and homogenized in a decontaminated stainless steel bowl, then placed in laboratory-supplied containers and immediately cooled with ice to less than 4°C. Liquid IDW samples were collected from individual drums using decontaminated stainless steel bowls and homogenized in empty laboratory-provided HDPE deionized water containers, then poured into laboratory-supplied sample containers and immediately cooled with ice to less than 4°C. New, disposable nitrile gloves were donned prior to sample collection and were worn throughout the sample collection process. Soil and liquid IDW samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) volatile organic compounds, TCLP semi volatile organic compounds, TCLP Resource Conservation and Recovery Act metals, and total polychlorinated biphenyls. The soil, PVC, and liquid IDW were characterized as non-hazardous and waste profiles were signed by the MANGB POC. IDW was picked up by Capitol Environmental Services, Inc. on 16 February 2018 and transported to Environmental Recovery Corporation in Lancaster, PA. The IDW Profiles and Waste Manifest are provided in Appendix G.

# 5.14 Laboratory

PFC samples were submitted to Vista in El Dorado Hills, California. Waste Characterization samples were submitted to TestAmerica Laboratories Inc. in Arvada Colorado. Both laboratories are accredited under the DoD Environmental Laboratory Accreditation Program and maintain a National Environmental Laboratory Accreditation Program. Laboratory analytical reports and chain of custody forms are provided in **Appendix H**.

## 5.15 Field Quality Assurance/Quality Control Sample Results

Quality Assurance and Quality Control (QA/QC) samples, including field duplicates matrix

spike/matrix spike duplicates (MS/MSD), equipment rinsate samples, and field blanks were analyzed for the same PFC parameters as the associated project samples. The analytical results for the field duplicates are presented in **Table 4** through **Table 7**.

# 5.16 Data Validation and Usability

Amec Foster Wheeler performed a data quality review of samples collected during field activities and submitted to Vista for analysis of PFCs, consisting of: 62 soil samples (including five field duplicates); three sediment samples (including one field duplicate); and 24 aqueous samples (including 16 primary groundwater samples, one primary surface water sample, three field duplicates, three equipment rinsate blanks, and one decontamination source water sample).

The laboratory analytical data generated during the SI were reviewed by a qualified analytical chemist for conformance with the project Data Quality Objectives specified in the QAPP found in the *Final Work Plan* (Amec Foster Wheeler, 2017). Amec Foster Wheeler performed USEPA Stage 4 validation on 10 percent (%) of the field samples and USEPA Stage 2B validation on the remaining field samples associated with this sampling event. The Stage 4 validation includes review of the QC results in the laboratory's analytical report and reported on QC summary forms as well as recalculation checks and review of the instrument raw data outputs. The Stage 2B validation includes review of the QC results in the laboratory's analytical report and reported on QC summary forms with no review of the associated raw data. Data from equipment and field blanks did not undergo validation because results from these samples are only used to assess data usability for field samples. The validation was performed in general accordance with: Amec Foster Wheeler Final QAPP found within the *Final Work Plan* (Amec Foster Wheeler, 2017); DoD Quality Systems Manual for Environmental Laboratories (DOD, 2017); and USEPA Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (USEPA, 2009).

Amec Foster Wheeler evaluated 510 data records from field samples during the validation. Amec Foster Wheeler J qualified<sup>1</sup> or UJ qualified<sup>2</sup> 137 records (27%) as estimated values because of

<sup>&</sup>lt;sup>1</sup> The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

<sup>&</sup>lt;sup>2</sup> The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.

holding time exceedances, high or low internal standard recoveries, imprecision between MS and MSD results, analyte concentrations outside the equipment's calibration range, and/or imprecision between field duplicate results. Laboratory analytical reports and chain of custody forms are provided in **Appendix H.** The Data Validation Report, including qualified data, is included as **Appendix I**.

## 6.0 SITE INVESTIGATIONS

This SI field program was designed to collect data needed to evaluate the presence/absence of PFC at each of the ten PRLs. The scope of the SI was designed using recommendations presented in the PA prepared by BB&E. The following sections describe the investigation approach that was used to fulfill the objectives of the SI. The work was conducted in accordance with the QAPP, SHSP, and FSP presented in the approved *Final Work Plan* (Amec Foster Wheeler, 2017).

## 6.1 Field Activities Summary

Site Inspection activities are summarized in **Table 3** and consist of advancement of 29 soil borings and installation of 16 temporary wells, and collection of 57 soil samples, 16 groundwater samples, one surface water sample, and two sediment samples. Individual sampling locations are shown on **Figure 4** through **Figure 14**. Soil boring and monitoring well construction, well development, groundwater sampling, and surface water/sediment sampling logs are included in **Appendices A**, **C**, **D**, and **F**, respectively.

## 6.2 General Work Plan Deviations

Deviations from the general work plan included one or more of the following conditions:

- The base POC completed and signed a Base CE Work Clearance Request on 29 September 2017.
- Soil borings were advanced using sonic drilling instead of hollow-stem auger or directpush technology. The decision to use sonic drilling was made due to drill rig availability. The use of sonic drilling is not expected to affect sample results.
- The November 2017 USEPA residential soil Regional Screening Level (RSL) value for Perfluorobutanesulfonic Acid (PFBS) (1,300,000 micrograms per kilogram [µg/kg]) was used as the screening value in place of the May 2016 USEPA residential soil RSL value for PFBS (1,600,000 µg/kg). The updated RSL value was not published at the time the Work Plan was finalized.
- The November 2017 USEPA Tap Water RSL value for PFBS [400 micrograms per liter (μg/L)] was used as the screening value in place of the May 2016 USEPA Tap Water RSL value for PFBS (380 μg/L). The updated RSL value was not published at the time the Work Plan was finalized.

- 54 drums of drilling water were generated by the sonic drilling and not disposed of as IDW. Drilling water was filtered through activated carbon charcoal, flowed through the MANGB oil-water separator, and discharged to the municipal sewer. A temporary National Pollutant Discharge Elimination Permit was obtained through WVDEP for discharge of drilling water (Appendix G).
- Groundwater samples were not collected using USEPA Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells due to slow groundwater recharge. Groundwater samples were collected using a ProActive Stainless Steel Mega-Monsoon XL submersible pump with ProActive Low Flow with Power Booster 3 XL LCD Controller. The low flow controller is designed to regulate low flow sampling as low as 40 mL/minute; however, at sufficiently low speeds, the submersible pump would shut off. Pumping speeds were kept as low as possible while maintaining constant pumping.
- A ProActive Stainless Steel Monsoon submersible pump with low flow controller was used to collect groundwater samples due to the low recharge rate and the depth to groundwater. An equipment blank, ESHEP-EB-001-103117, was collected from the stainless-steel downhole pump end to confirm the pump was PFC-free.

Work Plan deviations specific to an individual PRL are discussed in the following sub sections.

# 6.3 PRL 1: Former FTA (IRP Site 4)

## 6.3.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. Due to insufficient groundwater, TW-01 was not developed or purged prior to sampling and no water quality parameters were recorded. No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.3.2 Soil Sampling

Three soil borings (01SB01, 01SB02, and 01SB03) were advanced using sonic drilling techniques on 18 and 19 October 2017, and two soil samples were collected from each boring. Per the Work Plan, the shallow sample at 01SB01 was collected from surficial material (0-2 ft bgs), and the shallow samples at 01SB02 and 01SB03 were collected from the upper 2-ft of native material beneath the burn pit fill (5-7 ft bgs and 8-10 ft bgs respectively). The deep sample at 01SB01 was collected from 3-5 ft bgs, just above bedrock refusal. The deep samples at 02SB02 and

02SB03 were collected from 13 to 15 ft bgs. A total of six soil samples were collected at this PRL.

## 6.3.3 Groundwater Sampling

Temporary monitoring well TW-01 was drilled to a depth of 40 ft bgs on 19 October 2017, and a well screen was installed from 30 - 40 ft bgs. No groundwater was observed during drilling. Groundwater was measured at a depth of 38.5 ft below top of casing (TOC) in TW-01 on 21 November 17 and one groundwater sample was collected.

Soil boring and temporary monitoring well locations are illustrated on Figure 4.

# 6.4 PRL 2: Hangar 119

## 6.4.1 Site Deviations

No deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.4.2 Soil Sampling

Three soil borings (02SB01, 02SB02, and 02SB03) were advanced at PRL 2 on 27 and 30 October 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13 -15 ft or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

## 6.4.3 Groundwater Sampling

Temporary monitoring well TW-02 was drilled to a depth of 40 ft bgs on 30 October 2017, and a well screen was installed from 29.5 - 39.5 ft bgs. Groundwater was measured at a depth of 27.9 ft below TOC in TW-02 prior to purging and sampling. One groundwater sample was collected on 31 October 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 5.

# 6.5 PRL 3: Former Hangar 128

## 6.5.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. Due to insufficient groundwater, TW-03 was pumped dry during development and groundwater parameters did not stabilize. A groundwater sample was collected upon recharge. No other deviations, apart from the general

Work Plan deviations (see Section 6.2), occurred at this PRL.

# 6.5.2 Sediment Sampling

One sediment sample (03SD01) was collected at PRL 3 on 6 November 2017. The sediment sample was collected using hand tools from the upper 0.5 ft of sediment in the drainage ditch located northeast of the former hangar, downgradient from PRL 3.

## 6.5.3 Surface Water Sampling

One surface water sample (03SW01) was collected at PRL 3 on 6 November 2017. The surface water sample was collected in the drainage ditch located northeast of the former hangar, downgradient from PRL 3.

## 6.5.4 Soil Sampling

Two soil borings (03SB02 and 03SB03) were advanced at PRL 3 on 6 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last two ft before refusal) were collected from the bottom of each boring. A total of four soil samples were collected at this PRL. Surface water was present at the 03SB01 location during field investigations; therefore, consistent with the Work Plan, a surface water and sediment sample were collected in lieu of the soil sample 03SB01.

## 6.5.5 Groundwater Sampling

Temporary monitoring well TW-03 was drilled to a depth of 30 ft bgs on 6 November 2017, and a well screen was installed from 19 - 29 ft bgs. Groundwater was measured at a depth of 17.2 ft below TOC in TW-03 prior to developing and sampling. One groundwater sample was collected on 21 November 2017.

Soil boring, temporary monitoring well, surface water and sediment sample locations are illustrated on **Figure 6**.

# 6.6 PRL 4: Former Hangar 110

## 6.6.1 Site Deviations

No deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.6.2 Soil Sampling

Three soil borings (04SB01, 04SB02, and 04SB03) were advanced at PRL 4 on 30 October and 1 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last two ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

# 6.6.3 Groundwater Sampling

Temporary monitoring well TW-04 was drilled to a depth of 41 ft bgs on 31 October and 1 November 2017, and a well screen was installed from 30 - 40 ft bgs. Groundwater was measured at a depth of 8.72 ft below TOC in TW-03 prior to purging and sampling. One groundwater sample was collected on 1 November 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 7.

# 6.7 PRL 5: Building 139 (Northeast Fire Department Equipment Testing)

# 6.7.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. Due to insufficient groundwater, TW-05 was pumped dry during development and groundwater parameters did not stabilize. A groundwater sample was collected upon recharge. No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.7.2 Soil Sampling

Three soil borings (05SB01, 05SB02, and 05SB03) were advanced at PRL 5 on 23 October 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

# 6.7.3 Groundwater Sampling

Temporary monitoring well TW-05 was drilled to a depth of 40 ft bgs on 24 October 2017, and a well screen was installed from 30 - 40 ft bgs. Groundwater was measured at a depth of 36.2 ft below TOC in TW-05 prior to sampling. One groundwater sample was collected on 21 November 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 8.

# 6.8 PRL 6: Former Building 114 (Old Tower)

## 6.8.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. Temporary well TW-06 was installed with a 15-ft screen. No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

# 6.8.2 Soil Sampling

Three soil borings (06SB01, 06SB02, and 06SB03) were advanced at PRL 6 on 9 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

# 6.8.3 Groundwater Sampling

Temporary monitoring well TW-06 was drilled to a depth of 40 ft bgs on 9 and 13 November 2017, and a well screen was installed from 25 -40 ft bgs. TW-06 was co-located with soil boring 06SB02. Groundwater was measured at a depth of 27.35 ft below TOC in TW-06 prior to purging and sampling. One groundwater sample was collected on 13 November 2017 as per the Work Plan.

Soil boring and temporary monitoring well locations are illustrated on Figure 9.

# 6.9 PRL 7: Former Building 111 (Former Fire Department)

# 6.9.1 Site Deviations

No deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.9.2 Soil Sampling

Three soil borings (07SB01, 07SB02, and 07SB03) were advanced at PRL 7 on 25 October 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

### 6.9.3 Groundwater Sampling

Temporary monitoring well TW-07 was drilled to a depth of 40 ft bgs on 26 October 2017, and a well screen was installed from 30 -40 ft bgs. TW-07 was co-located with soil boring 07SB01. Groundwater was measured at a depth of 29.73 ft below TOC in TW-07 prior to purging and sampling. One groundwater sample was collected on 26 October 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 10.

# 6.10 PRL 8: Building 303 – Current Fire Department

#### 6.10.1 Site Deviations

Two deviations from the Work Plan occurred at this PRL.

- Sufficient rock was present to keep the borehole for TW-08 open, so no well screen was set. A groundwater sample was collected from the open borehole at TW-08.
- Due to insufficient groundwater, TW-08 was pumped dry during development and groundwater parameters did not stabilize. A groundwater sample was collected upon recharge.

No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.10.2 Soil Sampling

Three soil borings (08SB01, 08SB02, and 08SB03) were advanced at PRL 8 on 13 and 14 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13 -15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

## 6.10.3 Groundwater Sampling

Temporary monitoring well TW-08 was drilled to a depth of 40 ft bgs on 15 November 2017. No well screen was installed. Groundwater was measured at a depth of 34.6 ft below TOC in TW-08 prior to sampling. One groundwater sample was collected on 15 November 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 11.

## 6.11 PRL 9: Building 140 – Former Fire Department

## 6.11.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. Sufficient rock was present to keep the borehole for TW-09 open, so no well screen was set. A groundwater sample was collected from the open borehole at TW-09. No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

# 6.11.2 Soil Sampling

Three soil borings (09SB01, 09SB02, and 09SB03) were advanced at PRL 9 on 2 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. A total of six soil samples were collected at this PRL.

# 6.11.3 Groundwater Sampling

Temporary monitoring well TW-09 was drilled to a depth of 30 ft bgs on 2 November 2017. No well screen was installed. Groundwater was measured at a depth of 16.58 ft below TOC in TW-09 prior to sampling. One groundwater sample was collected on 3 November 2017.

Soil boring and temporary monitoring well locations are illustrated on Figure 12.

# 6.12 PRL 10: Former Wastewater Treatment Plant

## 6.12.1 Site Deviations

One deviation from the Work Plan occurred at this PRL; No surface water sample (10SW01) was collected from the drainage ditch located northeast of the former WWTP, downgradient from PRL 10, due to lack of surface water at the time of sampling. No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

## 6.12.2 Sediment Sampling

One sediment sample (10SD01) was collected at PRL 10 on 19 October 2017. The sediment sample was collected using hand tools from the upper 0.5 ft of sediment in the drainage ditch located northeast of the former WWTP, downgradient from PRL 10.

## 6.12.3 Soil Sampling

Three soil borings (10SB01, 10SB02, and 10SB03) were advanced at PRL 10 on 19 October 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. Two borings (10SB01 and 10SB03) were completed using sonic drilling techniques, and deep samples (13-15 ft bgs or the last 2 ft before refusal) were collected from the bottom of each boring. Boring 10SB02 was advanced with a hand auger to 2 ft bgs and no deep sample was collected due to refusal. A total of five soil samples were collected at this PRL.

# 6.12.4 Groundwater Sampling

Temporary monitoring well TW-10 was drilled to a depth of 37 ft bgs on 20 October 2017, and a well screen was installed from 27-37 ft bgs. Groundwater was measured at a depth of 32.0 ft below TOC in TW-10 prior to purging and sampling. One groundwater sample was collected on 20 October 2017.

Soil boring, temporary monitoring well, and sediment sample locations are illustrated on **Figure 13**.

## 6.13 Base Boundary Wells

## 6.13.1 Site Deviations

Two deviations from the Work Plan occurred at this PRL.

- Well screens were not installed in three boundary wells (BW), BW01, BW-05, and BW-06 Sufficient rock was present to keep the boreholes open, so no well screen was set. A groundwater sample was collected from the open borehole at these locations. Groundwater samples were collected from open boreholes at these boundary wells.
- Due to insufficient groundwater, BW-01 was not developed and a grab sample was collected. BW-05 was pumped dry during development and groundwater parameters did not stabilize. A groundwater sample was collected at BW-05 upon recharge. A groundwater sample was collected at BW-06 after multiple hours of development although groundwater parameters did not stabilize.

No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

### 6.13.2 Groundwater Sampling

Temporary monitoring well BW-01 was drilled to a depth of 40 ft bgs on 21 November 2017 and the initial depth to water was measured at 35 ft below TOC. No well screen was installed. One groundwater sample was collected on 21 November 2017.

Temporary monitoring well BW-02 was drilled to a depth of 40 ft bgs on 20 November 2017, and a well screen was installed from 30-40 ft bgs. Groundwater was measured at a depth of 34.5 ft below TOC prior to purging and sampling. One groundwater sample was collected on 21 November 2017.

Temporary monitoring well BW-03 was drilled to a depth of 40 ft bgs on 16 November 2017, and a well screen was installed from 27.5-37.5 ft bgs. Groundwater was measured at a depth of 32.5 ft below TOC prior to purging and sampling. One groundwater sample was collected on 16 November 2017.

Temporary monitoring well BW-04 was drilled to a depth of 30 ft bgs on 8 November 2017, and a well screen was installed from 20-30 ft bgs. Groundwater was measured at a depth of 20.34 ft below TOC prior to purging and sampling. One groundwater sample was collected on 9 November 2017.

Temporary monitoring well BW-05 was drilled to a depth of 40 ft bgs on 7 November 2017 and the initial depth to groundwater was measured at 32.5 ft below TOC. No well screen was installed. One groundwater sample was collected on 20 November 2017.

Temporary monitoring well BW-06 was drilled to a depth of 40 ft bgs on 17 November 2017. No well screen was installed. Groundwater was measured at a depth of 32.5 ft below TOC prior to purging and sampling. One groundwater sample was collected on 17 November 2017.

Base boundary monitoring well locations are illustrated on Figure 14.

### 7.0 SOIL AND GROUNDWATER STANDARDS

A soil or groundwater standard is an environmental and/or public health statute or rule used in identifying Base contamination that may pose a risk to human health or the environment. Soil and groundwater standards are federal and state human health and environment-based regulations used to:

- Determine the appropriate levels of Base clean-up;
- Define and formulate remedial action alternatives; and,
- Govern implementation and operation of the selected remedial action.

Currently no promulgated Standards exist for the six PFCs sampled during the SI program.

In accordance with Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure Installations [United States Air Force (USAF), August 2012] and USEPA lifetime drinking water HAs for PFOS (USEPA, May 2016a) and PFOA (USEPA, May 2016b), a release is considered confirmed if the following concentrations are exceeded:

#### PFOS:

- 0.07 μg/L in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOA value).
- 1,260 μg/kg in soil (calculated in the absence of RSL values<sup>3</sup>).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values<sup>3</sup>).

#### PFOA:

- 0.07 µg/L in groundwater/surface water (combined with PFOS value).
- 1,260 µg/kg in soil (calculated in the absence of RSL values<sup>3</sup>).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values<sup>3</sup>).

USEPA has also derived RSL values for PFBS, for which there is a Tier 2 toxicity value (USEPA, November 2017). The RSL values with a target hazard quotient of 1.0 are used for this SI. The USAF will also consider a release to be confirmed if the following concentrations are exceeded:

<sup>&</sup>lt;sup>3</sup> Air Force Guidance screening levels calculated using the USEPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgibin/chemicals/csl\_search]. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg/day derived by USEPA in their Drinking Water Health Advisories for both PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b).

PFBS:

- 400 µg/L in groundwater/surface water.
- 1,300,000 µg/kg in soil/sediment.

The Health Advisory (HA), RSLs and USAF guidance screening levels are collectively referred to as screening criteria in this Report. **Table 8** presents the screening criteria for comparing the analytical results for PFBS, PFOA, and PFOS.

### 8.0 SITE INVESTIGATION RESULTS

This section presents the soil, groundwater, surface water, and sediment data collected during the SI activities and a comparison of detections. Detections of PFBS, PFOA and PFOS are compared to the screening criteria as defined in the Work Plan, and presented in **Table 8**. Locations of detected analytes are shown on **Figure 15** through **Figure 25**.

## 8.1 PRL 1: Former FTA (IRP Site 4)

## 8.1.1 PRL 1 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.3.2**: 01SB01 from 0-2 and 3-5 ft bgs; 01SB02 from 5-7 and 13-15 ft bgs; and 01SB03 from 8-10 and 13-15 ft bgs. A field duplicate was collected at 01SB03 from 13-15 ft bgs. Analytical results from soil samples indicate that the six PFC compounds were detected above the laboratory reporting limit in all samples collected, with one compound exceeding the screening criterion. PFOS was detected in 01SB03 from 8-10 ft bgs at a concentration of 1,710  $\mu$ g/kg, which is above the 1,260  $\mu$ g/kg standard.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 15**.

## 8.1.2 PRL 1 Groundwater Analytical Results

One groundwater sample was collected from TW-01 and analyzed as described in **Section 6.3.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the groundwater screening criterion. PFOS and PFOA were detected in TW-01 above the 0.07  $\mu$ g/L USEPA Drinking Water HA (USEPA, 2016a), at concentrations of 45.7  $\mu$ g/L and 18.9  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 64.6  $\mu$ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 15**.

# 8.2 PRL 2: Hangar 119

## 8.2.1 PRL 2 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in Section

**6.4.2**: 02SB01 from 0-2 and 13-15 ft bgs; 02SB02 from 0-2 and 13-15 ft bgs; and 02SB03 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate that five PFCs were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 1.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 16**.

# 8.2.2 PRL 2 Groundwater Analytical Results

One groundwater sample was collected from TW-02 and analyzed as described in **Section 6.4.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected in TW-02 at concentrations of 0.544  $\mu$ g/L and 0.112  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 0.656  $\mu$ g/L at this location.

Comparisons of analytical results to applicable groundwater screening criteria are presented on **Table 5**. The monitoring well location showing detected compounds is illustrated on **Figure 16**.

# 8.3 PRL 3: Former Hangar 128

# 8.3.1 PRL 3 Sediment Analytical Results

One sediment sample was collected and analyzed as described in **Section 6.5.2**, 03SD01 from 0-0.5 ft bgs. Analytical results from the sediment sample indicate five PFC compounds were detected above the laboratory reporting limit; however, no compounds exceeded the screening criterion in the sediment sample collected from PRL 3.

Comparisons of analytical results to applicable criteria are presented on **Table 6**. The sediment sample location showing detected compounds are depicted on **Figure 17**.

# 8.3.2 PRL 3 Surface Water Analytical Results

One surface water sample (03SW01) was collected and analyzed as described in **Section 6.5.3**. A field duplicate was collected at this location. Analytical results from the surface water sample indicate six PFCs were detected above the laboratory reporting limit; with two compounds exceeding the surface water screening criterion of 0.07  $\mu$ g/L. PFOS and PFOA were detected in

the primary sample at concentrations of 2.92  $\mu$ g/L<sup>4</sup> and 0.142  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 3.062  $\mu$ g/L in the primary sample. PFOS and PFOA were detected in the duplicate sample at concentrations of 2.89  $\mu$ g/L and 0.133  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 3.023  $\mu$ g/L in the duplicate sample.

Comparisons of analytical results to applicable screening criteria are presented on **Table 7**. The surface water location showing detected compounds is illustrated on **Figure 17**.

# 8.3.3 PRL 3 Soil Analytical Results

Four soil samples were collected and analyzed from two soil borings as described in **Section 6.5.4**: 03SB02 from 0-2 and 13-15 ft bgs; and 03SB03 from 0-2 and 12-14 ft bgs. Analytical results from soil samples indicate PFOS is the only PFC present above the laboratory reporting limit, and detected in two of the four samples collected. There were no exceedances of the screening criteria in the four samples collected from PRL 3.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 17**.

# 8.3.4 PRL 3 Groundwater Analytical Results

One groundwater sample was collected from TW-03 and analyzed as described in **Section 6.5.5**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected at concentrations of 3.34  $\mu$ g/L and 0.112  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 3.452  $\mu$ g/L at this location.

Comparisons of analytical results to applicable criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 17**.

# 8.4 PRL 4: Former Hangar 110

# 8.4.1 PRL 4 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in Section

<sup>&</sup>lt;sup>4</sup> Result J qualified indicating that the result was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

**6.6.2**: 04SB01 from 0-2 and 13-15 ft bgs; 04SB02 from 0-2 and 11-13 ft bgs; and 04SB03 from 0-2 and 13-15 ft bgs. A field duplicate was collected at 04SB03 from 0-2 ft bgs. Analytical results from soil samples indicate that three PFC compounds were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 4.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 18**.

# 8.4.2 PRL 4 Groundwater Analytical Results

One groundwater sample was collected from TW-04 and analyzed as described in **Section 6.6.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected in TW-04 at concentrations of 0.981  $\mu$ g/L and 0.319  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 1.3  $\mu$ g/L at this location.

Comparisons of analytical results to applicable groundwater screening criteria are presented on **Table 5**. The monitoring well location showing detected compounds is illustrated on **Figure 18**.

# 8.5 PRL 5: Building 139 – Northeast Fire Department Equipment Testing Area

# 8.5.1 PRL 5 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.7.2**: 05SB01 from 0-2 and 10-12 ft bgs; 05SB02 from 0-2 and 5-7 ft bgs; and 05SB03 from 0-2 and 13-15 ft bgs. Analytical results from soil samples indicate that six PFC compounds were detected above the laboratory reporting limit in at least one sample, with one compound exceeding the screening criterion. PFOS was detected in 05SB01 from 0-2 ft bgs at a concentration of 2,140  $\mu$ g/kg, above the 1,260  $\mu$ g/kg screening level.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 19**.

# 8.5.2 PRL 5 Groundwater Analytical Results

One groundwater sample was collected from TW-05 and analyzed as described in **Section 6.7.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected

at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected in TW-05 at concentrations of 2.68  $\mu$ g/L and 1.01  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 3.69  $\mu$ g/L at this location.

Comparisons of analytical results to applicable criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 19**.

# 8.6 PRL 6: Former Building 114 (Old Tower)

# 8.6.1 PRL 6 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.8.2**: 06SB01 from 0-2 and 13-15 ft bgs; 06SB02 from 0-2 and 11-13 ft bgs; and 06SB03 from 0-2 and 3-5 ft bgs. A field duplicate was collected at 06SB01 from 0-2 ft bgs. Analytical results from soil samples indicate that three PFC compounds were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 6.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 20**.

# 8.6.2 PRL 6 Groundwater Analytical Results

One groundwater sample was collected from TW-06 and analyzed as described in **Section 6.8.3**. Analytical results from the groundwater sample indicate that two of six PFCs were detected at concentrations above the laboratory detection limit; however, no compounds exceeded the screening criteria.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 20**.

# 8.7 PRL 7: Former Building 111 (Former Fire Department)

# 8.7.1 PRL 7 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.9.2**: 07SB01 from 0-2 and 10-12 ft bgs; 07SB02 from 0-2 and 6-8 ft bgs; and 07SB03 from 0-2 and 7-9 ft bgs. A field duplicate was collected at 07SB02 from 6-8 ft bgs. Analytical results from soil samples indicate that six PFC compounds were detected above the laboratory reporting limit

in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 7.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 21**.

# 8.7.2 PRL 7 Groundwater Analytical Results

One groundwater sample was collected from TW-07 and analyzed as described in **Section 6.9.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected in TW-07 at concentrations of 4.35  $\mu$ g/L and 1.23  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 5.58  $\mu$ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 21**.

# 8.8 PRL 8: Building 303 (Current Fire Department)

# 8.8.1 PRL 8 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.10.2**: 08SB01 from 0-2 and 10-12 ft bgs; 08SB02 from 0-2 and 6-8 ft bgs; and 07SB03 from 0-2 and 12-14 ft bgs. Analytical results from soil samples indicate that six PFC compounds were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 8.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 22**.

# 8.8.2 PRL 8 Groundwater Analytical Results

One groundwater sample was collected from TW-08 and analyzed as described in **Section 6.10.3**. Analytical results from the groundwater sample indicate that four of six PFCs were detected at concentrations above the laboratory detection limit; however, no compounds exceeded the screening criteria.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 22**.

# 8.9 PRL 9: Building 140 (Former Fire Department)

# 8.9.1 PRL 9 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.11.2**: 09SB01 from 0-2 and 13-15 ft bgs; 09SB02 from 0-2 and 11-13 ft bgs; and 09SB03 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate that six PFC compounds were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 9.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 23**.

# 8.9.2 PRL 9 Groundwater Analytical Results

One groundwater sample was collected from TW-09 and analyzed as described in **Section 6.11.3**. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS and PFOA were detected in TW-09 at concentrations of 0.297  $\mu$ g/L and 0.100  $\mu$ g/L, respectively. The combined PFOS and PFOA concentration is 0.397  $\mu$ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 23**.

# 8.10 PRL 10: Former Wastewater Treatment Plant

## 8.10.1 PRL 10 Sediment Analytical Results

One sediment sample was collected and analyzed as described in **Section 6.12.2**, 10SD01 from 0-0.5 ft bgs. A field duplicate was collected at this location. Analytical results from the sediment sample indicate five PFC compounds were detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in the sediment sample collected from PRL 10.

Comparisons of analytical results to applicable criteria are presented on **Table 6**. The sediment sample location showing detected compounds are depicted on **Figure 24**.

## 8.10.2 PRL 10 Soil Analytical Results

Five soil samples were collected and analyzed from three soil borings as described in **Section 6.12.3**: 10SB01 from 0-2 and 3-5 ft bgs; 10SB02 from 0-2 ft bgs; and 10SB03 from 4-6 and 13-

15 ft bgs. A field duplicate was collected at 10SB01 from 0-2 ft bgs. Analytical results from soil samples indicate that six PFC compounds were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the six samples collected from PRL 10.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The soil boring locations showing detected compounds are depicted on **Figure 24**.

# 8.10.3 PRL 10 Groundwater Analytical Results

One groundwater sample was collected from TW-10 and analyzed as described in **Section 6.12.4**. A field duplicate was collected at this location. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit, with one compound exceeding the USEPA Drinking Water HA of 0.07  $\mu$ g/L. PFOS was detected in the primary and duplicate samples at concentrations of 0.255  $\mu$ g/L and 0.345  $\mu$ g/L, respectively. The combined PFOS and PFOA concentrations at the primary and duplicate samples are 0.278  $\mu$ g/L and 0.363  $\mu$ g/L, respectively.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 24**.

# 8.11 Base Boundary Wells

# 8.11.1 Boundary Well Groundwater Analytical Results

Six groundwater samples were collected at temporary wells located along the base boundary, with samples collected from each as described in **Section 6.13.2**. A summary of analytical results includes the following:

- One groundwater sample was collected from BW-01. Analytical results from the groundwater sample indicate that one PFC compound was detected at a concentration above the laboratory detection limit; however, no compounds exceeded the USEPA Drinking Water HA of 0.07 μg/L.
- One groundwater sample was collected from BW-02. A field duplicate was collected at this location. Analytical results from the groundwater sample indicate that six PFC compounds were detected at concentrations above the laboratory detection limit. Although no individual compounds exceeded screening criteria, the combined PFOS and PFOA result exceeded the USEPA Drinking Water HA of 0.07 µg/L in both the primary

(0.103  $\mu$ g/L) and duplicate (0.0961  $\mu$ g/L) samples.

- One groundwater sample was collected from BW-03. Analytical results from the groundwater sample indicate that one PFC compound was detected at a concentration above the laboratory detection limit; however, no compounds exceeded the USEPA Drinking Water HA of 0.07 μg/L.
- One groundwater sample was collected from BW-04. Analytical results from the groundwater sample indicate that one PFC compound was detected at a concentration above the laboratory detection limit; however, no compounds exceeded the USEPA Drinking Water HA of 0.07 μg/L.
- One groundwater sample was collected from BW-05. Analytical results from the groundwater sample indicate that one PFC compound was detected at a concentration above the laboratory detection limit; however, no compounds exceeded the USEPA Drinking Water HA of 0.07 μg/L.
- One groundwater sample was collected from BW-06. Analytical results from the groundwater sample indicate that no PFC compounds were detected at a concentration above the laboratory detection limit.

Comparisons of analytical results to applicable screening criteria are presented on **Table 5**. The temporary monitoring well locations showing detected compounds are illustrated on **Figure 25**.

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#### 9.0 CONCLUSIONS/RECOMMENDATIONS

This section presents the SI conclusions and recommendations at each PRL. The recommendations are based upon data collected by Amec Foster Wheeler during this SI, and an evaluation of results compared to applicable screening criteria. Amec Foster Wheeler recommends that further investigations include analysis of additional compounds, including precursor compounds, to supplement the UCMR3 list. Precursor compounds have potential to result in increased concentrations downgradient and can serve as a lingering source.

## 9.1 PRL 1: Former FTA (IRP Site 4)

A review of soil analytical data compared to soil screening criteria indicates an exceedance of USAF guidance screening levels exists at PRL 1 for PFOS. There are no USEPA RSL exceedances for PFBS, and no Air Force Guidance screening level exceedances for PFOA at this location.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 1. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following are recommended for PRL 1:

- Additional investigations to further evaluate concentrations and extent of PFCs in soil.
- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soils (including within the saturated zone, as a potential contributing source to groundwater.

## 9.2 PRL 2: Hangar 119

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 2.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 2. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following is recommended for PRL 2:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

# 9.3 PRL 3: Former Hangar 128

A review of sediment analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 3.

A review of surface water data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA exists at PRL 3 for PFOS and PFOA. PFBS did not exceed its respective screening criterion at this location.

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 3.

A review of groundwater analytical data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 3. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following are recommended for PRL 3:

- Additional investigations to further evaluate concentrations of PFCs in surface water. This
  should include an evaluation to identify the source, and downstream investigation to
  determine the nature and extent of the release. A second round of surface water samples
  should be collected concurrent with this evaluation to relate concentrations within the
  stormwater basin to concentrations up- and down-stream.
- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

## 9.4 PRL 4: Former Hangar 110

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA

at PRL 4.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 4. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following is recommended for PRL 4:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

# 9.5 PRL 5: Building 139 – Northeast Fire Department Equipment Testing Area

A review of soil analytical data compared to soil screening criteria indicates an exceedance of Air Force Guidance exists at PRL 5 for PFOS. There are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOA at this location.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 5. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following are recommended for PRL 5:

- Additional investigations to further evaluate concentrations and extent of PFCs in soil.
- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

# 9.6 PRL 6: Former Building 114 (Old Tower)

A review of soil analytical data indicates there are detections of PFCs, however, compared to screening criteria there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 6.

A review of groundwater data indicates detections of PFCs, however, a comparison to screening criteria found no exceedances of the USEPA Drinking Water HA for PFOS or PFOA, and no exceedances of the USEPA Tap Water RSL for PFBS downgradient of PRL 7.

Based on the SI results, the following are recommended for PRL 6:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone), as a potential contributing source to groundwater.

# 9.7 PRL 7: Former Building 111 (Former Fire Department)

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 7.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 7. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following is recommended for 7:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

# 9.8 PRL 8: Building 303 (Current Fire Department)

A review of soil analytical data indicates there are detections of PFCs, however, compared to screening criteria there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 8.

A review of groundwater data indicates detections of PFCs, however, comparison to screening criteria found no exceedances of the USEPA Drinking Water HA for PFOS or PFOA, and no exceedances of the USEPA Tap Water RSL for PFBS downgradient of PRL 8.

Based on the SI results, the following is recommended for PRL 8:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

## 9.9 PRL 9: Building 140 (Former Fire Department)

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 9.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient of PRL 9. PFBS did not exceed its respective screening criterion at this location.

Based on the SI results, the following is recommended for 9:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

## 9.10 PRL 10: Former Wastewater Treatment Plant

A review of sediment analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 10.

A review of soil analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF guidance screening level exceedances for PFOS or PFOA at PRL 10.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS exists downgradient of PRL 10. PFOA and PFBS did not exceed their respective screening criteria at this location.

Based on the SI results, the following is recommended for 10:

- Additional investigations to further evaluate concentrations and extent of PFCs in groundwater.
- Additional investigations to evaluate soil (including soil within the saturated zone, as a potential contributing source to groundwater.

## 9.11 Base Boundary Wells

A review of groundwater data compared to screening criteria found no exceedances of the

USEPA Tap Water RSL for PFBS at the six boundary wells, and no exceedances of the USEPA Drinking Water HA for PFOS or PFOA at five of the six boundary wells. At BW-02, concentrations of PFOS and PFOA were individually below screening criteria; however, the combined concentration exceeded USEPA Drinking Water HA.

Based on the SI results, the following is recommended for the Base Boundary:

- Additional investigations to further evaluate concentrations of PFCs in groundwater near BW-02. This should include a source evaluation and delineation to determine the nature and extent of the release.
- Investigations of off-Base groundwater upgradient to evaluate potential sources of PFCs migrating onto the Base and downgradient to further evaluate the migration pathway and the extent of PFC contamination.
- Investigations of a stormwater retention basin which is present immediately adjacent to BW-02. Collection of sediment and surface water samples are recommended to confirm or eliminate the retention basin as a potential source of PFCs to the environment. This evaluation should be supplemented with a records review to better understand the contributions (both on-Base and off-Base) to the stormwater system.

## 9.12 PRL Sites Summary

In summary, SI activities determined that two PRLs have USAF guidance screening level exceedances for soil. Based on these findings, Amec Foster Wheeler recommends additional investigations at PRLs 1 and 5to evaluate soil conditions.

SI activities determined that PFCs were detected in groundwater at the 10 PRLs investigated and at the Base boundary. Eight of the PRLs and one Base boundary location have USEPA Drinking Water HA exceedances. Based on these findings, Amec Foster Wheeler recommends additional investigations at each of the PRLs to further evaluate groundwater conditions and soils that may be an ongoing source of contamination.

Amec Foster Wheeler also recommends additional investigation at PRL 3 to further evaluate surface water conditions, and near BW-02 to further evaluate sediment and surface water conditions.

These recommendations are summarized in the following table:

	Screening Criteria Exceedance			riteria	
PRL	Soil	SW	S <u>D</u>	GW	Recommendations
1	х			х	Soil and GW investigation to evaluate the extent of the confirmed PFC release. Soils in the saturated zone should be investigated as a potential contributing source to GW.
2				х	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
3		х		х	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
4				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
5	х			x	Soil and GW investigation to evaluate the extent of the confirmed PFC release. Soils in the saturated zone should be investigated as a potential contributing source to GW.
6					GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
7				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
8					GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
9				х	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
10				x	GW investigation to evaluate the extent of the confirmed PFC release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW. Sediment investigation to evaluate the extent of the PFC release.
Base Boundary Wells				х	GW Investigation to evaluate the extent of the confirmed PFC release at BW-02. Surface water and sediment investigation to evaluate the stormwater retention basin as a potential source of PFCs to the environment. Evaluation of the presence of PFC contamination in groundwater off-Base both up and downgradient.

#### Table 9: Screening Criteria Exceedances and Recommendation

Notes:

GW = Groundwater

X – Screening criteria exceedance SW = Surface Water PFC - Perfluorinated Compound

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### 10.0 REFERENCES

- AECOM, 2015. Regional Compliance Restoration Program, Final Preliminary Assessment/Site Inspection, Martinsburg Air National Guard Base, Martinsburg, West Virginia. July.
- AMEC, 2002. Environmental Baseline Survey for Proposed Property Transactions at the 167<sup>th</sup> Airlift Wing. September.
- Amec Foster Wheeler, 2017. Final Work Plan, FY16 Phase I Regional Site Inspections for Perfluorinated Compounds, 167<sup>th</sup> Airlift Wing, West Virginia Air National Guard, Martinsburg Air National Guard Base, Martinsburg, West Virginia. July 21, 2017.
- ANG, 2009. *Air* National Guard Investigation Guidance, *Environmental Restoration Program.* September 2009.
- ANG, 2013. Final Record of Decision, Installation Restoration Program Sites 1 Through 4, 167<sup>th</sup> Airlift Wing, West Virginia Air National Guard, Shepherd Field Air National Guard Base, Martinsburg, West Virginia. October.
- BB&E, 2015. Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, West Virginia Air National Guard Base, Eastern West Virginia Regional Airport, Martinsburg, West Virginia. December 2015.
- City of Martinsburg, 2015. Drinking Water Quality Report for the Year 2014. March.
- DoD, 2017. DoD Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories. Version 5.1, January 2017
- EARTH TECH (The Earth Technology Corporation), 1996. Final Site Investigation Report, West Virginia Air National Guard, Martinsburg, West Virginia. September.
- EDR, 2015. EDR Radius Map<sup>™</sup> Report with Geocheck®. Environmental Data Resources, Inc., Inquiry Number 4359501.1s. July.
- HTMC (Hazardous Materials Technical Center), 1986. Phase I Records Search. March.

NRCS, 2018. Natural Resources Conservation Services Web Soil Survey

[https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx]. 2018.

- USEPA, 2009. Method 537. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Version 1.1. EPA Document #: EPA/600/R-08/092. September 2009.
- USEPA, 2012. Federal Register, Volume 77, No. 85, Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 3) for Public Water Systems; Final Rule. May 2, 2012.
- USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), EPA 822-R-16-004. United States Environmental Protection Agency, May 2016.
- USEPA, 2016b. Drinking Water Health Advisory for Perfluotooctanoic Acid (PFOA), EPA 822-R-16-005. Unites States Environmental Protection Agency, May 2016.
- USEPA, 2017. EPA Regional Screening Levels [https://www.epa.gov/risk/regional-screeninglevels-rsls-generic-tables-november-2017], November 2017.
- USFWS (U. S. Fish and Wildlife Service) 2014. Endangered, Threatened, Proposed, and Candidate Species, West Virginia Counties, September.
- WVDEP (West Virginia Department of Environmental Protection), 2016. PFOS detections in a Martinsburg, WV water supply well. September.

