

То	Mr. Keith Freihofer Program Manager ANG/A4OR 3501 Fetchet Avenue Shepperd Hall Andrews AFB, MD 20762-5157	AMEC # 2-9133-0006				
From	Kerry Tull	сс				
Date	May 8, 2019					
Subject	Final Report - FY16 Phase I Regional Site Inspections for PFCs at Virginia Air National Guard, Former 192 nd Fighter Wing, Richmond IAP Byrd Field, Sandsto Virginia					

Mr. Freihofer:

Attached is one electronic copy and one hard copy of the Final Report – FY 16 Phase I Regional Site Inspections for PFCs at Virginia Air National Guard, Former 192nd Fighter Wing, Richmond IAP Byrd Field, Sandston, Virginia. This report has been completed as part of Contract No. W9133L-14-D-0002, Task Order 0006.

Please contact me at (207) 828-3514 if you have any questions.

Sincerely,

Kerry Tull Project Manager



FINAL REPORT FY16 PHASE I REGIONAL SITE INSPECTIONS FOR PERFLUORINATED COMPOUNDS Volume I of VII

VIRGINIA AIR NATIONAL GUARD FORMER 192ND FIGHTER WING RICHMOND IAP BYRD FIELD SANDSTON, VIRGINIA

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

Amec Foster Wheeler Project #: 2-9133-0006.07 7 May 2019

FY16 Phase I Regional Site Inspections For Perfluorinated Compounds

Virginia Air National Guard – Former 192nd Fighter Wing Richmond IAP Byrd Field Sandston, Virginia

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

Prepared by: Amec Foster Wheeler Environment & Infrastructure, Inc. 511 Congress St. Portland, ME 04101

Project No.: 291330006.07 7 May 2019

Prepared by:

Bonani Langan PERSM

Bonani Langan, PE**/**RS Regional Base Lead

Reviewed by:

Kerry Tull, LSP Project Manager

Jean Firth

Technical Reviewer

TABLE OF CONTENTS

EXEC	UTIVE SUMMARYE	S-1
1.0	INTRODUCTION	.1-1
1.1	Background	1-1
1.2	Purpose and Scope	1-2
2.0	INSTALLATION DESCRIPTION	.2-1
2.1	Location	2-1
2.2	Organization and History	2-1
3.0	ENVIRONMENTAL SETTING	3-1
3.1	Climate	3-1
3.2	Topography	3-1
3.3	Geology	3-1
3.4	Soils	3-2
3.5	Surface Water Hydrology	3-2
3.6	Regional Groundwater Hydrogeology	3-2
3.7	Local Groundwater Hydrology	3-4
3.8	Critical Habitat and Threatened/Endangered Species	3-4
3.9	Drinking Water Supply	3-5
4.0	PRELIMINARY ASSESSMENT	4-1
4.1	PRL 1: Building 3649 – Former Main Hangar	4-1
4.2	PRL 2: Building 3645 – Former Fire Station	4-1
4.3	PRL 3: Building 2851 – Former Fuel System Maintenance Dock	4-2
4.4	PRL 4: Building 96 – Former Hush House (Jet Engine Test Cell)	4-2
4.5	PRL 5: Concrete Apron/Ramp	4-3
5.0	FIELD PROGRAM METHODS	5-1
5.1	Utility Location and Clearance	5-1
5.2	Permits	5-1
5.3	Soil Boring Installation	5-2
5.4	Soil Sampling	5-2
5.5	Soil Boring Abandonment	5-3
5.6	Temporary Monitoring Well Installation and Development	5-3
5.7	Water Level Measurements	5-4
5.8	Groundwater Sampling	5-4
5.9	Temporary Monitoring Well Abandonment	5-5
5.10	Surface Water Sampling	5-5
5.11	Sediment Sampling	5-5
5.12	2Decontamination	5-6
5.13	Investigation Derived Waste Management	5-6
5.14	Laboratory	5-6
5.15	Field Quality Assurance/Quality Control Sample Results	5-7
5.16	Data Validation and Usability	5-7