TABLES

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## FV16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia Summary of Soil Analytical Testing Results Table 3

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acio (PFBS)	Perfluoroheptanoic acid (AqHT9)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Screeni	Screening Level:	1.26 <sup>1</sup>	1.26 <sup>1</sup>	$1300^{2}$	NA	NA	NA
PRL	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	FUAS FU	ESHEP-01-SB01-0-2	19-0ct-17	0.0-2.0	z	0.265	0.00453	0.000449J	0.00138J	0.0309	0.00142J
	TOOCTO	ESHEP-01-SB01-3-5	19-0ct-17	3.0-5.0	z	0.296	0.0275	0.00435	0.00193J	0.082	0.000703J
		ESHEP-01-SB02-5-7	18-Oct-17	5.0-7.0	z	0.523	0.0105	0.000453J	0.00128J	0.024	0.000892J
Ч	ZNACIN	ESHEP-01-SB02-13-15	18-Oct-17	13.0-15.0	z	0.253	0.0156	0.000301J	0.000868J	0.0289	0.00123J
		ESHEP-01-SB03-8-10	18-Oct-17	8.0-10.0	z	1.71	0.0761	0.00319	0.00769	0.165	0.00139J
	01SB03	ESHEP-01-SB03-13-15	18-Oct-17	13.0-15.0	z	0.46	0.0403J	0.000722J	0.0022	0.0629J	0.00107J
		ESHEP-SO-DUP01-101817	18-Oct-17	13.0-15.0	FD	0.552	0.0123J	0.00041J	0.00119J	0.0267J	0.000781J
		ESHEP-02-SB01-0-2	27-0ct-17	0.0-2.0	z	0.0404	0.00289	0.000954U	0.000618J	0.00459	0.0025
	TOBCZO	ESHEP-02-SB01-13-15	27-0ct-17	13.0-15.0	z	0.00099U	0.00099U	U 66000.0	U 66000.0	U 66000.0	0.00099 U
ſ	LUAJLU	ESHEP-02-SB02-0-2	27-0ct-17	0.0-2.0	z	0.00537	0.000946J	0.000976U	0.00029J	0.0012J	0.000976 U
V	200220	ESHEP-02-SB02-13-15	27-0ct-17	13.0-15.0	z	0.000971U	0.000971U	0.000971U	0.000971U	0.000971U	0.000971U
		ESHEP-02-SB03-0-2	30-Oct-17	0.0-2.0	z	0.0139	0.00189J	U.866000.0	U.80000.0	0.00642	0.000998U
	C09C70	ESHEP-02-SB03-8-10	30-Oct-17	8.0-10.0	z	0.000966U	0.000966U	0.000966U	0.0009660	0.000966U	0.000966U
	CUOSCU	ESHEP-03-SB02-0-2	06-Nov-17	0.0-2.0	z	0.000908U	0.000908U	U.806000.0	U.806000.0	0.000908U	0.000908U
n	200000	ESHEP-03-SB02-13-15	06-Nov-17	13.0-15.0	z	0.00116J	0.000942U	0.000942U	0.000942U	0.000942U	0.000942U
n	035002	ESHEP-03-SB03-0-2	06-Nov-17	0.0-2.0	z	0.000285J	0.000964U	0.000964U	0.000964U	0.000964U	0.000964U
	COACCO	ESHEP-03-SB03-12-14	06-Nov-17	12.0-14.0	z	0.000952U	0.000952U	0.000952U	0.000952U	0.000952U	0.000952U
	DA CR01	ESHEP-04-SB01-0-2	30-Oct-17	0.0-2.0	z	0.000987U	0.000632J	0.000987U	0.000987U	0.000987U	0.000987U
5		ESHEP-04-SB01-13-15	30-Oct-17	13.0-15.0	z	0.000798J	0.00108J	U 2000933 U	0.000993U	0.00107J	0.000993 U
+		ESHEP-04-SB02-0-2	30-Oct-17	0.0-2.0	z	0.00096U	0.00096U	0.00096 U	0.00096U	0.00096 U	0.00096 U
	2006-0	ESHEP-04-SB02-11-13	30-Oct-17	11.0-13.0	z	0.000985J	0.00032J	0.00103U	0.00103U	0.00103 U	0.00103 U

Summary of Soil Analytical Testing Results FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia Table 3

Perfluorononanoic acid (PFNA)	NA	mg/kg	0.000975U	0.000977U	0.000959 U	0.00593	0.000973 U	0.000675J	0.00373	0.00136J	0.000955 U	0.000901U	0.000985 U	0.000971U	0.000977U	0.000965 U	0.001 U	0.00101U	0.000346J	0.000988 U	0.00164J	0.00098 U	0.000994U
Perfluorohexanesulfonic acid (PFHxS)	NA	mg/kg	0.000975U	0.000977U	0.00116J	0.141	0.0238	0.0236	0.0403	0.0189	0.013	0.000901U	0.000985 U	0.000971U	0.00049J	0.000965 U	0.001 U	0.00101U	0.00464	0.00238	0.0242	0.00573	0.00391
Perfluoroheptanoic acid (AqH19)	NA	mg/kg	0.000975U	0.000977U	0.000959U	0.00314	0.00118J	0.000937J	0.00168J	0.000778J	0.00063J	0.000901U	0.000985U	0.000971U	0.000977U	0.000965U	0.001U	0.00101U	0.000313J	0.000988U	0.001J	0.000567J	0.000386J
Perfluorobutanesulfonic acid (PFBS)	$1300^{2}$	mg/kg	0.000975U	U776000.0	U 6 5 6 0 0 . 0	0.0075	0.00467	0.00143J	0.000604J	0.000341J	0.00135J	0.000901U	0.000985U	0.000971U	U770000.0	0.000965 U	0.001U	0.00101U	U 866000.0	U.880000.0	0.000549J	0.000293J	0.000994U
Perfluorooctanoic acid (PFOA)	1.26 <sup>1</sup>	mg/kg	0.000975U	U7700000	0.0011J	0.00705	0.00153J	0.00246	0.00488	0.0081	0.000964J	0.000901U	0.000423J	0.000971U	0.000676J	0.000965U	0.000569J	0.000366J	0.00128J	0.00205	0.00926	0.00559J	0.00333J
Perfluorooctanesulfonic acid (PFOS)	$1.26^{1}$	mg/kg	0.000645J	0.000483J	0.00171J	2.14	0.0271	0.0567	0.892	0.0707	0.0179	0.000901U	0.000762J	0.000971U	0.00206	0.000965 U	0.001U	0.00101U	0.022J	0.027	0.0875	0.0134J	0.00525J
Analyte:	Screening Level:	Sample Type	z	FD	N	Ν	N	N	N	N	N	Ν	FD	N	N	N	N	Ν	N	N	N	N	FD
	Screenir	Sample Depth (ft.)	0.0-2.0	0.0-2.0	13.0-15.0	0.0-2.0	10.0-12.0	0.0-2.0	5.0-7.0	0.0-2.0	13.0-15.0	0.0-2.0	0.0-2.0	13.0-15.0	0.0-2.0	11.0-13.0	0.0-2.0	3.0-5.0	0.0-2.0	10.0-12.0	0.0-2.0	6.0-8.0	6.0-8.0
		Sample Date	01-Nov-17	01-Nov-17	01-Nov-17	23-Oct-17	23-Oct-17	23-Oct-17	23-Oct-17	23-Oct-17	13-Oct-17	09-Nov-17	09-Nov-17	09-Nov-17	09-Nov-17	09-Nov-17	09-Nov-17	09-Nov-17	25-Oct-17	25-Oct-17	25-Oct-17	25-Oct-17	25-Oct-17
		Sample ID	ESHEP-04-SB03-0-2	ESHEP-SO-DUP04-110117	ESHEP-04-SB03-13-15	ESHEP-05-SB01-0-2	ESHEP-05-SB01-10-12	ESHEP-05-SB02-0-2	ESHEP-05-SB02-5-7	ESHEP-05-SB03-0-2	ESHEP-05-SB03-13-15	ESHEP-06-SB01-0-2	ESHEP-SO-DUP05-110917	ESHEP-06-SB01-13-15	ESHEP-06-SB02-0-2	ESHEP-06-SB02-11-13	ESHEP-06-SB03-0-2	ESHEP-06-SB03-3-5	ESHEP-07-SB01-0-2	ESHEP-07-SB01-10-12	ESHEP-07-SB02-0-2	ESHEP-07-SB02-6-8	ESHEP-SO-DUP03-102517
		Location		04SB03		OE CBO1	тлассо	DECDUS	700000	OE CB03	chacch		06SB01		CUasso	700000	CUGSDU	chacon		TORCIO		07SB02	
		PRL		4			-				-		<u> </u>		9	-		-		-	7	<u> </u>	

# Summary of Soil Analytical Testing Results FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia Table 3

### FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Summary of Soil Analytical Testing Results Table 3

Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia

Notes: Light Blue Shaded = Exceeds Screening Level

FD = Field Duplicate Sample

ft = Feet ID = Identification

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
 N = Normal Field Sample
 NA = Not applicable
 PRL - Potential Release Location
 U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

mg/kg = milligrams per kilogram PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

[https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017] 'Screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\_search] <sup>2</sup>EPA Residential Screening Levels (June 2017)

# Summary of Groundwater Analytical Testing Results FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia Table 4

(AN19) bise sionenonoroulh99	NA	NA	hg/L	0.57	0.00571 J	0.0101	0.0128	0.0232	0.00539 U	0.0158	0.00543 UJ	0.00364 J	0.00257 J	0.00279 J	0.00728 U	0.00785 J	0.00845 J	0.00573 U	0.00534 U	0.00573 U
(2xH19) biɔs ɔinofluɛənɛxədoıoulfıə9	AN	NA	hg/L	52.7 J	0.403	0.608	0.625	15.6	0.0176	1.9	0.0268 J	0.334	0.143	0.142	0.00728 U	0.102	0.113	0.0072 J	0.0048 J	0.00252 J
(AqH1q) bics cionstqərloroultrə <sup>q</sup>	NA	NA	hg/L	6.35	0.0631	0.114	0.132	0.734	0.00539 U	0.149	0.00288 J	0.0429	0.0247	0.0292	0.00728 U	0.0222	0.0252	0.00573 U	0.00534 U	0.00573 U
Perfluorobutanesulfonic acid (PFBS)	ΝA	400	hg/L	2.55	0.0321	0.0607	0.0896	3.84	0.00539 U	0.114	0.00301 J	0.0186	0.0231	0.0231	0.00728 U	0.00416J	0.00431 J	0.00573 U	0.00534 U	0.00573 U
PFO39+8O39	0.07	NA	µg/L	64.6	0.656	3.452	1.3	3.69	ΥN	5.58	ΥN	0.397	0.2784	0.3628	ΥN	0.103	0.0961	ΥN	ΥN	NA
Perfluorooctanoic acid (PFOA)	0.07	NA	µg/L	18.9	0.112	0.112	0.319	1.01	0.00539 U	1.23	0.00543 UJ	0.1	0.0234	0.0178	0.00728 U	0.0425	0.0367	0.00573 U	0.00534 U	0.00573 U
Perfluorooctanesulfonic acid (PFOS)	0.07	AN	µg/L	45.7	0.544	3.34	0.981	2.68	0.00519 J	4.35	0.015 J	0.297	0.255	0.345	0.00328 J	0.0605	0.0594	0.00573 U	0.00534 U	0.00573 U
		••	1																	
Analyte:	dvisory	pwater <sup>1</sup>	Sample Type	Z	z	Z	z	Z	z	Z	Z	z	z	FD	Z	z	FD	z	Z	z
Analyte	Health Advisory:	EPA RSL Tapwater <sup>1</sup> :	Sample Sample Depth (ft.) Type	39.0-39.0 N	26.0-26.0 N	17.0-17.0 N	0.0-0.6	36.0-36.0 N	28.0-28.0 N	35.0-35.0 N	35.0-35.0 N	17.0-17.0 N	32.0-32.0 N	32.0-32.0 FD	35.0-35.0 N	35.0-35.0 N	35.0-35.0 FD	33.0-33.0 N	23.0-23.0 N	33.0-33.0 N
Analyte	Health Advisory									5.0-35.0						5.0-35.0	5.0-35.0	3.0-33.0		
Analyte	Health Advisory		Sample Depth (ft.)	39.0-39.0	26.0-26.0	17.0-17.0	0.0-0.6	36.0-36.0	28.0-28.0	35.0-35.0	35.0-35.0	17.0-17.0	32.0-32.0	32.0-32.0	35.0-35.0	35.0-35.0	35.0-35.0	33.0-33.0	23.0-23.0	33.0-33.0
Analyte	Health Advisory		Sample Sample Date Depth (ft.)	21-Nov-17 39.0-39.0	31-Oct-17 26.0-26.0	21-Nov-17 17.0-17.0	01-Nov-17 9.0-9.0	21-Nov-17 36.0-36.0	13-Nov-17 28.0-28.0	26-Oct-17 35.0-35.0	15-Nov-17 35.0-35.0	03-Nov-17 17.0-17.0	ESHEP-GW-TW10-102017 20-Oct-17 32.0-32.0	20-Oct-17 32.0-32.0	21-Nov-17 35.0-35.0	ESHEP-GW-BW02-112117 21-Nov-17 35.0-35.0	21-Nov-17 35.0-35.0	16-Nov-17 33.0-33.0	09-Nov-17 23.0-23.0	20-Nov-17 33.0-33.0

Report Date: 2/21/2018

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## EV16 Dhace I Regional Site Inchections for Derfluorinated Comn Summary of Groundwater Analytical Testing Results Table 4

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard
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Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia

				$\supset$
Perfluorononanoic acid (PFNA)	ΝA	ΝA	hg/L	0.00543
Perfluorohexanesulfonic acid (PFHXS)	NA	NA	µg/L	0.00543 U
(AqH19) biss sionstqəhoroultrə9	NA	NA	hg/L	0.00543 U
Perfluorobutanesulfonic acid (PFBS)	NA	400	µg/L	0.00543 U
AO79+2O79	0.07	NA	hg/L	NA
(AOT9) bios oionetoooroultrag	0.07	NA	hg/L	0.00543 U
Perfluorooctanesulfonic acid (PFOS)	0.07	NA	hg/L	0.00543 U
Analyte:	dvisory:	water <sup>1</sup> :	Sample Type	z
	Health Advisory:	EPA RSL Tapwater <sup>1</sup>	Sample Depth (ft.)	33.0-33.0
			Sample Date	17-Nov-17
			Sample ID	ESHEP-GW-BW06-111717
			Location	BW-06
			PRL	BBW

### Notes:

Light Blue Shaded = Exceeds Health Advisory

Underlined results exceed the EPA RSL standard.

FD = Field Duplicate Sample

PFOS+PFOA = Co-occurrence of PFOA and PFOS (PFOA + PFOS) in aqueous samples is reported using the following guidelines. 1. If both PFOA and PFOS are detected at or above the detection limit (DL), then the sum of PFOA+ PFOS is reported.

2. If either PFOA or PFOS is detected at or above the DL and the other is below the DL, then PFOA + PFOS is reported as "NA" representing Not Applicable.

3. If neither PFOA nor PFOS is detected at or above the DL, then PFOA + PFOS is reported as "ND" representing Not Detected.

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

N = Normal Field Sample NA = Not applicable

ID = Identification ft = Feet

PRL = Potential Release Location

U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD). UI = The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

μg/L = micrograms per liter

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry Health Advisory from USEPA Office of Water, 2016a and 2016b, Health Advisories (HAs) for drinking water.

"EPA Regional Screening Levels (June 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017]

### Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia FV16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard Summary of Sediment Analytical Testing Results Table 5

Perfluorononoic acid (PFNA)	NA	mg/kg	0.000694J	0.000296J	0.000348J
Perfluorohexanesulfonic acid (PFHxS)	NA	mg/kg	0.00256	0.00136J	0.00164J
Perfluoroheptanoic acid (PFHpA)	NA	mg/kg	0.000526J	0.000469J	0.00034J
Perfluorobutanesulfonic acid (PFBS)	NA	mg/kg	0.000958U	U 666000.0	0.001 U
Perfluorooctanoic acid (PFOA)	1.261	mg/kg	0.00109J	0.000654J	0.00079J
Perfluorooctanesulfonic acid (PFOS)	$1.26^{1}$	mg/kg	0.041	0.0171	0.0145
Analyte:	Screening Level:	Sample Type	N	N	FD
	Screer	Sample Depth (ft.)	0.0-0.5	0.0-0.5	0.0-0.5
		Sample Date	06-Nov-17	19-Oct-17	19-Oct-17
		Sample ID	ESHEP-03-SD01-0-0.5	ESHEP-10-SD01-0-0.5	ESHEP-SD-DUP01-101917
		Location	03SD01	FUGSUF	TOPCOT
		PRL	ŝ	0	

Notes: Light Blue Shaded = Exceeds Screening Level

FD = Field Duplicate Sample

ID = Identification ft = Feet

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
 N = Normal Field Sample
 NA = Not applicable
 PRL = Potential Release Location

U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD). mg/kg = milligrams per kilogram PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

Screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\_search]

## Summary of Surface Water Analytical Testing Results Table 6

## Eastern West Virginia Regional Airport Shepherd Field (EWVRA), Martinsburg, West Virginia FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 167th Airlift Wing, West Virginia Air National Guard

				<u> </u>	
Perfluorononanoic acid (PFNA)	ΝA	NA	hg/L	0.0133	0.0125
Perfluorohexanesulfonic acid (PFHxS)	NA	NA	µg/L	0.432	0.353
(AqH19) biɔs ɔionstqənoroultı99	NA	٨A	hg/L	0.0882	0.0843
Perfluorobutanesulfonic acid (PFBS)	NA	400	hg/L	0.0164	0.0127
AO79+2O79	0.07	NA	hg/L	3.062	3.023
Perfluorooctanoic acid (PFOA)	0.07	NA	µg/L	0.142	0.133
Perfluorooctanesulfonic acid (PFOS)	0.07	NA	µg/L	2.92 J	2.89
Analyte:	dvisory:	water <sup>1</sup> :	Sample Type	z	FD
	Health Advisory:	EPA RSL Tapwater <sup>1</sup> :	Sample Depth (ft.)	0.5-0.5	0.5-0.5
			Sample Date	06-Nov-17	06-Nov-17
			Sample ID	ESHEP-03-SW01-110617	ESHEP-SW-DUP01-110617
			Location	10101350	TOMCED
			PRL		1

Notes: Light Blue Shaded = Exceeds Health Advisory

Underlined results exceed the EPA RSL standard. FD = Field Duplicate Sample

ft = Feet

ID = Identification

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
 N = Normal Field Sample
 NA = Not applicable
 PRL = Potential Release Area

μg/L = micrograms per liter

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry Health Advisory from USEPA Office of Water, 2016a and 2016b, Health Advisories (HAs) for drinking water.

"EPA Regional Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-risl-generic-tables-november-2017]

## Table 7

# FY16 Phase I Regional Site Inspections for Perfluorinated Compounds SI Screening Criteria

167th Airlift Wing, West Virginia Air National Guard, Martinsburg, West Virginia

Parameter	Chemical Abstract Number	USEPA Regional Screening Level Table (November 2017)a	Screening Level ole er 2017)a	Air Force Guidance for Soils and Sediments <sup>b</sup> (µg/kg)	USEPA Health Advisory Drinking Water (Surface Water or or Groundwater)
		Residential Soil (µg/kg)	Tap Water (µg/L)f		
Perfluorobutane sulfonate (PFBS)	375-73-5	1,300,000 <sup>d</sup>	400 <sup>e</sup>	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	1,260	*20 0
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	1,260	0.0
Notes:					

<sup>a</sup> USEPA Regional Screening Levels (USEPA, 2017a).

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

<sup>c</sup> USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA) and USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). <sup>d</sup> PFBS RSL (based on a THQ of 1.0) for Residential Soil concentration presented in the SI Work Plan (Amec Foster Wheeler, 2017) was 1,600,000 µg/kg based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in November 2017,

<sup>3</sup> PFBS RSL (based on a THQ of 1.0) for Tap Water presented in the SI Work Plan (Amec Foster Wheeler, 2017) was 380 µg/L based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in November 2017.

Only groundwater and surface water were sampled during the SI, but analytical results have been compared to the tap water screening levels.

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

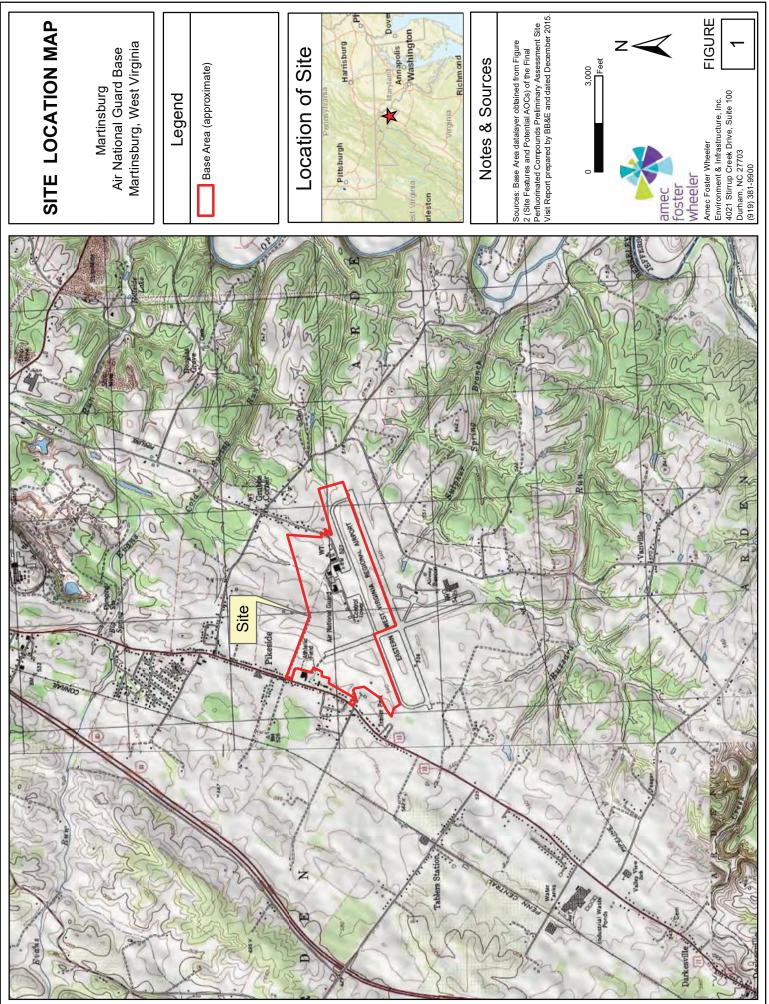
NL = not listed

µg/kg = micrograms per kilogram

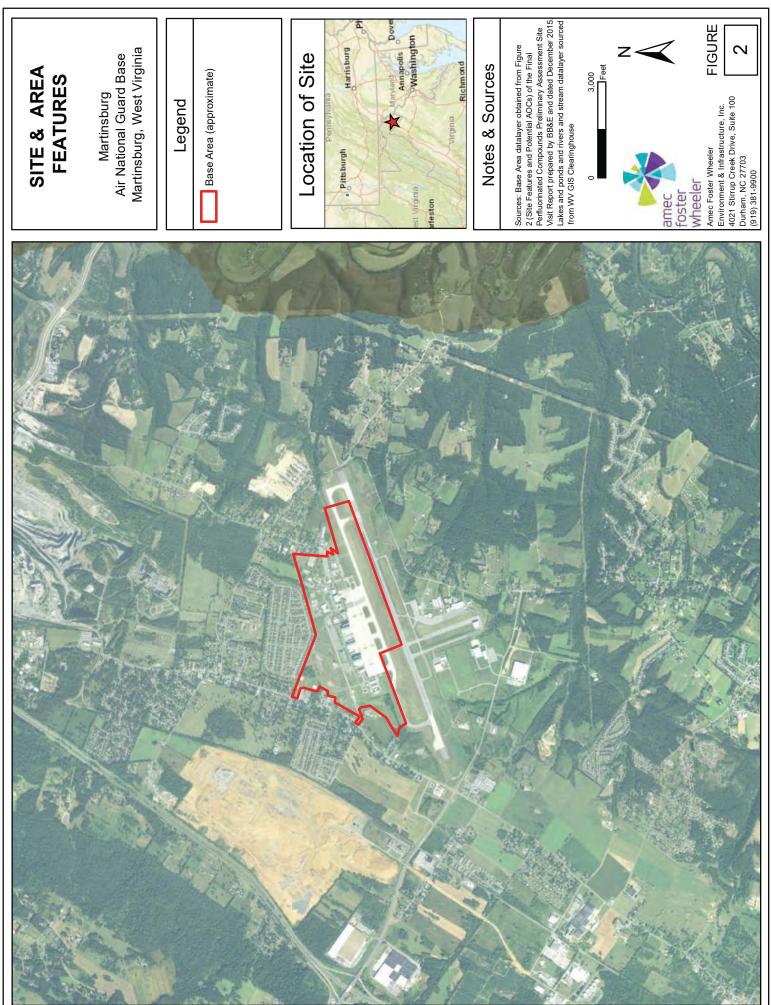
µg/L = micrograms per liter

**FIGURES** 

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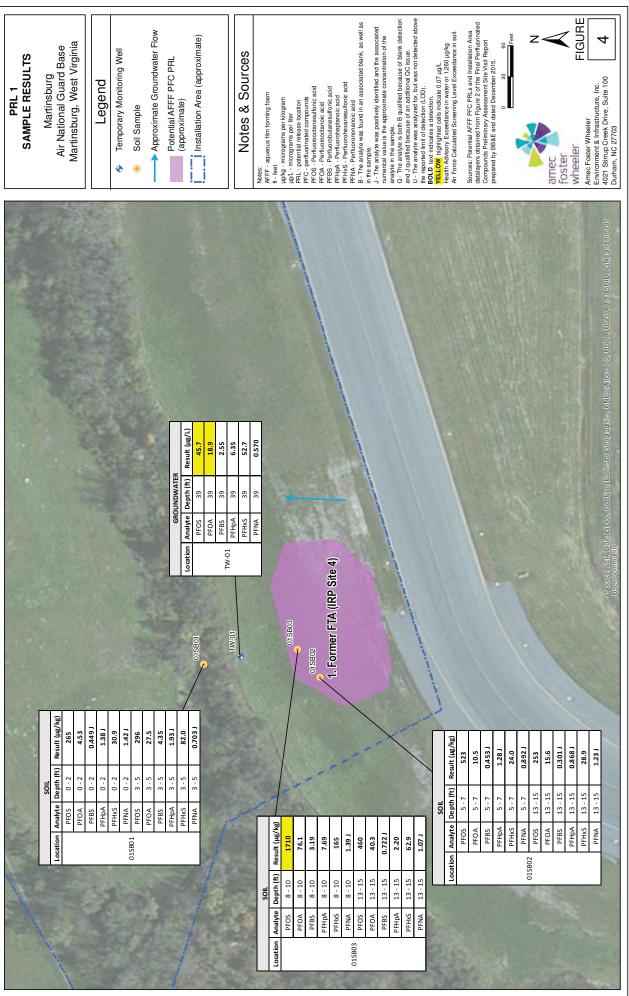
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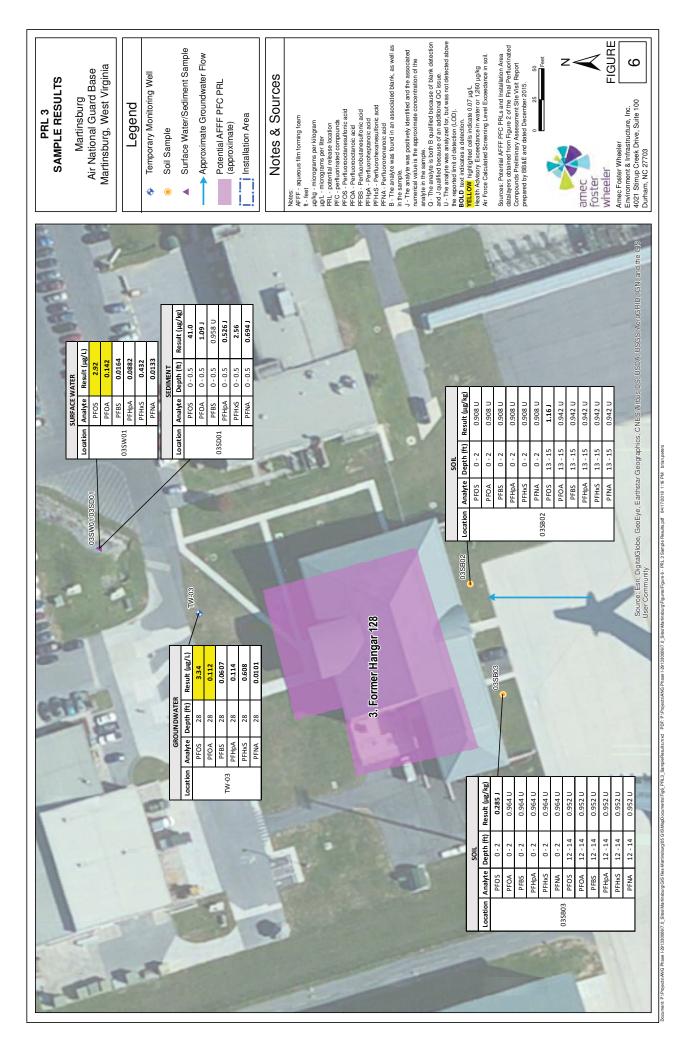


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PRL 2 SAMPLE RESULTS Martinsburg Air National Guard Base Martinsburg, West Virginia Legend Temporary Monitoring Well Soil Sample Potential AFF PFC PRL (approximate) Installation Area (approximate)	Potection of the second
GROUNDWATER           Location         Analyte         Depth (H)         Result (gg/L)           Location         Analyte         Depth (H)         Result (gg/L)           TVV-02         PFIS         35         0.0331           PFIA         35         0.0031         PFIA           PFIA         35         0.0031         PFIA	and and any of the second s
and house and the second	Location Analysis PENA D25B03 PENA PENA PENA PENA PENA





ment Fr/Pejdeds/MD Phane 1213300007 Q. SharkharinduugGS field MartineburgGS (SIMApCounnetsFg7.PH.4. Stropebaultant) PDF: Fr/Pejdeds/MD Phane 121330007 Q. SharkharindurgFune F-RH.4. Strape Results of 4172018 2.0 PM bits



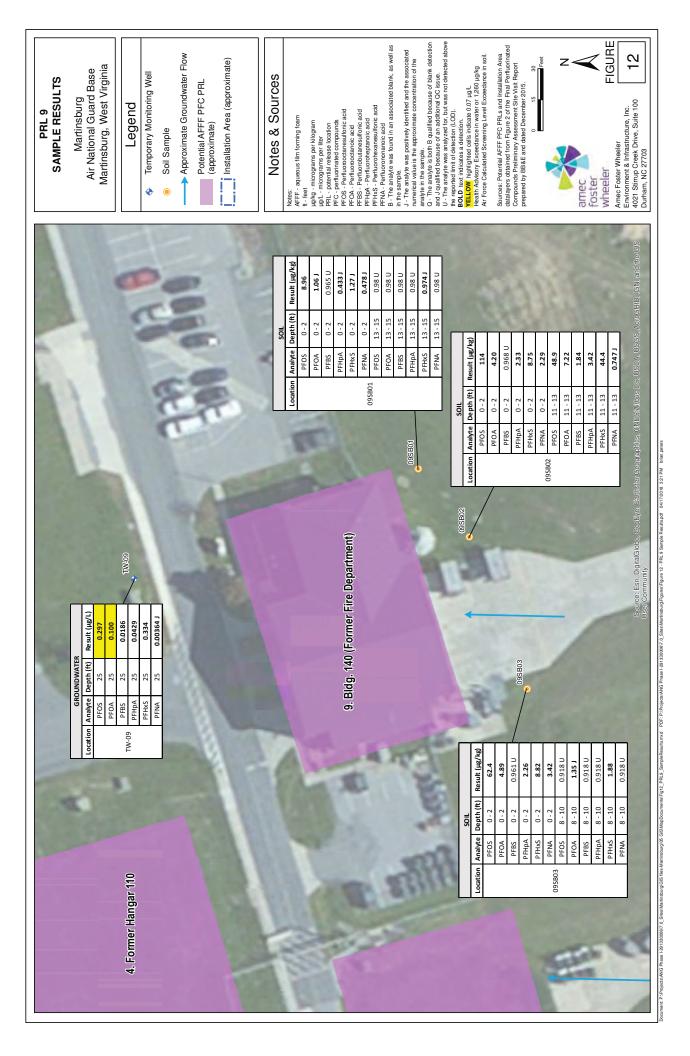


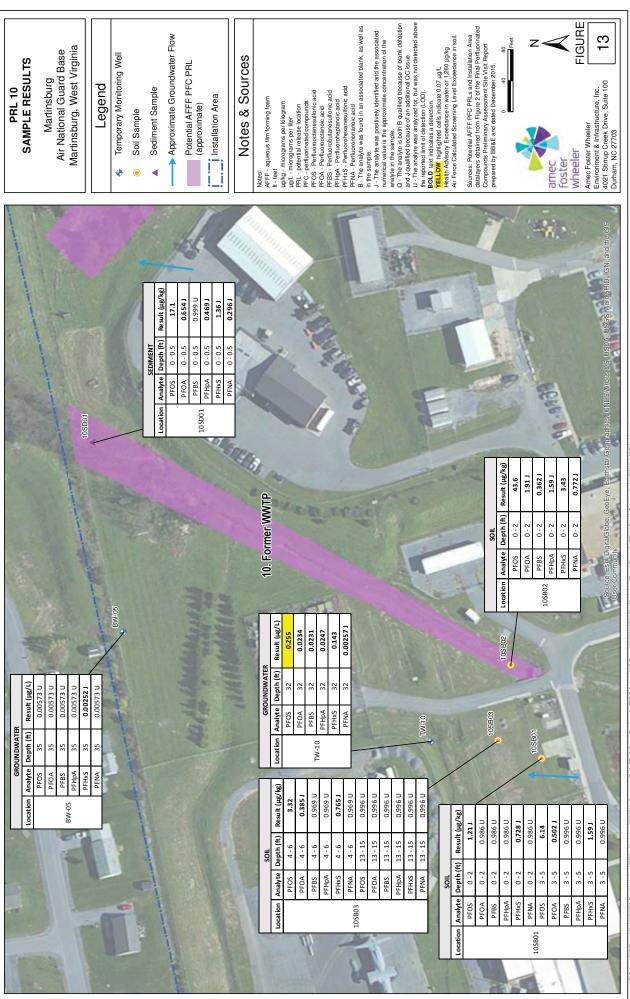
PDF: PhyloteckAG Phase 1291300097.0. Sies/MatrineburgGS (IS/MapDocuments/Eg.P.R.S. Sumplementsmum 7 PDF: PhyloteckAG Phase 1291300097.0. Sies/MatrineburgEgunes/Figures 7 (18. Sample Realistic et al. 17. 2019) 2. Steven Structure 2. Steven Structure 2. Steven Steven Structure 2. Steven Steve

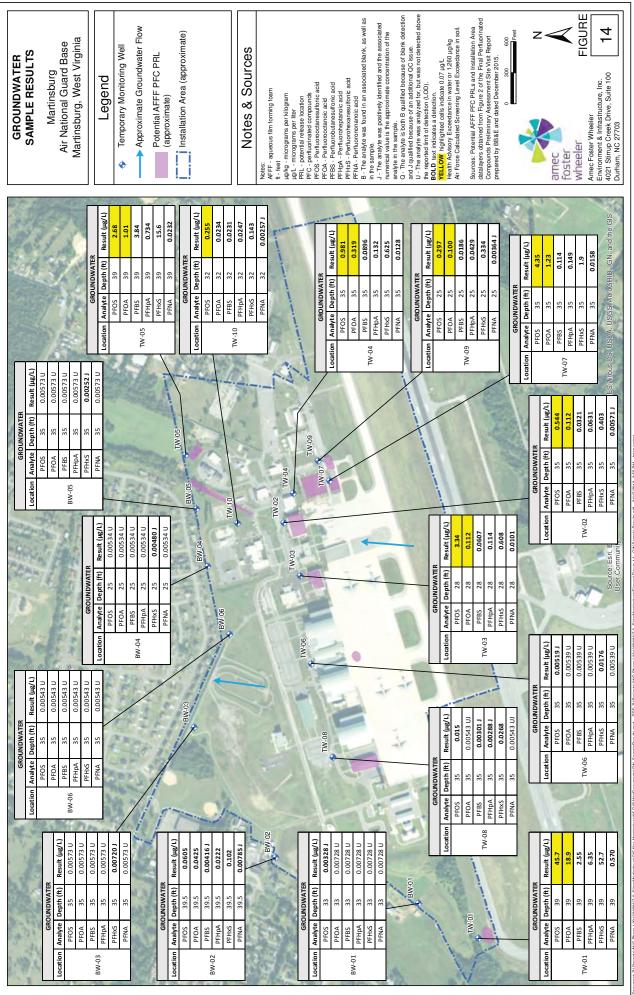


ment: PrippioteXHG Pman (2):3300870. SiteMahanabugGS (BeWathebround) GSMpDotomentsFig (0, PRT, SiteMahanabughateman (2, PSE) PrippioteXHG Pman (2):33008070. SiteMahanabugHaneSFigure 10 - PRL 7: SiteMahanabugHaneSFig (0, PRL 7): SiteMahanabugHanasFig (0, PRL 7): SiteMahanabugHanas









biat 2012 Standieffesuits mod PDF: P./Projectis/MND Phase 1-291330006/2/0 Stites/Martinsburd/Figures/Figure 14 - GW Sample Results pd 0417/2018 3:55 PM biat ment: P.(Projects) ANG Phase 1-291330006/7.0 Siles! Marfinsburd/GIS files - Martinsburd/05 GIS! MapDoc

### **APPENDIX A**

### SOIL BORING AND MONITORING WELL CONSTRUCTION LOGS

D E	SOIL CLASSIFICATION	L	E		SAMPLE	S			MONITORING WELL	_
P T H	AND REMARKS	E G E	L E V	BLOW CT PER 6	SAMPLE	T Y P E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	D E P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	Ē	(ppm)	R Y (inch)		н – о
	CLAY, some Silt, little fine gravel, loamy (CL), brown, homogenous, abundant roots, organics, moist, moderately plastic, slow dilatancy, low toughness, low dry strength, medium stiff				S-1 ESHEP-01SB01-0-2					-
			لورورول		ESHEP-01SB01-3-5		0.0	70/60	-	-
					ESHEF-013B01-3-3				Color change from brown to light brown at 3 ft bgs	-
- 5	Same as above			-					-	_ 5
	Gray limestone		-				0.0	24/24	Refusal at 7 ft	-
			_						bgs -	-
									-	10
			_						-	-
									-	_
									-	-
- 15									-	_ 15
			_						-	-
- 			_						-	-
									-	20
			_	-					-	-
2 – –			_						-	-
									-	-
- 25-			<u> </u>							25
START END DA DRILLE	R: Cascade NORTHING: 2262	33.2609 ft.							ITORING WELL RECOR	RD
- 20- - 20-                     	DD: Roto Sonic HORIZONTAL DATUM: DIA.: 4" OD PRL 1	16.3064 ft.		Pro	pject No: 291 ecked By: SH				ir National Guard Base Boring No. 01SB	01
EXPLORA MAY DIFFE	ED BY: Sean Hulburt ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AN ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS	D AT OTHER		ar	nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824	4
MAY BE G	RADUAL.								Page 1 of 1	

D E	SOIL CLASSIFICATION	L	E		SAMPLE	S			MONITORING WELL	
P T	AND REMARKS	E G	L	BLOW CT PER		Ţ		RECOVERY	CONSTRUCTION DETAILS AND REMARKS	D E P
H (ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	V (ft)	PER 6 IN	SAMPLE ID	T P E	PID (ppm)	V E Y (inch)		т Н
	Silty fine to coarse grained SAND and coarse angular GRAVEL; [FILL], red, Roots and organics top 1 ft. Some clay from 3-5ft.			_	S-1 ESHEP-01SB02-0-2		0.0	60/60		  5
  	CLAY, some well-graded angular Gravel (broken boulder fragments), little fine to coarse grained sand and silt (CL), tan, homogenous, occasional orange oxidation mottling., moist, moderately plastic, slow dilatancy, moderate toughness, medium dry strength, stiff			-	S-2		0.0	60/60		
	Same as above			-	S-3 ESHEP-01SB02-13- 15		0.0	60/60		
- 15- 				-			-		Stopped at 15 ft bgs	15
 - 20 				_						_ 20 
- 25				_						25
END DA DRILLE EQUIPM METHC HOLE D SITE:	R:     Cascade     NORTHING:     226192.       MENT:     Prosonic 10sdr7     EASTING:     -495501.       DD:     Roto Sonic     HORIZONTAL DATUM:		-	Pre Pro		rtin	sbu	irg A	ITORING WELL RECON ir National Guard Base Boring No. 01SB	
EXPLORA	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	AT OTHER "		ar	mec foster	W	he	eler	271 Mill Road Chelmsford, MA 0182 Page 1 of 1	4

LORING\_AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18

D E	SOIL CLASSIFICATION							R						
P T H	AND REMARKS	G E	L E V	BLOW CT PER 6 IN	SAMPLE	T Y E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P T				
(ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	ÎN	ID	E	(ppm)	R Y (inch)		H H				
Ű	CLAY and angular coarse Gravel, some fine to coarse sand and silt; [FILL], grass and roots in upper 6 inches				S-1									
			-						-	-				
			_	1			0.0	60/60						
			_	-										
			-	-					-	-				
- 5 -	Same as above			-			-			_ 5				
			-	-						-				
			_	-						-				
			_	-	ESHEP-01SB03-8-		0.0	60/60		_				
	CLAY, some coarse angular Gravel, trace fine to medium sand; possible base construction fill (CL), tan, homogenous, some oxidation mottling, moist, slightly plastic, slow		_		10		0.0							
- 10-	dilatancy, low toughness, low dry strength, medium stiff									10				
	Same as above		_		S-3									
			-				0.0	60/60						
			_		ESHEP-01SB03-13 15	-				_				
			_	1					-					
- 15-		¥/////Я		1					Stopped at 15 ft bgs	_ 15				
			-	-						-				
			-	-						-				
			-	-					-	-				
			_	-						-				
- 20-				-						_ 20				
			-	-						_				
			_	_						_				
			_											
			_											
- 25-										25				
20-						_	_							
END DA		1407 8				G	/ M	ON	ITORING WELL RECOR	RD				
EQUIPN	METHOD: Roto Sonic HORIZONTAL DATUM:				Project: Martinsburg Air National Guard Base									
HOLE D SITE:						Project No: 291330006 Checked By: SH Boring No. 01SB03								
THIS RECO EXPLORAT MAY DIFFE	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER 1		ar	nec foster	W	he	eler	271 Mill Road D Chelmsford, MA 0182	4				
MAY BE GF									Page 1 of 1					

LORING\_AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18

D		1	E		SAMPLE	S						
E P	SOIL CLASSIFICATION AND REMARKS	E	L	DI CIT		Ĺ		R	MONITORING WELL CONSTRUCTION DETAILS	D E		
T H		G E	E V	BLOW CT PER 6 IN	SAMPLE	T Y E	PID	RUCOVURY	AND REMARKS	P T		
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	ÎN	ID	E	(ppm)	R R Y (inch)		H		
- `0 -	Organic rich CLAY, some Silt, some well-graded Sand				0.4			(incit)		0		
	(OL/OH), dark brown, homogenous, roots organics, moist, slightly plastic, slow dilatancy, low toughness, stiff				S-1							
									-			
	Coarse GRAVEL, some Clay, little well-graded sand and			-			0.0		-			
	silt (GC), light brownish gray, fine to coarse grained, stratified, angular, moist						0.0	60/60				
									-			
				-					-	-		
										_ 5		
- 5 -	Same as above			1	S-2		1		-	- 5		
				-					-	-		
								60/60	-	-		
			L .	-			0.0	00/00	-	-		
	Limestone boulder											
				-					-	-		
- 10-				4					-	10		
	Same as above				S-3							
				1					-	-		
									-			
							0.0	60/60				
	CLAY, some well-graded sand, little fine gravel (CH), light			-	ESHEP-02SB01-13- 15		0.0		-	-		
	brown, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff				15				-			
- 15-				-			1		Stopped at 15 ft	15		
			L .						bgs	_		
				-					-			
			L .						_			
				-					-	-		
- 20-									_	_ 20		
20												
				-					-	-		
				-					-	-		
									_			
- 25-		1	L _							25		
START END DA	DATE: 10/27/2017 GROUND ELEVATION: ft. TE: 10/27/2017 VERTICAL DATUM:			S		G	/ M	ON	ITORING WELL RECOF	חא		
DRILLE			-						ir National Guard Base			
METHO	D: Roto Sonic HORIZONTAL DATUM:				ject No: 291					04		
HOLE D	PRL 2			Ch	ecked By: SH		_		Boring No. 02SB			
LOGGED BY: Sean Hulburt												
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES					amec foster wheeler D Chelmsford, MA 01824							
MAY DIFFE MAY BE GE	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	TWEEN ST	RATA		9.11.12	1						

LORING\_AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18

ſ	D			E		SAMPLES				MONITORING WELL			
	E P	SOIL CLASSIFICATION AND REMARKS	L E	L	BLOW		-		RE	CONSTRUCTION DETAILS	DE		
	T H		G E	E V	BLOW CT PER 6	SAMPLE	Ϋ́	PID	RECOVERY	AND REMARKS	E P T		
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	Υ Ρ Ε	(ppm)	R R Y (inch)		н		
ł	- 0	Well-graded SAND and GRAVEL, some clay, light brown;				6.1	Т		(		- 0		
		[FILL]				S-1 ESHEP-02SB02-0-2							
					-					-			
								0.0	60/60				
ľ					1					-			
					-					-			
											_		
ľ	- 5	CLAY, some Sand, trace coarse gravel (CH), brown,			1	S-2	T	1		-	_ 5		
		homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff								-			
ł									60/60	-			
								0.0	60/60	-			
		Limestone boulder											
										-			
	- 10									-	_ 10		
	10	Same as above				S-3							
ł					-					-			
										_			
								0.0	60/60				
						ESHEP-02SB02-13-				-			
		CLAY, some well-graded Sand, little fine gravel (CH), light				15		0.0		_			
		brown, homogenous, dry, moderately plastic, no dilatancy, moderate toughness, high dry strength, very stiff											
ł	- 15				-			-		Stopped at 15 ft	_ 15		
										bgs			
18													
4/9/										-			
GDT										-			
LATE													
EMP					-					-			
FC T	- 20									-	_ 20		
L L L L													
GS.G					-					-			
GLO										-			
ORIN													
RG B										-			
ISBU										-			
<b>RTIN</b>													
₩ N	- 25	1			」			I		<u> </u>	25		
AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18													
IWEL	START END DA	DATE:         10/27/2017         GROUND ELEVATION:         ft.           ATE:         10/27/2017         VERTICAL DATUM:         VERTICAL DATUM:	S	DIL BORINO	G	/ <b>M</b>	ON	ITORING WELL RECOR	RD				
CK-N	DRILLE			Pre	ject: Mar	tin	nsburg Air National Guard Base						
IL-RC	METHO HOLE D	D: Roto Sonic HORIZONTAL DATUM:				ject No: 291	33	8000	6	Boring No. 02SB	02		
C-SO	SITE:	PRL 2 ED BY: Sean Hulburt			Ch	ecked By: SH							
AME						and the second				271 Mill Road			
UTHIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.						amec foster wheeler to Chelmsford, MA 01824							
LOR	MAY DIFFE												

D E	SOIL CLASSIFICATION	L	E	S	AMPLE	S			MONITORING WELL	D
P T	AND REMARKS	E G E	L E V	BLOW CT PER		Ţ	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P
H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N	(ft)	6 00	MPLE ID	Y P E	(ppm)	V E R Y (inch)		Т Н — 0
- 0	Fill CLAY, some well-graded Sand and Gravel		-	ESHEP	S-1 02SB03-0-2	2	0.0	60/60	-	U 
- 5	Same as above, tannish brown CLAY, some well-graded Sand, little fine to coarse gravel (CH), light brown, moist, moderately plastic, no dilatancy,		_		S-2		0.0			_ 5
	(CH), light brown, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, stiff		-	ESHEP	-02SB03-8- 10		0.0	60/60		-
- 10	Possible bedrock or boulder		_		S-3		-			_ 10 _
			-				0.0	60/60		-
- 15			-				-		Stopped at 15 ft bgs	15 
		-	-							- - - 20
		-	-							_
		_	-							25
END DA DRILLEI EQUIPN METHO HOLE D SITE:	R:     Cascade     NORTHING:     227895       MENT:     Prosonic 10sdr7     EASTING:     -491563       DD:     Roto Sonic     HORIZONTAL DATUM:	.8243 ft. 3.2847 ft.	- F F	<b>SOIL E</b> Project: Project N Checked	Ma lo: 291	rtin 133	sbu	rg A	ITORING WELL RECOM ir National Guard Base Boring No. 02SB	
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER TIM		amec	foster	W	hee	eler	271 Mill Road D Chelmsford, MA 0182	24

D E P	SOIL CLASSIFICATION	L	E L		SAMPLE	S		R	MONITORING WELL CONSTRUCTION DETAILS	D
T H	AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION	G E N	E V	BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	RUCOVURY	AND REMARKS	E P T H
(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)					Y (inch)		_ 0
	Silty angular GRAVEL; [FILL]			_	S-1 ESHEP-03SB02-0-2		0.0	60/60		-
- 5	Same as above			-			0.0	60/60	-	_ 5
 	Same as above		- ·	-						_ 10
	CLAY, some well-graded Gravel and Sand (CH), tannish brown, homogenous, moist, moderately plastic, no dilatancy,			-	ESHEP-03SB02-13- 15		0.0 0.0	60/60		_
- 15 	moderate toughness, medium dry strength, very stiff			-					Stopped at 15 ft bgs	15 
 - 20-   		-	 	_					-	20
		-		_					-	_
- 25-										25
END DA DRILLEI EQUIPM METHO HOLE D SITE:	R: Cascade NORTHING: 227749. /ENT: Prosonic 10sdr7 EASTING: -491981. D: Roto Sonic HORIZONTAL DATUM:		_	Pre Pro		tin	sbu	rg A	ITORING WELL RECOM ir National Guard Base Boring No. 03SB	
THIS RECO	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER T		ar	nec foster	W	hee	eler	D 271 Mill Road Chelmsford, MA 0182	4

Ē P		SSIFICATION	L	E L		SAMPLE	S		Ŗ	MONITORING WELL	
Р Т Н (ft)	SEE KEY SYMBOL S	REMARKS SHEET FOR EXPLANATION BREVIATIONS USED BELOW.	G E N	E V (ft)	BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	R E C O V E R Y (inch)	CONSTRUCTION DETAILS AND REMARKS	5
- 0	Silty angular GRAVEL; [F					S-1 ESHEP-03SB03-0-2		0.0	60/60		
- 5	Clayey GRAVEL; [FILL]					S-2					-
- - - 10 -	Same as above			- - -		S-3 ESHEP-03SB03-12-		0.0	60/60		-
- - - - -	Dark gray limestone			- - -		14		0.0	60/60	Stopped at 15 ft bgs	-
- - - 20 -	-		-	- - - -							-
END DA DRILLE EQUIPN	R: Cascade MENT: Prosonic 10sdr7	EASTING: -492	722.821 ft. 070.0554 ft.		Pre	ject: Mar	tin	sbu	rg A	ITORING WELL RECO	
METHO HOLE D		HORIZONTAL DATUM:				ject No: 291 ecked By: SH	33	000	ю	Boring No. 03S	<b>B</b> 0

D E	SOIL CLASSIFICATION	LE		SAMPLE	S		R	MONITORING WELL	D
P T H	AND REMARKS	E L G E	E BLC	DW TT SAMPLE	T Y P E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P T
(ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D (f	t)	N ID	Ē	(ppm)	R Y (inch)		н Н
	CLAY, some well-graded Sand and Gravel; [FILL], light brown		-	S-1 ESHEP-04SB01-0-2		0.0	60/60	-	-
	CLAY little silt, some well-graded Sand, little fine gravel (CH), dark reddish brown, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, stiff		_			0.0	00/00	-	- 5
- 5	Same as above		-	S-2				-	-
			-			0.0	60/60	-	- 10
- 10 	Same as above		-	S-3			60/60	-	-
 			-	ESHEP-04SB01-13- 15		0.0	60/60		
  - 20-		-	-					Stopped at 15 ft bgs	-
- 20 		-	_					-	20
  		-	-						25
END DA DRILLEI EQUIPM METHO HOLE D SITE:	R: Cascade NORTHING: 227759 /IENT: Prosonic 10sdr7 EASTING: -491226 /D: Roto Sonic HORIZONTAL DATUM:	.8928 ft. 6.9248 ft.	- Pi Pi		tin	sbu	rg A	ITORING WELL RECOF ir National Guard Base Boring No. 04SB	
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER TIMES	6	amec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 0182	4

D E	SOIL CLASSIFICATION	L	E		SAMPLE	S			MONITORING WELL	D
P T H	AND REMARKS	E G E	L E V	BLOW CT PER	CANDIE	T	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P
(ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Y P E	(ppm)	É R Y (inch)		Т Н
	CLAY and SILT, some well-graded Sand and Gravel, light browish tan; [FILL], light blue		-	-	S-1 ESHEP-04SB02-0-2		0.0	60/60	-	_
- 5 -	Same as above, moist			-	S-2					_ 5
 	CLAY, little silt and well-graded sand, trace fine gravel (CH), dark reddish brown, homogenous, moist, highly plastic, no dilatancy, moderate toughness, high dry strength, stiff		-	-			0.0	60/60	-	_
10 	Same as above			-	S-3 ESHEP-04SB02-11- 13		0.0	60/60	- - -	_ 10 _ _
 - 15	Possible boulder or bedrock			-			0.0		Stopped at 15 ft	- - - 15 -
		-	-	-						- - - 20
- 20		-		-						
		-	-							25
END DA DRILLE EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     227878.       MENT:     Prosonic 10sdr7     EASTING:     -491259       DD:     Roto Sonic     HORIZONTAL DATUM:			Pre Pro		rtin	sbu	irg A	ITORING WELL RECOM ir National Guard Base Boring No. 04SB	
EXPLORA <sup>®</sup>	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS. TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	AT OTHER TI		ar	nec foster	W	he	eler	271 Mill Road Chelmsford, MA 0182	4

D E P	SOIL CLASSIFICATION	L E G	E L		SAMPLE	S		R	MONITORING WELL CONSTRUCTION DETAILS	
T H	AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION	N N	E V	BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	R E C V E R Y (inch)	AND REMARKS	
(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELC Clayey GRAVEL and SAND, light brown; [FILL]	DW. D	(ft) 	_	<b>C</b> 1			Y (inch)		-
· -	-		-		S-1 ESHEP-04SB03-0-2		0.0	60/60		_
- 5	CLAY, little well-graded sand, trace fine gravel (CH),	light	_		S-2		-			_
-	reddish brown, homogenous, moist, moderately plasti dilatancy, moderate toughness, medium dry strength, stiff	c, no very	-							_
-	-		-				0.0	60/60		_
- 10	Same as above				S-3		-			_
	-		-				0.0	60/60		_
·	-		-		ESHEP-04SB03-13- 15					_
- 15	_						-		Stopped at 15 ft bgs	-
· -		-	-							_
- 20-	-	-	_							-
· -	-	-	-							_
-		-	_							_
- 25										
END DA	ER: Cascade NORTHING: MENT: Prosonic 10sdr7 EASTING: DD: Roto Sonic HORIZONTAL DATUM:	ft. 227848.8231 ft. 491128.7666 ft.		Pro		rtin	sbu	rg A	ITORING WELL RECO	
SITE:	DIA:: 4 OD PRL 4 ED BY: Sean Hulburt		-	Che	ecked By: SH				Boring No. 04SE	0
	CORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CON								271 Mill Road	

E	SOIL CLASSIFICATION	L	E	<u> </u>	SAMPLE	S			MONITORING WELL	D
P T H	AND REMARKS	E G E	L E V	BLOW CT PER	SAMPLE	T Y P E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P T
(ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	E	(ppm)	E R Y (inch)		
	CLAY, some well-graded Sand, trace gravel and silt (CH), light brown, homogenous, roots and organics topsoil from 0-6 inches, moist, highly plastic, no dilatancy, moderate toughness, medium dry strength, stiff		 · -	-	S-1 ESHEP-05SB01-0-2		0.0	60/60	-	-
	Angular coarse GRAVEL (broken cobbles and boulders), some Clay and well-graded Sand (GC), light brownish gray, coarse grained, homogenous, angular, moist			-			0.0		-	
- 5	Same as above		 ·	-	S-2		0.0	60/60	-	- 5
 - 10	Same as above		· _	-	S-3 ESHEP-055B01-10- 12				-	- - 10 -
	Possible boulder or bedrock		· -	-			0.0	60/60	-	-
- 15				-					Stopped at 15 ft bgs	_ 15 _ _
20  			· -	-					-	- - 20 -
		-		-					-	25
END DA DRILLE EQUIPM METHO HOLE D SITE:	IR:     Cascade     NORTHING:     229004       MENT:     Prosonic 10sdr7     EASTING:     -490862       DD:     Roto Sonic     HORIZONTAL DATUM:       DIA.:     4" OD       PRL 5	.3647 ft. 2.0128 ft.		Pro Pro		rtin	sbu	rg A	ITORING WELL RECOF ir National Guard Base Boring No. 05SB	
LOGGE	ED BY: Sean Hulburt ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS		ľ		nec foster				271 Mill Road	

ſ	D		1	E		SAMPLE	S				
	E P T	SOIL CLASSIFICATION AND REMARKS	L E G	L	BLOW CT PER				REC	MONITORING WELL CONSTRUCTION DETAILS	D E P T
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	V (ft)	PER 6 IN	SAMPLE ID	T P E	PID (ppm)	R E C O V E R Y (inch)	AND REMARKS	Н
	- 0	Gravel sand clay; [FILL]			-	S-1 ESHEP-05SB02-0-2					_ 0
		CLAY, some Sand, trace coarse gravel (CH), light brown, homogenous, moist, highly plastic, no dilatancy, moderate toughness, medium dry strength, stiff			-				60/60	-	
		Coarse GRAVEL, some Clay, little well-graded sand and silt (GC), light brown, homogenous, angular,, moist						0.0		-	_
	- 5	Same as 2-4 feet, very stiff			-	S-2 ESHEP-05SB02-5-7		-		-	_ 5
		Crushed limestone fragments			_			0.0	24/48	-	
					-					-	
	- 10									Stopped at 9 ft bgs	_ 10
										-	
					_					-	
					-					-	
					-					-	
	- 15				-					-	_ 15
					-					-	
T 4/9/18					-					-	
ATE.GD										-	
CTEMPL										-	
SPJ PF(	- 20				-					-	_ 20
LOGS.0										-	
BORING										-	
SBURG										-	
MARTIN	- 25										_ 25
-L-ENV	-			,							-
:K-MWEL	END DA DRILLE	R: Cascade NORTHING: 229021.								ITORING WELL RECOR	RD
SOIL-ROC	EQUIPN METHO HOLE D SITE:	D: Roto Sonic HORIZONTAL DATUM:	.3256 ft.		Pro	ject No: 291 ecked By: SH	33	8000	)6	ir National Guard Base Boring No. 05SB	02
	LOGGE THIS RECO EXPLORA	D BY: Sean Hulburt ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A	AT OTHER "			nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824	Ļ
LOR	MAY DIFFE MAY BE GI	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	I WEEN ST	KAÍA							

D E	SOIL CLASSIFICATION	L E		SAMPLE	S			MONITORING WELL	D
P T H	AND REMARKS	E L G E E V	BLOW CT PER 6 IN	SAMPLE	T Y P E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D (ft)	6 IN	ID	P E	(ppm)	E R Y (inch)		Т Н 0
- 0  	CLAY, little well-graded sand, trace silt and fine gravel (CH), light brown, homogenous, roots, dark brown topsoil from 0 to 6 in, moist, highly plastic, no dilatancy, high toughness, medium dry strength, very stiff		-	S-1 ESHEP-05SB03-0-2				-	-
	Same as above		-	S-2			60/60	-	- 5
 - 10 	Same as above, increasing gravel below 12 feet		-	S-3				-	- - - -
  - 15			-	ESHEP-05SB03-13- 15		0.0	60/60	Stopped at 15 ft	- 15
  - 20-		-	-					-	20
  - 25			-					-	-
									25
START END DA DRILLE FOUIPI	DATE: 10/23/2017 GROUND ELEVATION: ft. ATE: 10/23/2017 VERTICAL DATUM:		S		G /	M		ITORING WELL RECOR	חא
METHO HOLE D	R:     Cascade     NORTHING:     229046.       MENT:     Prosonic 10sdr7     EASTING:     -490927       DD:     Roto Sonic     HORIZONTAL DATUM:		Pre Prc		tins	sbu	rg A	ir National Guard Base Boring No. 05SB	
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS. TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER TIMES	ar	nec foster	w	nee	eler	271 Mill Road Chelmsford, MA 0182	4
								Page 1 of 1	

D E P	SOIL CLASSIFICATION	L E G	E L		SAMPLE	S		R	MONITORING WELL CONSTRUCTION DETAILS	
T H	AND REMARKS	E N	E V	BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	R E C O V E R Y (inch)	AND REMARKS	5
(ft) 0 —	OF SYMBOLS AND ABBREVIATIONS USED BELOW. Organic Soil with Gravel (OL) Loamy topsoil, dark brown, homogenous, moist, non-plastic, stiff	D	(ft)	-	S-1 ESHEP-06SB01-0-2			(inch)		-
-	Same as above		-		ESHEP-06SB01-0-2		0.0			_
-			-				0.0	60/60		_
-			-	-						_
_			-							-
- 5	Cobbles, gravel, clay; [FILL], light brown				S-2					+
			_				0.0			
_	CLAY, some well-graded Sand (CH), light brown, homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff		_	_			0.0	60/60		_
_			-	-						_
10-	Same as above			-						+
-			=	-	3-3					-
_			-				0.0	60/60		-
_			-	-	ESHEP-06SB01-13- 15					_
_			-							-
15—										Ť
			-							
_			-	-					Stopped at 18 ft	_
_		-	-	_					bgs	_
20-				-						+
-			-	-						_
_			-	-						-
_			-							_
-			-							-
25–1				J		1				
START END DA DRILLEI		0.7675 ft.							ITORING WELL RECO	DR
	MENT: Prosonic 10sdr7 EASTING: -49310 DD: Roto Sonic HORIZONTAL DATUM:	07.0218 ft.		Pro	ject No: 291				ir National Guard Base Boring No. 06S	Bu
SITE:	PRL 6 ED BY: Sean Hulburt		-	Che	ecked By: SH			_		
LOGGE									271 Mill Road	

D E P	SOIL CLASSIFICATION	LE	E L		SAMPLE	S		R	MONITORING WELL	
Р Т Н (ft)	AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW	G E N	L E V (ft)	BLOW CT PER 6 IN	SAMPLE ID	ΤΥΡΕ	PID (ppm)	R E C O V E R Y (inch)	CONSTRUCTION DETAILS AND REMARKS	
0 -	Fill GRAVEL and CLAY, light brown to dark gray; [FILL]				S-1 ESHEP-06SB03-0-2				 	-
-				-	ESHEP-06SB03-3-5		0.0	60/60		_
5 -	Dark gray limestone				S-2				Rock at 5 ft bgs	-
-							0.0	60/60		_
-				_						_
10									Stopped at 10 ft bgs	+
-										_
- 15—		-								-
-		-		-						_
-				-						_
20										-
-		-		-						_
-		-		-						_
25										
end da Drillef Equipn Metho Hole d Site:	R: Cascade NORTHING: 227 IENT: Prosonic 10sdr7 EASTING: -49 ID: Roto Sonic HORIZONTAL DATUM: DIA.: 4" OD PRL 6	7354.4468 ft. 3305.1215 ft.		Pre Pro		tin	sbu	rg A	ITORING WELL RECON ir National Guard Base Boring No. 06SB	
OGGE	D BY: Sean Hulburt DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS		Ī		nec foster	14/	boo		271 Mill Road D Chelmsford, MA 0182	

D E		1	Е		SAMPLE	S				
Р	SOIL CLASSIFICATION AND REMARKS	L E G	L	BL OW				REC	MONITORING WELL CONSTRUCTION DETAILS	D E
T H		E	V	BLOW CT PER 6 IN	SAMPLE	T Y P E	PID	RECOVERY	AND REMARKS	P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	IN	ID	Ë	(ppm)	R Y (inch)		Н
- 0 -	Gravel, sand, clay; [FILL]		* -	1 -	S-1	Т				- 0
	Topsoil from 0-6 in, light brown loam		× ×	-					-	-
			×				0.0			
	Same as above, trace boulders of up to 2 ft			]				60/60	-	
			× X	-					-	-
			× -						-	_
										_
- 5 -	Same as above		 X	1	S-2				-	_ 5
	CLAY some well-graded Sand little fine to coarse angula		-	-	ESHEP-07SB02-6-8		0.0		-	-
	CLAY, some well-graded Sand, little fine to coarse angula gravel (CH), light brown, homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry									
	strength, very stiff						0.0	60/60		
			-	-					-	-
			-	-					-	-
										_ 10
- 10-	Same as above			1	S-3				-	_ 10
	Possible bedrock, or large boulder, dark gray limestone	_ ////	4	-			0.0		-	-
										_
			-				0.0	60/60		
				-					-	-
			-	-					-	-
45			-							_ 15
- 15-				1					Stopped at 15 ft bgs	_ 13
				-					-	-
									-	
			_	-					-	-
				-					-	-
										_ 20
- 20-				1					-	_ 20
				-					-	-
			_							_
			_	-					-	-
				-					-	-
- 25-										25
2.5										
	DATE: 10/25/2017 GROUND ELEVATION: ft.			~						
END DA	R: Cascade NORTHING: 2276	27.2372 ft.							ITORING WELL RECOF	<u>KD</u>
METHO	D: Roto Sonic HORIZONTAL DATUM:	70.2854 ft.			ject No: 291					~~
HOLE D	PRL 7				ecked By: SH	_	_		Boring No. 07SB	02
	D BY: Sean Hulburt				A second second				271 Mill Road	
EXPLORA	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AI INTEREACES RETWIEEN STRATA ARE ADDROXIMATE TRANSITIONS	ID AT OTHER		ar	nec foster	W	nee	eler	Chelmsford, MA 01824	4
MAY DIFFE	R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS RADUAL.	SCI WEEN SI	1171							

1	D			-		SAMPLE	S				
	E P T	SOIL CLASSIFICATION AND REMARKS	L E G E	E L E V	BLOW CT PER 6 IN		т	PID	RECOVERY	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	D E P
	H (ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Ý P E	(ppm)	E R Y (inch)		Т Н 0
		CLAY, little well-graded sand, trace fine gravel (CH), light brown, homogenous, moist, highly plastic, no dilatancy, moderate toughness, medium dry strength, very stiff				S-1 ESHEP-07SB03-0-2					
					_					-	_
		Broken COBBLES and angular well-graded GRAVEL, little well-graded sand and clay (GC), dark gray, coarse grained,			-			0.0	60/60	-	-
		homogenous, moist								-	-
	- 5	Same as above				S-3		-			_ 5
					_	ESHEP-07SB03-7-9				-	_
								0.0	60/60	-	_
		Possible bedrock or boulder, dark gray limestone			_			0.0		-	_
	- 10	Same as above			-	S-3		-		-	- 10
								0.0	24/24	-	
					-					Stopped at 12 ft bgs, bedrock	_
					-					-	-
	- 15				-					-	_ 15
9/18					_					-	_
E.GDT 4/9/18		-								-	_
EMPLATE					_					-	_
J PFC T	- 20				-						_ 20
LOGS.GF					-					-	_
BORING										-	-
INSBURG					-					-	_
AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE	- 25			L _	_						25
WELL-EN	START END DA	DATE: 10/25/2017 GROUND ELEVATION: ft. ATE: 10/25/2017 VERTICAL DATUM:			S		G	/ M	ON	ITORING WELL RECOR	RD
ROCK-N	DRILLE EQUIPM METHC	R:     Cascade     NORTHING:     227598       MENT:     Prosonic 10sdr7     EASTING:     -491110       DD:     Roto Sonic     HORIZONTAL DATUM:		-	Pre		tin	sbu	rg A	ir National Guard Base	
MEC-SOIL	HOLE E SITE: LOGGE	DIA.: 4" OD PRL 7 ED BY: Sean Hulburt		-		ecked By: SH				Boring No. 07SB	03
RING	EXPLORA MAY DIFFE	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER		ar	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 0182	4
2	MAY BE G	RADUAL.									

DEP	SOIL CLASSIFICATION	LE	E L		SAMPLE	S		R	MONITORING WELL	
T H	AND REMARKS	L G E N D	E V	BLOW CT PER 6 IN	SAMPLE ID	T Y E	PID (ppm)	R E C O V E R Y (inch)	CONSTRUCTION DETAILS AND REMARKS	
(ft) 0 —	OF SYMBOLS AND ABBREVIATIONS USED BELOW.		(ft)	-				(inch)		-
-	Gray to tan clayey GRAVEL and COBBLE; [FILL]		- ·	-	S-1 ESHEP-08SB01-0-2		0.0	60/60		-
5 —	Same as above									-
-			_ :	_	S-2					_
-			_ ·	_			0.0	6/60		_
10	Same as above			-	S-3 ESHEP-08SB01-10- 12					_
-	Dark gray limestone		_ ·	-			0.0 0.0	60/60		_
- 15				-					Stopped at 15 ft bgs	-
			_ ·	-						
			- ·	_						-
end dat Driller Equipmi Method	t: Cascade NORTHING: 227547 ENT: Prosonic 10sdr7 EASTING: -493803 D: Roto Sonic HORIZONTAL DATUM:	7.0274 ft. 3.1047 ft.		Pre		tin	sbu	rg A	ITORING WELL RECO	
	PRL 8 ) BY: Sean Hulburt			Ch	ecked By: SH				271 Mill Road	50
XPLORATI	RD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS ON LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BI ADUAL.	AT OTHER 1		ar	nec foster	W	hee	eler	Chelmsford, MA 0182	24

D E	SOIL CLASSIFICATION	L	E		SAMPLE	S			MONITORING WELL	D
P T H	AND REMARKS	E G E	L E V	BLOW CT PER	SAMPLE	T	PID	RUCOVURY	CONSTRUCTION DETAILS AND REMARKS	E P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	T P E	(ppm)	Ě R Y (inch)		Т Н
- 0	Clayey SAND and GRAVEL, dark gray, trace cobbles; [FILL]			-	S-1 ESHEP-08SB02-0-2		0.0	60/60	-	
- 5	Same as above			_	S-2 ESHEP-08SB02-6-8		0.0	60/60	-	_ 5
 	Dark gray limestone			-						- 10
				-					Stopped at 10 ft bgs	_
· -			_ ·	-						_
- 15				-						- 15
- 20-				_						2
-				_						_
				_						25
END DA DRILLE EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     227355.       MENT:     Prosonic 10sdr7     EASTING:     -493657       DD:     Roto Sonic     HORIZONTAL DATUM:			Pre Pro		rtin 33	sbu	rg A	ITORING WELL RECON ir National Guard Base Boring No. 08SB	
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS / TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER 1		ar	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 0182	4

DED		SSIFICATION	L	E L		SAMPLE	S		R	MONITORING WELL	
P T H		REMARKS	E G E	E V	BLOW CT PER 6	SAMPLE	T Y E	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	
(ft)		HEET FOR EXPLANATION BREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	E	(ppm)	R Y (inch)		
0	Clayey GRAVEL and COE	BLES, dark gray to brown; [FILL]				S-1 ESHEP-08SB03-0-2					
-											-
-					1			0.0	60/60		-
-											-
_											_
5 —	Same as above				-	S-2	┼				+
-					-	5-2					_
_											_
_								0.0	60/60		_
- 10											
	Same as above					S-3					
						ESHEP-08SB03-12- 14		0.0	60/60		
-					1						-
+	Dark gray limestone							0.0			-
15					1					Stopped at 15 ft bgs	+
_					1						-
_					-						-
-											-
_											-
20-											-
_			-								-
-											_
_											_
_											_
25											
START E END DA1 DRILLER		GROUND ELEVATION: ft. VERTICAL DATUM: NORTHING: 227496	.5797 ft.							ITORING WELL RECO	R
EQUIPMI METHOD	ENT: Prosonic 10sdr7 D: Roto Sonic		.9818 ft.	-		ject: Mai ject No: 291				ir National Guard Base	
HOLE DI, SITE: LOGGEE	A.: 4" OD PRL 8 ) BY: Sean Hulburt					ecked By: SH			-	Boring No. 08SE	30
HIS RECO	RD IS A REASONABLE INTERPRE	TATION OF SUBSURFACE CONDITIONS			ar	nec foster	14/	her		271 Mill Road D Chelmsford, MA 0182	2⊿
	ION LOCATION. SUBSURFACE CC R. INTERFACES BETWEEN STRAT	NDITIONS AT OTHER LOCATIONS AND			u	nee justel	V V	100	-101	Chelmsford, MA 0182	-7

DE	SOIL CLASSIFICATION	L E E L		SAMPLE	ES		R	MONITORING WELL	D
P T H		G E V	BLOV CT PER 6 IN		T Y E	PID	RUCOVURY	CONSTRUCTION DETAILS AND REMARKS	E P T
(ft) - 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D (ft)		ID	Ê	(ppm)	R Y (inch)		і 0
-	CLAY, some well-graded Sand, trace silt and fine gravel (CH), light reddish brown, homogenous, topsoil 0-4-in,, moist, moderately plastic, no dilatancy, moderate toughness, high dry strength, stiff		_	S-1		0.0	60/60		_
- 5	Same as above, mottling below 7 feet		-	S-2		0.0	60/60	Note: decreasing sand below 5 ft bgs	5
- 10 -	Same as above		_	S-3					10
- 15— -			_	ESHEP-09SB01-13 15	-	0.0	60/60	Stopped at 15 ft bgs	- - - 15 -
- 20 -		-	-						20
end da Drille Equipn	R: Cascade NORTHING: 22765 MENT: Prosonic 10sdr7 EASTING: -49083	8.6939 ft. 18.9788 ft.	Pre	oject: Ma	rtin	sbu	rg A	ITORING WELL RECOI	25 RD
HIS RECO	DIA.: 4" OD PRL 9 ED BY: Sean Hulburt ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION:		Ch	oject No: 29 <sup>.</sup> ecked By: SH		_		271 Mill Road Chelmsford, MA 0182	
IAY DIFFE	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS E RADUAL.			iner jobiel				Page 1 of 1	

D E P	SOIL CLASSIFICATION	L	E L		SAMPLE	S		R	MONITORING WELL	D
T H	AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION	E G E N	E V	BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	F F
(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW. Topsoil loam (OL/OH), dark brown, moist, slightly plastic,	D	(ft) 		S-1			Y (inch)		- c
-	slow dilatancy, stiff			-	S-1 ESHEP-09SB02-0-2				-	-
-	COBBLES and well-graded sandy CLAY, gray and tan (CH)						0.0 0.0	60/60	-	_
-									-	-
- 5										_ 5
-	Same as above			_	S-2		0.0		-	_
-	CLAY, trace fine grained sand (CH), light reddish brown, moist, highly plastic, no dilatancy, moderate toughness, high dry strength, stiff								-	_
-							0.0	60/60	-	-
-				-					-	-
10-	Same as above, little cobble below 10 ft				S-3				-	_ 1 
-					ESHEP-09SB02-11- 13					
_							0.0 0.0	60/60	-	_
_	Dark gray weathered limestone			-					-	_
15		0 P (1) 10 P (1)							Stopped at 15 ft	-
-		-							-3-	-
-									-	-
-										
- 20		-							-	_ 2
-		-							-	_
_		-							-	-
-		-							-	_
-									-	-
- 25										12
END DA DRILLE	R: Cascade NORTHING: 227634.		_						ITORING WELL RECOP	RD
EQUIPN METHO HOLE D SITE:		9649 ft.		Pro	ject No: 291 ecked By: SH				Boring No. 09SB	802
J L.	D BY: Sean Hulburt		ŀ	2.10	5					
	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS /	AT THE		20	nec foster	141	hor		271 Mill Road D Chelmsford, MA 0182	

	)		1	E		SAMPLE	S				
E P	<b>)</b>	SOIL CLASSIFICATION AND REMARKS	LE	L	D. OW				R	MONITORING WELL CONSTRUCTION DETAILS	D E
T H			G E	E V	BLOW CT PER	SAMPLE	T Y P E	PID	RUCOVURY	AND REMARKS	P
(ft		SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	ID	P E	(ppm)	E R Y		T H
	() 0 —				-		-		(inch)		0
	-	Loamy topsoil (OL/OH), dark brown, homogenous, moist, soft				S-1					
ŀ	-				-	ESHEP-09SB03-0-2		0.0		-	-
		Well-graded SAND and GRAVEL, some Clay, tan; [FILL]									
F	-				1					-	-
								0.0	60/60		
F	-				1					-	1
ſ			$\boxtimes$								
	5 -			L _						-	5
		CLAY, some well-graded Sand, trace fine gravel (CH), light reddish brown, homogenous, moist, moderately plastic, no				S-2					
ŀ	-	dilatancy, moderate toughness, high dry strength, very stiff			-					-	-
F	-				1					-	-
								0.0	60/60		
F	-				1	ESHEP-09SB03-8- 10				-	-
L				L		10					
	10—			L _	-					-	10
		Dark gray limestone				S-3					
ŀ	-	-			-			0.0	24/24	-	-
F	-				1					Stopped at 12 ft bgs, bedrock	1
	_			L .							
F	-				-					-	-
	15—	-			1					-	15
_					1					-	1
GDT 4/9/18	_	-								-	_
10 T											
	-	-			-					-	-
LAT											
Ш Ш	-				1					-	-
ΩL,	20—										20
2 1	20										
S.G.	_	-			-					-	_
Log											
- ING	-				1					-	-
BOR											
RG L	-	1			1					-	1
ISBL				L.						-	
RTIN											
₩ - 2	25			L _							25
N U U											
JU ST/		DATE: 11/2/2017 GROUND ELEVATION: ft.					_				
	D DA ILLEI		I513 ft.	ŀ						ITORING WELL RECOP	<u>KD</u>
		MENT: Prosonic 10sdr7 EASTING: -490945.		-						ir National Guard Base	
HOI	LE D	DIA.: 4" OD				ject No: 291	აპ	000	0	Boring No. 09SB	03
N SIT	E: GGF	PRL 9 ED BY: Sean Hulburt		Ļ	Ch	ecked By: SH				<b>U</b>	
			T TI			and the second second				271 Mill Road	
	ORA1	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A	T OTHER "		ar	nec foster	W	hee	eler	Chelmsford, MA 01824	4
		ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET RADUAL.	WEEN ST	RATA							
	21						_			Paga 1 of 1	

- [	D		1	E		SAMPLE	S				
	E P T H	SOIL CLASSIFICATION AND REMARKS	L E G E	L E V	BLOW CT PER			PID	RECOVERY	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	D E P
	(ft) - 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	T P E	(ppm)	Ë R Y (inch)		Т Н 0
-	- 0	Well-graded SAND, some Clay and coarse Gravel (SC), brown, homogenous, angular, roots and organics,, moist			-	S-1 ESHEP-10SB01-0-2				-	-
	_	Well-graded GRAVEL (broken boulder) (GW), dark gray, fine to coarse grained, homogenous, dry						0.0 0.0 0.0	60/60	-	
-	-	CLAY, some well-graded Sand and Gravel (CL), tan, homogenous, moist, slightly plastic, no dilatancy, moderate toughness, medium dry strength, stiff			-	ESHEP-10SB01-5-7		0.0		-	5
-	- 5 -	See remarks; [FILL]			-	S-3		0.0	0/36	Encountered possible old leach field drain line at 8 ft bgs, removed chunk of small pvc	
-	- - 10				-					pipe. Encountered abundant sand – and water below 8 ft bgs. Made call to stop boring. Verified as built	_ 10
-	-				-					drawings to ensure no utility. -	-
-	- - 15				-					-	_ 15
GDT 4/9/18	-				-					-	-
	-				-					-	20
IG LOGS.GPJ PI	- 20				-					-	
AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE	-			 	-					-	
ENV MART	- 25				]						25
ROCK-MWELL-I	END DA	R: Cascade NORTHING: 228430 /IENT: Prosonic 10sdr7 EASTING: -491519		_	Pre		tin	sbu	rg A	ITORING WELL RECOR	
EC-SOIL-	HOLE D			r		ecked By: SH			.0	Boring No. 10SB	01
RING	EXPLORA	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS. TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND J ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE, TRANSITIONS BE RADUAL.	AT OTHER "		ar	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 01824	4

D		L	E		SAMPLE	S			MONITORING WELL	
E P	SOIL CLASSIFICATION AND REMARKS	EG	L	BLOW				REC	CONSTRUCTION DETAILS	D E
T H		E	V	BLOW CT PER 6 IN	SAMPLE	T Y P E	PID	RECOVERY	AND REMARKS	P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	Ň	ID	Ē	(ppm)	R Y (inch)		н
- 0 -	CLAY, some Sand and fine Gravel (CL), brown,		+ -	-	S-1					- 0
	homogenous, top 6in - organics, roots and plant matter,, moist, moderately plastic, no dilatancy, moderate				3-1		00	24/24	Moundation	
	toughness, medium dry strength, stiff						0.0	2.021	Moved sample location twice to	
				-		┢┻	-		avoid gravel refusal - Bottom of hand	
									boring at 2 ft bgs, no refusal	
				-					-	
- 5 -										_ 5
									-	
			-	-					-	
			- ·						-	
				-					-	-
			-	1					-	
- 10-			<u> </u>	-					-	10
									-	
				-					-	
									-	-
				-					-	
										_ 15
- 15				1					-	- 15
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- 20-			L -	-					-	_ 20
			- ·	-					-	-
			L .	_					-	
				-					-	
			L .						-	-
- 25			L				1	1	L	25
OTADT										
END DA				<u>S</u> (	DIL BORIN	G	/ <u>M</u>	ON	ITORING WELL RECOR	RD
	IENT: Hand Auger EASTING: -4913	39.83 ft. 39.2011 ft.	-	Pre	oject: Mar	rtin	sbu	rg A	ir National Guard Base	
METHO HOLE D					ject No: 291	33	8000	)6	Boring No. 10SB	02
SITE:	PRL 10 D BY: Sarah Levine			Ch	ecked By: SH					
	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION	SATTHE					6	1	271 Mill Road	
EXPLORA <sup>®</sup>	ICD IS A REASONABLE IN TERFRE CONDITIONS AT OTHER LOCATIONS AN TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AN R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS	D AT OTHER		ar	nec foster	W	nee	eler	D Chelmsford, MA 01824	1
MAY BE GI						_				