6.0	SITE	INVESTIGATIONS	.6-1
6.1	Field	Activities Summary	6-1
6.2	Gene	ral Work Plan Deviations	6-2
6.3	PRL	1: Building 3649 – Former Main Hangar	6-2
6	.3.1	Site Deviations	6-2
6	.3.2	Soil Sampling	6-2
6	.3.3	Groundwater Sampling	6-2
6	.3.4	Sediment Sampling	6-3
6.4	PRL	2: Building 3645 – Former Fire Station	6-3
6	.4.1	Site Deviations	6-3
6	.4.2	Soil Sampling	6-3
6	.4.3	Groundwater Sampling	6-3
6	.4.4	Sediment Sampling	6-3
6	.4.5	Surface Water Sampling	6-4
6.5	PRL	3: Building 2851 – Former Fuel System Maintenance Dock	6-4
6	.5.1	Site Deviations	6-4
6	.5.2	Soil Sampling	6-4
6	.5.3	Groundwater Sampling	6-4
6	.5.4	Surface Water Sampling	6-4
6.6	PRL	4: Building 96 – Former Hush House	6-5
6	.6.1	Site Deviations	6-5
6	.6.2	Soil Sampling	6-5
6	.6.3	Groundwater Sampling	6-5
6.7	PRL	5: Concrete Apron/Ramp	6-5
6	.7.1	Site Deviations	6-5
6	.7.2	Soil Sampling	6-5
6	.7.3	Groundwater Sampling	6-6
6	.7.4	Surface Water Sampling	6-6
6.8	Base	Boundary Wells	6-6
6	.8.1	Site Deviations	6-6
6	.8.2	Groundwater Sampling	6-6
7.0	SOIL	AND GROUNDWATER STANDARDS	.7-1
8.0	SITE	INVESTIGATION RESULTS	.8-1
8.1	PRL	1: Building 3649 – Former Main Hangar	8-1
8	.1.1	PRL 1 Soil Analytical Results	8-1
8	.1.2	PRL 1 Groundwater Analytical Results	8-1
8	.1.3	PRL 1 Sediment Analytical Results	8-1
8.2	PRL	2: Building 3645 – Former Fire Station	8-2
8	.2.1	PRL 2 Soil Analytical Results	8-2
8	.2.2	PRL 2 Groundwater Analytical Results	8-2
8	.2.3	PRL 2 Sediment Analytical Results	8-2

8.2.4 PRL 2 Surf	ace Water Analytical Results	8-3
8.3 PRL 3: Building	2851 – Former Fuel System Maintenance Dock	8-3
8.3.1 PRL 3 Soil	Analytical Results	8-3
8.3.2 PRL 3 Grou	undwater Analytical Results	
8.3.3 PRL 3 Surf	ace Water Analytical Results	
8.4 PRL 4: Building	96 – Former Hush House	
8.4.1 PRL 4 Soil	Analytical Results	
8.4.2 PRL 4 Grou	undwater Analytical Results	
8.5 PRL 5: Concrete	e Apron/Ramp	
8.5.1 PRL 5 Soil	Analytical Results	
8.5.2 PRL 5 Grou	undwater Analytical Results	
8.5.3 PRL 5 Surf	ace Water Analytical Results	
8.6 Base Boundary \	Vells	
8.6.1 Groundwat	er Analytical Results	
9.0 CONCLUSIONS	RECOMMENDATIONS	9-1
9.1 PRL Sites Summ	ary	
10.0 REFERENCES.		10-1

LIST OF TABLES

- Table 1
 Preliminary Assessment Recommendations
- Table 2
 Summary of Site Inspection Activities
- Table 3
 Summary of Soil Analytical Testing Results
- Table 4
 Summary of Groundwater Analytical Testing Results
- Table 5
 Summary of Sediment Analytical Testing Results
- Table 6
 Summary of Surface Water Analytical Testing Results
- Table 7 USEPA and USAF SI Screening Criteria
- Table 8
 Screening Criteria Exceedances and Recommendations

LIST OF FIGURES

- Figure 1 Site Location Map
- Figure 2 Site & Area Features
- Figure 3 PRL Locations
- Figure 4 PRL 1 Sample Results
- Figure 5 PRL 2 Sample Results
- Figure 6 PRL 3 Sample Results
- Figure 7 PRL 4 Sample Results
- Figure 8 PRL 5 Sample Results
- Figure 9 Groundwater Sample Results

LIST OF APPENDICES

- Appendix A Field Activity Photographic Log
- Appendix B Soil Boring and Monitoring Well Construction Logs
- Appendix C Well Development Logs
- Appendix D Groundwater Sampling Records
- Appendix E Water Quality Sampling Instrument Calibration Forms
- Appendix F Sediment and Surface Water Sampling Logs
- Appendix G Investigation Derived Waste Profiles and Waste Manifest Forms
- Appendix H Data Validation Reports
- Appendix I Laboratory Analytical Reports