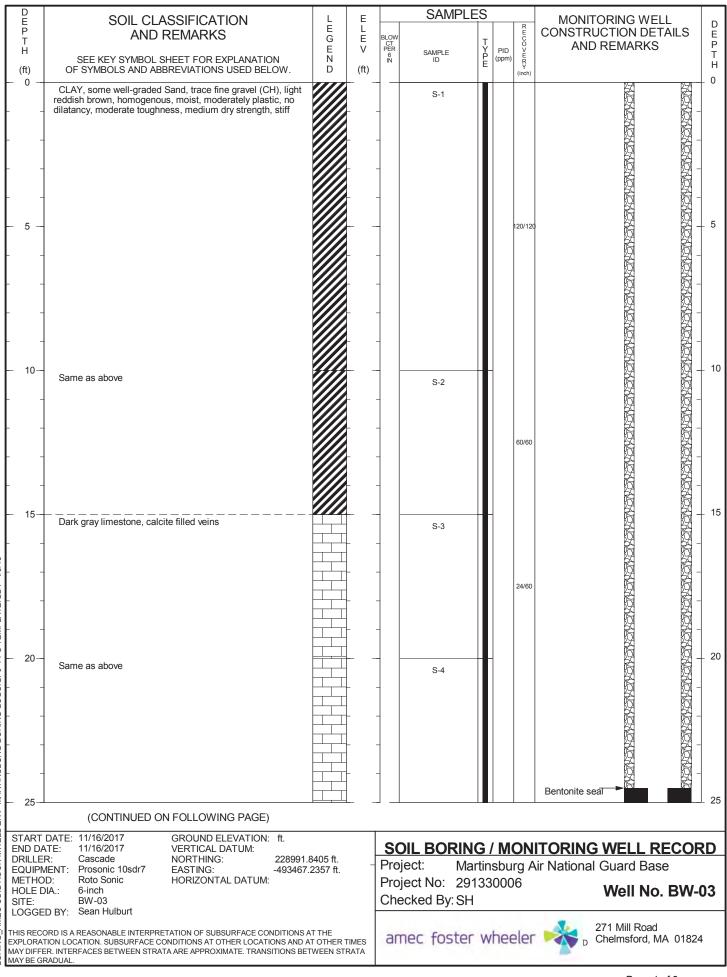
D E P	SOIL CLASSIFICATION	L	E L		SAMPLE	S		R	MONITORING WELL CONSTRUCTION DETAILS	D
T H	AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION	G E N	E V	BLOV CT PER 6 IN	SAMPLE ID	T Y E	PID (ppm	RECOVERY	AND REMARKS	E P T H
(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW. Broken BOULDER and COBBLES, little well-graded sand and silt (GW), dark gray, fine to coarse grained, angular, dry	D	 		S-1			(inch)	Topsoil from 0-0.5 ft bgs	_ 0
			-	-	ESHEP-10SB03-4-6		0.0	60/60		-
- 5	Lean CLAY, some Silt, little fine angular gravel and well-graded sand (CL), gray, homogenous, some organics, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff			_			-			5
-	Same as above, tan, stiff		-	-	S-2				-	_
-			-	-			0.0	60/60	-	_
- 10	Same as above			-	S-3		-			_ 10
-			-	_	ESHEP-10SB03-13- 15		0.0	60/60	-	_
- 15				_					Stopped at 15 ft bgs	- 1
-			-	-						_
- 20				-					-	20
-			_	_						_
-			-	_						_
- 25-										2
END DA DRILLEI EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     228485       MENT:     Prosonic 10sdr7     EASTING:     -491496       DD:     Roto Sonic     HORIZONTAL DATUM:			Pre Pre		rtin 133	sbı	irg A	ITORING WELL RECOM Air National Guard Base Boring No. 10SB	
HIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND <i>i</i> ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER 1		a	mec foster	W	he	eler	271 Mill Road Chelmsford, MA 0182	4

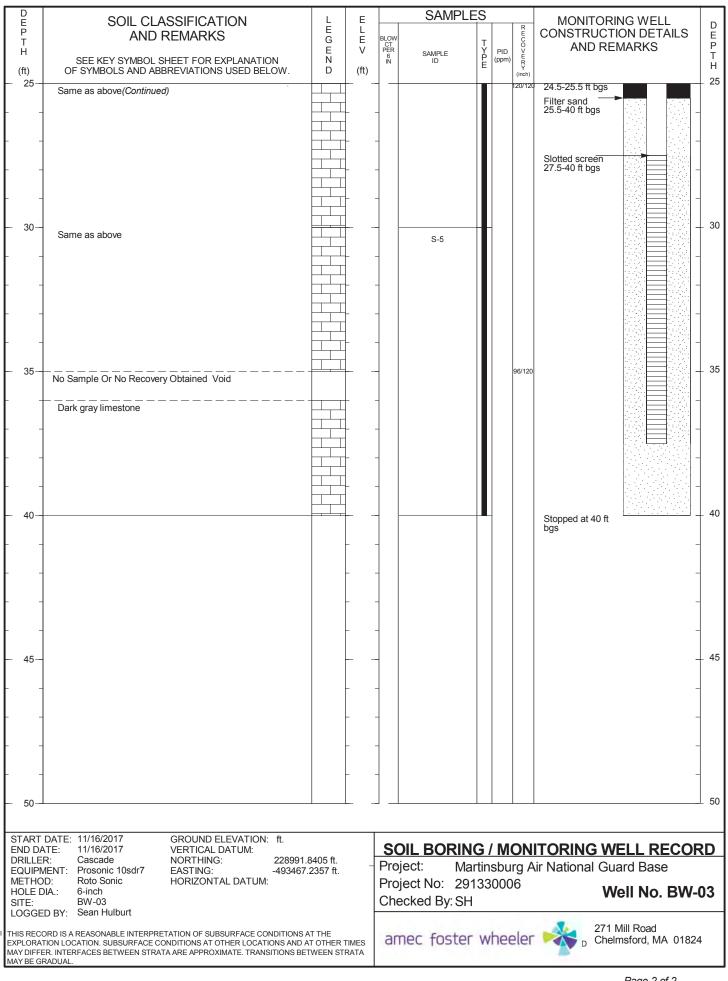
SOIL CLASSIFICATION	E	_	SAMPLI	ES		R		D
SEE KEY SYMBOL SHEET FOR EXPLANATION	G I E N	BLOW CT PER 6 IN	SAMPLE ID	T Y P	PID (ppm)	JCO VER	AND REMARKS	E P T H
OF SYMBOLS AND ABBREVIATIONS USED BELOW. Fat Clay with Sand (CH), light brown, no odor, homogenous,		it)	6.4			Y (inch)		н 0
moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, stiff		-	S-1				Open rock - borehole, no screened well constructed -	
		_			0.0	120/120	-	5
		-					-	10
Same as above		_	S-2				_	
		_					-	
		_					-	
		_			0.0	120/120	-	15
Same as above		-	S-3				- - - - - -	20
		-					-	
(CONTINUED ON FOLLOWING PAGE)					L	L		25
MENT: Prosonic 10sdr7 EASTING: -49516 DD: Roto Sonic HORIZONTAL DATUM: DIA.: 6-inch BW-01		- Pro Pro	ject: Ma ject No: 29	artin 133	sbu	rg A		
D BY: Sean Hulburt ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BI					he	eler	271 Mill Road Chelmsford, MA 01824	
	AND REMARKS         SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.         Fat Clay with Sand (CH), light brown, no odor, homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, stiff         Dark gray limestone	AND REMARKS     E       SEE KEY SYMBOL SHEET FOR EXPLANATION Or SYMBOLS AND ABBREVIATIONS USED BELOW.     Image: Comparison of the comp	AND REMARKS       E <th< td=""><td>Solution Service Contract Devices and the service of the service o</td><td>AND REMARKS SEE REY SYMBOL, SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USE BELOW. Fat Clay with Sand (CH), light brown, no dor, homogenous, most, incidentally plastic, no dilatancy, moderate toughness, medium dry strength, stiff Dark gray limestone Dark gray limestone Same as above Same as above CONTINUED ON FOLLOWING PAGE) DATE: 112/12017 TE: 112/12017 TE:</td><td>Solid CLASSIFICATION AND REMARKS SEE KEY SYMEOL SHEET FOR EXPLANATION OF SYMEOLS AND ABBREVIATIONS USED BELOW. The Clay with system the strength, stiff Dark gray limestone Same as above Same as abov</td><td>Some as above Same as above CONTINUED ON FOLLOWING PAGE CO</td><td>Solid DATE REMARKS SEE EXY SYNDOL SHEET FOR EXPLANATION OF SYNDOLS AND ARREWANDOWS INCOMENTATION Fat Claywin Sand CAh, lept hown to dor, honorate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance) and the synthesyn</td></th<>	Solution Service Contract Devices and the service of the service o	AND REMARKS SEE REY SYMBOL, SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USE BELOW. Fat Clay with Sand (CH), light brown, no dor, homogenous, most, incidentally plastic, no dilatancy, moderate toughness, medium dry strength, stiff Dark gray limestone Dark gray limestone Same as above Same as above CONTINUED ON FOLLOWING PAGE) DATE: 112/12017 TE:	Solid CLASSIFICATION AND REMARKS SEE KEY SYMEOL SHEET FOR EXPLANATION OF SYMEOLS AND ABBREVIATIONS USED BELOW. The Clay with system the strength, stiff Dark gray limestone Same as above Same as abov	Some as above Same as above CONTINUED ON FOLLOWING PAGE CO	Solid DATE REMARKS SEE EXY SYNDOL SHEET FOR EXPLANATION OF SYNDOLS AND ARREWANDOWS INCOMENTATION Fat Claywin Sand CAh, lept hown to dor, honorate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance), moderate to traditional control and the synthesis (no distance) and the synthesyn

Γ	D			-		SAMPLE	S				
	E P T H	SOIL CLASSIFICATION AND REMARKS	L E G E	E L E V	BLOW CT PER			PID	R ECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	D E P
	(ft) 25-	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	T P E				Т Н 25
	25-	Same as above(Continued)			1 -			0.0	120/120		- 20
ŀ	-	-			-					-	-
	-	-		-	_					-	
F	-	-			1					-	-
ŀ	-	-		-	-					-	
	30-	_								_	_ 30
	00	Same as above				S-4					
ŀ	-	-			-					-	
	-	-		- -	-					-	
ſ	-	]			1					-	
ŀ	-	-			-					-	
	35	_			_			0.0	120/120	-	_ 35
F	-	-		-	1					-	-
ŀ	-			_	-					-	-
	_	_								_	
ŀ	-	-			1					-	-
-	40-				-			-		Stopped at 40 ft	40
										bgs	
8	-				1					-	
GDT 4/9/18	-				-					-	
	-	-			_					-	-
PLATE											
TEM	-				1					-	-
PFC	45				-					-	45
S.GPJ	_	-								_	
LOGS											
RING	-	-			1					-	
G BO	-	-			-					-	-
SBUR											
RTIN	-				]					_	
⊿M >	50-	1		L							50
L-LEN											
-MWE	END DA		2110 #							ITORING WELL RECOP	RD
ROCK		MENT: Prosonic 10sdr7 EASTING: -495167		-						ir National Guard Base	
i l	HOLE [ SITE:					ject No: 291 ecked By: SH	33	000	Ö	Well No. BW-	01
MEC	LOGGE	ED BY: Sean Hulburt						_			
V DN E		CORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A ATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A		TIMES	ar	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 01824	1
LORII M M	IAY DIFF	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE SRADUAL.									

D E P	SOIL CLASSIFICATION	Ŀ	E		SAMPLI	ES	1	P	MONITORING		D
P T H	AND REMARKS	E G E	L E V	BLOW CT PER		T Y E	PID	RUCOVURY	CONSTRUCTION AND REMA		E P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	P   E	(ppm)	E R Y (inch)			H H
- 0	CLAY, some Sand, trace fine gravel (CH), light brown, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff			-	S-1			120/120	Native material backfill 0-21 ft bgs		- 5
 - 10 	Same as above				S-2						- 10
 - 15 				-				120/120			- 15
 - 20 	Same as above No Sample Or No Recovery Obtained Void				S-3				Bentonite seal 21-22 ft bgs Filter sand 22-40 ft bgs		20
END DA DRILLEI EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     228205       MENT:     Prosonic 10sdr7     EASTING:     -49472       D:     Roto Sonic     HORIZONTAL DATUM:	5.1649 ft. 5.9162 ft.		Proj Proj		artin 133	sbu	rg A	ITORING WEL Nir National Guard Well		
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND 3F. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS B	AT OTHER T		ап	nec foster	w	hee	eler	D 271 Mill D Chelmsfo	Road ord, MA 01824	4

D	SOIL CLASSIFICATION	L	E		SAMPLE	ΞS			MONITORING WELL	
E P T H	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	L E G E N D	L E V (ft)	BLOW CT PER 6 IN		T Y E		R E C O V E R Y (inch)	CONSTRUCTION DETAILS AND REMARKS	D E P T H
(ft) - 25								(inch)		25
	No Sample Or No Recovery Obtained Void(Continued)			_						
- 30  	Tan to gray dolomite/limestone			-	S-4				Slotted screen 30-40 ft bgs	30
- 35  				-				120/120		35
- 40  				_					Stopped at 40 ft	40
- 45				-						45
										50
END DA DRILLE EQUIPM METHO HOLE D SITE:	R: Cascade NORTHING: 22820 IENT: Prosonic 10sdr7 EASTING: -49472 D: Roto Sonic HORIZONTAL DATUM: IA.: 6-inch BW-02	5.1649 ft. 5.9162 ft.	_	Pre Prc		rtir 13	ารbเ	irg A	ITORING WELL RECORD Air National Guard Base Well No. BW-02	
THIS RECO	D BY: Sean Hulburt DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS E RADUAL.	AT OTHER		ar	nec foster	V	vhe	eler	271 Mill Road D Chelmsford, MA 01824	





MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18 AMEC-SOIL-ROCK-MWELL-ENV -ORING

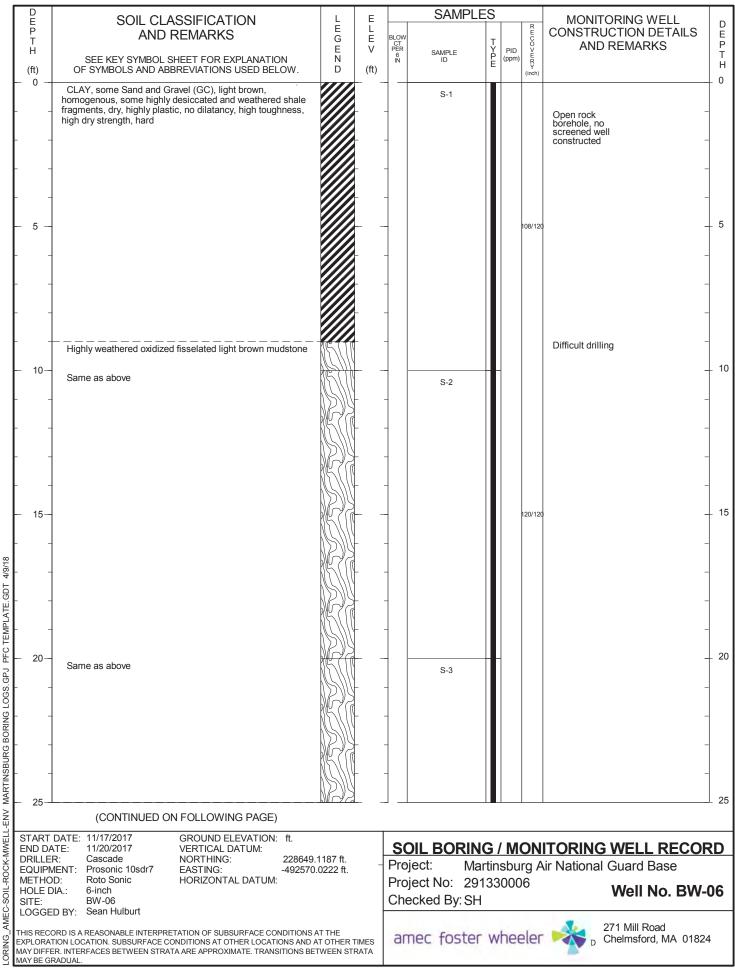
ſ	D			E		SAMPLE	S			
	E P	SOIL CLASSIFICATION AND REMARKS	E	L					R E	MONITORING WELL D CONSTRUCTION DETAILS E
	T H	AND REMARKS	G E	EV	BLOW CT PER 6 IN		T Y	PID	RECOVERY	AND REMARKS P
		SEE KEY SYMBOL SHEET FOR EXPLANATION	N		6 IN	SAMPLE ID		pm)	É R	T   T   H
	(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)				(i	inch)	
	Ū	CLAY, little well-graded sand (CH), light brown, no odor, moist, moderately plastic, no dilatancy, moderate				S-1				
		toughness, medium dry strength, very stiff								
					-					
							C	0.0	0/60	
					1					
							C	0.0		
					1					
	- 5			L _						
	Ũ	Same as above				S-2				
				ļ .						
					-					
				-						
					1					
				L						
				-						
	- 10			L _			C	).O 36	5/120	
ł					-					
				-						
		No Sample Or No Recovery Obtained Void			1		C	0.0		
								0.0		
		Dark gray limestone			1			0.0		
	- 15	No Sample Or No Recovery Obtained Void	<b>_</b>		-					
		No Sample of No Necovery Obtained Void								
					1					8 8 -
GDT 4/9/18										
T 4/							C	).0 c	)/60	Bentonite seal
										Filter sand
LATE										18-30 ft bgs
MM		Dark gray limestone	+				C	0.0		
L C T			$\left[ - \right]$							
H L	- 20				1	S-3				Slotted screen 20 20-30 ft bgs
GP.	. ]			1.						
000										
J DV			FFF -							
ORI										「「「「「「「」」」「「「」」「「」」「「」」「「」」「」「」」「」」「」」「
G B					-					
BUF										
<b>TINS</b>					1					
MAR	- 25			L _						25
N		(CONTINUED ON FOLLOWING PAGE)								
AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS GPJ PFC TEMPLATE	START	DATE: 11/7/2017 GROUND ELEVATION: ft.								
MWE	END DA	ATE: 11/9/2017 VERTICAL DATUM:	0500 0	ļ			<u>G / I</u>	MO	N	ITORING WELL RECORD
Ś	DRILLE			-						ir National Guard Base
L-RC	METHO	D: Roto Sonic HORIZONTAL DATUM:			Pro	ject No: 291	330	006	;	Well No. BW-04
SOI	HOLE D	BW-04			Che	ecked By: SH				
MEC	LOGGE	D BY: Sean Hulburt		ŀ						
		DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A			ar	nec foster	wh	وما	Pr	271 Mill Road Chelmsford, MA 01824
	MAY DIFFE	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE			u	nee justel	***11	CCI	CI	D Cheimstord, MA 01824
2	MAY BE GR									

D		L	Е		SAMPLI	ΞS				Π
E P	SOIL CLASSIFICATION AND REMARKS	E	L	PL OW		Ť		R	MONITORING WELL	ן ב ב
T H		G E	E V	BLOW CT PER 6 IN	SAMPI F	T Y P E	PID	R E C O V E R Y (inch)	AND REMARKS	Р
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	IN IN	SAMPLE ID	P   E	(ppm)	R Y		-
- 25-	No Sample Or No Recovery Obtained Void						0.0	(inch) 120/120		25
	No Sample Of No Recovery Obtained Void									
-			-	1						
			_	-						
-				1			0.0			
- 30-										30
									Stopped at 30 ft bgs due to	
				-					presence of ground water	
-			-	1						
			-	-					-	
									3	25
- 35-				1						50
				_						
				-					-	
			-	1						
L .				_						
- 40-				-					4	10
F -			-	1						
.			_	-					_	
				-					-	
				1						
- 45			L -	-					4	15
			-	-					-	
			_	-						
F -			-	1					-	
- 50-			L						5	50
START	DATE: 11/7/2017 GROUND ELEVATION: ft.									_
END D/	ATE: 11/9/2017 VERTICAL DATUM:	0E00 #	ļ						<b>ITORING WELL RECORD</b>	
	/IENT: Prosonic 10sdr7 EASTING: -491914		-						Air National Guard Base	
METHO HOLE D					ject No: 29		3000	)6	Well No. BW-04	Ļ
SITE:	BW-04 ED BY: Sean Hulburt			Ch	ecked By: SH					1
			[						271 Mill Road	
EXPLORA	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS / TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND /	T OTHER		ar	nec foster	W	he	eler	Chelmsford, MA 01824	
	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE									
			I						Page 2 of 2	_

D E P		SSIFICATION	L E E L		SAMPLE	S		R		TORING WELL	9
т Н		EMARKS	G E E V N		SAMPLE ID		PID (ppm)	R E C O V E R Y (inch)		D REMARKS	
(ft) 0 —		REVIATIONS USED BELOW.	D (ft)	)				Y (inch)			
-	homogenous, moist, modera moderate toughness, mediu	ately plastic, slow dilatancy,		_	S-1				Open rock		_
-				_					Open rock borehole, r well constr	io ucted	_
-				_							_
											_
5 —	light brownish yellow, fine to moist	II-graded sand and silt (GC), coarse grained, subangular,		_				120/120			1
_											_
											_
-											_
10-	Dark gray limestone with ca Aphanitic	alcite vein infilling			S-2						+
_											_
-				-							_
-				-							_
-				-							-
15—				_				120/120			+
-				-							-
-				-							-
-				-							-
-				-							_
20	Same as above			-	S-3						+
-				_							-
-				-							_
-				-							_
-				-							_
25-		FOLLOWING PAGE)									
	DATE: 11/7/2017	GROUND ELEVATION: ft.				~ '					
	R: Cascade //ENT: Prosonic 10sdr7	EASTING: -491	968.2076 ft. 357.4049 ft.	Pro	ject: Mar	tins	bu	rg A		G WELL REC al Guard Base	
METHO	DIA.: 6-inch BW-05	HORIZONTAL DATUM:			ject No: 291 ecked By: SH	330	000	6		Well No. B	W-0
HOLE D SITE:	D BY: Sean Hulburt			1 0							

Page 1 of 2

	D			-		SAMPLE	S				
	E P T H	SOIL CLASSIFICATION AND REMARKS	L E G E	E L E V	BLOW CT PER			PID	R E C O V E R Y (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	D E P
	(ft) 25-	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	ΤΥΡΕ	(ppm)			Т Н 25
	25	Same as above(Continued)			] _				120/120		0
ŀ	-			_	-					-	-
	_									-	
F	_	_			1					-	-
	-	-			_					-	-
F	30—	Same as above			1	S-4		1		-	_ 30
-	-	-			-					-	-
Ē	-				1					-	-
ŀ	-	-			-					-	-
Ē	-				1					-	
$\vdash$	35—	-			-				120/120	-	_ 35
ſ					]						
F	-				-					-	-
	_									-	_
ŀ	_				-					-	-
	40									Stopped at 40 ft	40
										bgs	
	-	-			-					-	-
GDT 4/9/18	-	-			-					-	-
DT 2											
	-				1					-	-
MPL	-	-			-					-	-
C TE											45
	45—				1					-	- 45
SS.GF	-				-					-	-
D LOO											
RING	-			_	1					-	-
G B(	-	-		_	-					-	-
SBUF				L							
ARTIN											
₩ -	50-	1		L				1			50
I I I I I I I I I I I I I I I I I I I	ND DA				S	DIL BORING	3	<u>/ M</u>	<u>ON</u>	ITORING WELL RECOP	RD
Ϋ́O		MENT: Prosonic 10sdr7 EASTING: -491357	.2076 ft. '.4049 ft.	-	Pre	ject: Mar	tin	sbu	rg A	ir National Guard Base	
H H	IETHO OLE D	DIA.: 6-inch				ject No: 291	33	8000	)6	Well No. BW-	05
S S	ITE: OGGE	BW-05 ED BY: Sean Hulburt			Ch	ecked By: SH					
UN EX	IS RECO PLORA	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER		ar	nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824	4
9 ма		RADUAL.					-				



	D				E		SAMPLE	S				
	E P	SOIL CLASSIFICA AND REMARKS		L E G	L	BLOW				REC	MONITORING WELL CONSTRUCTION DETAILS	D E
	T H			G E	E V	CT PER 6 IN	SAMPLE	T Y P E	PID	R E C O V E R Y (inch)	AND REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR E OF SYMBOLS AND ABBREVIATION		N D	(ft)	IŇ	ID	Ė	(ppm)	R Y (inch)		н
	25—	Dark gray limestone	-					T		120/120		25
	-		-								-	_
			-									
F	-		-			1					-	-
	_		-								-	_
			-									
F	-		-			1					-	-
-	30		=			-			-		-	30
		Same as above	-				S-4					
F	-		-			1					-	-
	_		-			-					-	-
			-									
F	-		-			1					-	1
ŀ	-		-			-					-	-
			-									_ 35
	35—		-			1				120/120	-	- 35
-	-		-			-					-	-
			-									
	_		-			1					-	
-	-		-			-					-	-
			-									
	-		-			1					-	
+	40-					-			-		Stopped at 40 ft	40
											bgs	
	_					1					-	
GDT 4/9/18	-					-					-	-
GDT												
	_					1					-	
- MPL	-					-					-	-
E D	45											45
	45—					1					-	- 43
SS.GF	-					-					-	-
D LOC												
NINC						1					-	
G B(	-					-					-	-
SBUF					_							
AMEC-SOIL-ROCK-MWELL-ENV MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE. このエヌのロの/					-							
AM-	50											50
L-EN												
III S	TART ND DA		ELEVATION: ft. DATUM:			S		G /	/ M	ON	ITORING WELL RECOP	RD
	RILLEI					Pre	ject: Mar	tin	sbu	rg A	ir National Guard Base	
П-RC	ETHO OLE D	D: Roto Sonic HORIZONT				Pro	ject No: 291	33	8000	6	Well No. BW-	90
S S	TE:	BW-06				Ch	ecked By: SH					00
	IS RECO	D BY: Sean Hulburt DRD IS A REASONABLE INTERPRETATION OF SUE TION LOCATION. SUBSURFACE CONDITIONS AT C				ar	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 0182	4
MA	Y DIFFE	ER. INTERFACES BETWEEN STRATA ARE APPROX RADUAL.					1					
	22.01										Page 2 of 2	

D E P T H	AND REMARKS	E G	L E			1	l I	E	CONSTRUCTION DETAILS
(51)	SEE KEY SYMBOL SHEET FOR EXPLANATION	E N D		BLOW CT PER 6 IN	SAMPLE ID	T Y P E	PID (ppm)	RECOVERY	AND REMARKS
(ft) - 0 - - - - - - - - - - -	OF SYMBOLS AND ABBREVIATIONS USED BELOW. Fill of varying lithology from clay to gravel; [FILL], Brown from 0 to 3 ft bgs then red from 3 to 10 ft bgs,		(ft)  		S-1			(inch) 72/120	
- - - - - - - - - - - - - - - - - - -	Same as above CLAY, some fine Gravel, little medium sand and silt (CH), reddish brown, homogenous, moist, moderately plastic, slow dilatancy, high toughness, high dry strength, hard		· -		S-2				Possible fill from 12 to 30 feet
- 15 - - - - - - - - - -	Same as above, decreasing gravel below 22 feet			· ·	S-3			96/120	
END DA	R: Cascade NORTHING: 226247.9 ENT: Prosonic 10sdr7 EASTING: -495508.			Pro	ject: Mai	rtin	sbu	rg A	ITORING WELL RECORN ir National Guard Base
HOLE DI SITE: LOGGEE		IT THE		Che	ject No: 291 ecked By: SH nec foster	_			271 Mill Road Chelmsford, MA 01824

D	SOIL CLASSIFICATION	L	E		SAMPLE	ES			
E P T	AND REMARKS	E G E	L E V	BLOW CT PER		Ţ		R E C O ;	CONSTRUCTION DETAILS E AND REMARKS P
H (ft) 25	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	T P E	PID (ppm)	R E C V E R Y (inch)	лид немлико т Н 25
- 23-   	Same as above, decreasing gravel below 22 feet( <i>Continued</i> )		-	-				8/120	Bentonite seal 27-28 ft bgs Filter sand 28-40 ft bgs
	Boulder, fine grained sediment			-	S-4				Slotted screen 30-40 ft bgs
- 35	Same as 12-20 ft, reddish brown, homogenous, dry, highly plastic, no dilatancy, high toughness, high dry strength, hard			-				10/120	35
  - 40	Dark gray limestone			-					Stopped at 40 ft
  - 45 				-					- - - - 45
 - 50				-					50
END DA DRILLEI EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     226247.       MENT:     Prosonic 10sdr7     EASTING:     -495508       D:     Roto Sonic     HORIZONTAL DATUM:		_	Proj Proj		irtins 1330	sbu	rg A	ir National Guard Base Well No. TW-01
EXPLORA	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS / TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	AT OTHER T		an	nec foster	w	nee	eler	271 Mill Road D Chelmsford, MA 01824

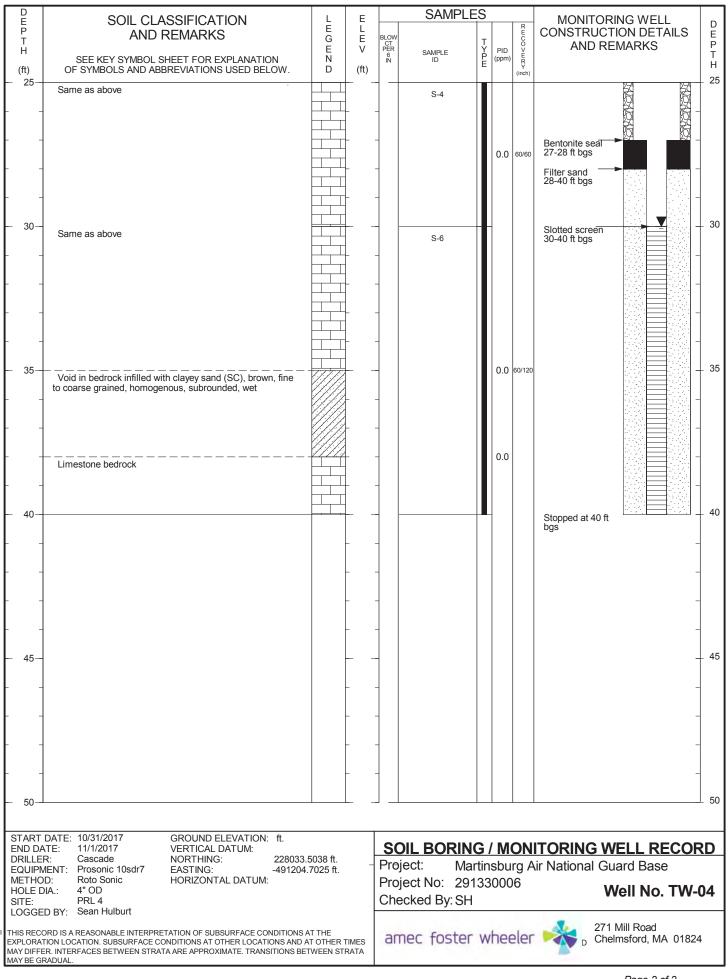
D		E			SAMPL	ES			
E P T	AND REMARKS	L	BĻ	ow				RECO	CONSTRUCTION DETAILS
Ĥ	SEE KEY SYMBOL SHEET FOR EXPLANATION	V	P	LOW CT PER 6 IN	SAMPLE ID	Y P E	PID (ppm)	RECOVERY	AND REMARKS
(ft) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW. D	(ft)	_	_				(inch)	<u> </u>
	Topsoil over Limestone gravel; [FILL] $\frac{\sqrt{4k_c}}{k_c}$				S-1				Clayey gravel at 15 and 18 feet in 6 in lenses
		<u>N 13</u>							
	CLAY, little silt, trace well-graded sand (CH), dark reddish brown, homogenous, moist, highly plastic, no dilatancy,		-				0.0		
	moderate toughness, medium dry strength, very stiff		-						
			-						
- 5 -							0.0	84/120	
Ű							0.0	0 11 120	
			-						
			-						
			-						
- 10	Same as above, light brown		1	_	S-2				
			-						
			-						
	Well-graded GRAVEL, some well-graded Sand and Silt (GW), dark gravish brown, fine to coarse grained, angular,						0.0		
- 15	stratified with 6 in thick clayey zones, moist		-				0.0	120/120	Clayey gravel at 5 – 15 15 and 18 feet 6 – 15 in 6 in lenses 6 –
			-						in 6 in lenses
2 5			_						
			1						
	Same as above		-		S-3				
; ;			-		5-3				
	CLAY, little silt and sand (CH), light brown, Homogenous,, moist, medium stiff						0.0		
								60/60	
			1						
			-				0.0		
- 25-	Fractured limestone	Ц					0.0		25
START END DA DRILLEI		ł							ITORING WELL RECORD
	IENT: Prosonic 10sdr7 EASTING: -491489.5001			Proje	ect: Ma ect No: 29				ir National Guard Base
HOLE D	IA.: 4" OD PRL 2				ked By: SF		000	0	Well No. TW-02
	D BY: Sean Hulburt								271 Mill Road
EXPLORAT	RD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE ION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHE R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN		ć	am	ec foster	W	hee	eler	D Chelmsford, MA 01824
MAY BE GF									Page 1 of 2

D	SOIL CLASSIFICATION	L	E		SAMPLE	S					
E P T	AND REMARKS	E G	L E	BLOW CT PER		т		RECO	CONSTRUCTION DETAILS		
H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	V (ft)	PER 6 IN	SAMPLE ID	T P E	PID (ppm)	R E C O V E R Y (inch)	ТН		
- 25	Dark gray limestone				S-4				25		
  - 30 	Same as above, fractured aphanitic limestone, dark gray			-	S-5		0.0	60/60	Bentonite seal 26.5-27.5 ft bgs Filter sand 27.5-39.5 ft bgs Void in limestone from 29 to 30 feet. Drill stem dropped suddenly		
  - 35	Same as above			-	S-6		0.0	60/60	Sheared drill stem at 33 feet but was able to recover - 35		
			-	-			0.0	60/60	Slotted screen 29.5-39.5 ft bgs		
40  				-					Stopped at 40 ft - 40 bgs		
45  				-					45 - - -		
- 50-									- 50		
END DA DRILLEF EQUIPM METHOI HOLE D SITE:	R:         Cascade         NORTHING:         228125.           IENT:         Prosonic 10sdr7         EASTING:         -491489.           D:         Roto Sonic         HORIZONTAL DATUM:		_	Pro Pro		tin	sbu	rg A	ITORING WELL RECORD ir National Guard Base Well No. TW-02		
EXPLORAT	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TON LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE TADUAL.	AT OTHER T		an	nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824		

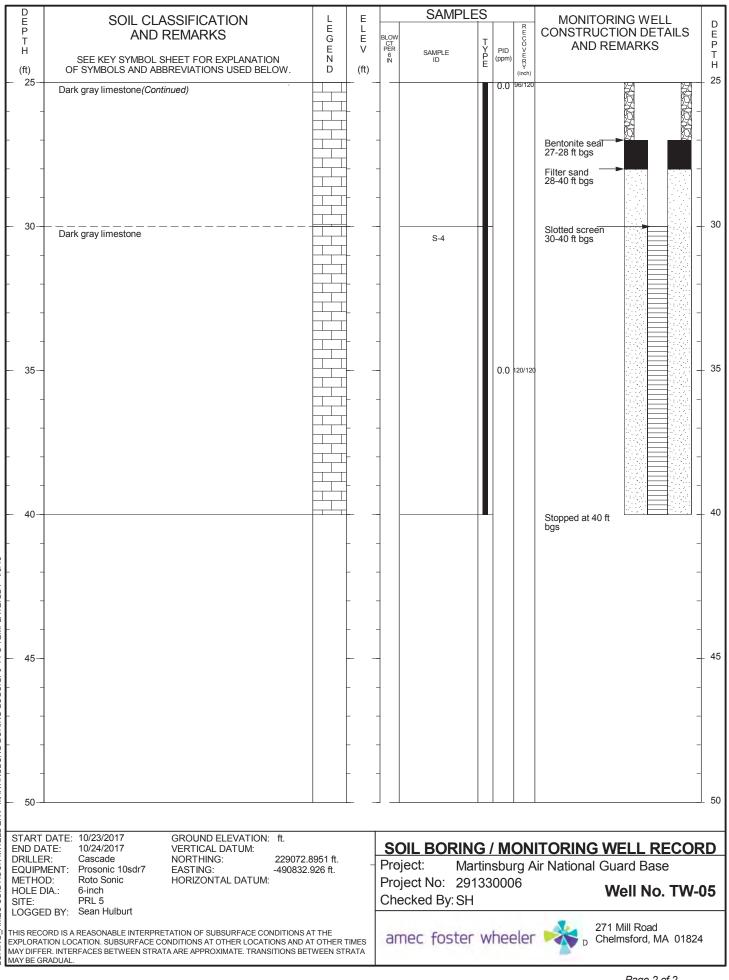
D F	SOIL CLASSIFICATION	L	E		SAMPLE	ĒS						
E P T	AND REMARKS	E G	L E	BLOW CT PER		Т		RECO	CONSTRUCTION DETAILS			
H (ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	V (ft)	PER 6 IN	SAMPLE ID	T P E	PID (ppm)	RECOVERY (inch)	AND REMARKS P T H			
	Clayey GRAVEL, some Sand; [FILL] CLAY, little well-graded gravel and sand (CH), light reddish brown, no odor, homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, stiff		· · ·	-	S-1		0.0	120/120				
10  	Same as above, light reddish brown		 	-	S-2							
- 15 - 15 	Light gray limestone		 	-			0.0	120/120	Bentonite seal 16-17 ft bgs Filter sand 17-29 ft bgs Begin drilling with water			
 - 20 	Dark gray limestone		· ·	-	S-3		0.0		Slotted screen 19-29 ft bgs - 20			
  	Dark gray limestone		· ·	-			0.0		25			
	(CONTINUED ON FOLLOWING PAGE)											
START END DA DRILLE EQUIPM METHO HOLE D SITE:	R:     Cascade     NORTHING:     227967.2       MENT:     Prosonic 10sdr7     EASTING:     -492004.7       D:     Roto Sonic     HORIZONTAL DATUM:		_	Proj Proj		rtin 133	sbu	rg A	ITORING WELL RECORD air National Guard Base Well No. TW-03			
EXPLORA <sup>®</sup>	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A' TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A' ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET RADUAL.	T OTHER TI		an	nec foster	W	hee	eler	271 Mill Road Chelmsford, MA 01824			
									Page 1 of 2			

SOIL CLASSIFICATION											
	SF										
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	S E P T										
SEE KEY SYMBOL SHEET FOR EXPLANATION     N     6 N     SMMPLE ID     P     (ppm)     E R       (ft)     OF SYMBOLS AND ABBREVIATIONS USED BELOW.     D     (ft)     (ft)     ID     ID     ID	Ĥ										
25 No Sample Or No Recovery Obtained Void	25										
	rd -										
Casing Casing advanced to 30 F2 F6											
30	₩21 - 30										
	_										
	-										
	_										
	_ 35										
35-	- 33										
	_										
	-										
	_										
	-										
40-	_ 40										
	-										
	_										
	-										
45-	_ 45										
	-										
	_										
4   + +	-										
50	50										
START DATE: 11/6/2017 GROUND ELEVATION: ft. END DATE: 11/6/2017 VERTICAL DATUM: SOIL BORING / MONITORING WELL REC	חסרי										
DRILLER: Cascade NORTHING: 227967.2654 ft. Preject: Martinghurg Air National Cuard Page											
METHOD: Rote Sonic HORIZONTAL DATUM: Project No: 201330006											
HOLE DIA.: 4" OD SITE: PRL 3 Well No. T	w-03										
OGGED BY: Sean Hulburt											
HIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE REPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES AMOUNT OF SUBSURFACE CONDITIONS AT OTHER TIMES	1824										
AY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA AY BE GRADUAL.											
AT BE GRADUAL. Page 2 of 2											

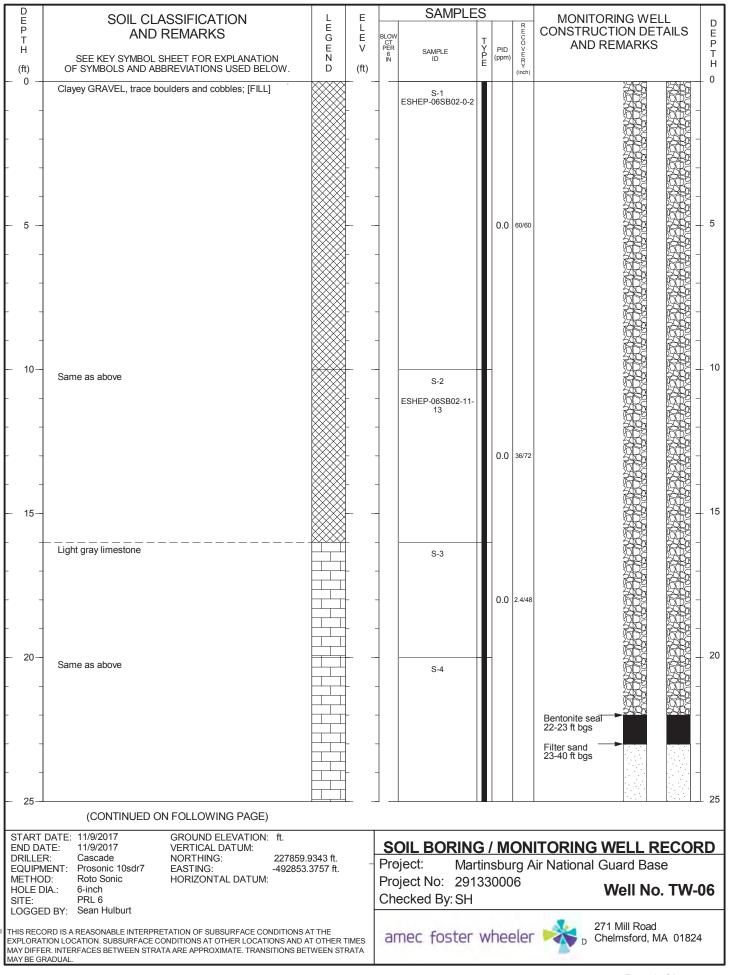
D		L	Е		SAMPLE	S						
E P	SOIL CLASSIFICATION AND REMARKS	E	L	BLOW				RE	CONSTRUC	RING WELL FION DETAI	S	D E
T H		GE		DELOW CT PER 6 IN	SAMPLE	T Y P E	PID	RECOVERY		EMARKS		E P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	Ň	ID	Ē	(ppm)	R Y (inch)				Н
- 0 -	Organic rich CLAY and fine SAND (OL/OH), brownish				S-1					2	₽4	- 0
	black, homogenous, moist, slightly plastic, slow dilatancy, low toughness, low dry strength, medium stiff				0-1						A.	
			]								X	
	CLAY, trace silt and fine grained sand (CH), reddish			-			100.0		At 2 ft bgs encountered an	Ä	¥ -	
	brown, strong odor, homogenous,, moist, highly plastic, no dilatancy, moderate toughness, stiff								old cast iron pipe that was		R _	
									empty but soil around it has	B	B	
			_	-					strong petroleum odor.		<b>Ø</b> -	
- 5							0.0	108/120	Stopped drilling to assess and			- 5
Ŭ	CLAY, some well-graded Sand, little silt and fine gravel (CH), reddish brown, moist, moderately plastic, no dilatancy						0.0		determined the line is most likely			
	moderate toughness, very stiff		-	-					abandoned.		<b>A</b> -	
										NA NA	X.	
										i i i i i i i i i i i i i i i i i i i		
			-	-							<b>6</b> -	
							0.0			Ŕ		
	Well-graded GRAVEL, some clay (GC), tannish brown, fine to coarse grained, homogenous, angular, moist						0.0					
- 10-	Same as above			-	S-2						8- 	_ 10
					3-2						A -	
			1							Ä	A	
	Dark gray limestone, possible bedrock		<b>∠</b> .	-			0.0	48/48		Ŕ	8 -	
			-							B		
			-									
				-							- A	
- 15											A.	_ 15
	Same as above		-		S-3							
			-	-						X	<b>R</b> -	
			-							E C	B.	
			-							B	B	
				-							<b>B</b> -	
			-									
			-									
- 20-				-			0.0	84/120			NANANANANANANANANANANA	_ 20
			-								X.	
			-									
			-	-							<b>8</b> -	
			-								B.	
			-									
				-					Stopped for day		<b>A</b> -	
- 25-									Stopped for day at 25 ft bgs 10/31		R	- 25
	(CONTINUED ON FOLLOWING PAGE)											-
	DATE: 10/31/2017 GROUND ELEVATION: ft.					~		<u></u>				
END DA DRILLE	R: Cascade NORTHING: 22803	3.5038 ft.			<b>DIL BORIN</b> ject: Mar						,UR	Ű
EQUIPN METHO		4.7025 ft.			ject No: 291				ir National G			
HOLE D					ecked By: SH	55	500	,0	V	Vell No. T	<b>W-</b> (	)4
LOGGE				5110								
	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITION TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS ANI			ar	nec foster	W	hee	eler	271	Mill Road elmsford, MA (	)1824	
	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS E			-	ise joster							
WAT DE G												

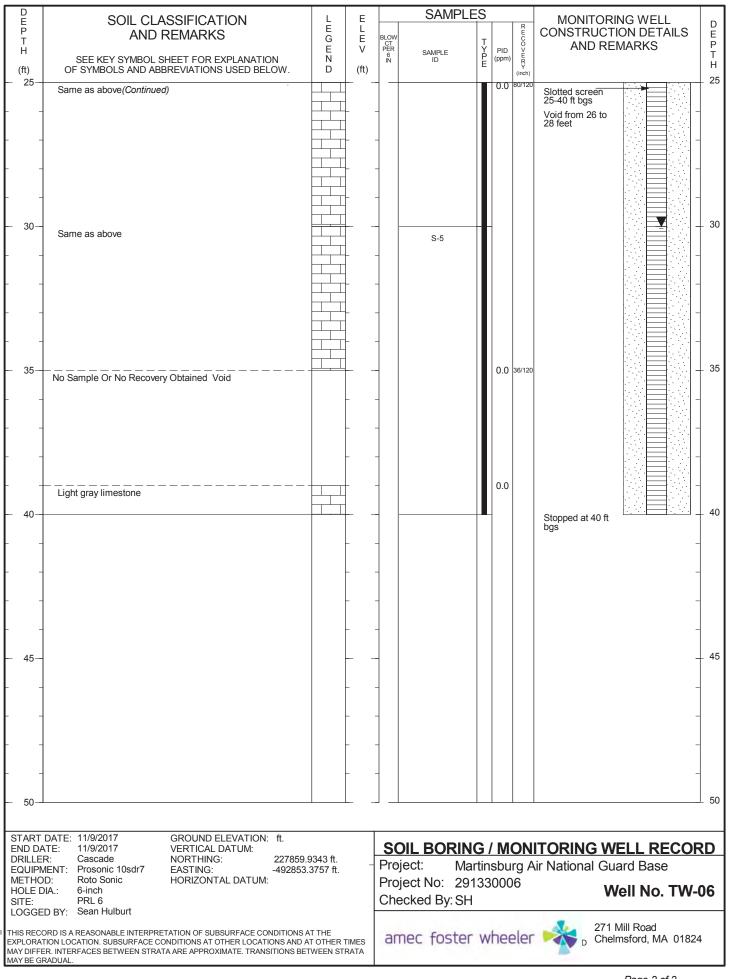


D E P	SOIL CLASSIFICATION	L E E L		SAMPL	ES		R	MONITORING WELL CONSTRUCTION DETAILS		
P T H	AND REMARKS	G E V	BLOW CT PER 6	SAMPLE	T Y E	PID	R E C V E R Y (inch)	CONSTRUCTION I AND REMAR		E P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D (ft)	6 IN	ID	E	(ppm)	R Y (inch)			H H
- 0	CLAY, little well-graded sand and silt, trace fine to coarse gravel (CH), light brown, no odor, homogenous, Topsoil, 0-6 in, dry, highly plastic, no dilatancy, high toughness, high dry strength, hard		-	S-1		0.0	120/120	Began running 6 in outer casing at 10 ft	- - - - - - - - - - - - - - - - - - -	_ 5
	Light gray broken limestone		-			0.0				
- 10	Tan laminated siltstone		-	S-2		0.0		Began running 6 in outer casing at 10 ft	- - -	_ 10
 - 15	Dark gray limestone		_			0.0	120/120			_ 15
  - 20  	Dark gray limestone			S-3					- - - - - - - - -	_ 20
- 25-								Ŕ		_ 25
START	(CONTINUED ON FOLLOWING PAGE) DATE: 10/23/2017 GROUND ELEVATION: ft.									
END DA DRILLEF EQUIPM METHO HOLE D SITE:	ATE: 10/24/2017 VERTICAL DATUM: R: Cascade NORTHING: 229072 MENT: Prosonic 10sdr7 EASTING: -490832 DD: Roto Sonic HORIZONTAL DATUM:	2.8951 ft. 2.926 ft.	- Pro Pro	ject: Ma	artin 133	sbu	rg A	ITORING WELL ir National Guard I Well		
THIS RECO EXPLORAT	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BI	AT OTHER TIMES	an	nec foster	w	hee	eler	271 Mill R D Chelmsfor	oad d, MA 01824	Ļ
								Pag	ge 1 of 2	



MARTINSBURG BORING LOGS.GPJ PFC TEMPLATE.GDT 4/9/18 AMEC-SOIL-ROCK-MWELL-ENV -ORING





D	SOIL CLASSIFICATION	L	Е		SAMPLE	S			MONITO			
E P	AND REMARKS	E G	L	BLOW				REC	CONSTRU	CTION	DETAILS	D E
T H		E	V	PER	SAMPLE	T Y P E	PID	RECOVERY	AND	REMA	RKS	P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELO		(ft)	6 IN	ID	Ē	(ppm)	R Y (inch)				Ĥ
- 0 -	Well-graded GRAVEL and well-graded SAND, some	Clay			S-1				Native materia backfill 0-27 ft		59	- 0
L -	and Silt (GC), light brown, fine to coarse grained, homogenous, subangular, moist				5-1				bgs			_
		6 A										
				-			0.0			A A	a de la companya de la	-
							0.0	60/60		Ŕ	E.	_
	Broken COBBLES and well-graded GRAVEL, some C trace well-graded sand (GC), light brown, fine to coarse	Clay,					0.0			B		
	grained, homogenous, angular, moist			-						Ŕ		-
- 5												_ 5
	CLAY, some fine grained Sand and fine Gravel (CH), brown, homogenous, moist, highly plastic, no dilatancy	light			S-2					10A		
	moderate toughness, medium dry strength, very stiff			-								-
										24 A		
							0.0	60/60		Ŕ	a de la de l	
			_	-						ß		-
										Ŕ		_
- 10-	Same as above			-	S-3					NOX NOX		_ 10
					5-3							_
										2A	A	
	Possible bedrock/boulder, dark gray limestone		_	-			0.0			Ŕ		-
							0.0	60/60		B		_
										Ŕ	Ŕ	
				-								-
- 15												15
10	Dark gray limestone, infilled veins with calcite				S-4							
				-						R	A	-
			_							K		_
							0.0	60/60		B		
			_	-						Ŕ		-
												_
									Void at 19 ft bgs, lost drillir water return.	ig 🛱		
- 20-	Same as above			-	S-5				Tagged water 18.9 ft bgs, wi	at 🖁		_ 20
					3-0				drill deeper to confirm.		Ŕ	_
										Ŕ	i i i i i i i i i i i i i i i i i i i	
			_	-						ß		-
										Ŕ		_
				-								-
- 25-												25
	(CONTINUED ON FOLLOWING PAGE)											-
	DATE: 10/25/2017 GROUND ELEVATION:	ft.		-		_		<u> </u>				
END DA	R: Cascade NORTHING: 2	227686.3519 ft.			DIL BORINO							КŊ
	/IENT: Prosonic 10sdr7 EASTING: -4	491084.9556 ft.	-		ject: Mar ject No: 291				ir National (			
HOLE D					ecked By: SH	53	000	0		Well	No. TW	-07
	D BY: Sean Hulburt			Und								
	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT OTHER LOCATION			an	nec foster	W	hee	ler		71 Mill I helmsfo	Road ord, MA 0182	24
	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATION R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSIT 2401 JAI			u	ice foster		incl					- ·
WAT BE G												

D			Е	SAMPLES MONITORING WELL						
E P T H	SOIL CLASSIFICATION AND REMARKS	L E G E	E L E V	BLOW CT PER 6 IN		TYPE	PID	RECOVERY	MONITORING WELL CONSTRUCTION DETAIL AND REMARKS	P
(ft) - 25-	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	P E	(ppm	(inch)		T H 25
	Same as above( <i>Continued</i> )			-			0.0	80/120	Bentonite seal 27-28 ft bgs Filter sand 28-42 ft bgs	
- 30-	Same as above			_	S-5		_		Slotted screen 30-42 ft bgs	
  - 35-				-			0.0	60/120	Void from 35 to 38 feet	- - - - - - 35
				-						
40  							-		Stopped at 40 ft	- 40 
 - 45 										- - 45 -
  - 50			_	_						50
END DA DRILLE EQUIPM METHO HOLE D SITE:	R: Cascade NORTHING: 227686. IENT: Prosonic 10sdr7 EASTING: -491084 D: Roto Sonic HORIZONTAL DATUM:			Pro Pro		tin	sbu	irg A	ITORING WELL REC ir National Guard Base Well No. T	
THIS RECO	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS. ION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER "		ar	nec foster	W	he	eler	271 Mill Road D Chelmsford, MA	)1824

D E	SOIL CLASSIFICATION	LE		SAMPL	ES			MONITORING WELL	D
P T H	AND REMARKS	E L G E	BLOW CT PER		Ţ	PID	RECOVERY	CONSTRUCTION DETAILS AND REMARKS	E P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D (fi	IN IN	SAMPLE ID	T P E	(ppm	) R Y (inch)		Т Н 0
- 0 -	Clayey GRAVEL and SAND; [FILL]			S-1				Open borehole	
			-					bedrock temporary well sampled	-
			-			0.0	60/60		-
			-			0.0	00/00		_
			_			0.0			
F	Silty GRAVEL and COBBLES; [FILL]								_ 5
- 5 -	Same as above			S-2					
			-						-
			-				60/60		-
	Dark gray limestone with calcite filled veins		_			0.0			_
10									10
- 10	Same as above			S-3					_ 10
			-						-
			-						-
			_						_
			_						
									15
- 15						0.0	120/120		_ 13
			-						-
			-						-
-			_						-
			_						_
									20
- 20	Same as above			S-3		1		Stopped at 20 ft bgs on 11/14	_ 20
-			-						-
-			-						-
-			_						-
-			_						_
25									25
- 25	(CONTINUED ON FOLLOWING PAGE)								_ 20
END DA			S	DIL BORIN	G	/ M	ON	ITORING WELL RECO	RD
	/IENT: Prosonic 10sdr7 EASTING: -493760	.0951 ft. ).1836 ft.	- Pre	ject: Ma	artir	isbu	irg A	Air National Guard Base	
METHO HOLE D SITE:	DIA.: 6-inch PRL 8			ject No: 29 ecked By: S⊦		s00(	JQ	Well No. TW-	<b>80</b>
LOGGE	D BY: Sean Hulburt							271 Mill Road	
EXPLORA	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ZR. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER TIMES		nec foster	W	he	eler	Chelmsford, MA 0182	4
MAY BE GE								Page 1 of 2	

	D			-		SAMPI F	SAMPLES						
	E P T H	SOIL CLASSIFICATION AND REMARKS	L E G E	E L E V	BLOW CT PER		TYPE	PID	R E C O V E R Y (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	D E P		
(	ft) 25	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Р Е				Т Н 25		
	25-	Same as above(Continued)			] _			0.0	120/120				
F	-				-					-	-		
	_				_					-	_		
				-									
F	-				1					-			
ŀ	-				-					-	-		
	30—										30		
		Same as above		-		S-4							
F	-				1					-	-		
ŀ	-			-	-					-	-		
	_												
				-									
F	-				-					-	1		
╞	35—				-			0.0	120/120	-	35		
				-									
				-									
F	-			-	-					-	-		
-	-			-	-					-	-		
				-									
					]					-			
F	40-				-			-		Stopped at 40 ft	40		
	-				-						-		
9/18													
GDT 4/9/18					1					-			
	-			-	-					-	-		
MPLA	_			- ·	_					-	_		
C TE											45		
F L	45—				1					-	45		
GS. G	-				-					-	-		
0 LO	_			L .						-	_		
BORIN													
URG	-				1					-	1		
TINSB	-			-	-					-	-		
MAR	50										50		
μN	-												
I ST		DATE: 11/14/2017 GROUND ELEVATION: ft. TE: 11/15/2017 VERTICAL DATUM:			S		2	/ M		ITORING WELL RECOP	חא		
	RILLEF	R: Cascade NORTHING: 2276	53.0951 ft. 60.1836 ft.	-						ir National Guard Base			
ME HC		D: Roto Sonic HORIZONTAL DATUM:				ject No: 291				Well No. TW-	08		
SI CIII LC	TE:	PRL 8 D BY: Sean Hulburt			Ch	ecked By: SH			_				
	S RECO LORAT	D D T CONTRACTOR OF SUBSURFACE CONDITION ION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AT R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS	ID AT OTHER		ar	nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824	4		
		ADUAL.								Page 2 of 2			

D E P		SSIFICATION	LE	E	SAMPL	ES		R	MONITORING WELL CONSTRUCTION DETAILS	
г Т Н		EMARKS	G E	E BLOV CT V PER 6 IN	SAMPLE	T Y P E	PID (ppm)	RUCOVURY	AND REMARKS	
(ft) - 0	OF SYMBOLS AND ABB	REVIATIONS USED BELO	W. D	(ft)		E		Y (inch)		
	Well-graded GRAVEL and [FILL]	SAND, some Clay, light bro	DWN;	-	S-1				Open rock borehole, no screened well constructed	_
- 5				-			0.0	20/120		_
	CLAY, little fine to medium light reddish brown, moist, n moderate toughness, mediu	noderately plastic, no dilata	incy,	_			0.0			_
- 10	Same as above, moist, stiff	Ŧ		_	S-2					_
				_			0.0	60/60		_
	Dark gray limestone			-			0.0			-
- 15	Same as above			-	S-3					
- 20				_			0.0	20/120		_
	Clayey debris filled void			_			0.0		Ţ	_
- 25-	(CONTINUED ON	FOLLOWING PAGE)								-
END DA	DATE: 11/2/2017 ATE: 11/6/2017 R: Cascade MENT: Prosonic 10sdr7 D: Roto Sonic	GROUND ELEVATION: f VERTICAL DATUM: NORTHING: 2	t. 27795.8465 ft. 190892.1037 ft.	- Pro		artins 133	sbui	rg A	ITORING WELL RECO Nir National Guard Base Well No. TW	
LOGGE	D BY: Sean Hulburt DRD IS A REASONABLE INTERPRET TION LOCATION. SUBSURFACE COI CR. INTERFACES BETWEEN STRATZ	DITIONS AT OTHER LOCATION			mec foster		hee	ler	271 Mill Road D Chelmsford, MA 0182	24

D			L E	F		SAMPLE	ES				
D E P T		SSIFICATION REMARKS	EG	L	BLOW				R E C	CONSTRUCTION DETAILS	D E
T H		HEET FOR EXPLANATION	EN	V	BLOW CT PER 6 IN	SAMPLE ID	Y P E	PID (ppm)	RECOVERY	AND REMARKS	E P T
(ft)		REVIATIONS USED BELOW.	D	(ft)	IN	U	E	(PP)	(inch)		н
- 25-	Clayey debris filled void			<u>⊢</u> –	1 -	S-4		1			_ 25
	-				-					-	-
				L .						_	
								0.0	20/60		
	-				1					-	
	-			- ·						-	-
											_ 30
- 30-				F -	1					Stopped at 30 ft	- 30
	-				-					bearing zone -	
	_			L .						-	-
-	1			- ·	1					-	-
	-			- ·	-					-	
- 35-											_ 35
- 35-										-	
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- 40-											
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- 50-				L_							50
- 45- - 45- - 50- - 50- - 50- - 50- - 50- - 50- - 50- 					_	_	-	_	_		
START	DATE: 11/2/2017	GROUND ELEVATION: ft.			•		~	/	~		
END D/ DRILLE	R: Cascade	VERTICAL DATUM: NORTHING: 227795		_						ITORING WELL RECOR Air National Guard Base	<u>KD</u>
EQUIP METHO	DD: Roto Sonic	EASTING: -490892 HORIZONTAL DATUM:	1037 ft.			ject No: 29'					00
HOLE I	PRL 9					ecked By: SH				Well No. TW-	09
LOGGE	ED BY: Sean Hulburt			ĺ						271 Mill Road	
EXPLORA	TION LOCATION. SUBSURFACE CO	TATION OF SUBSURFACE CONDITIONS INDITIONS AT OTHER LOCATIONS AND A ARE APPROXIMATE. TRANSITIONS BE	AT OTHER		ar	nec foster	N	hee	eler	Chelmsford, MA 01824	1
MAY DIFF		A ARE APPROXIMATE. TRANSITIONS BE	IVVEEN SI	RATA							
										Page 2 of 2	

D E	SOIL CLASSIFICATION	L	E		SAMPLE	ES			
P T	AND REMARKS	E G	L E V	BLOW CT PER		Ţ		RECOVERY	CONSTRUCTION DETAILS E AND REMARKS P
H (ft) 0	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	v (ft)	6 IN	SAMPLE ID	T P E	PID (ppm)	V E R Y (inch)	
	CLAY, some fine grained Sand and fine Gravel (CL), brown, homogenous, dry, slightly plastic, no dilatancy, low toughness, medium stiff			-	S-1				
- 5   	Same as above, homogenous, moist, moderately plastic, no dilatancy, moderate toughness, medium dry strength, very stiff			-			0.0	120/120	
	Same as above			_	S-2		•		
- 15	Crushed rock			-			0.0	120/120	
- 20	No recovery. All material washed away by water used for drilling.			-	S-3				Bentonite chip seal 23-25 ft bgs
- 25-	(CONTINUED ON FOLLOWING PAGE)								25
END DA DRILLEI	DATE:         10/20/2017         GROUND ELEVATION:         ft.           ATE:         10/23/2017         VERTICAL DATUM:            R:         Cascade         NORTHING:         228572.           MENT:         Prosonic 10sdr7         EASTING:         -491497           DD:         Roto Sonic         HORIZONTAL DATUM:         -491497           DATE:         4" OD         PRL 10         -		_	Proj Proj		rtin 133	sbu	rg A	ITORING WELL RECORD ir National Guard Base Well No. TW-10
THIS RECO	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS. TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER T		an	nec foster	W	hee	eler	271 Mill Road D Chelmsford, MA 01824

D		1	E	SAMPLES					
E P	SOIL CLASSIFICATION AND REMARKS	L E	L	DI CIT		Ē		R	MONITORING WELL D CONSTRUCTION DETAILS E
T H		G E	E V	BLOW CT PER 6 IN	SAMPLE	T Y P E	PID	RECOVERY	AND REMARKS P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	IN IN	ID	P   E	(ppm)		T H
- 25-							00	(inch) 120/120	Filter sand
	No recovery. All material washed away by water used for drilling. (Continued)						0.0		25-37 ft bgs
			-	-					
[									0.010 Slotted
				-					27-37 ft bgs
			_ ·	1					
- 30									
- 30-	Same as 15-20 ft				S-4		]		
			-	-					
			-						
				1					
							0.0		
	CLAY, some coarse Gravel, some crushed rock (CL), yellowish brown, homogenous, wet, moderately plastic, no							60/84	
	dilatancy, moderate toughness, medium dry strength,			-					
	medium stiff								
- 35-				1					
L		64/4							
		Y	1	-					Stopped at 37 ft
									bgs
			_	-					-
				]					
- 40			L -	-					_ 40
			-	-					-
				-					-
- 1			_ ·	1					_
- 45									45
				-					-
- 1			-	1					-
L .									
-			-	-					-
- 50			L		I	1			50
START END DA	DATE: 10/20/2017 GROUND ELEVATION: ft. ATE: 10/23/2017 VERTICAL DATUM:			S		G	M	ON	ITORING WELL RECORD
DRILLE	R: Cascade NORTHING: 228572	2.3741 ft. 7.5093 ft.	_						ir National Guard Base
METHC	D: Roto Sonic HORIZONTAL DATUM:	.JU93 II.			ject No: 291				
HOLE D	DIA.: 4" OD PRL 10				ecked By: SH			-	Well No. TW-10
	D BY: Sarah Levine				. , <b>.</b>				
	DRD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS			ar	nec foster	14/	ho		271 Mill Road Chelmsford, MA 01824
MAY DIFFE	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BI			a	nec justel	vv	inet	lei	D Chelmsford, MA 01824
MAY BE G	RADUAL.								

		Attachment	1 –Photographic Log	
Client:	Air National Gu	ıard	Project Number:	291330006.09
Site Name:	Martinsbur	g ANGB	Site Location:	Martinsburg, WV
	evine 25/2017			
Photograph: Direction:	ST-01 West			
Description: Partial view area	v of staging			
<b>Photographer</b> Sarah Le			1	
<b>Date:</b> 10/25	5/2017			
Photograph:	ST-02			
<b>Direction:</b>	Southeast			
<i>Description:</i> Rig at stagin awaiting rep	ng area pair			

		Attachment	1 –Photographic Log	
Client:	Air National G	uard	Project Number:	291330006.09
Site Name:	Martinsburg	g ANGB	Site Location:	Martinsburg, WV
Date:	Levine /19/2017			
Direction:	West			
<i>Description:</i> Drilling of 01SB01				
Data	Levine			
<i>Date:</i> 10/	18/2017			
Photograph	: SB-002			
<i>Direction:</i> S	outhwest	deritar a constitution of the		
<i>Description:</i> Drilling 01				

	Attachme	nt 1 –Photographic Log	
<i>Client:</i> Air Nationa	l Guard	Project Number:	291330006.09
Site Name: Martinsb	urg ANGB	Site Location:	Martinsburg, WV
Photographer: Sarah LevineDate: 10/27/2017Photograph: SB-003			
<i>Direction:</i> North			
<i>Description:</i> 02SB01 location			
<b>Photographer:</b> Sarah Levine	1.1.1		
Date: 10/19/2017		Part of the second	
Photograph: SB-004			
<i>Direction:</i> Southeas t			
<b>Description:</b> Hand-augering at location 10SB02			

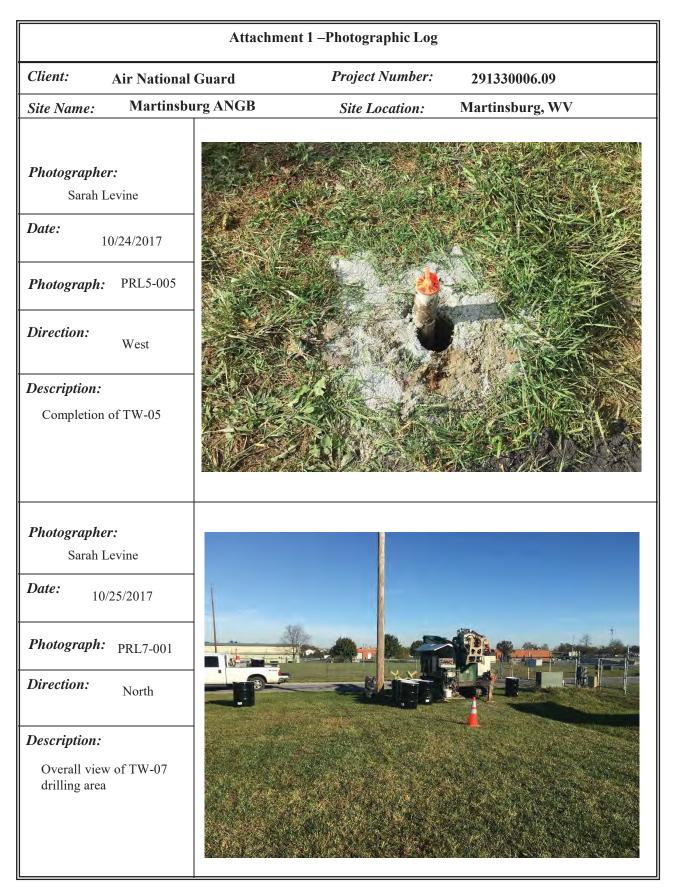
		Attachmen	nt 1 –Photographic Log	
Client:	Air National (	Guard	Project Number:	291330006.09
Site Name:	Martinsbu	rg ANGB	Site Location:	Martinsburg, WV
	Levine			
Photograph	/19/2017 : SB-005	- 93	555 3 F 1 T	
Direction:	Southeast			
	of 10SB02 itch			
<b>Photograph</b> Sarah	<i>er:</i> Levine			
<b>Date:</b> 10/	/23/2017			
Photograph	: SB-006			
Direction:	N			
Description: Surface cor 05SB03 aft abandonme representati backfilled b and tempor	mpletion of ter borehole ent; ive of poreholes			

	Attachment 1 – Photographic Log					
Client:	Air National	Guard	Project Number:	291330006.09		
Site Name:	Martinsbu	rg ANGB	Site Location:	Martinsburg, WV		
Photographe Sarah I Date: 10/						
Photograph:	PRL1-001					
Direction:	West		1 days			
<i>Description:</i> Drilling of T	W-1					
Photographe Sarah I Date: 10/	Levine					
Photograph: Direction:	18/2017 PRL1-002					
Direction:						
<i>Description:</i> PRL-1 soil						

Attachment 1 – Photographic Log				
Client: Air National	Guard	Project Number:	291330006.09	
Site Name: Martinsbu	rg ANGB	Site Location:	Martinsburg, WV	
<i>Photographer:</i> Sarah Levine	<b>R</b> Á			
Date: 10/19/2017				
Photograph: PRL1-003				
<i>Direction:</i> Northwest				
<i>Description:</i> Temporary well TW-01 installation				
<i>Photographer:</i> Sarah Levine		1 FR	- Hereit	
Date: 10/19/2017				
Photograph: PRL1-004				
<i>Direction:</i> North-northeast	HT SA			
<i>Description:</i> Completed TW-01 installation				

	Attachme	nt 1 –Photographic Log	
Client: Air Nation	nal Guard	Project Number:	291330006.09
Site Name: Martin	sburg ANGB	Site Location:	Martinsburg, WV
<i>Photographer:</i> Sarah Levine <i>Date:</i> 10/23/2017			
<i>Photograph:</i> PRL5-00 <i>Direction:</i> West			
<i>Description:</i> Drilling of TW-05			
<i>Photographer:</i> Sarah Levine			
<i>Date:</i> 10/23/2017			
Photograph: PRL5-002	2		
Direction: West			
<i>Description:</i> TW-05 soil cuttings			

Attachment 1 – Photographic Log					
<i>Client:</i> Air Nationa	l Guard	Project Number:	291330006.09		
Site Name: Martinsh	urg ANGB	Site Location:	Martinsburg, WV		
<i>Photographer:</i> Sarah Levine					
Date: 10/23/2017					
Photograph: PRL5-003					
Direction: West					
<i>Description:</i> Drilling halted at TW- 05 to repair drill rig					
<i>Photographer:</i> Sarah Levine					
Date: 10/27/2017					
Photograph: PRL5-004					
Direction: West					
<i>Description:</i> Installation of temporary well TW-05					



	Attachme	nt 1 –Photographic Log	
Client: Air Nationa	l Guard	Project Number:	291330006.09
Site Name: Martinsk	ourg ANGB	Site Location:	Martinsburg, WV
Photographer: Sarah Levine Date: 10/25/2017			
<i>Photograph:</i> PRL7-002			
Direction:			
<i>Description:</i> TW-07 borehole and drilling water containment tub			
<i>Photographer:</i> Sarah Levine			
Date: 10/27/2017			
Photograph: PRL7-003			
Direction: North			
Description:		-	
Developing TW-07			

	Attachme	ent 1 –Photographic Log	
<i>Client:</i> Air Nation	al Guard	Project Number:	291330006.09
Site Name: Martins	burg ANGB	Site Location:	Martinsburg, WV
<i>Photographer:</i> Sarah Levine <i>Date:</i> 10/27/2017		LOSIC HIDI	
Photograph: PRL7-004			
Direction:	E		
<i>Description:</i> Drums with recovered drilling water and TW- 07 development water			
<i>Photographer:</i> Sarah Levine			_
Date: 10/20/2017			
Photograph: PRL10-001			
Direction: Northeast			
<b>Description:</b> Rig set up at location TW-10			

	Attachment 1 – Photographic Log											
Client:	Air National G	fuard	Project Number:	291330006.09								
Site Name:	Martinsburg	ANGB	Site Location:	Martinsburg, WV								
Photographe Sarah I Date:												
Photograph:	PRL10-002											
Direction:	West											
<b>Description:</b> Well develo TW-10												
Photographe Sarah I												
<b>Date:</b> 10	)/23/2017											
Photograph.	: PRL10-002			- della in								
Direction:			A Cont									
Description: Developme location TV	nt water from											

amec 🗾 🍸
foster
wheeler

wneeler												
Project Name:		Phase Compo	1 Regional ounds at Mu	Site Inspect	ions for Per- ional Guard I	Fluorinated	Project Number:				291330006	
Contract:			V	V9133L-14-[	D-0002		Task Ord	er:			0006	
Installation:				PITTS			Date Started/Date Completed:				10/19/18/10/19/17	
Well ID:				Tw-01				oth to Wate			40.0	
Measuring Point				Top of Ri	ser			th of Well (			40.0	
Development Me									Purging (ft):			
Total Volume Pu Technician(s):	irged (gai):		Sean	hulburt				Volume (ga Volumes (g				
recinician(s).			Court	Haibart		Specific	J Casing	volumes (g	ai).			
Date/Time	Intake Depth (feet)	Water Level (feet)			pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
											Pumping Started	
ļ					ļ	<u> </u>			ļ			
L												
						+	+		+			
					1							
			1	1	1							
la chu un cuto (N		Madala	und Caria									
Instruments (N Equipment Calibrate		, wodel, a		i NO.): 'es		Calibrated Within	Critoria (V/NI)				Yes	
Equipment Calibrate	u (1/N).				/ater Quality	Meter, Water Leve					163	
				•	rater Quality	, valei Leve	r weter, r ens	taitic Fump				
						Horiba u 52 U52	73969					
Calculations:											Signature:	
Saturated well casing volume: $V = \Pi(R^2)H^*7.48 \text{ gal/ft}^3$ V = Volume (gal/ft) $V = \Pi(R^2)H^*7.48 \text{ gal/ft}^3$ $\Pi = 3.14$ $=\Pi * (2.0 (in)/12 (in/ft))/2)^2 * 0.00 * 7.48 \text{ gal/ft}^3$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2) $= 1 * (2.0 (in)/12 (in/ft))/2$											2 AA	
H = height of water		,	,								2mm -	
Notes:											Name (print):	
					Dry see note	es					Sean hulburt	
QA/QC'd by:								C	A/QC Date:			



Project Neme:		Phase	e 1 Regional		291330006							
Project Name:			ounds at Mul	tiple Air Nati	onal Guard I		Project N					
Contract:			N	/9133L-14-E			Task Orde				0006	
Installation: Well ID:			ESHEF TW-0			Date Started/Date Completed: Initial Depth to Water (ft):				10/30/17/10/31/17 25.6		
Measuring Point				Top of Ris			-	th of Well (			40.0	
Development Me				PUMPE		<u>.</u>	Depth to Water After Purging (ft):				25.72	
Total Volume Pu	rged (gal):			30 gal				Volume (ga			2.4	
Technician(s):		S hulburt c white						Volumes (g	al):		7.1	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/min)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
10/31/17 10:34			3000								Pumping Started	
10/31/17 10:38		25.64	2400	16.93	6.94	0.860	4.78	207.0	0			
10/31/17 10:44		25.65	2400 2400	16.88	6.98 6.98	0.852	4.32	211.8	1095			
10/31/17 10:49 10/31/17 10:53		25.65 25.66	2400	16.79 16.65	6.97	0.836	3.90 4.04	215.1 208.3	99.0 84.6			
10/31/17 10:58		25.69	2400	16.58	6.97	0.831	4.00	198.5	51.5			
10/31/17 11:03		25.69	2400	16.52	6.96	0.828	3.96	182.8	58.0			
10/31/17 11:08		25.70	2400	16.44	6.96	0.827	3.92	165.5	61.0			
10/31/17 11:13		25.72	2400	16.46	6.96	0.827	3.90	143.3	37.6	μ]		
10/31/17 11:18		25.71	2400 2400	16.44	6.96 6.97	0.826	3.87	123.7	35.6			
10/31/17 11:23 10/31/17 11:29		25.72 25.72	2400 2400	16.44 16.43	6.97 6.98	0.825	3.82 3.80	108.3 97.5	32.3			
10/31/17 11:29		25.72	2400	16.43	6.98	0.824	3.80	97.5 89.2				
10/31/17 11:39		25.72	2400	16.40	6.98	0.824	3.75	84.4	1			
10/31/17 11:44		25.72	2400	16.39	6.97	0.824	3.74	81.6				
							-		-			
					ļ				<u> </u>	]		
Instruments (M	anufacturer	Model a	nd Serial	No.).								
Equipment Calibrate		mouci, c		es		Calibrated Within	Criteria (Y/N)	:			Yes	
- 1	- ( ).				er. Water Qu	ality Meter, Water	. ,		ole Pump			
				,		Lamotte 2020 YSI 556 MPS 8	1286,					
Calculations:											Signature:	
Saturated well ca	asing volume:	V= П(R^2	2)H*7.48 da	l/ft^3						ĺ		
V = Volume (gal/ft) $\Pi$ = 3.14 R = well radius (ft) = H = height of water of	(well diameter (i					=∏ * (2.0	) (in)/12 (in/ft)	2)H*7.48 gal/ft )/2)^2 * 14.40 2.4 gal.	^3 * 7.48 gal/ft^3		Sorte	
Notes:											Name (print):	
					None						Seanhulburt	
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/12/2017	



Project Nerror		Phase	1 Regional	Site Inspect	ons for Per-F	luorinated	Project Number:				291330006	
Project Name:					onal Guard I		Project Number: Task Order: Date Started/Date Completed: Initial Depth to Water (ft):				0006	
Contract:			V	V9133L-14-D								
Installation:				ESHEP							11/21/17/11/21/17	
Well ID:				Tw-03			-				17.2 30.0	
Measuring Point: Development Me				Top of Ris PUMPE				th of Well (1	rt): Purging (ft):		Dry	
Total Volume Pu				4	0			Volume (ga		-	2.1	
Technician(s):	igeu (gai).	4 Sean hulburt									6.3	
recificiari(3).			Court	haibart		Specific	3 Casing Volumes (gal):					
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/21/17 12:43			1000								Pumping Started	
11/21/17 12:46	29	19	500	15.59	7.17	.890	4.42	54.2	200			
11/21/17 12:47	29	20.5	500	15.81	6.94	.888	4.26	60.6	135			
11/21/17 12:51	29	21.2	600	15.43	6.77	.721	4.41	61.1	89			
11/21/17 12:53	29	22.5	600	16.60	6.70	.720	4.15	63.1	103			
11/21/17 13:02 11/21/17 13:04	29	25.2	600	16.72	6.57	.730	4.47	69	250		Dry	
11/21/17 13.04									-		Diy	
							+		+	<u> </u>		
				1			+		1			
				1	1		1 1					
									-			
				1								
									-			
							+ -					
									1			
									1		1	
Instruments (M	anufacturer,	Model, a	nd Seria	l No.):								
Equipment Calibrate	ed (Y/N):		Y	′es		Calibrated Within	Criteria (Y/N)	:			Yes	
			Т	urbidity Mete	er, Water Qu	ality Meter, Water Lamotte 2020 YSI 556 MPS 8	1286,	Geosubmersik	ble Pump			
Coloulations											Signaturo	
Calculations:											Signature:	
Saturated well casing volume: $V = \Pi(\mathbb{R}^{2})\mathbb{H}^{+}7.48 \text{ gal/ft}^{+}3$ V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2) H = height of water column (ft) $V = \Pi(\mathbb{R}^{2})\mathbb{H}^{+}7.48 \text{ gal/ft}^{+}3$ $= \Pi^{+} (2.0 (in)/12 (in/ft))/2)^{+}2^{+} 12.80^{+}7.48 \text{ gal/ft}^{+}3$ = 2.1  gal.									Som			
Notes:											Name (print):	
					None						Sean hulburt	
QA/QC'd by:	Sarah Levine							0	QA/QC Date:		12/13/2017	



Wheeler												
Project Name:			e 1 Regional ounds at Mul				Project Number:				291330006	
Contract:			W	/9133L-14-E	0-0002						0006	
Installation:				ESHEP			Date Started/Date Completed:				11/01/17/11/01/17	
Well ID:				TW-04	4			oth to Water			8.72	
Measuring Point	:			Top of Ris	ser			th of Well (i			41.0	
Development Me								Water After	Purging (ft):		8.73	
Total Volume Pu				15			1 Casing	Volume (ga	I):		5.3	
Technician(s):								3 Casing Volumes (gal):			15.9	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/min)	Temp. (°C)	pH (units)	Specific Electrical Conductance	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/01/17 13:10		(leet)	1100			(mS/cm)				(gai.)	Pumping Started	
11/01/17 13:14		8.72	1100	16.02	7.22	0.783	3.96	193.2	0			
11/01/17 13:18		8.73	1100	16.26	7.26	0.769	3.57	185.0	622			
11/01/17 13:23		8.73	1100	16.21	7.20	0.767	3.49	180.1	53.5			
11/01/17 13:28		8.73	1100	16.25	7.20	0.766	3.45	170.3	32.0			
11/01/17 13:33		8.74	1100	16.29	7.20	0.764	3.39	158.5	26.7			
11/01/17 13:38		8.76	1100	16.25	7.20	0.763	3.30	147.6	26.8			
11/01/17 13:41		8.76	1100	16.12	7.19	0.763	3.32	142.9	19.0			
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	1		1			1	1		1			
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									-			
		1		1				l				
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									1			
Instruments (M		Model, a		No.): es	•	Colibrated Within			·		Yes	
Equipment Calibrate	va ( 1714).				or Motor O	Calibrated Within			Duren		100	
			I		er, water Qu	ality Meter, Water Lamotte 2020 YSI 556 MPS 8	1286,	Geosubmersit	be Pump			
Calculations:											Signature:	
Saturated well ca	asing volume:	V= П(R^2	2)H*7.48 ga	l/ft^3						İ		
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) = H = height of water c	(well diameter (i					=∏ * (2.0	) (in)/12 (in/ft)	2)H*7.48 gal/ft )/2)^2 * 32.28 5.3 gal.	^3 * 7.48 gal/ft^3			
Notes:											Name (print):	
			Us	ed monsoor	ı pump, refer	to eb 01 sample					Sean hulburt	
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/12/2017	



Project Name: Phase 1 Regional Site Inspections for Per-Fluorin Compounds at Multiple Air National Guard Installa							Project N	umber:		291330006		
Contract:		Compo		V9133L-14-E	0-0002		Task Orde				0006	
Installation:				ESHEP			Date Started/Date Completed:				10/24/17/10/24/17	
Well ID:				TW-05				oth to Water	. ,		33.0	
Measuring Point				Top of Cas	-			th of Well (	,		40.0	
Development Me				PUMPE	D		-		Purging (ft):		38.7	
Total Volume Pu	rged (gal):			5				Volume (ga			1.1	
Technician(s):		S	arah Levine	, Sean Hulb	urt		3 Casing	Volumes (g	al):		3.4	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (Gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
		(,	0.5			(mS/cm)				(3)		
10/24/17 09:36			0.5	10.01	7.45	0.544	1.07				Pumping Started	
10/24/17 09:45	39.5	34	1.0	18.04	7.45	0.544	1.65	58.0	Over	0	Turbid, brown	
10/24/17 09:49	39.5	39	0	Na	Na Na	Na Na	Na	Na	Na	5	Well dry, pump stopped	
10/24/17 10:34	39.5	38.7	U	Na	INa	INA	Na	Na	Na	C	Checked water level; no recharge	
							+		+			
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			-						+		1	
			-						+		1	
									1			
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						İ						
									ļ			
Instruments (N Equipment Calibrate		Model, a		l <b>No.):</b> ′es		Calibrated Within	Criteria (Y/N)	:			Yes	
			٦	Furbidity Met	er, Water Qu	ality Meter, Water LaMotte 2020 128 YSI 556 MPS 09F	36-3511,	Mega Monsoo	on Pump			
Calculations:											Signature:	
Calculations.											Signature.	
Saturated well c V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water of the set of the se	: (well diameter (i	,	, ,	al/ft^3		= <b>∏</b> * (2.	0 (in)/12 (in/ft	2)H*7.48 gal/ft ))/2)^2 * 7.00 1.1 gal.			SAL	
Notes:											Name (print):	
	parameters were	e collected b	efore well w	as set. Well	developmen	t was not possible	due to lack of	recharge. Dry	y well was set at	TW05	Sarah Levine	
QA/QC'd bv:	Sarah Levine								QA/QC Date:		12/11/2017	