ACRONYMS & ABBREVIATIONS

192 nd FW	192 nd Fighter Wing
A4OR	Operations Restoration Branch
Accumark	Accumark, LLC
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AMSL	Above Mean Sea Level
ANG	Air National Guard
BB&E	BB&E, Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
CRAC	Capital Regional Airport Commission
°C	Degrees Celsius
°F	Degrees Fahrenheit
DoD	Department of Defense
DPT	Direct Push Technology
DQO	Data Quality Objective
EBS	Environmental Baseline Survey
EDR	Environmental Data Resources
ELAP	Environmental Laboratory Accreditation Program
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
ft	Feet/foot
FSP	Field Sampling Plan
FSS	Fire Suppression System
FTA	Fire Training Area
HA	Health Advisory
HDPE	High-Density Polyethylene
HSA	Hollow Stem Auger
<mark>IAP</mark> IDW IRP	Investigation Derived Waste Installation Restoration Program
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
NFA	No Further Action
NGB	National Guard Bureau
NRCS	National Resources Conservation Service

OWS	Oil Water Separator
ORP	Oxidation Reduction Potential
PA	Preliminary Assessment
%	percent
PFBS	Perfluorobutanesulfonic Acid
PFC	Perfluorinated 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
RIBF	Richmond IAP Byrd Field
RSL	Regional Screening Level
SAIC	Science Applications International Corporation
SB	Soil Boring (sample designation)
SD	Sediment (sample designation)
SW	Surface Water (sample designation)
SHSP	Site Health and Safety Plan
SI	Site Inspection
TestAmerica	Test America Laboratories, Inc.
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Top of Casing
TW	Temporary Well (sample designation)
UCMR3	Third Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VA811	Virginia 811 One Call Utility Notification Center
VANG	Virginia Air National Guard
Vista	Vista Analytical Laboratories, Inc.

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 Former 192nd Fighter Wing (192nd FW), Virginia Air National Guard, Richmond IAP Byrd Field (RIBF), in the city of Sandston, Virginia. This Report presents the results and recommendations from the 2017 SI field activities conducted in November 2017 at RIBF. 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 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 (DQOs) if further investigations are recommended.

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

- PRL 1: Building 3649 Former Main Hangar;
- PRL 2: Building 3645 Former Fire Station;
- PRL 3: Building 2851 Former Fuel System Maintenance Dock;
- PRL 4: Building 96 Former Hush House; and
- PRL 5: Concrete Apron/Ramp.

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. Samples were analyzed for 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, 2016a) and HA for PFOA (USEPA, 2016b); the USEPA Regional Screening Level (RSL) table for PFBS in residential

soil (USEPA, 2018); 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 below:

Parameter	Chemical Abstract Number	USEPA Regional Screening Level Table (November 2017) ^a Residential Soil (µg/kg) Tap Water (µg/L)		USAF Guidance for Soils and Sediments ^b (µg/kg)	USEPA Health Advisory Drinking Water (Surface Water or Groundwater) (μg/L) ^c	
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1,300,000 ^d	400 ^f	NL	NL	
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL 1,260		0.07e	
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	1,260		

Table ES-1: USEPA and USAF SI Screening Criteria

Notes and Abbreviations: NL – Not listed USAF – U.S. Air Force USEPA – U.S. Environmental Protection Agency μg/L - micrograms per liter μg/kg - micrograms per kilogram

^a USEPA Regional Screening Levels (USEPA, 2017).

^b 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).

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

^d PFBS RSL for Residential Soil concentration presented in Work Plan 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.

^e 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 for groundwater and surface water.

^f PFBS RSL for Tap Water presented in the SI Work Plan (Amec, 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.

Based on comparison of analytical data to the screening criteria in the table above, Amec Foster Wheeler recommends further investigation at each of the five PRLs investigated and at the base boundary. 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 recommended DQOs for future investigations, includes the following:

	Screening Criteria Exceedance				
PRL	Soil	GW	sw	SD	Recommendations
1		х			GW investigation to determine the nature and 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.
2		х	x		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.
3		x	x		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.
4					GW investigation to determine the nature and extent of the confirmed release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
5		x	x		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.
Base Boundary Wells		x			GW investigation both up and downgradient of the base boundary to evaluate potential off base sources and to evaluate the nature and extent of the confirmed release.

Table ES-2:	Screening	Criteria	Exceedances	and	Recommendations
-------------	-----------	----------	-------------	-----	-----------------

Notes:

GW – Groundwater

NFA – No Further Action

PFC – Perfluorinated Compound

PRL – Potential Release Area

SD – Sediment

SW – Surface water

X – Screening criteria exceedance

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau (NGB) under Contract # W9133L-14-D-0002, Delivery Order 0006 to conduct Phase I Regional Site Inspections (SIs) for perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutane sulfonate (PFBS) at multiple Air National Guard (ANG) Installations. The scope of the Contract includes performance of an SI at on-Base Potential Release Locations (PRLs) identified at the 192nd Fighter Wing (192nd FW), Virginia Air National Guard (VANG), former Richmond IAP Byrd Field (RIBF), in the Town of Sandston, 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 VANG, operating most recently as the 192nd FW, serviced a variety of military aircraft and occupied approximately 143 acres between 1947 and 2008. In 2005, the 192nd FW facility was placed in the United States Air Force (USAF) Base Realignment and Closure (BRAC) Program. As a result, the Base was closed in 2007/2008 and the property was developed by the Capital Regional Airport Commission (CRAC) for industrial use (BB&E, Inc. [BB&E], 2016). Additionally, a portion of the former Base is currently leased by the Federal Bureau of Investigation (FBI). Prior to the Preliminary Assessment (PA) (BB&E, 2016), potential releases of perfluorinated compounds (PFCs) from use and storage of aqueous film forming foam (AFFF) had not been evaluated at RIBF.