Wheeter												
Project Name:					ons for Per-F onal Guard I		Project Number:				291330006	
Contract:	-		V	V9133L-14-E	0-0002		Task Orde	er:			0006 11/13/17/11/13/17	
Installation:				ESHEP			Date Star	ted/Date Co	mpleted:			
Well ID:				Tw-06			Initial Dep	oth to Water	r (ft):		27.35	
Measuring Point				Top of Ris				th of Well (i			40.0	
Development Me				PUMPE	D				Purging (ft):		27.35	
Total Volume Pu	rged (gal):			24				Volume (ga			2.1	
Technician(s):		Sean hulburt						3 Casing Volumes (gal):			6.2	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/I)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/13/17 10:35			2000			(iiio/ciii)					Pumping Started	
11/13/17 10:37	35	27.4	2000	15.65	7.87	1.054	5.42	113.7	47.3			
11/13/17 10:42	35	27.4	2000	15.84	8	1.054	4.77	95.7	33.7			
11/13/17 10:50	35	27.45	2000	15.91	8.1	1.054	4.56	100.3	28			
11/13/17 10:53	35	27.45	2000	15.86	8.22	1.054	4.44	83.5	17.5			
11/13/17 11:03	35	27.45	2000	15.87	8.25	1.054	4.42	75.5	13.5			
11/13/17 11:08	35	27.45	2000	15.85	8.32	1.054	4.40	80.3	10.26			
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Instruments (M	lanufacturer.	Model, a	nd Seria	No.):	1				1			
Equipment Calibrate		,.		'es		Calibrated Within	Criteria (Y/N)	:			Yes	
	. , .		-	Furbidity Met	er. Water Qu	ality Meter, Water			on Pump			
				,,		Lamotte 2020 YSI 556 MPS 8	1286,					
Calculations:											Signature:	
Saturated wall or			\U*7 40 ad	1/6402						i		
Saturated well ca V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water of the set of the s	: (well diameter (ii	x	, c	au 11' 'S		=∏ * (2.0	) (in)/12 (in/ft)	)H*7.48 gal/ft )/2)^2 * 12.65 2.1 gal.	^3 * 7.48 gal/ft^3		Som	
Notes:											Name (print):	
					None						Sean hulburt	
QA/QC'd by:	QA/QC'd by: Sarah Levine QA/QC Date:									12/13/2017		



Project Name:					ions for Per-F ional Guard I		Project N	umber:			291330006
Contract		oomp					Tools Ord				0000
Contract: Installation:			V	V9133L-14-D ESHEP			Task Orde	er: ted/Date Co	mpleted:		0006 10/26/17/10/26/17
Well ID:				TW-07				oth to Water	-		29.1
Measuring Point				Top of Cas				th of Well (1			42.1
Development Me				PUMPE	-			•	Purging (ft):		29.73
Total Volume Pu				10			-	Volume (ga			2.1
Technician(s):		S	arah Levine	, Sean Hulbi	urt			Volumes (g		-	6.4
(0)						Specific		(3			
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (Gpm)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/26/17 14:40			0.5								Pumping Started
10/26/17 14:41	35	29.64	.5	16.81	7.31	0.448	3.59	205.4	142	2	Brown, turbid
10/26/17 14:45	35	29.73	.5	16.41	7.08	0.479	3.49	182.6	57.0	4	Light brown
10/26/17 14:49	35	29.72	.5	16.39	7.06	0.477	3.32	154.0	31.8	6	Clear
10/26/17 14:53	35	29.73	.5	16.30	7.03	0.473	3.15	124.2	19.1	8	Clear
10/26/17 14:57	35	29.73	.5	16.25	7.02	0.472	3.09	104.6	15.0	10	Clear
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Instruments (N Equipment Calibrate		Model, a		'es		Calibrated Within	Criteria (Y/N)	:			Yes
			٦	Furbidity Met	er, Water Qu	lality Meter, Water LaMotte 2020 128 YSI 556 MPS 09F	36-3511,	Mega Monsoo	on Pump		
Calculations:											Signature:
Calculations.											Signature.
Saturated well c	asing volume:	V= Π(R^2	2)H*7.48 ga	al/ft^3							
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) = H = height of water of		n)/12 (in/ft))/	2)			=∏ * (2.0	0 (in)/12 (in/ft)	2)H*7.48 gal/ft )/2)^2 * 13.00 2.1 gal.	^3 * 7.48 gal/ft^3		Sahri
Notes:					Nono						Name (print):
	0				None						Sarah Levine
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/11/2017



Wheeter											
Project Name:	Compounds at Multiple Air National Guard Installations         Task Order:         0006										
Contract			V	V9133L-14-F	0-0002		Task Ord	er:			0006
Installation:				ESHEF					mpleted:		11/15/17/11/15/17
Well ID:				Tw-08				oth to Water	-		34.6
Measuring Point				Top of Ris	ser			th of Well (1			39.0
Development Me				PUMPE					Purging (ft):		35.9
Total Volume Pu				8				Volume (ga	• • • •		0.7
Technician(s):	0 10 /		Sean	hulburt				Volumes (g			2.2
		Water				Specific				Cum.	Comments/Observations
Date/Time	Intake Depth (feet)	Level (feet)	Rate (MI /m)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Volume (gal.)	During Purging (color, sediment, etc.)
11/15/17 14:27			2000								Pumping Started
11/15/17 14:30	35	37	2000	15.77	7.00	1.495	8.86	159.5	92		
11/15/17 14:35	35	37.6	2000	15.68	6.80	1.488	7.54	159	57		Pumped dry
11/15/17 14:45									10		Sampled upon rebounding
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						1	1		1		
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Instruments (N	lanufacturer,	Model, a	nd Seria	l No.):							
Equipment Calibrate	ed (Y/N):		Y	'es		Calibrated Within	Criteria (Y/N)	:			Yes
			1	Furbidity Met	er, Water Qu	ality Meter, Water	Level Meter,	Mega Monsoo	on Pump		
						Lamotte 2020					
						YSI 556 MPS 8	36749				
Calculations:											Signature:
Saturated well c	asing volume:	V= П(R^2	2)H*7.48 ga	al/ft^3							
			-)								
V = Volume (gal/ft)								2)H*7.48 gal/ft			
<b>Π</b> = 3.14						=∏ * (2.			* 7.48 gal/ft^3		
R = well radius (ft) =		n)/12 (in/ft))	(2)				=	0.7 gal.			- m
H = height of water	column (ft)										
Notes:											Name (print):
Well pumped dry a						oment. A total of 32 ring purging , turbic				llons flowed	Sean hulburt
QA/QC'd by:	Sarah Levine	1						(	QA/QC Date:		12/13/2017
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Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations       Project Number:       291330006         W9133L-14-D-0002       Task Order:       0006         ESHEP       Date Started/Date Completed:       11/03/17/11/03/17										
Contract:			V	V9133L-14-E	0-0002		Task Ord	er:			0006	
Installation:				ESHEP	)				mpleted:		11/03/17/11/03/17	
Well ID:				Tw-09			Initial Dep	oth to Water	r (ft):		16.8	
Measuring Point	:			Top of Ris	ser		Total Dep	th of Well (	ft):		40.0	
Development Me				PUMPE	D		Depth to	Water After	Purging (ft):		16.8	
Total Volume Pu	rged (gal):			20				Volume (ga			3.8	
Technician(s):			Sean	hulburt			3 Casing	Volumes (g	al):		11.4	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI /m)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/03/17 12:47			3000			(mo/cm)					Pumping Started	
11/03/17 12:47	25	16.85	3000	16.18	6.07	.645	6.05	120.36	44			
11/03/17 12:57	25	16.85	3000	16.19	6.10	.645	6.05	119.2	39			
11/03/17 13:02	25	16.85	3000	16.19	5.78	.645	6.05	118.4	34			
11/03/17 13:09	25	16.85	3000	16.18	5.79	.645	6.05	116.1	19.4			
11/03/17 13:17	25	16.88	3000	16.19	5.81	.644	6.06	114.8	12.2			
			<u> </u>	<u> </u>	<u> </u>		+					
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			1		1	1						
					<u> </u>				<u> </u>			
		<u> </u>					+					
	1		1	1		1			1			
Instruments (M Equipment Calibrate		Model, a		No.): <sup>′es</sup>	•	Calibrated Within	Criteria (Y/N)	):			Yes	
Turbidity Meter, Water Quality Meter, Water Level Meter, Mega Monsoon Pump Lamotte 2020 1286, YSI 556 MPS 86749												
Calculations:											Signature:	
Saturated well ca	asing volume:	V= П(R^2	2)H*7.48 ga	al/ft^3								
V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water o		n)/12 (in/ft))/	2)			=∏ * (2.0	0 (in)/12 (in/ft)	2)H*7.48 gal/ft ))/2)^2 * 23.20 3.8 gal.	^3 * 7.48 gal/ft^3		Som	
Notes:											Name (print):	
					None						Sean hulburt	
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/12/2017	



Project Name:					ions for Per-F ional Guard Iı		Project N	umber:			291330006
Contract:			v	/9133L-14-E	0-0002		Task Orde	er:			0006
Installation:				ESHEP		,		ted/Date Co	mpleted:	-	10/20/17/10/20/17
Well ID:				TW-10			Initial Dep	oth to Water	(ft):		32.0
Measuring Point	:			Top of Cas	sing		Total Dep	th of Well (f	t):		37.0
Development Me	thod:			PUMPE	D		Depth to \	Nater After	Purging (ft):		35.61
Total Volume Pu	rged (gal):			30			1 Casing	Volume (ga	I):		0.8
Technician(s):			S Le	evine			3 Casing	Volumes (g	al):		2.5
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (Gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/20/17 11:52			.73		1	(IIIS/CIII)					Pumping Started
10/20/17 11:53	37	33.62	.73	19.23	7.57	0.601	7.70	186.8	Over	0	Brown, turbid
10/20/17 11:57	37	34.95	.73	17.61	7.04	0.550	5.40	217.6	Over	3	Light brown, turbid
10/20/17 12:01	37	35.5	.73	17.02	7.04	.537	5.13	215.5	1952	6	Light brown, turbid
10/20/17 12:05	.37	35.83	.73	16.67	7.05	0.532	5.63	218.2	1843	9	Light brown, turbid
10/20/17 12:10	.37	36.08	.73	16.52	7.09	0.527	5.68	218.1	1691	12	Light grown, turbid
10/20/17 12:14	.37	35.63	.73	16.42	6.98	0.537	4.78	219.4	1174	15	Light brown
10/20/17 12:26	.37	35.60	.73	17.61	7.22	0.554	6.67	221.4	982	21	Light brown
10/20/17 12:33	.37	35.61	.73	17.57	6.97	0.556	4.52	217.6	917	26	Brown tint
						<u> </u>					
			1								
					<u> </u>						
						<u> </u>					
			<u> </u>		<u> </u>						
Instruments (Manufacturer, Model, and Serial No.):       Yes       Calibrated Within Criteria (Y/N):       Yes										Yes	
				Tur	bidity Meter,	Water Quality Met LaMotte 2020 128 YSI 556 MPS 09F	36-3511,	nsoon Pump			
Calculations:											Signature:
Saturated well ca	asing volume:	V= Π(R^2	2)H*7.48 ga	ıl/ft^3							
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) = H = height of water of		n)/12 (in/ft))/	2)			= <b>∏</b> * (2.	0 (in)/12 (in/ft	)H*7.48 gal/ft⁄ ))/2)^2 * 5.00 * 0.8 gal.			Supri
Notes:					None						Name (print): Sarah Levine
QA/QC'd by: Sarah Levine QA/QC Date: 12/11/2017											

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Project Name:			Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations     Project Number:     291330006       W9133L-14-D-0002     Task Order:     0006       PITTS     Date Started/Date Completed:     11/21/17/11/21/17											
Contract:			V	V9133L-14-E	0-0002		Task Ord	er:			0006			
Installation:				PITTS							11/21/17/11/21/17			
Well ID:				Bw-01				oth to Water			40.0			
Measuring Point				Top of Ris	ser	<u> </u>		th of Well (	ft): Purging (ft):		40.0			
Development Me Total Volume Pu						<u> </u>		water After Volume (ga	/					
Technician(s):	i geu (gai).		Sean	hulburt		<u></u>		Volumes (ga						
		Weter				Specific				Cum	Comments/Observations			
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate ()	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	During Purging (color, sediment, etc.)			
											Pumping Started			
					1									
							+							
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					1									
					1									
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							-							
Instruments (M	anufacturer	Model, a	and Seria	l No.):										
Equipment Calibrate				es		Calibrated Within	Criteria (Y/N)	:			Yes			
				W	ater Quality	Meter, Water Leve	I Meter, Peris	taltic Pump						
						, Horiba u 52 U52	73969							
Calculations:						. 101.104 4 02 002					Signature:			
											Signature.			
Saturated well c: V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water c	(well diameter (i			al/ft^3		=∏ * (2.	0 (in)/12 (in/ft	!)H*7.48 gal/ft/ ))/2)^2 * 0.00 * = gal.			Som			
Notes:											Name (print):			
				Dŋ	upon comp	letion					Sean hulburt			
QA/QC'd by:	QA/QC'd by: QA/QC Date:													



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Project Name:	weight of the standard installations     Task Order:     0006       lation:     ESHEP     Date Started/Date Completed:     11/21/17/11/21/17											
Contract:			V	V9133L-14-E	0-0002		Task Orde	er:			0006	
Installation:					)							
Well ID:				Bw-02				oth to Water			34.5	
Measuring Point				Top of Ris				th of Well (			40.0	
Development Me				PUMPE	D				Purging (ft):		32.8	
Total Volume Pu	rged (gal):			20				Volume (ga			0.9	
Technician(s):	,		Sean	hulburt		0 10	3 Casing	Volumes (g	al):		2.7	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/m)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/21/17 07:29	1		1000								Pumping Started	
11/21/17 07:35	36	34.5	1000	14.73	6.95	.818	3.22	59.9	455			
11/21/17 07:41	38	36.5	1000	14.81	6.81	.806	2.42	53.6	320			
11/21/17 07:49	38.5	37.9	750	14.49	6.75	.795	2.21	37.8	300			
11/21/17 07:57	38.5	34.5	750	14.60	6.70	.745	2.20	30.7	80			
11/21/17 08:01	38.5	34.2	750	14.59	6.68	.740	2.04	25.2	35			
11/21/17 08:08 11/21/17 08:16	38.5 38.5	34.3	750 737	14.72	6.67 6.66	.740 .737	1.94	15.9	25			
11/21/17 08:18	38.5	34.5 34.5	740	14.65 14.67	6.67	.734	1.88 1.80	14.8 13.6	20 19			
11/2 1/17 00.19	00.0	04.0		10.07	0.07		1.00	13.0	13			
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									1			
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						1			1			
					1		1		1			
Instruments (M	lanufacturer,	Model, a	nd Serial	No.):								
Equipment Calibrate	ed (Y/N):		Y	es		Calibrated Within	Criteria (Y/N)	:			Yes	
Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump Lamotte 2020 1286, YSI 556 MPS 86749												
Coloulations											Signatura	
Calculations:											Signature:	
Saturated well ca V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water ca	(well diameter (ii			al/ft^3		=∏ * (2.	0 (in)/12 (in/ft	t)H*7.48 gal/ft ))/2)^2 * 5.50 0.9 gal.	^3 * 7.48 gal/ft^3		Som	
Notes:											Name (print):	
					None						Sean hulburt	
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/13/2017	



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Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations       Project Number:       291330006         W9133L-14-D-0002       Task Order:       0006         ESHEP       Date Started/Date Completed:       11/16/17/11/16/17										
Contract:			W	/9133L-14-E	0-0002		Task Orde	er:			0006	
Installation:				ESHEF	)		Date Star	ted/Date Co	mpleted:		11/16/17/11/16/17	
Well ID:				Bw-03			Initial Dep	oth to Wate	r (ft):		36.5	
Measuring Point				Top of Ris	ser		Total Dep	th of Well (	ft):		37.0	
Development Me	ethod:			PUMPE	D		Depth to \	Water After	Purging (ft):		36.5	
Total Volume Pu	rged (gal):			8			1 Casing	Volume (ga	l):		0.1	
Technician(s):			Sean	hulburt			3 Casing	Volumes (g	al):		0.2	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/min)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
11/16/17 13:30			1000			(mo/cm)					Pumping Started	
11/16/17 13:31	36	Ukn	1000	14.67	7.09	0.880	5.95	125	1268			
11/16/17 13:37	36		1000	14.70	6.61	0.896	5.35	164.7	39			
11/16/17 13:41	36	Ukn	1000	14.63	6.55	.890	5.22	169.5	17.5			
11/16/17 13:44	36	Ukn	1000	14.62	6.52	0.896	5.15	171.6	15.5			
11/16/17 13:52	36	Ukn	1000	14.46	6.46	.886	5.07	169.4	16.5			
11/16/17 13:59	36	Ukn	1000	14.30	6.46	0.867	5.16	166.4	117			
11/16/17 14:05	36	Ukn	1000	14.30	6.37	0.884	4.95	163.9	68.4			
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Instruments (M Equipment Calibrate		Model, a		No.): es		Calibrated Within	Criteria (Y/N)	:			Yes	
Turbidity Meter, Water Quality Meter, Water Level Meter, Mega Monsoon Pump Lamotte 2020 1286,												
						YSI 556 MPS 8						
Calculations:											Signature:	
Saturated well ca V = Volume (gal/ft)	asing volume:	V= П(R^2	2)H*7.48 ga	I/ft^3			V= П(R^2	2)H*7.48 gal/ft	^3		AA	
$\Pi = 3.14$ R = well radius (ft) = H = height of water of		n)/12 (in/ft))	/2)			=∏ * (2.	.0 (in)/12 (in/ft		* 7.48 gal/ft^3		Som	
Notes:											Name (print):	
					None						Sean hulburt	
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/13/2017	



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Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations       Project Number:       291330006         W9133L-14-D-0002       Task Order:       0006         ESHEP       Date Started/Date Completed:       11/09/17/11/09/17											
Contract:			W	/9133L-14-E	0-0002		Task Orde	er:			0006		
Installation:									mpleted:				
Well ID:				Bw-04				oth to Water			20.34		
Measuring Point				Top of Ris	ser		Total Dep	th of Well (i	ft):		30.0		
Development Me	thod:			PUMPE	D		Depth to V	Water After	Purging (ft):		22.7		
Total Volume Pu	rged (gal):			25				Volume (ga			1.6		
Technician(s):			Sean	hulburt			3 Casing	Volumes (g	al):		4.8		
		Water				Specific				Cum.	Comments/Observations		
Date/Time	Intake Depth (feet)	Level (feet)	Rate (MI/min)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Volume (gal.)	During Purging (color, sediment, etc.)		
11/09/17 07:20			2000								Pumping Started		
11/09/17 07:20	25	22.1	2000	14.48	6.45	.799	6.90	162.6	672		Au turb		
11/09/17 07:25	25	22.2	2000	14.69	6.55	.804	6.20	155.6	21				
11/09/17 07:31	25	22.3	2000	14.73	6.56	.804	6.28	154	15				
11/09/17 07:34	25	22.3	2000	14.78	6.56	.788	6.09	150.8	13.8				
11/09/17 07:40	25	22.6	2000	14.78	6.56	.776	6.04	146	8.15				
11/09/17 07:44	25	22.6	2000	14.78	6.56	.780	6.02	143.8	5				
11/09/17 07:46	25	22.6	2000	14.78	6.56	.780	6	141.8	4				
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Instruments (M	lanufacturer.	Model, a	nd Serial	No.):					1		•		
Equipment Calibrate				es		Calibrated Within	Criteria (Y/N)	:			Yes		
			Т	urbidity Met	er. Water Qu	ality Meter, Water			on Pump				
Lamotte 2020 1286, YSI 556 MPS 86749													
Calculations:											Signature:		
				1/// 100							, č		
Saturated well c: V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water of the set of the s	: (well diameter (i			Ш/П/^З		=∏ * (2.	0 (in)/12 (in/ft	!)H*7.48 gal/ft ))/2)^2 * 9.66 1.6 gal.	^3 * 7.48 gal/ft^3		Som		
Notes:											Name (print):		
					None						Sean hulburt		
QA/QC'd by:	Sarah Levine							(	QA/QC Date:		12/12/2017		
www.caby:	Jaran Levine							C C	KAN WO Date:		12/12/2017		



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Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations     Project Number:     291330006       W9133L-14-D-0002     Task Order:     0006       ESHEP     Date Started/Date Completed:     11/16/17/11/20/17										
Contract:			V	V9133L-14-D	0-0002		Task Orde	er:			0006	
Installation:									mpleted:	-		
Well ID:				Bw-05				oth to Water			32.5	
Measuring Point	:			Top of Ris	ser			th of Well (i			40.0	
Development Me				PUMPE	D				Purging (ft):		38.2	
Total Volume Pu	rged (gal):			4			1 Casing	Volume (ga	I):		1.2	
Technician(s):			Sean	hulburt			3 Casing	Volumes (g	al):		3.7	
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/m)	Temp. (°C)	pH (units)	Specific Electrical Conductance	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume	Comments/Observations During Purging (color, sediment, etc.)	
		(leet)	1000			(mS/cm)				(gal.)	,	
11/16/17 15:20	05		1000	44.40	7.04	000	0.05	100.7			Pumping Started	
11/16/17 15:30	35 37	33.6	1000 1000	14.12 14.25	7.84 7.78	.860 .874	2.35	128.7	93			
11/16/17 15:35 11/16/17 15:40	38	34.8 35.8	1000	14.25	7.71	.873	2.20 2.17	106.6 65.9	110 105			
11/16/17 15:43	38	36.6	1000	14.29	7.69	.875	2.17	35.9	103			
11/16/17 15:46	40	37.7	1000	14.16	7.85	.937	1.56	-17.7	1915		Pumping dry.	
11/20/17 11:19	40	36.7	1000	14.10	1.00		1.00	-11.1	1010		Dry will sample in am	
11/20/17 11:19		36.7							1		Sampled	
11/20/11/11.10		00.1							1			
			1		1				1			
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Instruments (M Equipment Calibrate		Model, a		<b>No.):</b> ′es		Calibrated Within	Criteria (Y/N)	:			Yes	
Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump, Mega Monsoon Pump Lamotte 2020 1286, YSI 556 MPS 86749												
Calculations:											Signature:	
Saturated well ca V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water of the set of the s	(well diameter (i			al/ft^3		=∏ * (2.	0 (in)/12 (in/ft	t)H*7.48 gal/ft ))/2)^2 * 7.50 1.2 gal.	^3 * 7.48 gal/ft^3		Som #	
Notes:			Sampled			bw-05-112017 at 1	1125.				Name (print): Sean hulburt	
QA/QC'd by:	After pumping ary on 11/16/2017,											



Wilecter											
Project Name:					ons for Per-F onal Guard I		Project N	umber:			291330006
Contract:	-		۷	V9133L-14-E	0-0002		Task Orde	er:			0006
Installation:				ESHEP	)		Date Star	ted/Date Co	mpleted:		11/17/17/11/17/17
Well ID:				Bw-06			Initial Dep	th to Water	· (ft):		23.0
Measuring Point				Top of Ris				th of Well (f			40.0
Development Me				PUMPE	D				Purging (ft):		35.7
Total Volume Pu	rged (gal):			20				Volume (ga			2.8
Technician(s):			Sean	hulburt	-		3 Casing	Volumes (g	al):		8.4
Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (MI/m)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
11/17/17 11:30			1000								Pumping Started
11/17/17 11:38	35	32.5	1000	17.98	6.55	.795	1.25	-118.3	Err	Turbid	
11/17/17 11:44		33	1000	17.81	6.58	.783	.87	-129	Err	Turbid	
11/17/17 11:51		33.4	1000	17.45	6.56	.796	.96	-106	Err		Turbid
11/17/17 12:00	07	34.6		17.33	6.48	.815	.96	-87	Err		
11/17/17 12:16 11/17/17 12:40	37	35.6 35.7		16.39 16.36	6.29 6.18	.820 .840	1.23 1.15	-63.3 -55	3773 898		
11/17/17 12:50		35.7		16.08	6.16	.838	1.15	-55	72		
11/17/17 13:02		35.7		15.93	6.16	.840	.88	-63.8	1000		
11/17/17 13:10		35.7	1	15.8	6.15	.838	.79	-68	815		
11/17/17 13:17		35.7	570	15.70	6.15	.830	1.10	-53	962		
11/17/17 13:23		35.7		15.37	6.17	.826	1.14	-53.7	671		
11/17/17 13:28		35.7		15.37	6.17	.816	1.41	-44.6	700		
11/17/17 13:38		35.7		15.51	6.19	.816	1.52	-42.7	64		
					1.52						
			1								
Instruments (M Equipment Calibrate		Model, a		No.): <sup>'es</sup>		Calibrated Within	Criteria (Y/N)				Yes
Subrate					er Water Ou	-	. ,				
Turbidity Meter, Water Quality Meter, Water Level Meter, Mega Monsoon Pump Lamotte 2020 1286, YSI 556 MPS 86749											
Calculations:		-			-						Signature:
Saturated well ca	asing volume:	V= П(R^2	P)H*7 48 ga	al/ft^3						i	
V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water of the second sec	(well diameter (ii					=∏ * (2.0	) (in)/12 (in/ft)	)H*7.48 gal/ft⁄ )/2)^2 * 17.00 2.8 gal.	^3 * 7.48 gal/ft^3		Som
Notes:											Name (print):
			Ould	d not stabiliz	e parameters	ran out to 2hours					Sean hulburt
QA/QC'd by:	A/QC'd by: Sarah Levine QA/QC Date: 12/13/2017										



wheeler														
Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations     Project Number:     291330006       W9133L-14-D-0002     Task Order:     0006       ESHEP     Technician(s):     Sch       TW-01     Date:     11/21/17												
Contract:		-	۷	/9133L-14-D	-0002		Task Orde	er:		0006				
Installation:										Sch				
Well ID:				TW-01			Date:			11/21/17				
Initial Depth to	Water (ft):			38.5			Well Diam	eter (in):		2.0				
Total Depth of				40.0			-	Volume (g	,	0.2				
Method of Pure				Pumping			3 Casing			0.7				
Measuring Poi	nt (toc, tor, et	ic.):		Тор	of Riser		Pump Inta	ake Depth	(feet):	39				
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging				
	•	Stabilizatio	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)				
10:40		1000								Pumping/Purging Started				
							-							
							-							
							_							
	+													
							-							
							-							
Stability Reach	ned (Y/N)			No		If No, Provide E	xplanation		No - I	nsufficient volume to purge				
		Einel	Values		//		-							
		Finai	Values:	#N/A		#N/A		#N/A	#N/A					
Sample ID:	- ()( ())-)-		Est	ep-gw-tw01- No	112117			f Sampling	J:	Submersible pump 11/21/17				
QA/QC Sample Duplicate ID:	s (res/No):			NA			Sample Da	ate: ollection T	ime:	10:45				
Sample Contai	ner Type(s)		125 ml p	astic, 250 ml	amber glass		-	ime Purge		.2				
Preservative(s)		-		Ice (4 °C			Sample D	-	a (gai).	39				
Analysis/Metho			PFA	S (EPA 537-					r Sampling (ft):	40				
	struments (Manufacturer, Model, and Serial No.):  uppent Calibrated (Y/N): Calibrated Within Criteria (Y/N):													
	Water Level Meter, Mega Monsoon Pump													
						,								
Calculations:										Signature:				
Saturated well V=Volume (gal/ft) $\Pi$ = 3.14 R = well radius (ft H = height of wate	) = (well diamete			al/ft^3		= Π * (;	2.0 (in)/12 (in/f	2)H*7.48 gal. ft))/2)^2 * 1.5 ፡ 0.2 gal.	/ft^3 0 * 7.48 gal/ft^3	Smit				
Notes:										Name (print):				
Highly	suspect for rain	water. Well w	as dry for on	e week, then	heavy rain.	Well immediately p	umped dry . B	arely enoug	h to fill sample bottle	es. Sean hulburt				
QA/QC'd by:	A/QC'd by: Sarah Levine QA/QC Date: 12/13/2017													



WIEElei										
Project Name:					Per-Fluorina uard Installati	ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D	-0002		Task Orde	er:	-	0006
Installation:				ESHE	P		Technicia	n(s):	-	Sch cw
Well ID:				TW-02			Date:		_	10/31/17
Initial Depth to				27.9			Well Diam			2.0
Total Depth of				41.0 Pumping			-	Volume (ga	-	2.1 6.4
Method of Purg Measuring Poi		tc ):		Pumping	of Riser		Pump Inta	Volumes (g		35
Measuring For				10	0110301	Specific	r unip inta	ike Deptil	leet).	
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
	1	Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
10:34		3000								Pumping/Purging Started
							-			
	1									
							-			
	1									
							-			
							-			
Stability Reach	ed (Y/N)	1	,	Yes	1	If No, Provide E	xplanation	1	۰ <b>ــــــ</b>	NA
		Final	Values		44517 A					
0		Final	Values:	#N/A		#N/A		#N/A		Cub numn
Sample ID: QA/QC Sample	c (Voc/No):		ESI	rep-gw-tw02- Yes MS/M			Sample Da	f Sampling		Sub pump 10/31/17
Duplicate ID:	s (165/100).			NA	50			ale. ollection T	ime:	11:49
Sample Contai	ner Type(s):		125 m	hdpe and 25	i0 ml glass		-	ime Purge	-	16
Preservative(s)				Ice (4 °C	)		Sample D	-		35
Analysis/Metho					C (EPA 9060	)	Depth to V	Nater After	r Sampling (ft):	25.7
	Instruments (Manufacturer, Model, and Serial No.): Equipment Calibrated (Y/N): Yes Calibrated Wit							:		Yes
Turbidity Meter, Water Quality									sible Pump	
Calculations:					Laine	1200, 13	1 550 MF 5 607	45		Signature:
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2) H = height of water column (ft)							.0 (in)/12 (in/ft	2)H*7.48 gal/ :))/2)^2 * 13.1 : 2.1 gal.	/ft^3 10 * 7.48 gal/ft^3	Groff
Notes:										Name (print):
						as free water and c arameters- MHL 4/				Sean hulburt
QA/QC'd by:	Sarah Levin								QA/QC Date:	12/12/2017



WIEElei										
Project Name:					Per-Fluorinat	ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D-	-0002		Task Orde	er:		0006
Installation:				ESHEP			Technicia	n(s):		Sch
Well ID:				TW-03			Date:			11/21/17
Initial Depth to				17.2			Well Diam	• • •		2.0
Total Depth of				30.0			1 Casing			2.1
Method of Pure				Pumping			3 Casing			6.3
Measuring Poi	nt (toc, tor, et	(C.):	1	lop	of Riser	Creatific	Pump Inta	ike Depth	(feet):	28
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
12:44		1000								Pumping/Purging Started
							-			
L	-						+			
	+									
							+			
L	-									
L	-									
Otabilita Daash				Nie		I KAIs Desuida D				No. Duran of day
Stability Reach	ied (1/N):			No	-	If No, Provide E	Explanation		•	No - Pumped dry
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:			Est	nep-gw-tw03-	112117			f Sampling	J:	Submersible pump
QA/QC Sample	es (Yes/No):			No			Sample D			11/21/17
Duplicate ID:	<b>–</b> / \		405	NA			•	ollection T		13:05
Sample Contai			125 mi p	lastic, 250 mi Ice (4 °C	amber glass			Ime Purge	d (gal):	4 28
Preservative(s Analysis/Metho					) , TOC (EPA 9	2060)	Sample D		r Sampling (ft):	2o Dry
Instruments (					, 100 (EI A 3	,000)	Deptil to v	Nalei Aile	r Sampling (n).	Diy
Equipment Calibra	-			'es		Calibrated Within	n Criteria (Y/N)	:		Yes
				Turbidity M		uality Meter, Wate otte 2020 1286, YS			oon Pump	
Calculations:										Signature:
Saturated well	casing volun	ne: V= П(R <sup>/</sup>	2)H*7 48 o	al/ft^3						
V=Volume (gal/ft) Π = 3.14 R = well radius (ft H = height of wate	) = (well diamete	,	, .			= ∏ * (2	2.0 (in)/12 (in/ft	2)H*7.48 gal ())/2)^2 * 12.7 : 2.1 gal.	/ft^3 80 * 7.48 gal/ft^3	Smit
Notes:										Name (print):
		l pumped dry well developr				l sample when wat 4/9/18	er level reache	ed pump dep	oth.	Sean hulburt
QA/QC'd by:	Sarah Levin	e							QA/QC Date:	12/13/2017



wheeler										
Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:		-	۷	/9133L-14-D-	0002		Task Orde	er:	-	0006
Installation:		-		ESHE	C		Technicia	n(s):	-	Sch cw
Well ID:				TW-04			Date:		_	11/01/17
Initial Depth to				8.72			Well Diam		_	2.0
Total Depth of				40.0			-	Volume (g	·	5.1
Method of Purg				Pump				Volumes (		15.4
Measuring Poin	nt (toc, tor, el	ic.):	1	Тор	of Riser		Pump Inta	ake Depth	(feet):	35
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
	•	Stabilizatio	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
13:10		1100								Pumping/Purging Started
	-									
	1									
	1									
	1									
	1									
						-				
						-				
				N/s s		If No. Descriptor D				NA
Stability Reach	ied (1/N):			Yes		If No, Provide E	Explanation	-		NA
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:			Est	nep-gw-tw04-	110117			f Sampling	j:	Submersible pump
QA/QC Sample	s (Yes/No):			No			Sample D			11/01/17
Duplicate ID:			105 ml n	NA	ambar alaaa			ollection T		13:46 15
Sample Contai Preservative(s)			125 m p	lastic, 250 ml Ice (4 °C)			Sample D	Ime Purge	d (gai):	35
Analysis/Metho		F	PFAS (EPA 5	i37-modified),		9060)			r Sampling (ft):	8.73
Instruments (							Deptilito	Mater Arte	roumpning (it).	0.10
Equipment Calibra				es		Calibrated Within	n Criteria (Y/N)	c	-	Yes
Turbidity Meter, Water Quality Meter, Water Level Meter, G Lamotte 2020 1286, YSI 556 MPS 8674									sible Pump	
Calculations:										Signature:
Saturated well		ne: V= П(R/	^2)H*7 48 o	al/ft^3						
	eaching retain		_)							
V=Volume (gal/ft)						- E * (2		2)H*7.48 gal		$\langle \rangle$
$\Pi = 3.14$		or (in)/12 (in/ft)	))/ <b>2</b> )			=11 (2		:))/2)*2 31 : 5.1 gal.	28 * 7.48 gal/ft^3	Andt
R = well radius (ft) H = height of wate		ει (Π1)/ 1∠ (Π1/Π)	))/∠)					<u>.</u>		14000
	17									
Notes:										Name (print):
					Nie					Coop kulturet
					None See we	ell development rec	ord for field pa	aramaters- N	/HL 4/9/18	Sean hulburt
QA/QC'd bv:	Sarah Levin	е							QA/QC Date:	12/12/2017



Wheeler										
Project Name:					Per-Fluorinat	ted Compounds ons	Project Nu	umber:		291330006
Contract:	-		V	/9133L-14-D-	-0002		Task Orde	er:		0006
Installation:	-			ESHEP			Technicia			Sch
Well ID:	-			TW-05			Date:			11/21/17
Initial Depth to Wa				36.2			Well Diam			2.0
Total Depth of We	• • •			40.0			1 Casing V		,	0.6
Method of Purging				Pumping			3 Casing			1.9
Measuring Point (1	toc, tor, et	c.):		Тор	o of Riser	On a sifi s	Pump Inta	ike Depth	(feet):	39
Time	/ater Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:37		1000								Pumping/Purging Started
┣────┼										
<b>├</b> ───┼─										
<b>├</b> ───┼─					1	1	1	-	+	
Stability Reached	(Y/N):			No		If No, Provide E	Explanation		No - Ir	nsufficient volume for purge
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:			Est	nep-gw-tw05-	112117	1	Method of			Submersible pump
QA/QC Samples ()	Yes/No):			No			Sample D			11/21/17
Duplicate ID:	_			NA			Sample C			11:45
Sample Container	Type(s):		125 ml p		amber glass		Total Volu	-	d (gal):	.5
Preservative(s):	· · ·		DEA	Ice (4 °C	,		Sample D			39
Analysis/Method(s Instruments (Ma		vr Model		S (EPA 537-	modilied)		Depth to v	vater Atte	r Sampling (ft):	Dry
Equipment Calibrated		ar, moder, e		-		Calibrated Within	n Criteria (Y/N)	:		
Water Level Meter, Mega Monsoon Pump										
Calculations:										Signature:
Saturated well cas			·2)H*7 40 ~	al/ft^3						
V=Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = (v H = height of water co	well diamete					= П * (;	2.0 (in)/12 (in/f	2)H*7.48 gal (t))/2)^2 * 3.8 : 0.6 gal.	/ft^3 30 * 7.48 gal/ft^3	Smit
Notes:										Name (print):
		Well was pun See well deve				collected grab sam MHL 4/9/18	ple and well pu	umped dry.		Sean hulburt
QA/QC'd by: Sa									QA/QC Date:	12/13/2017
· · · · · · · · · · · · · · · · · · ·										



WITEELEI									
Project Name:			spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:		V	/9133L-14-D-	0002		Task Orde	er:	-	0006
Installation:			ESHEP			Technicia		-	Sch cw
Well ID:			TW-06			Date:		-	11/13/17
Initial Depth to Water (ft):			27.35			Well Diam	eter (in):	_	2.0
Total Depth of Well (ft):			40.0			1 Casing	Volume (ga	al):	2.1
Method of Purging:			Pumping			-	Volumes (g		6.2
Measuring Point (toc, tor,	etc.):		Тор	of Riser		Pump Inta	ke Depth	(feet):	35
Time Water Leve (feet)	I Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
	Stabilizatio	n Criteria	±0.5°C	±0.1	(mS/cm) ±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
10:27	2000							NIG	Pumping/Purging Started
	2000								· · · · · · · · · · · · · · · · · · ·
						-			
						-			
	_					-			
						-			
Stability Reached (Y/N):	-		Yes		If No, Provide E	Explanation		· · ·	NA
	Eine al	Values		//					
a i ia	Final	Values:	#N/A	#N/A	#N/A		#N/A	#N/A	Quick are any likely and any
Sample ID:		ESI	ep-gw-tw06- No	111317			f Sampling	l:	Submersible pump 11/13/17
QA/QC Samples (Yes/No): Duplicate ID:			NA			Sample D	ate: ollection T		11:15
Sample Container Type(s):		125 ml p	astic, 250 ml	amber glass		-	ime Purge	-	24
Preservative(s):			Ice (4 °C			Sample D	-	- (gui).	35
Analysis/Method(s):	F	PFAS (EPA 5	37-modified),		9060)			r Sampling (ft):	27.35
Instruments (Manufactu Equipment Calibrated (Y/N):		I No.): es		Calibrated Within				Yes	
				eter, Water C	er Level Meter,		oon Pump		
			749						
Calculations:									Signature:
Saturated well casing volu V=Volume (gal/ft) Π = 3.14 R = well radius (ft) = (well diame H = height of water column (ft)	·	, .	al/ft^3		= П * (2	2.0 (in)/12 (in/ft	2)H*7.48 gal :))/2)^2 * 12.6 : 2.1 gal.	/ft^3 65 * 7.48 gal/ft^3	Smit
Notes:									Name (print):
			ard for field as	rameters M	HI 4/0/18	Sean hulburt			
QA/QC'd by: Sarah Levi	ne		See W	ell devlopment reco	ora ior neia pa	iameters- M	QA/QC Date:	12/13/2017	



Wheeler										
Project Name:	:			spections for ir National Gu		ed Compounds	Project Nu	imber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:	_	0006
Installation:				ESHEP			Technicia	n(s):	_	Sarah Levine, Sean Hulburt
Well ID:				TW-07			Date:			10/26/17
Initial Depth to				29.73			Well Diam		_	2.0
Total Depth of				40.0			1 Casing \		-	1.7
Method of Pur				Monsoon			3 Casing \			5.1
Measuring Po	int (toc, tor, e	tc.):		Тор	of Casing	0.10	Pump Inta	ke Depth (	feet):	35
Time	Water Level (feet)	Flow Rate (Gpm)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
	-!	Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
14:58		.39								Pumping/Purging Started
14:58	29.61	.39	0	16.28	7.03	0.473	2.96	97.1	12.4	Clear
15:02	29.70	.39	1.56	16.96	7.03	0.481	3.02	91.8	11.26	Clear
15:06	26.82	.39	3.11	16.40	7.02	0.476	3.05	83.3	9.35	Clear
15:10	26.88	.39 .39	4.78 6.24	16.33	7.01	0.476	3.13	77.9	7.74 7.01	Clear
15:14	29.70	.39	0.24	16.31	7.01	0.476	3.17	74.5	7.01	Clear
		1			1			1		
	_									
	-									
	_									
Ctability Deca	had (M/N):			Vee	1	If No. Drowido F	welcontion			NIA
Stability Reac	neu (m).			Yes		If No, Provide E	xpianation			NA
		Final	Values:	16.31	7.01	0.476	3.17	74.5	7.01	
Sample ID:			ESH	EP-GW-TW07	7-102617		Method of	Sampling	: _	Monsoon
QA/QC Sample	es (Yes/No):			No			Sample Da		_	10/26/17
Duplicate ID:				NA			Sample Co			15:15
Sample Conta				lass 250ml, H			Total Volu	-	d (gal):	7
Preservative(s				Ice (4 °C), H2			Sample De			35
Analysis/Meth		an Madal I		PA 537), TOO	) (EPA 9060)		Depth to V	Vater After	Sampling (ft):	29.72
Instruments Equipment Calib		er, wodel, a		i NO.): 'es		Criteria (Y/N):	:		Yes	
				Turbidity Me		r Level Meter, SI 556 MPS 09		oon Pump		
Calculations	:									Signature:
Saturated well casing volume: V= ⊓(R^2)H*7.48 gal/ft^3										
V=Volume (gal/ft Π = 3.14 R = well radius (f H = height of wat	ft) = (well diamete	er (in)/12 (in/ft)	)/2)			= Π * (2	.0 (in)/12 (in/ft	2)H*7.48 gal/ ))/2)^2 * 10.2 1.7 gal.	ft^3 27 * 7.48 gal/ft^3	Sulta
Notes:									Name (print):	
See well develoment record for a							ord for addition	al field para	meters- MHL 4/10/18	3 Sarah Levine
QA/QC'd by:	Sarah Levir	ne							QA/QC Date:	12/11/2017



WIECICI										
Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:		0006
Installation:				ESHEP			Technicia	n(s):		Sch cw
Well ID:				TW-08			Date:			11/15/17
Initial Depth to		-		34.6			Well Diam			2.0
Total Depth of W				40.0 Pumping			-	Volume (ga	,	0.9
Method of Purg Measuring Poin		ic ):			of Riser		-	Volumes (g ake Depth		35
incusuring r on				100		Specific		ike beptill		
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
14:27		2000								Pumping/Purging Started
							-			
							-			
							-			
							-			
Stability Reache	ed (Y/N):		1	No	1	If No, Provide E	Explanation		1	No - Pumped dry
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:		- Indi		nep-gw-tw08-				f Sampling		Submersible pump
QA/QC Samples	(Yes/No):	-		No			Sample D			11/15/17
Duplicate ID:	· /			NA			•	ollection T	ime:	14:45
Sample Contain	er Type(s):		125 ml p	lastic, 250 ml	amber glass		Total Volu	ime Purge	d (gal):	8
Preservative(s):				Ice (4 °C			Sample D			35
Analysis/Metho				37-modified)	TOC (EPA 9	9060)	Depth to V	Nater After	r Sampling (ft):	35.8
Instruments (N Equipment Calibrat		er, Model, a		I NO.): 'es		Calibrated Within	Criteria (Y/N)	:		Yes
				Turbidity M		uality Meter, Wate otte 2020 1286, YS			oon Pump	
Calculations:										Signature:
Saturated well of V=Volume (gal/ft) $\Pi$ = 3.14 R = well radius (ft) H = height of water	= (well diamete			al/ft^3		= П * (;	2.0 (in)/12 (in/f	2)H*7.48 gal/ ft))/2)^2 * 5.4 = 0.9 gal.	/ft^3 0 * 7.48 gal/ft^3	mit
Notes:										Name (print):
10000					y low at time Il developme	of collection nt record for field p	aramaters- M	HL 4/9/18`		Sean hulburt
QA/QC'd by:	Sarah Levin	e		200 110	22701000000		W		QA/QC Date:	12/13/2017
aniao u uy.		-							a a o Duio.	



WIEElei											
Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006	
Contract:			V	V9133L-14-D-	0002		Task Orde	er:		0006	
Installation:				ESHEP			Technicia		—	Sch cw	
Well ID:				TW-09			Date:			11/03/17	
Initial Depth to	Water (ft):			16.58			Well Diam	eter (in):	_	2.0	
Total Depth of				40.0			1 Casing V	Volume (ga	al):	3.8	
Method of Purg				Pump			3 Casing			11.5	
Measuring Poi	nt (toc, tor, e	tc.):		Тор	of Riser		Pump Inta	ke Depth	(feet):	25	
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging	
	-!	Stabilizatio	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)	
12:47		3000								Pumping/Purging Started	
							-				
							-				
									1		
							-				
							-				
			1								
			-+		<u> </u>						
							-				
							-				
			1								
Stability Reach	ned (Y/N):			Yes		If No, Provide E	Explanation			NA	
		Final	Values:	#N/A	#N/A	#N/A	#N/Δ	#N/A	#N/A		
Sample ID:				nep-gw-tw09-			Method of			Submersible pump	
QA/QC Sample	es (Yes/No):		20.	No			Sample D			11/03/17	
Duplicate ID:				NA			Sample C		ime:	13:20	
Sample Contai	iner Type(s):		125 ml p	lastic, 250 ml	amber glass		Total Volu			20	
Preservative(s)	):			Ice (4 °C)			Sample D	epth (ft):		25	
Analysis/Metho	od(s):	F	PFAS (EPA 5	37-modified),	TOC (EPA 9	9060)	Depth to V	Nater After	r Sampling (ft):	16.8	
Instruments (Manufacturer, Model, and Serial No.): Equipment Calibrated (Y/N): Yes Calibrated Withi								:		Yes	
	Turbidity Meter, Water Quality Meter, Water Le Lamotte 2020 1286, YSI 55								oon Pump		
Calculations:										Signature:	
Saturated well	casing volun	ne: V= П(R′	<sup>\</sup> 2)H*7.48 g	al/ft^3						$/\Lambda$	
V=Volume (gal/ft) Π = 3.14 R = well radius (ft H = height of wate	) = (well diamete	er (in)/12 (in/ft	))/2)			= П * (2	.0 (in)/12 (in/ft	2)H*7.48 gal/ ())/2)^2 * 23.4 : 3.8 gal.	/ft^3 42 * 7.48 gal/ft^3	Smit	
Notes:										Name (print):	
					See w	ell development red	cord for field n	arameters- N	/IHL 4/9/18	Sean hulburt	
QA/QC'd bv:	Sarah Levin	e							QA/QC Date:	12/12/2017	



WINCELEI										
Project Name:	:			spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:	-	0006
Installation:				ESHEP			Technicia		-	Sarah Levine
Well ID:				TW-10			Date:	( )	-	10/20/17
Initial Depth to	o Water (ft):			32.0			Well Diam	eter (in):	-	2.0
Total Depth of				37.0			1 Casing V	Volume (ga	al):	0.8
Method of Pur	rging:			Submersibl	е		3 Casing V	Volumes (g	gal):	2.5
Measuring Po	int (toc, tor, e	tc.):		Тор	of Casing		Pump Inta	ke Depth	(feet):	32
			Cum.			Specific				
Time	Water Level (feet)	Flow Rate (Gpm)	Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
	_	Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
12:53		.74								Pumping/Purging Started
12:58	34.3	.74	3.7	16.05	6.85	0.528	3.84	214.9	1169	Brown tint
13:03	34.36	.74	7.4	15.58	6.88	0.520	3.63	186.8	84.1	Light brown tint
13:08	34.37	.74	11.1	15.59	6.90	0.525	3.60	178.9	51.7	Clear
13:13	34.40	.74	14.8	15.52	6.91	0.519	3.62	170.6	35.3	Clear
13:18	34.42	.74	18.5	15.55	6.90	0.520	3.62	167.9	18.5	Clear
							_			
							-			
							-			
			1							
					1					
Stability Reac	hed (Y/N):			Yes		If No, Provide E	Explanation			NA
	. ,	Final	Values:	45.55	6.90	0.520	0.00	407.0	10.5	
		Fillai		15.55		0.520		167.9	18.5	
Sample ID:				EP-GW-TW10			Method of			Monsoon pump
QA/QC Sample	es (Yes/No):			es DUP, MS/			Sample Da			10/20/17
Duplicate ID:			ESHE	P-GW-DUP0			Sample Co		-	13:20
Sample Conta				125ml HDP			Total Volu	-	d (gal):	20
Preservative(s	-			Ice (4 °C)			Sample D		• ·· ·· ··	32
Analysis/Meth		an Madal		PFAS (EPA 5	537)		Depth to V	Vater After	r Sampling (ft):	34.40
Instruments Equipment Calibi	-	er, Model, a		i NO.): 'es		Calibrated Within	n Criteria (Y/N)	:		Yes
				Turbidity Me		r Level Meter, I 556 MPS 09I		oon Pump		
Calculations	:									Signature:
Saturated wel	l casina volun	ne: V= П(R/	2)H*7.48 c	al/ft^3						j , ,
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2) H = height of water column (ft)								2)H*7.48 gal, t))/2)^2 * 5.0 0.8 gal.	′ft^3 0 * 7.48 gal/ft^3	Supri
Notes: See well devlopment record							and for addition	al naramete	ere- MHI Δ/10/19	Name (print): Sarah Levine
QA/QC'd by: Sarah Levine								ar paramete		
QA/QC'd bV:	Saran Levin	IE							QA/QC Date:	12/11/2017



wheeler										
Project Name:				spections for ir National Gu		ted Compounds ons	Project N	umber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:		0006
Installation:				ESHEP	0002		Technicia			Sch
Well ID:				BW-01			Date:	(-)		11/21/17
Initial Depth to	Water (ft):			35.0			Well Diam	eter (in):		2.0
Total Depth of	Well (ft):			40.0			1 Casing	Volume (g	al):	
Method of Purg	ging:			Pumping			3 Casing	Volumes (	gal):	
Measuring Poir	nt (toc, tor, et	:c.):		Тор	of Riser		Pump Inta	ake Depth	(feet):	39.5
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
	<u>ļ</u>	Stabilizatio	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
15:56		Na								Pumping/Purging Started
	-									
					1	1	1	1	1	
									-	
	1									
							-			
Stability Reach	ed (Y/N):			No		If No, Provide E	Explanation		No - Insufficient vol	ume for low flow purging or development.
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:				ep-gw-bw01-	112117		Method of			Submersible pump
QA/QC Sample	s (Yes/No):			No			Sample D		-	11/21/17
Duplicate ID:				NA			Sample C	ollection 1	Fime:	15:20
Sample Contain	••••		125 ml p	astic, 250 ml	amber glass		Total Volu	ıme Purge	ed (gal):	
Preservative(s)				Ice (4 °C			Sample D			39.5
Analysis/Metho	. ,			37-modified),	TOC (EPA 9	9060)	Depth to V	Nater Afte	r Sampling (ft):	Dry
Instruments ( Equipment Calibra		er, Model, a	and Seria	I NO.): -		Calibrated Within	Criteria (Y/N)			-
					Water	r Level Meter, Meg	a Monsoon Pi	ump		
Calculations:						,				Signature:
Saturated well V=Volume (gal/ft) $\Pi$ = 3.14 R = well radius (ft) H = height of wate	) = (well diamete	, ,	, .	al/ft^3		= Π * (;	2.0 (in)/12 (in/1	2)H*7.48 gai ft))/2)^2 * 5.( = gal.	l/ft^3 00 * 7.48 gal/ft^3	Smit
Notes:										Name (print):
		was pumped eld parameter			unable to reco	over. Managed to f	ill bottles from	what left in	line.	Sean hulburt
QA/QC'd by:									QA/QC Date:	12/13/2017



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Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:	•		۷	/9133L-14-D-	0002		Task Orde	er:	-	0006
Installation:				ESHEP			Technicia		-	Sch cw
Well ID:				BW-02			Date:		_	11/21/17
Initial Depth to Wa	ater (ft):			34.5			Well Diam	eter (in):	-	2.0
Total Depth of Wel	ll (ft):			40.0			1 Casing V	Volume (g	al):	0.9
Method of Purging	g:			Pumping			3 Casing V	Volumes (	gal):	2.7
Measuring Point (t	toc, tor, et	c.):		Тор	of Riser		Pump Inta	ke Depth	(feet):	38.5
Time	/ater Level (feet)	Flow Rate (mL/min)	Cum. Volume	Temp. (°C)	pH (SU)	Specific Electrical Conductance	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations
	(1001)		(gal.)			(mS/cm)			±10% and <10	During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	NTU	
07:25		1000								Pumping/Purging Started
						-				
						-				
							-			
							_			
							-			
Stability Reached	(Y/N)·			Yes		If No, Provide E	volanation	•	•	NA
orability redefied	(1/14).									
		Final	Values:	#N/A		#N/A		#N/A	#N/A	
Sample ID:			Esh	ep-gw-bw02-			Method of		l:	Submersible pump
QA/QC Samples (Y	Yes/No):			Yes DUP			Sample Da			11/21/17
Duplicate ID:				ep -gw-dup06			Sample Co			08:20
Sample Container	Type(s):		125 ml p	lastic, 250 ml			Total Volu	-	d (gal):	20
Preservative(s):			DEA	Ice (4 °C) S (EPA 537-r			Sample Do		- Sompling (ft)	<u>38.5</u> 32.5
Analysis/Method(s			noumed)		Depth to v	vater Attel	r Sampling (ft):	52.5		
Instruments (Manufacturer, Model, and Serial No.):           Equipment Calibrated (Y/N):         Yes         Calibrated Within Cr								:		Yes
Turbidity Meter, Water Quality Meter, Water Level Me Lamotte 2020 1286, YSI 556 MPS									oon Pump	
Calculations:										Signature:
Saturated well cas	sina volum	ле• V= П(R^	2)H*7 48 o	al/ft^3						
	ing volui	<b>10. V</b> 11(1)	2)11 7.10 g							
V=Volume (gal/ft)						+ //		2)H*7.48 gal		$\langle \langle   \rangle \rangle$
Π = 3.14		( ) 140 ( (f))				= 11 ^ (;		t))/2)^2 ^ 5.5 0.9 gal.	0 * 7.48 gal/ft^3	malt
R = well radius (ft) = (w H = height of water col		n (in)/12 (in/ft)	)/∠)					5.0 yun		14000
- noight of water col	//////////////////////////////////////									
Notes:										Name (print):
										~ · ·
					See we	ell development red	cord for field pa	arameters- I	MHL 4/10/18	Sean hulburt
QA/QC'd by: Sa	arah Levin	e							QA/QC Date:	12/13/2017



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Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:	-	0006
Installation:				ESHEP			Technicia		-	Sch cw
Well ID:				BW-03			Date:		_	11/16/17
Initial Depth to				32.5			Well Diam	. ,		2.0
Total Depth of	. ,			40.0			-	Volume (ga	· _	1.2
Method of Purg				Pumping	of Riser		-	Volumes (g		3.7
Measuring Poir			1	TOP		Specific	Fumpinta	ake Depth	leet).	30
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
10:32		Na								Pumping/Purging Started
							-			
	1									
						-				
			+							
							-			
Stability Reach	od (V/N):			Yes	I	If No, Provide E	znlanation		11	NA
			N/ 1					1		
		Finai	Values:	#N/A	#N/A	#N/A		#N/A	#N/A	
Sample ID: QA/QC Sample			ESI	ep-gw-bw03- No	111617		Sample D	f Sampling		Submersible pump 11/16/17
Duplicate ID:	s (165/100).			NA				ollection T	ime:	14:10
Sample Contain	ner Type(s):		125 ml p	astic, 250 ml	amber glass		•	ime Purge		8. See well development form
Preservative(s)				Ice (4 °C			Sample D	-		35
Analysis/Metho	od(s):	P	PFAS (EPA 5	37-modified),	TOC (EPA 9	9060)	Depth to V	Nater After	r Sampling (ft):	37.5
Instruments ( Equipment Calibra		er, Model, a		I No.): es		Calibrated Withir	n Criteria (Y/N)	:		Yes
Turbidity Meter, Water Quality Meter, Water Level Meter, Mega Monsoo Lamotte 2020 1286, YSI 556 MPS 86749									oon Pump	
<b>.</b>					Lanic	Jue 2020 1200, 13	1 550 IVIE 5 607	749		
Calculations:										Signature:
Saturated well V=Volume (gal/ft) $\Pi$ = 3.14 R = well radius (ft) H = height of wate	) = (well diamete	,	, .	al/ft^3		= П * (;	2.0 (in)/12 (in/f	2)H*7.48 gal/ ft))/2)^2 * 7.5 • 1.2 gal.	/ft^3 0 * 7.48 gal/ft^3	Smy
Notes:										Name (print):
					See w	ell development re	cord for field p	arameters- N	/IHL 4/10/18	Sean hulburt
QA/QC'd by:	Sarah Levin	e							QA/QC Date:	12/13/2017



wheeler										
Project Name:				spections for ir National Gu		ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D-	0002		Task Orde	er:	_	0006
Installation:				ESHEP			Technicia		_	Sch
Well ID:				BW-04			Date:	.,	_	11/09/17
Initial Depth to	Water (ft):			20.34			Well Diam	eter (in):		2.0
Total Depth of V	Vell (ft):			30.0			1 Casing V	Volume (ga	al):	1.6
Method of Purg				Pumping				Volumes (		4.8
Measuring Poin	t (toc, tor, et	:c.):		Тор	of Riser		Pump Inta	ke Depth	(feet):	25
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging
		Stabilizatio	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	(color, sediment, odor, etc.)
07:20		2000								Pumping/Purging Started
							-			
					-		+			
									1	
							-			
		Image: state								
							-			
					-		+			
	1.0700			Ň						
Stability Reache	ea (Y/N):			Yes		If No, Provide E	Explanation			NA
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:			Esh	ep-gw-bw-04-	-110917		Method of	f Sampling	;:	Submersible pump
	s (Yes/No):			No			Sample D	ate:	_	11/09/17
							-			07:50
Duplicate ID:         NA           Sample Container Type(s):         125 ml plastic, 250 ml amber glass           Preservative(s):         Ice (4 °C)           Analysis/Method(s):         PFAS (EPA 537-modified), TOC (EPA 9060)           Instruments (Manufacturer, Model, and Serial No.):         Equipment Calibrated (Y/N):	NA 125 ml plastic, 250 ml amber glass					Sample Collection Time: Total Volume Purged (gal):			25	
	Ice (4 °C)					Total Volume Purged (gal): Sample Depth (ft): Depth to Water After Sampling (ft):			25	
				TUC (EPA	9060)	Depth to V	Nater After	r Sampling (ft):	23	
	Calibrated Within	n Criteria (Y/N)			Yes					
Calculations:		er, Model, and Serial No.): Yes Calibrated Turbidity Meter, Water Quality Meter					, Water Level Meter, Mega Monsoon Pump			Signature:
			0)1187 40	1/5/40						
<b>V</b> =Volume (gal/ft) <b>Π</b> = 3.14 <b>R</b> = well radius (ft)	= (well diamete	,	, .	amro		= П * (;	2.0 (in)/12 (in/f	2)H*7.48 gal ft))/2)^2 * 9.6 • 1.6 gal.	/ft^3 6 * 7.48 gal/ft^3	Smit
H = height of water	column (ft)									
Notes:										Name (print):
					See w	ell devlopment reco	ord for field pa	rameters- M	HL 4/10/18	Sean hulburt
QA/QC'd bv:	Sarah Levin	e							QA/QC Date:	12/12/2017



miceter										
Project Name:				spections for ir National Gu		ed Compounds	Project Nu	umber:		291330006
Contract:			٧	V9133L-14-D-	0002		Task Orde	er:		0006
Installation:				ESHEP			Technicia			Sch
Well ID:				BW-05			Date:	(-)		11/20/17
Initial Depth to	Water (ft):			32.5			Well Diam	eter (in):		2.0
Total Depth of				40.0				/olume (ga	al):	1.2
Method of Pur	• •			Pumping			-	/olumes (g	,	3.7
Measuring Poi		c.):			of Riser		-	ke Depth (		38
g						Specific				1
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilizatio	on Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:15		Na								Pumping/Purging Started
12:04										Dry
						ļ				
	-									
	-									
	-									
	+									
	-									
	1									-
	1									-
Otal III to Deser			1	N.	1	KNI Devide F	Sealan attain	N		
Stability Reacl	nea (Y/N):			No		If No, Provide E			nsufficient volume f	or low flow sampling and parameters, previously
		Final	Values:	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Sample ID:			Est	nep-gw-bw05-	112017		Method of	Sampling	:	Peristaltic pump
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/20/17
Duplicate ID:				NA			Sample Co	ollection T	ime:	11:20
Sample Conta	iner Type(s):			125 ml plas				me Purge	d (gal):	.1
Preservative(s	s):						Sample D	• • • •		38
Preservative(s):         Ice (4 °C)           Analysis/Method(s):         PFAS (EPA 537-modified)           Instruments (Manufacturer, Model, and Serial No.):         Equipment Calibrated (Y/N):				modified)		Depth to V	Vater After	Sampling (ft):	Dry	
			Calibrated Within	Criteria (Y/N):			Yes			
					Water Quality	v Meter, Water Leve , Horiba U-52		taltic Pump		
Calculations	Equipment Calibrated (Y/N):									Signature:
Saturated well		<b>ne:</b> V= П(R^:	2)H*7.48 g	al/ft^3						
V=Volume (gal/ft) Π = 3.14 R = well radius (ft H = height of wat	t) = (well diamete	er (in)/12 (in/ft)	)/2)			= ∏ * (2	2.0 (in)/12 (in/f	2)H*7.48 gal/ t))/2)^2 * 7.5 1.2 gal.	ft^3 0 * 7.48 gal/ft^3	Smit
Notes:										Name (print):
140165.		Incuffic	ient volume i	for low flow or	moling and a	arameters pumped	d dry on 11/19	/17		Name (print): Sean hulburt
		msunic		or low now Se	mping anu p	arameters pumper	a ary 011 11/10			
QA/QC'd by:									QA/QC Date:	



WIECIEI										
Project Name:					Per-Fluorinat	ted Compounds ons	Project Nu	umber:		291330006
Contract:			V	/9133L-14-D	-0002		Task Orde	er:		0006
Installation:				ESHEP			Technicia	n(s):		Sch cw
Well ID:				BW-06			Date:			11/17/17
Initial Depth to				32.5			Well Diam	. ,		2.0
Total Depth of	. ,			40.0			-	Volume (g	-	1.2
Method of Pur Measuring Poi		(c.):		Pumping	of Riser		-	Volumes ( ake Depth		3.7 35
Measuring For			-	ιο <sub>μ</sub>		Specific	Fumpinta		(leet).	
Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:38		1000								Pumping/Purging Started
			1							
	-									
			1							
			1							
	-									
	1						+			
Stability React	ned (V/N):		Other	(some do no	t stabilize)	If No, Provide E	volanation	1	Other (some do p	ot stabilize) - Turb orp do ran to 2 hours
								1	``	
		Finai	Values:	#N/A	#N/A	#N/A	#N/A		#N/A	
Sample ID: QA/QC Sample		-	ESI	ep-gw-bw06- No	111717		Sample D	f Sampling	<b>j</b> :	Submersible pump 11/17/17
Duplicate ID:	s (165/140).			NA			•	ollection T	lime:	13:40
Sample Conta	iner Type(s):	-	125 ml p		amber glass		Total Volu			20
		-		Ice (4 °C			Sample D	-	(3*)	35
Analysis/Meth	od(s):	P	PFAS (EPA 5	37-modified)	, TOC (EPA 9	9060)	Depth to V	Nater Afte	r Sampling (ft):	35.7
Preservative(s): Analysis/Method(s): PFAS (EPA 537- Instruments (Manufacturer, Model, and Serial N Equipment Calibrated (Y/N): Yes		-		Calibrated Within	n Criteria (Y/N)	:		Yes		
				Turbidity M		uality Meter, Wate tte 2020 1286, YSI			soon Pump	
Calculations					Lamo					Signature:
			\ <u>0</u> \∐*7 40 -	ol/ft/2						
Saturated well V=Volume (gal/ft) Π = 3.14 R = well radius (ff H = height of wate	) = (well diamete			anro		= Π * (2	2.0 (in)/12 (in/f	2)H*7.48 gal ft))/2)^2 * 7.5 : 1.2 gal.	/ft^3 50 * 7.48 gal/ft^3	Smit
Notes:										Name (print):
					See we	ell development rec	cord for field p	arameters- I	MHL 4/10/18	Sean hulburt
QA/QC'd by:	Sarah Levin	е							QA/QC Date:	12/13/2017

			1 M	ATER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	G INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins	spections for Per-F	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	t Multiple Air N	ational Guard	Project Number:	umber:	26	291330006
Contract:		W9	W9133L-14-D-0002	1-0002	Task Order:	0000		Date:			10/20/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		11:16
Sample Technician(s):	ian(s):			Sarah Le	Sarah Levine, Sean Hulburt			Calibratio	Calibration End Time:		11:56
					Reading	Readings Before Calibration	alibration				
Date	Time (24hr)	Temperature (°C)	Hd (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	ŭ	Comments
10/20/17	11:16	Na	4.03 6.97 9.99	10.05 NA Na	1.297	104.4	R	220.0	760		None
					Reading	Readings After Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hq (NS)	Turbidity (NTUs)	Specific Electrical Conductance	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Ho)	Ŭ	Comments
			4.00	10.00	()						
10/20/17	12:55	R N	7.00	Na Na	1.409	100	Ra	220.0	760		None
Calibration Materials Record:	terials Record	ij									
	0 Hq	pH Calibration Standards	ırds		Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	luctance, Salini on Potential (Of	ty, Dissolved O: RP) Calibration	xygen (DO) and C Standards	vidation	Turbidity Standards	tandards
Standard	Cal. Star	Cal. Standard Lot #	EXI	Expiration Date	<u>Standard</u>	Cal. Stan	Cal. Standard Lot #	Expiration Date	late Standard	rd Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C689840	02/01/18
pH (7)	G1	G163-23		06/22/19	Salinity	~	NA	10/22/17	20	NA	10/22/17
pH (10)	G1	G166-09		12/22/18	D.O.	2	NA	10/22/17	100	NA	10/22/17
					ORP	~	NA	10/22/17	800	NA	10/22/17
Instruments (N	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				Signature:	ure:	-
		Manufacturer/Model	er/Model	Serial No					0		
Water Quality Meter: Turbidity Meter:	eter:	YSI 556 MPS LaMotte 2020	MPS 2020	09F101780 1286-3511						L'	all h
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	iteria (Y/N):		Yes	Used callt	oration documents	Used calibration documents for ORP, no standard provided	ard provided		)	
If No, Provide Explanation:	planation:		NA						Name (print):	(print):	Sarah Levine
QA/QC'd by:		Sarah Levine	vine						QA/QC Date:		12/11/2017

			<b>M</b>	NTER QUAI	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	<b>S INSTRU</b>	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins	pections for Per-F Ir	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air N	ational Guard	Project Number:	umber:	29	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	9000		Date:		-	10/24/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		07:20
Sample Technician(s):	ian(s):			Š	Sarah Levine			Calibratic	Calibration End Time:		07:58
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	3	Comments
10/24/17	07:30	Na	3.98 7.01 9.97	9.58 Na Na	1.318	102.1	R	237.2	760		None
					Readings	gs After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hd (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	8	Comments
10/24/17	07:55	Na	4.00 7.00 10.00	10.00 Na Na	1.409	100	Z	240.0	760		None
Calibration Materials Record:	terials Recore	d: d									
	0 Hq	pH Calibration Standards	rds		Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	uctance, Salini on Potential (OF	ty, Dissolved Ox RP) Calibration \$	tygen (DO) and O Standards	xidation	Turbidity Standards	andards
Standard	Cal. Star	Cal. Standard Lot #	Exc	Expiration Date	<u>Standard</u>	<u>Cal. Stan</u>	Cal. Standard Lot #	Expiration Date	ate Standard	Ird Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	G08	G083-08	03/30/19	10	C689840	02/01/18
pH (7)	G1	G163-23		06/22/19	Salinity	2	Na	10/24/17	20	Na	10/24/17
pH (10)	G1	G166-09		12/22/18	D.O.	~	Na	10/24/17	100	Na	10/24/17
					ORP	14	1422	04/01/22	800	Na	10/24/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.): Manufacturer/Model	al No.): "/Model	Sorial No.	Notes:				Signature:	inre:	1
Water Quality Meter:	ster:	YSI 556 MPS	APS	09F101780						5	
Turbidity Meter:		LaMotte 2020	2020	1286-3511	ODD standard brought fr	om Durhom Office	No high turbidity.	ehodored krouischt from Durchom Officia. Nic kisch truckischer strandersta resouisted hu EET		L	11/1
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	riteria (Y/N):		Yes			s. INO IIIGII LUIDIULU	stariuarus proviueu u			
If No, Provide Explanation:	planation:		NA						Name	Name (print):	Sarah Levine
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/11/2017

			<b>M</b>	ITER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	G INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins	pections for Per-I	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	t Multiple Air N	ational Guard	Project Number:	umber:	26	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	0000		Date:		-	10/26/17
Installation:					ESHEP			Calibratio	Calibration Start Time:		14:51
Sample Technician(s):	ian(s):			Sarah Le	Sarah Levine, Sean Hulburt			Calibratic	Calibration End Time:		07:48
					Reading	Readings Before Calibration	alibration				
Date	Time (24hr)	Temperature (°C)	Hd (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Ŭ	Comments
10/26/17	07:21	Na	4.04 7.05 9.93	9.46 Na Na	1.355	116.9	R	232.8	760		None
					Readings	ds After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	ö	Comments
10/26/17	07:46	N N	4.00 7.00 10.00	10.0 Na Na	1.409	100	a N	240.0	760		None
Calibration Materials Record:	terials Recore	d:									
	) Hq	pH Calibration Standards	rds		Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	luctance, Salini on Potential (Of	ty, Dissolved O: RP) Calibration	vygen (DO) and O Standards	xidation	Turbidity Standards	andards
Standard	Cal. Star	Cal. Standard Lot #	Exc	Expiration Date	<u>Standard</u>	<u>Cal. Stan</u>	Cal. Standard Lot #	Expiration Date	ate Standard	d Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C689840	02/01/18
(7) Hq	G1	G163-23		06/22/19	Salinity	2	Na	10/26/17	20	Na	10/26/17
pH (10)	G1	G166-09		12/22/18	D.O.	2	Na	10/26/17	100	Na	10/26/17
					ORP	14	1422	04/01/22	800	Na	10/26/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				Signature.		
		Manufacturer/Model	sr/Model	Serial No							
Water Quality Meter:	eter:	YSI 556 MPS	MPS	09F101780						$ \land $	11/1/
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	riteria (Y/N):	0202	1280-3511 Yes		2	None				
If No, Provide Explanation:	olanation:		NA		1				Name (print):	print):	Sarah Levine
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/11/2017

			<b>A</b> W	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRU	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regio	nal Site Ins	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air Na	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	9000		Date:		11	11/01/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		12:14
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:		12:31
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Col	Comments
21/10/11	12:15	Za	4.06 6.9 9.9	0 Na	1.534	Na	g	237	N		Ra
					Readings	ds ∆fter Calibration	ihration				
						אס אונפו כמו		-	,	-	
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Cor	Comments
			4	0 6							
11/01/17	12:31	Na	10	a a	1.409	Na	Ra	240	Na		Na
Calibration Materials Record:	terials Record										
		'n			Snacific Electrical Condi	uctanca Salini	tv Discolved Ov	O pue (OO) nepro	vidation		
	) Hd	pH Calibration Standards	ards		specific Electrical Contractance; Saminy, Dissorved Oxygen (DO) and Oxtuation Reduction Potential (ORP) Calibration Standards	inclarice, saini on Potential (OF	ty, Dissolved O: RP) Calibration {	standards	XIUAUOII	Turbidity Standards	Indards
Standard	<u>Cal. Stai</u>	Cal. Standard Lot #	Exp	Expiration Date	Standard	<u>Cal. Stan</u>	Cal. Standard Lot #	<b>Expiration Date</b>	ate Standard	rd Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	G08	G083-08	03/30/19	10	C796782	05/01/18
PH (7)	G1	G163-23		06/22/19	Salinity	2	Na	11/01/17	20	C689840	02/01/18
pH (10)	G1	G166-09		12/22/18	D.O.	2	Na	11/01/17	100	Na	11/01/17
					ORP	14	1422	04/01/22	800	Na	11/01/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				0		
		Manufacturer/Model	er/Model	Serial No					olgriature	. And the second s	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749						V	1.4
Turbidity Meter:		Lamotte 2020	2020	1286		Z	None				INNI
Calibrated Within Acceptance Criteria (Y/N):	Acceptance CI	riteria (Y/N):		Yes		Ξ	2			V	
If No, Provide Explanation:	olanation:		AN						Name (print):	(print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/12/2017

			M	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins <sub>l</sub>	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air N	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	0000		Date:		11	11/03/17
Installation:					ESHEP			Calibratic	Calibration Start Time:	1	12:41
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:	1	12:52
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Cor	Comments
11/03/17	12:41	R	5.3 8.1 9.1	0 Na Na	1.450	N	a N	223	a N		Na
					Reading	Readings After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hq (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure	Cor	Comments
			4.0	0					(8)		
11/03/17	12:52	ø	C ~ 1	Na Na	1.409	Na	Ra	240	R		Na
			2	Na							
Calibration Materials Record:	terials Recor	d:									
	) Hq	pH Calibration Standards	Irds		Specific Electrical Condi Reductio	uctance, Salini in Potential (OF	ty, Dissolved O RP) Calibration	Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	xidation	Turbidity Standards	ndards
Standard	Cal. Star	Cal. Standard Lot #	Exp	Expiration Date	Standard	Cal. Stan	Cal. Standard Lot #	Expiration Date	late Standard	d Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C796782	02/28/18
(7) Hq	G1	G163-23		06/22/19	Salinity	~	Na	11/03/17	20	C689840	02/03/18
pH (10)	G1	G166-09		12/22/18	D.O.	~	Na	11/03/17	100	Na	11/03/17
					ORP	12	1422	04/01/22	800	Na	11/03/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				Cicrot		
		Manufacturer/Model	sr/Model	Serial No					oigilature.	'all	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749						V	Mad
I urbidity Meter:			2020	1286		Z	None				JUUN !
Calibrated Within Acceptance Criteria (Y/N):	Acceptance CI	riteria (Y/N):		Yes						0	
If No, Provide Explanation:	olanation:		NA						Name (print):	print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/12/2017

			M V	ITER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	G INSTRU	JMENT C	ALIBRATI	ON FOR	W	amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	: Multiple Air N	ational Guard	Project Number:	umber:		291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	9000		Date:			11/09/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		06:51
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:		07:06
					Reading	Readings Before Calibration	alibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)		Comments
11/09/17	06:52	Na	4.8 5.78 9.13	0 Na	1.409	Na	R	258	Na		Na
					Reading	Readings After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUS)	Specific Electrical Conductance	D.O.	Salinity (%)	ORP/Eh (mV)	Barometric Pressure		Comments
					(mS/cm)				(mm Hg)		
11/09/17	07:08	Na	4 7 10	Na Na	1.409	R	Ra	240	Na		Na
Calibration Materials Record:	terials Record	d:									
	0 Hd	pH Calibration Standards	Irds		Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	uctance, Salini on Potential (OF	ty, Dissolved O	vygen (DO) and O Standards	xidation	Turbidity	Turbidity Standards
Standard	Cal. Star	Cal. Standard Lot #	Exp	Expiration Date	Standard	Cal. Stan	Cal. Standard Lot #	Expiration Date		Standard Cal. Standard Lot #	# Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	G08	G083-08	03/30/19	-	10 C689840	02/22/18
(7) Hq	G1	G163-23		06/22/19	Salinity	~	Na	11/09/17	2	20 C796782	02/09/18
pH (10)	G1	G166-09		12/22/18	D.O.	2	Na	11/09/17		100 Na	11/09/17
					ORP	14	1422	04/01/22	8(	800 Na	11/09/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				č		
		Manufacturer/Model	sr/Model	Serial No					ußie	signature:	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749							No. M
Turbidity Meter:		Lamotte 2020	2020	1286		Z	None				
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	riteria (Y/N):		Yes		:	0				
If No, Provide Explanation:	planation:		NA						Nam	Name (print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:	ate:	12/12/2017

			<b>M</b>	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regio	nal Site Ins	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air N	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	9000		Date:		11	11/13/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		10:25
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:		10:30
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Č	Comments
11/13/17	10:17	5.40	3.9	0 10 Na	1405	Na	a Z	230	Na		Na
					Readings	ds After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	C	Comments
			4	0 5							
11/13/17	10:30	5.55	7 10	e a a	1409	Na	Na	240	Na		Na
Calibration Materials Record	terials Record	- lt									
					Specific Flectrical Condi	uctance. Salini	ty. Dissolved Ox	O pue (DO) and O	xidation		
	) Hq	pH Calibration Standards	ards		Specific Lieutreal Contactance, Saminy, Dissofted Corgan (CC) and Contacton Reduction Potential (ORP) Calibration Standards	on Potential (OF	RP) Calibration {	Standards	VIGNION	Turbidity Standards	Indards
Standard	Cal. Sta	Cal. Standard Lot #	Exp	Expiration Date	Standard	<u>Cal. Stan</u>	Cal. Standard Lot #	<b>Expiration Date</b>	ate Standard	rd Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	G08	G083-08	03/30/19	10	C689840	11/13/17
(7) Hq	G1	G163-23		06/22/19	Salinity	~	Na	11/13/17	20	C796782	05/19/18
pH (10)	G1	G166-09		12/22/18	D.O.	2	Na	11/13/17	100	Na	11/13/17
					ORP	14	1422	04/01/22	800	Na	11/13/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	ial No.):		Notes:				Cicnot		
		Manufacturer/Model	er/Model	Serial No					Signature:	ure:	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749						V	1.4
Turbidity Meter:		Lamotte 2020	2020	1286		Z	None				INNI
Calibrated Within Acceptance Criteria (Y/N):	Acceptance CI	riteria (Y/N):		Yes		2	2			V	
If No, Provide Explanation:	olanation:		AN						Name (print):	(print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/13/2017

			M V	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins <sub>i</sub>	oections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	: Multiple Air N	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M9	W9133L-14-D-0002	-0002	Task Order:	0000		Date:		11	11/15/17
Installation:					ESHEP			Calibratic	Calibration Start Time:	-	12:28
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:	1	13:56
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Cor	Comments
11/15/17	12:28	6.44	5.76 14.4 12	2 11 Na	1.544	a N	a N	240	a N		Na
					Reading	Readings After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hq (NS)	Turbidity (NTUs)	Specific Electrical Conductance	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure	Con	Comments
				.	(ms/cm)				(mm Hg)		
11/15/17	13:57	6.44	4 7 10	Na Na	1.409	a N	a Z	240	Ra		вИ
Calibration Materials Record:	terials Recor	ä									
	) Hq	pH Calibration Standards	Irds		Specific Electrical Cond Reductio	uctance, Salini in Potential (Of	ty, Dissolved O. RP) Calibration	Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	xidation	Turbidity Standards	ndards
Standard	Cal. Stal	Cal. Standard Lot #	Exp	Expiration Date	<u>Standard</u>	<u>Cal. Stan</u>	Cal. Standard Lot #	Expiration Date	ate Standard	d Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C689840	02/19/18
(7) Hq	G1	G163-23		06/22/19	Salinity	~	Na	11/15/17	20	C796782	05/19/18
pH (10)	G1	G166-09		12/22/18	D.O.	~	Na	11/15/17	100	Na	11/15/17
					ORP	14	1422	04/01/22	800	Na	11/15/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:						
		Manufacturer/Model	er/Model	Serial No					oigilature.	'all	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749						V	Man
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	iteria (Y/N):	0404	Yes		2	None			N	
If No, Provide Explanation:	planation:		NA						Name (print):	print):	Sean Hulburt
QA/QC'd by: 8	Sarah Levine								QA/QC Date:		12/13/2017

			M V	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins <sub>i</sub>	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air N	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	9000		Date:		11	11/16/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		15:11
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:	1	14:13
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Cor	Comments
11/16/17	15:11	12.3	3.98 7.2 9.6	0 Na	1.400	N	a N	Na	a N		Na
					Reading	Readings After Calibration	ibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hɑ)	Cor	Comments
11/16/17	15:22	12.3	4 7 10	Na 10 o	1.409	a Z	a Z	a Z	Na		Na
Calibration Materials Record:	terials Recort	ij									
	) Hq	pH Calibration Standards	Irds		Specific Electrical Condu Reductio	uctance, Salini in Potential (OF	ty, Dissolved O. RP) Calibration	Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	xidation	Turbidity Standards	Indards
Standard	Cal. Star	Cal. Standard Lot #	Exp	Expiration Date	Standard	Cal. Stan	Cal. Standard Lot #	Expiration Date	ate Standard	d Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C689840	11/13/17
(7) Hq	61	G163-23		06/22/19	Salinity	~	Na	11/16/17	20	C796782	05/19/18
pH (10)	G1	G166-09		12/22/18	D.O.	~	Na	11/16/17	100	Na	11/16/17
					ORP	12	1422	04/01/22	800	Na	11/16/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				Cicroti		
		Manufacturer/Model	∋r/Model	Serial No					oigilature.		
Water Quality Meter:	eter:	YSI 556 MPS Lamotte 2020	MPS	86749 1286						V	Man
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	iteria (Y/N):		Yes		2	None			N	
If No, Provide Explanation:	olanation:		NA		1				Name (print):	print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/13/2017