In 2015, BB&E conducted a PA site visit for VANG at the former RIBF to identify potential locations of historical environmental releases of PFOA, PFOS, and PFBS, specifically from AFFF usage and storage. The PA site visit process included a review of any documented Fire Training Areas (FTAs) in operation since 1970, other uses or releases of AFFF, and the completion of a site reconnaissance. The goal of the PA site visit was to determine if any PRLs posed a potential threat to human health and the environment, and required additional inspection (BB&E, 2015).

According to the PA, there is no evidence that a FTA was located within the footprint of the former RIBF. The USAF/ANG online administrative record was reviewed for references to potential FTAs located on the former RIBF. The administrative record did not contain any references to an on-Base FTA for the former RIBF. Fire training activities historically were conducted at a FTA

Page 1-1

operated by CRAC and located off-Base, on airport property. An *Environmental Baseline Survey* (EBS) conducted in 2001 shows the location of two adjacent facilities used for fire training (Science Applications International Corporation [SAIC], 2001). One is the former fire training pit, located off-Base to the southwest of the airport. This FTA was reportedly used by the VANG and was operated by the CRAC. The EBS stated that it can be assumed that "…aircraft was used for training purposes and thousands of gallons of jet propellant-4 were dumped on the field". Former Fire Chief Troy Springer indicated that the area was remediated and has not been used for the past six years, as of 2001 (SAIC, 2001). The other FTA is the City of Richmond Fire Training Academy was operated by the City of Richmond and was used to train municipal fire fighters.

Although no FTAs were historically located at the former RIBF, five PRLs were identified where AFFF types Ansulite Mil-spec [3 percent (%)] and Ansul Class A (1%) were potentially stored, used, or released. These PRLs consisted of hangars, fire stations, and fuel spill areas (BB&E, 2016). The five PRLs were recommended for further inspection (**Table 1**).

1.2 Purpose and Scope

The objective of the SI is to determine the presence or absence of PFOA, PFOS, and PFBS in the potentially affected media (i.e., soil, sediment, surface water, and/or groundwater) at each of the PRLs and at the former Base boundary. This data has been used to develop recommendations for appropriate paths forward to either provide an NFA conclusion or recommendations for further investigations. SI investigative tasks included:

- Advancing up to 20 soil borings using direct push technology (DPT) to a maximum depth of 10 feet (F) below ground surface (bgs), or first encountered groundwater, at the PRLs, and collect up to two soil samples from each boring;
- Installing up to six temporary monitoring wells at locations downgradient of the PRLs and along the base boundary, and collect groundwater samples at each location;
- Collecting two groundwater samples from existing permanent wells to characterize groundwater downgradient of PRLs and at the base boundary;
- Collecting one surface water sample from each PRL as appropriate; and,
- Collecting two sediment samples, one each from PRL 1 (Former Main Hangar; Building 3649) and PRL 2 (Former Fire Station; Building 3645).

Based on locations where AFFF was potentially used or stored, five PRLs were identified at the Base in the *PFC PA Site Visit Report* (BB&E, 2016). The PRLs are illustrated on **Figure 3**, and the SI summary is presented as **Table 2**.

All 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 outlined in the following sections.

2.0 INSTALLATION DESCRIPTION

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

2.1 Location

The former RIBF is located approximately four miles east-southeast of Richmond, Virginia, adjacent to the Richmond International Airport in Henrico County, Virginia (**Figures 1** and **2**). The RIBF is bounded to the north by single-family residential properties; to the east by the Richmond Fire Academy, a residence, and vacant wooded land; and to the south and west by the Richmond International Airport. Each of the five PRLs is located in separate areas across the RIBF. The locations of each PRL are shown on **Figure 3**.

2.2 Organization and History

The VANG, operating most recently as the 192nd FW, serviced a variety of military aircraft and occupied approximately 143 acres between 1947 and 2008. In 2005, the 192nd FW facility was placed in the USAF BRAC Program. As a result, the Base was closed in 2007/2008 and the property was developed by the CRAC for industrial use (BB&E, 2016). Additionally, a portion of the former base is currently leased by the FBI.