			M	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	S INSTRI	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins <sub>i</sub>	Phase 1 Regional Site Inspections for Per-Fluorinated Installations	-Fluorinated Compounds at Multiple Air National Guard Installations	t Multiple Air N	ational Guard	Project Number:	umber:	29	291330006
Contract:		6M	W9133L-14-D-0002	-0002	Task Order:	0000		Date:		-	11/17/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		11:08
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:		11:34
					Reading	Readings Before Calibration	alibration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	පී 	Comments
21/21/11	11:09	11	1.23 5.42 10.49	0 Na Na	1.409	Na	Na	240	Na		Na
					Reading	Readings After Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hq)	රි 	Comments
21/21/11	11:34	7	4 7 10.02	Na 10 0	1.410	Na	a	240	Za		a
Calibration Materials Record:	terials Recort	ij									
	D Hq	pH Calibration Standards	irds		Specific Electrical Cond Reductio	uctance, Salini on Potential (Of	ty, Dissolved O RP) Calibration	Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards	xidation	Turbidity Standards	andards
Standard	Cal. Star	Cal. Standard Lot #	Exp	Expiration Date	Standard	Cal. Stan	Cal. Standard Lot #	Expiration Date	ate Standard	ard Cal. Standard Lot #	Expiration Date
pH (4)	G1	G163-22		06/22/19	Spec. Conductance	GOE	G083-08	03/30/19	10	C689840	11/13/17
(7) Hq	G1	G163-23		06/22/19	Salinity	~	Na	11/17/17	20	C796782	05/19/18
pH (10)	G1	G166-09		12/22/18	D.O.	~	Na	11/17/17	100	Na	11/17/17
					ORP	14	1422	04/01/22	800	Na	21/21/11
Instruments (M.	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:				Signaturo.		
		Manufacturer/Model	sr/Model	Serial No					019118		
Water Quality Meter:	eter:	YSI 556 MPS	SdN	86749						v	Mad
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	riteria (Y/N):		Yes		2	None			0	
If No, Provide Explanation:	planation:	•	NA						Name	Name (print):	Sean Hulburt
QA/QC'd by: Sarah Levine	sarah Levine								QA/QC Date:		12/13/2017

			M V	TER QUA	WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM	<b>S INSTRU</b>	JMENT C	ALIBRATI	ON FORM		amec foster wheeler
Project Name:		Phase 1 Regior	nal Site Ins <sub>i</sub>	pections for Per-	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	Multiple Air Na	ational Guard	Project Number:	umber:	291	291330006
Contract:		6M	W9133L-14-D-0002	0002	Task Order:	9000		Date:		11	11/21/17
Installation:					ESHEP			Calibratic	Calibration Start Time:		07:13
Sample Technician(s):	ian(s):				Sch			Calibratic	Calibration End Time:	)	08:31
					Reading	Readings Before Calibration	libration				
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Č	Comments
11/21/17	07:20	6.67	3.5 6.68 8.89	0 0 0 Na 8 0		Ra	a Z	237	a Z		a Z
					Readings	der Calibration	ibration				
								-			
Date	Time (24hr)	Temperature (°C)	Hd (NS)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	CO	Comments
			4	0 6							
11/21/17	07:33	6.81	7 10	Na 2	1.409	Na	Ra	250	Ra		Ла
Calibration Materials Record:	terials Record										
5	) Ha	pH Calibration Standards	rds		Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation	uctance, Salini	ty, Dissolved O	vgen (DO) and O	kidation	Turbidity Standards	andards
					Reductio	n Potential (OF	RP) Calibration \$	standards	-		0
<u>Standard</u>	<u>Cal. Stai</u>	Cal. Standard Lot #	Exp	Expiration Date	Standard	<u>Cal. Stan</u>	Cal. Standard Lot #	Expiration Date	Sta	Cal. S	Expiration Date
pH (4)	61	G163-22		06/22/19	Spec. Conductance	. C08	G083-08	03/30/19	10	C689840	11/13/17
	ט פ	G103-23 G166 00		00/22/18 12/22/18		~ ~		71/12/11	700	U/ 90/82	21/81/60
	5	3			ORP	14	1422	04/01/22	800	Na	11/21/17
Instruments (M	lanufacturer,	Instruments (Manufacturer, Model, and Serial No.):	al No.):		Notes:						
		Manufacturer/Model	ir/Model	Serial No					Signature:	:eur	
Water Quality Meter:	eter:	YSI 556 MPS	MPS	86749						V	, ,
Turbidity Meter:		Lamotte 2020	2020	1286		2					INNI
Calibrated Within Acceptance Criteria (Y/N):	Acceptance Cr	riteria (Y/N):		Yes		2				7	
If No, Provide Explanation:	olanation:		NA						Name (print):	print):	Sean Hulburt
QA/QC'd by: S	Sarah Levine								QA/QC Date:		12/13/2017

Page 1 of 1

Rev. 1, Date: 12/29/2016



# SAMPLE COLLECTION LOG SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:		onal Site Inspecti t Multiple Air Nati			Project Nu	ımber:		291330006
Contract:		W9133L-14-E	0-0002		Task Orde	r:	-	0006
Installation:		ESHEP	)		Date:		-	10/19/17
Location ID:		Swsd-0	1		Northing/E	Easting:	-	Not Collected
Technician(s):					Sch	SML	-	
				SEDIMEN	T SAMPLE			
				Descr	iption			
	NAME	(USCS Symbol)	): color, mois	ture, % by wt, pla	sticity, dilatan	cy, toughnes	s, dry strengt	n,consistency
		OLbro	own,moist '	medium pi, no c	dl, medium t	ough, low c	lry st, stiff	
Sample Depth (ft):		NA			Sample ID	:		Eshep-10-SD01-0-0.5
MS/MSD Collected:		Yes			Sample Da	ate:	-	10/19/17
Duplicate ID:	E	SHEP-SD-DUP	01-101917		Sample Co	ollection T	ime:	13:00
Sample Container Ty	pe(s):	6oz	: plastic		Sample Co	ollection N	lethods:	Hand auger
Preservative(s):		lce (4 °C	C)		Analysis/M	lethod(s):		PFAS (EPA 537)
				SURFACE S	OIL SAMP	LE		
				Descr	iption			
	NAME	(USCS Symbol)	): color, mois	ture, % by wt, pla	sticity, dilatan	cy, toughnes	s, dry strengt	n,consistency
				Ν	A			
Sample Depth (ft):		NA			Sample ID	:	-	NA
MS/MSD Collected:		NA			Sample Da	ate:	-	NA
Duplicate ID:		NA			Sample Co		-	NA
Sample Container Ty	pe(s):		NA		Sample Co	ollection N	lethods:	NA
Preservative(s):		NA			Analysis/M			NA
			5	SURFACE WA	TER SAM	PLE		
Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)
NA	NA	NA	NA	NA	NA	NA	NA	NA
Sample Depth (ft):		NA			Sample Da	ate:		NA
Sample ID:		NA			Sample Co	ollection T	ime:	NA
MS/MSD Collected:		NA			Sample Co		-	NA
Duplicate ID:		NA			Surface W		• • •	NA
Sample Container Ty	pe(s):		NA		Water Boo	ly and Wat	ter Quality C	Characteristics:
Preservative(s):	-	NA						NA
Analysis/Method(s):		NA						
Location Sketch:						•		Model, and Serial No.):
			ALC: N. 1. 177		Equipment (		-	NA
			Swsd-01		Calibrated V	Vithin Criteria	a (Y/N):	NA
		Pipes rcp	_				Ot	her(s): Hand auger ,
	~	_	_		Notes:			Signature:
	+	North					None	SIA
								<b>Name</b> (print): Sean Hulburt
QA/QC'd by:		Sai	rah Levine			QA	QC Date:	12/11/2017

-	
amec	
foster	
wheeler	

# SAMPLE COLLECTION LOG SEDIMENT / SURFACE SOIL / SURFACE WATER

miceter										
Project Name:		ional Site Inspecti at Multiple Air Nati			Project Nu	mber:		291330006		
Contract:		W9133L-14-E	-0002		Task Orde	r:		0006		
Installation:		ESHEP			Date:		-	11/06/17		
Location ID:		Prl 3			Northing/E	asting:	•	Not Collected		
Technician(s):						h				
				SEDIMEN	T SAMPLE					
	NAME	E (USCS Symbol)	: color, mois	ture, % by wt, pla	sticity, dilatano	y, toughnes	s, dry strengt	h,consistency		
				Sw, brown, we	et, no pi , loo	se				
Sample Depth (ft):		0 - 0.5			Sample ID			Eshep-03-sd01-110617		
MS/MSD Collected:		No			Sample Da	te:		11/06/17		
Duplicate ID:		NA					-	11:20		
Sample Container Ty	pe(s):						lethods:			
Preservative(s):		lce (4 °C	)					PFAS (EPA 537-modified)		
						.E				
		- (1000 0								
	NAME	E (USCS Symbol)	: color, mois	ture, % by wt, pla	sticity, dilatano	y, toughnes	s, dry strengt	h,consistency		
				Ν	A					
Sample Depth (ft):	W01331-40-D002     Task Order:     000       Bit     ESHEP     Date:     110017       (g):     Ph3     NorthingEasting:     NotCleased       (g):     Sen     NotCleased       (g):     Sen     NotCleased       (g):     Sen     NotCleased       (g):     Sen     NotCleased       (g):     Sen     NotCleased       (g):     Sen     NotCleased       (g):     On 0.5     Sample Dit:     110617       Olected:     No     Sample Dit:     110617       Olected:     No     Sample Dit:     110617       Olected:     No     Sample Dit:     110617       Olected:     No     Sample Collection Time:     110617       Dit (ft):     On 0.5     Sample Dit:     110617       Olected:     No     Date:     110617       NAME (USCS Symbol): coler, molare.     No     Date:     No       NAME (USCS Symbol): coler, molare.     No     Date:     No       NAME (USCS Symbol): coler, molare.     No     No     No       NAME (USCS Symbol): coler, molare.     No     No     No       NAME (USCS Symbol): coler, molare.     No     No     No       NAME (USCS Symbol): coler, molare.									
MS/MSD Collected:										
Duplicate ID:							-			
Sample Container Ty	pe(s):		NA				lethods:			
Preservative(s):		NA						NA		
	T	[	5	1	TER SAM	LE	· · · · ·			
Time				Electrical Conductance				During Purging		
NA	NA	NA	NA	NA	NA	NA	NA	No parameters collected		
Sample Depth (ft):					Sample Da	ite:		11/06/17		
Sample ID:			-110617							
MS/MSD Collected:										
Duplicate ID:							• • •			
	pe(s):				Water Bod	y and Wat	er Quality (	Characteristics:		
Preservative(s):							Ou	ıtfall, Flowing, Clear		
Analysis/Method(s):		PFAS (EPA 557	-modilied)		Inchrome	ata (Man	feeturer	Medel and Cariel No. ):		
Location Sketch:						•	,	, ,		
					Calibrated V	ithin Criteria	a (Y/N):	NA		
			•		Stainless Steel Spoon, Manual Hand Tools, Other(s): Sample containers ,					
	Sam	pie location			Notes:			Signature:		
F						03s	b01replacem	Name (print):		
QA/QC'd by:		Sai	ah Levine		1	QA/	QC Date:	3/22/2018		

5.

NON-HAZARDOUS WASTE

. \*

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No. NA			Manifest Document No.	D58634	2. Page 1 of <b>1</b>
Generator's Name and Mailing Address Martinsburg Air National Gua 107 Airlift Wing 3801 Winche Martinsburg, WV 25405 Generator's Priore 304-616-5418	3	Site Address				
Transporter 1 Company Name	6.	US EPA ID Number		A. State Trans		
Environmental Recovery Corp		PAD987	200/49	B. Transporter		7-393-2627
Transporter 2 Company Name	8. 	US EPA ID Number		C. State Trans D. Transporter	A CONTRACTOR OF THE OWNER OWNER OF THE OWNER OWNE	
Designated Facility Name and Site Address	10.	US EPA ID Number		E. State Facili		
Environmental Recovery Corr 1076 Old Manheim Pike Lancaster, PA 17601	oration	PAD987	266749	F. Facility's Ph	717-393	2627
. WASTE DESCRIPTION			C. No.	ontainers Type	13. Total Quantity	14. Unit Wt.Mol
Non RCRA/DOT Solids (Soi	Cuttings)		32	Dm	25,600	P
Non RCRA/DOT Solids (PV	C Pipes)	-	4	Dm	1,000	P
Non, RCRA/DOT Liquids (Gr	oundwater)	1	8	DM	2,000	ρ
4. 19 <sup>2</sup>						
Additional Descriptions for Materiala Listed Above				H, Handling (	Codes for Wastes Listed Abo	VB
1.) Approval #: 1802-00346-5	SPT		•		4	к. <sup>1</sup>
2.) Approval # 1802-00347-5	SPT ,				a a	
3.) Approval # 1802-00348-L	.WT					i -
Special Handling Instructions and Additional Infor	mation					K
		е (			PO:	
3	,					ri -
			3			
GENERATOR'S CERTIFICATION: I hereby certi	ly that the contents of this shipment	are fully and accurately deal	ribed and are in	all respects	••••••	: · · · ·
in proper condition for transport. The materials d	lescribed on this manifest are not st	ubject to federal hazardous w	aste regulations.			
nted Typed Name /2		Bignature				Date nth Day Y
XPERIENCE Etve		x Jul	6			2 16 1
Transporter 1 Acchowledgement of Receipt of Ma	aterials	11			· · · · · · · · · · · · · · · · · · ·	Date
nted/Typegvierre Unis Wa	such s	signature / korte	T		Mo	nth Pay Y
Transporter Acknowledgement of Receipt of Ma	thials				ار 	- / <u>0</u> //
nted / Typed Name	the state of the s	Signatura	/		Мо	
Discrepancy Indication Space		and the second sec		4. 4.	an agus	
Facility Owner or Operator: Certification of receip	t of the waste materials covered by	this manifest, except as note	d in item 19.	1 x	·	
					~	Date

- •

Gold Copy; Generator

<b>ERC</b>
1076 Old Manheim Pike, Lancaster, PA 17601
Phone 717.393.2627 • Fax 717.393.0432 • EPA ID # PAD987266749
WASTE PROFILE

Approval Code

Generator Name	MARTINSBURG AIR N	ATIONAL	GUARD E	BASE - 16	7th AIRLIFT WING	
Site Address	167th AIRLIFT WIN					
City	Martinsburg			St	ate <u>WV</u>	Zip25405
Phone #	(304) 616-5418				Fax #	
Contact Name	First Captain Bla	ke			Last Bennett	
Mailing Address (it	f different)					
City				Sto	ate	Zip
	tor Site Berkeley Co					·
Same as abo						
Bill to Name	Capitol Environme		vices, In	С.		
Mailing Address	200 Biddle Ave, Su	uite 205				
City	Newark			St	tate DE	<u>Zip_19702</u>
Phone #	302-380-3737				Fax #	·
Contact Name	First Terri				Last Fort	
	_			Waste	Information	
Waste Name GF	ROUNDWATER				<sub>Quantity</sub> 8 drums	Frequency ONCE
	iition (must equal 100%)				Bulk 🗌 Tote 🗌	Drum 🔳 Roll-off 🗌
-	al Name	Avg%	Min%	Max%	Preferred Disposal Method: Landfill 🔲 Waste to En	ergy 🔲 Recycling/Treatment 🔳
WATER	annume	98	95	100	Flash Point (°F) NONE	
SEDIMENT		2	0	5	pH 6 to 9	
					Color VARIES	
					Water (%)98	Solids (%)
				<u> </u>	Solid 📃 Liquid 🔳	Sludge
				<u> </u>	Odor: None 🔳 Mi	
				<b> </b>	TX < 1000ppm (Yes or No)	YES
				<u> </u>	(If TX >1000 pj Pumpable (Yes or No) Air/Wa	om, a pre-sample is required) <sub>ter</sub> YES
					Hazardous Material (Yes or N	
Process Generatin	ng Waste: ITE INVESTIGATION	J				
Shipping Name:	NONHAZARDOUS,	NON-R	EGULA	ΓED		
EMAIL ADDRESS	TO SEND APPROVAL TO	blake	.w.ber	nett.m	nil@mail.mil	
l hearby certify th of my ability	nat the above described	waste is N	lon-Hazaro	dous and i	s Pennsylvania Residual Wast	e and has been disclosed to the best
			167	th AW	Environmental Engine	eer 6 Feb 2018
	Signature				Title	Date
For ERC Use Only	У					
	Approved By		1	Residual	Waste Code	Date

<b>ERC</b>
1076 Old Manheim Pike, Lancaster, PA 17601
Phone 717.393.2627 • Fax 717.393.0432 • EPA ID # PAD987266749
WASTE PROFILE

Approval Code

Generator Name	MARTINSBURG AIR	NATIONAL	GUARD	BASE -	167th AIRLIFT WING	
Site Address	167th AIRLIFT WI	NG, 3801	Winche	ester Av	е	
City	Martinsburg			St	ate WV	
Phone #	(304) 616-5418					
Contact Name	First Captain Bla	ke			Last Bennett	
Mailing Address (i	if different)					
City				Sto	ate	Zip
County of Genero	itor Site Berkeley C	ounty				
Same as abo						
Bill to Name	Capitol Environme		ices, Ind	C		
Mailing Address	200 Biddle Ave. S	uite 205				
City	Newark			S <sup>.</sup>	tate DE	
Phone #	302-380-3737				Fax #	
Contact Name	<sub>First</sub> Terri				Last Fort	
					Information	
Waste Name SC	OIL CUTTINGS				Quantity_21 drums	Frequency Once
	sition (must equal 100%)				Bulk 🗌 Tote 🗌	Drum 🔳 Roll-off 🗌
	cal Name	Avg%	Min%	Max%	Preferred Disposal Method:	ergy 🔲 Recycling/Treatment 🗌
					—	
					рН	
		+			Color	
		+			Water (%)	Solids (%)
		+			Solid Liquid	Sludge
		<u> </u>			Odor: None 🗌 Mile	d 🗌 Strong 🗌
		<u> </u>			TX < 1000ppm (Yes or No)	
					(If TX >1000 pp Pumpable (Yes or No) Air/Wat	m, a pre-sample is required)
					Hazardous Material (Yes or No	
Process Generati	ng Waste:				Huzurdous Hutehur (Tes of No	
Shipping Name:						
EMAIL ADDRESS	S TO SEND APPROVAL T	0:				
	hat the above described	waste is No	n-Hazard	lous and i	s Pennsylvania Residual Waste	e and has been disclosed to the best
of my ability						
	<u></u>					
For ERC Use Onl	Signature				Title	Date
	,					
	Approved By	I		Residual	Waste Code	Date

<b>ERC</b>
1076 Old Manheim Pike, Lancaster, PA 17601
Phone 717.393.2627 • Fax 717.393.0432 • EPA ID # PAD987266749
WASTE PROFILE

Approval Code

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					рН	
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		+			Water (%)	Solids (%)
		+			Solid Liquid	Sludge
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of my ability						
	<u></u>					
For ERC Use Onl	Signature				Title	Date
	,					
	Approved By	I		Residual	Waste Code	Date

5.

NON-HAZARDOUS WASTE

. \*

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No. NA			Manifest Document No.	D58634	2. Page 1 of <b>1</b>
Generator's Name and Mailing Address Martinsburg Air National Gua 107 Airlift Wing 3801 Winche Martinsburg, WV 25405 Generator's Priore 304-616-5418	3	Site Address				
Transporter 1 Company Name	6.	US EPA ID Number		A. State Trans		
Environmental Recovery Corp		PAD987	200/49	B. Transporter		7-393-2627
Transporter 2 Company Name	8. 	US EPA ID Number		C. State Trans D. Transportes	A CONTRACTOR OF THE OWNER OWNER OF THE OWNER OWNE	
Designated Facility Name and Site Address	10.	US EPA ID Number		E. State Facili		
Environmental Recovery Corr 1076 Old Manheim Pike Lancaster, PA 17601	oration	PAD987	266749	F. Facility's Ph	717-393	2627
. WASTE DESCRIPTION			C. No.	ontainers Type	13. Total Quantity	14. Unit Wt.Mol
Non RCRA/DOT Solids (Soi	Cuttings)		32	Dm	25,600	P
Non RCRA/DOT Solids (PV	C Pipes)	-	4	Dm	1,000	P
Non, RCRA/DOT Liquids (Gr	oundwater)	1	8	DM	2,000	ρ
4. 19 <sup>2</sup>						
Additional Descriptions for Materiala Listed Above				H, Handling (	Codes for Wastes Listed Abo	VB
1.) Approval #: 1802-00346-5	SPT		•		4	к. <sup>1</sup>
2.) Approval # 1802-00347-5	SPT ,				a a	
3.) Approval # 1802-00348-L	.WT					x
Special Handling Instructions and Additional Infor	mation					K
		е (			PO:	
3	,					ri -
			3			
. GENERATOR'S CERTIFICATION: I hereby certi	ly that the contents of this shipment	are fully and accurately deal	ribed and are in	all respects	••••••	: · · · ·
in proper condition for transport. The materials d	lescribed on this manifest are not st	ubject to federal hazardous w	aste regulations.			
nted Typed Name /2		Bignature				Date nth Day Y
XPERIENCE Etve		x Jul	51			2 16 1
Transporter 1 Acchowledgement of Receipt of Ma	aterials	11			· · · · · · · · · · · · · · · · · · ·	Date
nted/Typegvierre Unis Wa	such s	signature / korte	T		Mo	nth Pay Y
Transporter Acknowledgement of Receipt of Ma	thials				ار 	- / <u>0</u> //
nted / Typed Name	the state of the s	Signatura	/		Мо	
Discrepancy Indication Space		and the second sec		4. 4.	an agus	
Facility Owner or Operator: Certification of receip	t of the waste materials covered by	this manifest, except as note	d in item 19.	11 x	·	
					~	Date

- •

Gold Copy; Generator

<b>ERC</b>
1076 Old Manheim Pike, Lancaster, PA 17601
Phone 717.393.2627 • Fax 717.393.0432 • EPA ID # PAD987266749
WASTE PROFILE

Approval Code

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Phone #	(304) 616-5418						
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Mailing Address (i	if different)						
City				Sto	ate	Zip	
County of Genero	itor Site Berkeley C	ounty					
Same as abo							
Bill to Name	Capitol Environme		ices, Ind	C			
Mailing Address	200 Biddle Ave. S	uite 205					
City	Newark			S <sup>.</sup>	tate DE		
Phone #	302-380-3737				Fax #		
Contact Name	First Terri				Last Fort		
					Information		
Waste Name SC	OIL CUTTINGS				Quantity_21 drums	Frequency Once	
	sition (must equal 100%)				Bulk 🗌 Tote 🗌	Drum 🔳 Roll-off 🗌	
	cal Name	Avg%	Min%	Max%	Preferred Disposal Method:	ergy 🔲 Recycling/Treatment 🗌	
					—		
					рН		
		+			Color		
		+			Water (%)	Solids (%)	
		+			Solid Liquid	Sludge	
		<u> </u>			Odor: None 🗌 Mile	d 🗌 Strong 🗌	
		<u> </u>			TX < 1000ppm (Yes or No)		
					(If TX >1000 pp Pumpable (Yes or No) Air/Wat	m, a pre-sample is required)	
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of my ability							
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For ERC Use Onl	Signature				Title	Date	
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	Approved By	I		Residual	Waste Code	Date	

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					рН		
		+			Color		
		+			Water (%)	Solids (%)	
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For ERC Use Onl	Signature				Title	Date	
	,						
	Approved By	I		Residual	Waste Code	Date	

## BERKELEY COUNTY PUBLIC SERVICE SEWER DISTRICT

P.O. Box 944 Martinsburg, WV 25402 Phone: (304) 263-8566 Fax: (304) 267-7478

<u>Board of Directors:</u> John C Kunkle, Chairman Gregory S. Rhoe, Treasurer John E. Myers, Secretary



Curtis B. Keller General Manager

November 27, 2017

Scott Mandirola WV/DEP Office of Water & Waste Management Permitting and Engineering Branch 601 57th Street Charleston, WV 25304

Re: Request for temporary permission to accept flow

Dear Mr. Mandirola:

Wood, PLC contacted the District office in November 2017 with a request to dispose of wastewater from a drilling operation at the Air National Guard. The District corresponded with Mr. Netar Wadhwa and made Wood, PLC aware of the parameters that would be required for testing.

The total amount of wastewater is estimated at 3100 gallons and would be discharged at a rate of one thousand gallons a day. The discharge would begin upon acceptance of this request and proceed for four days.

If you have any questions or need any additional information, please let me know.

Sincerely, Berkeley County Public Service Sewer District

1/01 Rodney Hanes

Assistant General Manager-Operations Cc: Curtis B, Keller, General Manager Netar Wadhwa, WV DEP



Visit us at:

www.testamericainc.com

**TestAmerica** 

THE LEADER IN ENVIRONMENTAL TESTING

# ANALYTICAL REPORT

TestAmerica Laboratories, Inc. TestAmerica Denver 4955 Yarrow Street Arvada, CO 80002 Tel: (303)736-0100

TestAmerica Job ID: 280-103753-1 Client Project/Site: Martinsburg, WV ANG

For: AMEC Foster Wheeler E & I, Inc 271 Mill Road Chelmsford, Massachusetts 01824

Attn: Denise King

Stiphanie Rothmayn

Authorized for release by: 11/27/2017 11:14:16 AM

Stephanie Rothmeyer, Project Manager I (303)736-0182 stephanie.rothmeyer@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1 2 3

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# **Table of Contents**

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# Definitions/Glossary

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

### TestAmerica Job ID: 280-103753-1

3

# Qualifiers

Metals Qualifier	Qualifier Description
Quanto	
Q	One or more quality control criteria failed.
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation

Qualifier	Qualifier Description	
U	Undetected at the Limit of Detection.	

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
a	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
OD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

#### TestAmerica Job ID: 280-103753-1

#### Job ID: 280-103753-1

#### Laboratory: TestAmerica Denver

Narrative

## CASE NARRATIVE

#### Client: AMEC Foster Wheeler E & I, Inc

#### Project: Martinsburg, WV ANG

#### Report Number: 280-103753-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

#### RECEIPT

The sample was received on 11/17/2017 at 9:00 AM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 4.2° C.

Total Metals/Mercury and TSS analysis are reported under SDG 280-103753-1 on a 5 business day TAT. The Free Cyanide analysis is logged for 10 business day TAT and will be reported under SDG 280-103753-2.

#### TOTAL METALS (ICP)

Sample DW-01-1117 (280-103753-1) was analyzed for Total Metals (ICP) in accordance with 6010C. The samples were prepared on 11/21/2017 and analyzed on 11/22/2017.

The low level continuing calibration verification (CCVL) associated with batch 280-396211 recovered above the upper control limit for As. The samples associated with this CCV were non-detect for the affected analyte; therefore, the data have been reported. Associated results are flagged "Q".

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### TOTAL MERCURY

Sample DW-01-1117 (280-103753-1) was analyzed for total mercury in accordance with 7470A. The samples were prepared and analyzed on 11/21/2017.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### TOTAL SUSPENDED SOLIDS

Sample DW-01-1117 (280-103753-1) was analyzed for total suspended solids in accordance with SM20 2540D. The samples were analyzed on 11/20/2017.

The following sample was diluted due to slow filtration and high Total Suspended Solids: DW-01-1117 (280-103753-1). Elevated reporting limits (RLs) are provided.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG TestAmerica Job ID: 280-103753-1

# Client Sample ID: DW-01-1117

Lab Sample ID: 280-103753-1

3 4 5

(E)

Analyte	Result	Qualifier	LOQ	DL	Unit	Dil Fac	D Method	Prep Type
Chromium	17		15	0.66	ug/L	1	6010C	Total/NA
Copper	26		15	4.2	ug/L	1	6010C	Total/NA
Nickel	2.7	J	40	2.6	ug/L	1	6010C	Total/NA
Silver	1.0	J	15	0.93	ug/L	1	6010C	Total/NA
Zinc	40	J	150	4.5	ug/L	1	6010C	Total/NA
Total Suspended Solids	86		8.0	2.2	mg/L	1	SM 2540D	Total/NA

This Detection Summary does not include radiochemical test results.

# **Method Summary**

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG TestAmerica Job ID: 280-103753-1

5

6

Method	Method Description	Protocol	Laboratory
6010C	Metals (ICP)	SW846	TAL DEN
7470A	Mercury (CVAA)	SW846	TAL DEN
SM 2540D	Solids, Total Suspended (TSS)	SM	TAL DEN

#### Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater", SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

#### Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

# Sample Summary

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

TestAmerica Job ID: 280-103753-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
280-103753-1	DW-01-1117	Water	11/15/17 15:20	11/17/17 09:00

# **Client Sample Results**

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

TestAmerica Job ID: 280-103753-1

Client Sample ID: DW-01-1117 Date Collected: 11/15/17 15:20							Lab Sam	ole ID: 280-10 Matrix:	
Date Received: 11/17/17 09:00 Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	15	UQ	25	4.4	ug/L		11/21/17 15:10	11/22/17 00:48	1
Cadmium	1.8	U	5.0	0.45	ug/L		11/21/17 15:10	11/22/17 00:48	1
Chromium	17		15	0.66	ug/L		11/21/17 15:10	11/22/17 00:48	1
Copper	26		15	4.2	ug/L		11/21/17 15:10	11/22/17 00:48	1
Lead	10	U	15	2.7	ug/L		11/21/17 15:10	11/22/17 00:48	1
Nickel	2.7	J	40	2.6	ug/L		11/21/17 15:10	11/22/17 00:48	1
Silver	1.0	J	15	0.93	ug/L		11/21/17 15:10	11/22/17 00:48	1
Zinc	40	J	150	4.5	ug/L		11/21/17 15:10	11/22/17 00:48	1
Client Sample ID: DW-01-1117 Date Collected: 11/15/17 15:20 Date Received: 11/17/17 09:00 Analyte	Result	Qualifier	LOQ	DL	Unit	D	Lab Samı Prepared	ole ID: 280-10 Matrix: Analyzed	
Date Collected: 11/15/17 15:20 Date Received: 11/17/17 09:00 Analyte	Result		LOQ 0.20	DL 0.027		<u>D</u>		Matrix:	Water
Date Collected: 11/15/17 15:20 Date Received: 11/17/17 09:00 Analyte Hg						<u>D</u>	Prepared	Matrix: Analyzed	Water
Date Collected: 11/15/17 15:20 Date Received: 11/17/17 09:00 Analyte Hg General Chemistry Client Sample ID: DW-01-1117 Date Collected: 11/15/17 15:20	0.080	U		0.027	ug/L	D	Prepared 11/21/17 10:56	Matrix: Analyzed	Water Dil Fac
Date Collected: 11/15/17 15:20 Date Received: 11/17/17 09:00 Analyte Hg General Chemistry Client Sample ID: DW-01-1117	0.080			0.027		D	Prepared 11/21/17 10:56	Matrix: Analyzed 11/21/17 16:04 ole ID: 280-10	Water Dil Fac

## Method: 6010C - Metals (ICP)

#### Lab Sample ID: MB 280-396044/1-A Matrix: Water Analysis Batch: 39621

11								Prep Type: To Prep Batch: 3	
		MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
	15	UQ	25	4.4	ug/L		11/21/17 15:10	11/22/17 00:39	1
	1.8	U	5.0	0.45	ug/L		11/21/17 15:10	11/22/17 00:39	1
	2.6	U	15	0.66	ug/L		11/21/17 15:10	11/22/17 00:39	1
	10	U	15	4.2	ug/L		11/21/17 15:10	11/22/17 00:39	1

2.7 ug/L

2.6 ug/L

0.93 ug/L

4.5 ug/L

### Lab Sample ID: LCS 280-396044/2-A

#### Matrix: Water Analysis Detals 200044

Analyte Arsenic Cadmium Chromium Copper

Lead

Nickel

Silver

Zinc

Analysis Batch: 396211							Prep Batch: 396044
	Spike	LCS	LCS				%Rec.
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits
Arsenic	1000	898	Q	ug/L		90	87 - 113
Cadmium	100	92.3		ug/L		92	88 - 113
Chromium	200	186		ug/L		93	90 - 113
Copper	250	219		ug/L		87	86 - 114
Lead	500	455		ug/L		91	86 - 113
Nickel	500	446		ug/L		89	88 - 113
Silver	50.0	46.7		ug/L		93	84 - 115
Zinc	500	457		ug/L		91	87 - 115

15

40

15

150

10 U

5.0 U

3.5 U

15 U

#### Lab Sample ID: LCSD 280-396044/3-A Matrix: Water

### Analysis Batch: 396211

Analysis Batch: 396211							Prep Ba		96044
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Arsenic	1000	990	Q	ug/L		99	87 - 113	10	20
Cadmium	100	101		ug/L		101	88 - 113	9	20
Chromium	200	205		ug/L		102	90 - 113	9	20
Copper	250	241		ug/L		96	86 - 114	10	20
Lead	500	499		ug/L		100	86 - 113	9	20
Nickel	500	489		ug/L		98	88 - 113	9	20
Silver	50.0	51.0		ug/L		102	84 - 115	9	20
Zinc	500	500		ug/L		100	87 - 115	9	20

#### Lab Sample ID: 280-103753-1 MS Matrix: Water

Analysis Batch: 396211

Analysis Batch: 396211 Sam	le Sample	Spike	MS	MS				Prep Batch: 396044 %Rec.
Analyte Res	ult Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits
Arsenic	15 U Q	1000	1000	Q	ug/L		100	87 - 113
Cadmium	.8 U	100	99.3		ug/L		99	88 - 113
Chromium	17	200	221		ug/L		102	90 - 113
Copper	26	250	273		ug/L		99	86 - 114
Lead	10 U	500	495		ug/L		99	86 - 113
Nickel	2.7 J	500	488		ug/L		97	88 - 113
Silver	.0 J	50.0	52.4		ug/L		103	84 - 115

TestAmerica Denver

#### TestAmerica Job ID: 280-103753-1

Client Sample ID: Method Blank

11/21/17 15:10 11/22/17 00:39

11/21/17 15:10 11/22/17 00:39

11/21/17 15:10 11/22/17 00:39

11/21/17 15:10 11/22/17 00:39

Client Sample ID: Lab Control Sample

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Type: Total/NA

Client Sample ID: DW-01-1117

Prep Type: Total/NA

Client Sample ID: DW-01-1117

3 4 5

9

10

## Method: 6010C - Metals (ICP) (Continued)

ab Sample ID: 280-103753-1 MS							C	lient Sa	ample ID: DW-01-1117
Matrix: Water						Prep Type: Total/NA			
Analysis Batch: 396211									Prep Batch: 396044
	Sample	Sample	Spike	MS	MS				%Rec.
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits
Zinc	40	J	500	531		ug/L		98	87 . 115

## Lab Sample ID: 280-103753-1 MSD Matrix: Water

Matrix: Water Analysis Batch: 396211									Prep Typ Prep Ba		
	Sample	Sample	Spike	MSD	MSD				%Rec.		RPD
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Arsenic	15	UQ	1000	1020	Q	ug/L		102	87 - 113	1	20
Cadmium	1.8	U	100	101		ug/L		101	88 - 113	2	20
Chromium	17		200	224		ug/L		104	90 - 113	2	20
Copper	26		250	277		ug/L		100	86 - 114	1	20
Lead	10	U	500	503		ug/L		101	86 - 113	2	20
Nickel	2.7	J	500	500		ug/L		100	88 - 113	3	20
Silver	1.0	J	50.0	53.7		ug/L		105	84 - 115	2	20
Zinc	40	J	500	542		ug/L		100	87 - 115	2	20

# Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 280-39603 Matrix: Water	6/1-A							le ID: Method Prep Type: To	
Analysis Batch: 396216								Prep Batch:	396036
	MB	MB							
Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Hg	0.080	U	0.20	0.027	ug/L		11/21/17 10:56	11/21/17 15:53	1

Lab Sample ID: LCS 280-396036/2-A					nt Sa	mple ID	: Lab Control Sample
Matrix: Water						Prep Type: Total/NA	
Analysis Batch: 396216							Prep Batch: 396036
The second	Spike	LCS	LCS				%Rec.
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits
Hg	5.00	5,30		ug/L	-	106	82.119

Lab Sample ID: LCSD 280-396036/3-A				client Sa	mple	ID: Lat	Control	Sample	e Dup
Matrix: Water						Ргер Ту	pe: Tot	al/NA	
Analysis Batch: 396216							Prep Ba	atch: 39	96036
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Hg	5.00	5.26		ug/L		105	82 - 119	1	20

# Method: SM 2540D - Solids, Total Suspended (TSS)

Lab Sample ID: MB 280-395948/3 Matrix: Water Analysis Batch: 395948							Client Sam	ple ID: Method Prep Type: To	
Analysis Baton. 000040	MB	МВ							
Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Total Suspended Solids	2.8	U	4.0	1.1	mg/L			11/20/17 16:38	1

5 N

9

# Method: SM 2540D - Solids, Total Suspended (TSS) (Continued)

Lab Sample ID: LCS 280-395948/1				Clie	nt Sa	mple ID	: Lab Con	trol Sa	ample
Matrix: Water							Prep Typ	e: Tot	al/NA
Analysis Batch: 395948									
	Spike	LCS	LCS				%Rec.		
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits		
Total Suspended Solids	100	91.6		mg/L		92	86 - 114		
Lab Sample ID: LCSD 280-395948/2			c	client Sa	mple	ID: Lab	Control	Sample	e Dup
Matrix: Water							Prep Typ	e: Tot	al/NA
Analysis Batch: 395948									
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Total Suspended Solids	100	92.0		mg/L		92	86 - 114	0	20

# QC Association Summary

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

## Metals

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-103753-1	DW-01-1117	Total/NA	Water	7470A	
MB 280-396036/1-A	Method Blank	Total/NA	Water	7470A	
LCS 280-396036/2-A	Lab Control Sample	Total/NA	Water	7470A	
LCSD 280-396036/3-A	Lab Control Sample Dup	Total/NA	Water	7470A	
Prep Batch: 396044					
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-103753-1	DW-01-1117	Total/NA	Water	3010A	
MB 280-396044/1-A	Method Blank	Total/NA	Water	3010A	
LCS 280-396044/2-A	Lab Control Sample	Total/NA	Water	3010A	
LCSD 280-396044/3-A	Lab Control Sample Dup	Total/NA	Water	3010A	
280-103753-1 MS	DW-01-1117	Total/NA	Water	3010A	
280-103753-1 MSD	DW-01-1117	Total/NA	Water	3010A	
Analysis Batch: 3962	11				
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-103753-1	DW-01-1117	Total/NA	Water	6010C	396044
MB 280-396044/1-A	Method Blank	Total/NA	Water	6010C	396044
LCS 280-396044/2-A	Lab Control Sample	Total/NA	Water	6010C	396044
LCSD 280-396044/3-A	Lab Control Sample Dup	Total/NA	Water	6010C	396044
280-103753-1 MS	DW-01-1117	Total/NA	Water	6010C	396044
280-103753-1 MSD	DW-01-1117	Total/NA	Water	6010C	396044
nalysis Batch: 3962	16				
Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-103753-1	DW-01-1117	Total/NA	Water	7470A	396036
MB 280-396036/1-A	Method Blank	Total/NA	Water	7470A	396036
LCS 280-396036/2-A	Lab Control Sample	Total/NA	Water	7470A	396036
LCSD 280-396036/3-A	Lab Control Sample Dup	Total/NA	Water	7470A	396036

#### Analysis Batch: 395948

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-103753-1	DW-01-1117	Total/NA	Water	SM 2540D	
MB 280-395948/3	Method Blank	Total/NA	Water	SM 2540D	
LCS 280-395948/1	Lab Control Sample	Total/NA	Water	SM 2540D	
LCSD 280-395948/2	Lab Control Sample Dup	Total/NA	Water	SM 2540D	

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

#### Lab Sample ID: 280-103753-1 N

Client Sample ID: DW-01-1117 Date Collected: 11/15/17 15:20

-			-
Ma	trix	: W	ater

11

Date Receive	d: 11/17/17 0	9:00								
Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3010A			50 mL	50 mL	396044	11/21/17 15:10	MLS	TAL DEN
Total/NA	Analysis	6010C		1			396211	11/22/17 00:48	CML	TAL DEN
Total/NA	Prep	7470A			30 mL	50 mL	396036	11/21/17 10:56	CDH	TAL DEN
Total/NA	Analysis	7470A		1			396216	11/21/17 16:04	CDH	TAL DEN
Total/NA	Analysis	SM 2540D		1	125 mL	250 mL	395948	11/20/17 16:38	SVC	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

# Accreditation/Certification Summary

Client: AMEC Foster Wheeler E & I, Inc Project/Site: Martinsburg, WV ANG

#### TestAmerica Job ID: 280-103753-1

#### Laboratory: TestAmerica Denver Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below. Authority Program **EPA Region Identification Number Expiration Date** A2LA DoD ELAP 2907.01 10-31-19 \* Analysis Method Prep Method Matrix Analyte CO0002 Maine State Program 03-03-19 1 The following analytes are included in this report, but accreditation/certification is not offered by the governing authority: Analysis Method Prep Method Matrix Analyte 6010C 3010A Water Arsenic 6010C 3010A Water Cadmium 6010C 3010A Water Chromium 3010A 6010C Water Copper 3010A Water Lead 6010C Nickel 6010C 3010A Water 6010C 3010A Water Silver 6010C 3010A Water Zinc 7470A 7470A Water Hg SM 2540D Water **Total Suspended Solids** NELAP 8-999-405 Minnesota 5 12-31-17 The following analytes are included in this report, but accreditation/certification is not offered by the governing authority: Analysis Method Prep Method Matrix Analyte 6010C 3010A Water Arsenic 6010C 3010A Water Cadmium 6010C 3010A Water Chromium 3010A Water Copper 6010C 3010A Water Lead 6010C 3010A Water Nickel 6010C 6010C 3010A Water Silver 6010C 3010A Water Zinc 7470A 7470A Water Hg New York NELAP 2 11964 04-01-18 The following analytes are included in this report, but accreditation/certification is not offered by the governing authority: Analysis Method Prep Method Matrix Analyte 6010C 3010A Water Arsenic 6010C 3010A Water Cadmium 6010C 3010A Water Chromium 6010C 3010A Water Copper 6010C 3010A Water Lead 6010C 3010A Water Nickel 6010C 3010A Water Silver 6010C 3010A Water Zinc 7470A 7470A Water Hg Pennsylvania NELAP 3 68-00664 07-31-18 The following analytes are included in this report, but accreditation/certification is not offered by the governing authority: Analysis Method Prep Method Matrix Analyte 6010C 3010A Water Arsenic 6010C 3010A Water Cadmium 6010C 3010A Water Chromium

\* Accreditation/Certification renewal pending - accreditation/certification considered valid.