Activities at the Base have been typical of those at most airports and military air bases, including fueling and maintenance operations. These activities include the usage, handling, storage, and disposal of various products, including potentially hazardous materials.

3.0 ENVIRONMENTAL SETTING

The following sections provide information on the environmental setting at the former RIBF. This information is summarized from reports prepared during previous environmental evaluations at the former RIBF, as referenced in the following subsections.

3.1 Climate

The average summertime high in Sandston is 86 degrees Fahrenheit (°F). The average low in the winter is 30 °F. The hottest month is July with an average high temperature of 87.5 °F. The coldest month is January with an average low temperature of 27.6 °F. Precipitation averages 43.91 inches per year. July is the wettest month with an average of 4.67 inches of precipitation. February is the driest month with an average of 2.98 inches of precipitation (rssWeather, 2011).

3.2 Topography

Henrico County, Virginia overlaps the Coastal Plain Physiographic Province and the Piedmont Physiographic Province. The boundary of the two provinces, known as the Fall Zone, runs north-south through the county. The Coastal Plain is found to the east of the Fall Zone, and the Piedmont to the west. The former RIBF facility is located seven miles east of the Fall Zone in the Coastal Plain Physiographic Province. The elevation of the Coastal Plain Physiographic Province ranges from sea level to a maximum topographic elevation of 300 ft above mean sea level (amsl). The topography of the general region of the former RIBF facility is relative flat to gently rolling, with surface elevations range from approximately 145 to 160 ft amsl (AECOM, 2013).

3.3 Geology

Site geologic conditions observed during historical investigations at the former RIBF indicate that clay and silty-clay soils are present from the ground surface to depths of approximately 14 to 17 ft bgs. Below this depth, the formation transitions to a silty-sand/clayey-sand aquifer to a depth of approximately 30 ft bgs and then transitions to clayey-sand and gravel aquifer. Overall, the soil at the site is tan brown to dark gray, dry to moist, very plastic clay that overlies white to tan and red fine-grained sand that is less than five percent clay and silt content. Red and tan gravel was encountered at a depth of approximately 30 ft bgs and continued to the base of the lower surficial aquifer. A silty-clay layer at the base of the lower aquifer of undetermined thickness was encountered at a depth of 48 ft bgs (CH2M Hill, 2001).

3.4 Soils

According to the National Resources Conservation Service Web Soil Survey (National Resources Conservation Service [NRCS], 2017), soils in the vicinity of Former Main Hangar (PRL 1) and the Concrete Apron/Ramp (PRL 5) are mapped as Lynchburg fine sandy loam on the western portion of the PRLs, and Atlee very fine sandy loam on the east. Soils in the vicinity of the Former Fire Station (PRL 2), the Former Fuel System Maintenance Dock (PRL 3), and the Former Hush House (PRL 4) are mapped as Lynchburg fine sandy loam (NRCS, 2017). Lynchburg fine sandy loams and Atlee very fine sandy loams are derived from loamy marine deposits originating from marine terraces parent material.

Soils observed during the SI activities generally consisted of fine silt and clays over layers of poorly graded and well-graded sand strata. Within the sand strata, occasional layers of finer material (silty sand) and coarser material (gravelly sand) were encountered. Native material appeared to be of marine origin, which coincides with regionally mapped NRCS soil classifications.

3.5 Surface Water Hydrology

The site is located within the watershed of the Lower James River. Storm water at the former RIBF is directed to man-made collection and conveyance structures, which drain to the White Oak Swamp Creek and its on-site, unnamed tributary. The White Oak Swamp Creek enters the RIBF property from a 7.5-ft diameter culvert, which provides drainage from the adjacent Richmond International Airport. White Oak Swamp Creek drains to the Chickahominy River, which flows in to the James Rivers, 21 miles east of the former base. The Base does not lie within the 100- or 500-year floodplains (ITSI, 2009).

3.6 Regional Groundwater Hydrogeology

The main aquifers of the Coastal Plain province are the Chickahominy, the Patuxent, the Aquia, and the Yorktown. The Yorktown aquifer is unconfined or semi-confined. The other three aquifers are confined. Characteristics of each aquifer are provided below.

The Patuxent aquifer, the principal aquifer of Henrico County, is associated with deltaic stream channels that are highly porous and permeable. The screened interval for wells that produce potable water from the Patuxent aquifer is between 166 and 595 ft bgs.

Overlying the Patuxent Aquifer is the Aquia aquifer, which lies within the Tertiary Age Aquia Formation. The thickness of the aquifer ranges from 50 to 60 ft and the screened interval for potable water wells in this aquifer is between 120 and 130 ft bgs. It is confined by the underlying clays of the Cretaceous Age Potomac Group and the overlying Tertiary Age Marlboro.

Lying above the Aquia aquifer within the Tertiary Age Piney Point Formation is the Chickahominy aquifer. It is confined by the underlying Marlboro clay and the overlying Choptank clay. Potable water wells in this aquifer have an average depth of 75 ft bgs and the aquifer's average thickness is between 10 and 15 ft.

Above the Chickahominy aquifer in the Tertiary Age Yorktown-Eastover Formation is the watertable aquifer, also known as the Yorktown aquifer. Potable water wells in this aquifer are screened from 35 to 45 ft bgs; however, this aquifer has not been significantly developed because it may be vulnerable to contamination from leaking tanks and septic systems and can be susceptible to fluctuations in yield during times of drought.

With the exception of the Yorktown aquifer, each aquifer is recharged to the west of the former RIBF in the unconfined portions near the Fall Zone. The surficial Yorktown aquifer is recharged by vertical infiltration of rainfall and surface water. The Yorktown aquifer is the most susceptible to contamination by surface pollutants because it is unconfined to semi-confined. The deeper aquifers are shielded from vertical infiltration of contaminated groundwater by the overlying Choptank clay aquiclude (CH2M Hill, 2001).

Referencing the *Final Remedial Investigation/Feasibility Study Report for Site 1 and Site 3* (CH2M Hill, 2001), the site aquifer (Yorktown Aquifer) is a semi-confined aquifer consisting of relatively clean sand beginning at about 20 ft bgs. The upper portion of the aquifer, starting at approximately 18 to 20 ft bgs consists of a less permeable upper/transitional zone extending to approximately 35 ft bgs. The upper zone is underlain by a more permeable lower zone (approximately 35 to 47 ft bgs). The depth to water across the site is 9 to 14 ft bgs. The groundwater velocity in the upper less permeable zone is approximately 32 to 43 ft per year, while the groundwater in the lower more permeable zone is 70 to 122 ft per year. The groundwater flow direction in both the upper and lower portions of the aquifer is generally to the southeast toward White Oak Swamp Creek.

3.7 Local Groundwater Hydrology

Shallow groundwater at the former RIBF is located within the semi-confined Yorktown aquifer. The potentiometric groundwater surface is generally located between 9 and 14.3 ft bgs, with seasonal fluctuations of up to 5 ft.

According to AECOM's 2013 *Focused Feasibility Study* (AECOM, 2013), horizontal groundwater flow directions in the upper and lower portions of the Yorktown aquifer are towards White Oak Swamp Creek, with average hydraulic gradients of 0.0037 ft/ft (upper) and 0.003 ft/ft (lower); vertical groundwater flow direction is downward from the upper to lower portion of the surficial aquifer with an estimated hydraulic gradient of 0.047 ft/ft. As groundwater migrates toward the White Oak Swamp Creek, an upward vertical gradient is present where groundwater discharges to the creek bed.

Groundwater flow in both the upper and lower portions of the Yorktown aquifer are toward White Oak Swamp Creek. Historical reports indicate that the direction of groundwater flow to the south of White Oak Swamp Creek was northwestward toward the creek, and that groundwater flow to the north of White Oak Swamp Creek was to the southeast. The mean hydraulic conductivity of the upper aquifer is approximately 2.41 ft/day; the mean hydraulic conductivity of the lower aquifer is approximately 9.65 ft/day; and the average groundwater velocity is estimated at 21.7 ft/year and 42 ft/year in the upper aquifers, respectively (AECOM, 2013).

3.8 Critical Habitat and Threatened/Endangered Species

According to the Virginia Department of Game and Inland Fisheries Fish & Wildlife Information Service (VDGIF, 2017), there are seven endangered species found in Henrico County: the Small Whorled Pogonia, Sensitive Joint-vetch, Swamp Pink, Atlantic sturgeon, Dwarf wedgemussel, James Spinymussel, and the northern long-eared bat. The Dwarf wedgemussel and James Spinymussel are species of bivalve mollusk that are endangered. Small Whorled Pogonia, Sensitive Join-vetch, and Swamp Pink are species of flowering plants that are endangered. The Atlantic sturgeon is an endangered fish species and the northern long-eared 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.

3.9 Drinking Water Supply

The former Base is supplied with municipal water purchased from the Henrico County Department of Public Utilities. Henrico County municipal water is derived from the James River approximately eight miles south of the Base (HCPU, 2017). Historically, commercial water wells owned by Henrico County also provided water for the municipal drinking water system. The majority of Henrico County commercial water wells produced from the confined Patuxent aquifer (SAIC, 2001).

A review of the Environmental Data Resources (EDR) Radius Map[™] Report with Geocheck® dated 27 July 2015, shows two water wells within a one-mile radius of the former RIBF (EDR, 2015). These wells are listed on the United States Geological Survey database which typically lists monitoring or test wells. Both wells identified in the EDR Report are depicted on **Figure 2**.

According to the 2001 EBS (SAIC, 2001), no water wells were drilled within the Base boundary (other than groundwater monitoring wells) between 1947 and 2001. However, SAIC identified four nearby water supply wells within one mile of the RIBF. The closest well identified was a Municipal Water Well #36, located approximately 700-800 ft northeast of the RIBF. Two domestic water supply wells were identified between ½ and one mile to the east-southeast of the RIBF. And one fire protection well was identified between ½ and one mile to the west of the RIBF. Seven additional wells were identified in the surrounding area greater than one mile from the base. Wells identified by SAIC are depicted on **Figure 2**.

4.0 PRELIMINARY ASSESSMENT

BB&E conducted a PA site visit for ANG at the former RIBF in August 2015, to identify potential locations of historical environmental releases of PFOA, PFOS, and PFBS, specifically from AFFF usage and storage. Briefly, the PA site visit process included a review of documented FTAs in operation since 1970, and any other use or release of AFFF, and the completion of a site reconnaissance. The goal of the PA site visit was to determine if a PRL poses a potential threat to human health and the environment and requires additional inspection (BB&E, 2015).

The findings of AFFF use and storage at each of the five PRLs recommended for inclusion in the SI, as documented in the *PA Site Visit Report*, are summarized below. A summary of recommendations is presented in **Table 1**.

4.1 PRL 1: Building 3649 – Former Main Hangar

Building 3649 was the former Main Hangar. It is unknown if AFFF was utilized or stored at this location; however, based on the dates of operation and the use of the building, AFFF may have been present at this location. The former Main Hangar (64,605 square ft) was constructed in 1958 with concrete block walls and a concrete floor and was equipped with an Oil Water Separator (OWS). No record of historical AFFF use or spills was noted. Photographs taken during the 2001 EBS site visit show the inside of the Main Hangar. The presence of overhead piping may indicate that a Fire Suppression System was a part of this structure. No other information regarding the type of piping was identified during the PA investigation. Photographs taken during the EBS show a trench drain that was reportedly discharged to the OWS (SAIC, 2001). The OWS would have likely discharged to the sanitary sewer system, similar to other OWSs on-Base, with subsequent discharge to the local publicly owned treatment works (POTW). AFFF may have impacted environmental media by bypassing the onsite containment floor drain and oil water separator system.

4.2 PRL 2: Building 3645 – Former Fire Station

Building 3645 was the former Fire Station. It is unknown if AFFF was utilized at this location; however, based on the dates of operation and the use of the building, AFFF may have been used. According to the 2009 *Final Modified Comprehensive Site Evaluation Phase I Report* (ITSI, 2009), the former Fire Station (6,191 square ft) was built in 1958 with concrete block walls and a sealed concrete floor. No record of historical AFFF use or spills was noted. A photograph from the 2001

EBS site visit shows five overhead doors on the north side of the Fire Station (SAIC, 2001). Four Aircraft Rescue Fire Fighting vehicles are noted to be parked inside the Fire Station. The discharge location from the floor drains within the Fire Station, if present, is not known. It should be noted that the EBS discusses the presence of 10 OWSs at the Base. No OWSs are listed in association with the Fire Station. The sanitary sewer at the Base was connected to the local POTW. No records of known releases of AFFF were identified as part of the PA investigation (BB&E, 2016). AFFF may have impacted environmental media by bypassing the onsite containment floor drain system.

4.3 PRL 3: Building 2851 – Former Fuel System Maintenance Dock

Building 2851, the Former Fuel System Maintenance Dock, was built in 1977 with concrete walls and a concrete pad for the floor. The building is 17,052 square ft. The 2001 EBS indicates that the building is equipped with floor drains that are connected to a 2,000-gallon OWS system, which was noted as "active" during the EBS site visit. This OWS system was noted to have been installed in 1996, replacing the previous 400-gallon OWS that was installed when the building was constructed (1977). Both OWS systems were constructed of steel and drained to the sanitary sewer. According to the EBS, no major spills were noted to have occurred at the Fuel System Maintenance Dock, only minor spills that were cleaned up with absorbent materials (SAIC, 2001). While conducting surveillance and oversight on injections at the nearby Installation Restoration Program (IRP) Site 3 on 29 September 2015, BB&E toured this building. Mr. Jim Colmer of BB&E, noted that the building had an AFFF system with four turrets and a 150-gallon ANSUL (manufacturer's name) AFFF tank. The storage tank was noted to be sweating, indicating that some liquid likely remained inside the tank. Floor drains were also observed within the Former Fuel System Maintenance Dock during the site visit (BB&E, 2015). No records of known releases of AFFF were identified at the Former Fuel System Maintenance Dock as part of the PA investigation. AFFF may have impacted environmental media by bypassing the onsite containment floor drain and OWS system.

4.4 PRL 4: Building 96 – Former Hush House (Jet Engine Test Cell)

Building 96 was the former Hush House or Jet Engine Test Cell. According to the 2001 EBS, this Hush House was built in 1992 as a requirement of the conversion of the Base to the F-16 airframe. The Hush House is a 5,440 square ft building equipped with metal walls and a concrete pad floor. Floor drains are present within the Hush House. One of the floor drains is connected to a 2,000-

gallon steel OWS that was installed in 1992. The OWS discharges to the sanitary sewer. The remainder of the floor drains within the Hush House discharge directly to the sanitary sewer. An uncovered, concrete-bermed fuel storage area was noted adjacent to the west of the Former Hush House (SAIC, 2001). No records of known releases of AFFF were identified as part of the PA investigation (BB&E, 2016). AFFF may have impacted environmental media by bypassing the onsite containment floor drain and oil water separator system.

4.5 PRL 5: Concrete Apron/Ramp

Although there are no records or Base personnel accounts of AFFF usage, the Concrete Ramp/Apron area located in the southwestern portion of the RIBF property may have been impacted by AFFF due to the historical presence and operation of aircraft. A wash rack with a drain was noted to be present during the 2001 EBS site visit on the southern portion of the apron (SAIC, 2001). Storm water from the remainder of the Concrete Ramp/Apron area appears to flow to the north toward an unnamed ditch. No records of known releases of AFFF were identified as part of the PA investigation (BB&E, 2016).

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 *Final Work Plan* (Amec Foster Wheeler, 2017) and the *ANG Investigation Guidance* (ANG, 2009). The SI field activities were conducted during 6 through 10 November 2017. Photographs of field activities are included in **Appendix A**.

5.1 Utility Location and Clearance

On 13 February 2017, a site reconnaissance was completed at the former RIBF to evaluate each of the PRLs and identify areas where AFFF may have been potentially discharged or infiltrated into vadose zone soil. Amec Foster Wheeler was accompanied during the site reconnaissance by personnel from CRAC and the FBI to evaluate and verify the placement of each drilling location.

Prior to commencement of SI activities, drilling locations were pre-marked, and details of the proposed borehole locations were provided to the Virginia 811 One Call utility notification center (VA811). VA811 assigned ticket No. B729900469-00B to drilling activities on the site on 26 October 2017. Prior to subsurface activities, public utilities were cleared, and no locations were required to be moved. Due to the former RIBF being an inactive base, a USAF-103 ticket was not required.

On 31 October 2017, Amec Foster Wheeler met with a private utility company, Accumark, LLC (Accumark) and cleared Base utilities at each of the 20 proposed soil boring and six proposed temporary well locations using geophysical techniques. Equipment employed by Accumark 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 RIBF Point of Contact (POC) accompanying as an escort.

5.2 Permits

As described in **Section 5.1**, Amec Foster Wheeler obtained utility clearance permits for the SI activities, including VA811 with One Call. It was determined by the RIBF 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 14 August 2017
from Mr. Kyle Allison of the FAA providing work clearance approval. No other permits were required.

5.3 Soil Boring Installation

Between 6 November and 10 November 2017, 20 soil borings were advanced and six temporary monitoring wells installed to investigate potential PFC impacts in soil and groundwater at RIBF. The borings were advanced by Cascade Drilling LP with TWS Environmental, LLC and Amec Foster Wheeler oversight using DPT and hollow stem auger (HSA) drilling techniques. Soil borings advanced solely for soil sample collection were completed at 10 ft bgs. Soil borings advanced for installation of temporary monitoring wells were completed below the water table, at depths up to 20 ft bgs. Individual borehole depths are provided in the soil boring logs included in **Appendix B**.

Soil boring locations were selected based on PRL use and physical characteristics to target the most probable AFFF release areas. Twenty-five soil borings were advanced in and around the five PRLs using DPT and HSA drilling methods (19 borings for soil sampling only, five borings for temporary monitoring well installation, and one boring for combined temporary monitoring well installation and soil sampling). Soil cores were collected continuously for field screening at 5-ft intervals in new, dedicated acetate liners. 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

As described in the *Final Work Plan* (Amec Foster Wheeler, 2017), shallow soil samples were to be collected from the upper two ft of soil, directly beneath asphalt or pavement, if present; and deep soil samples were to be collected from the 2-ft interval above the soil/water table interface or 10 ft bgs, whichever was encountered first.

Soil samples were collected directly from single-use, acetate liners. After retrieval from the core barrel, the core liner 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 potential impacts. 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 8 to 10 ft bgs at every location, as the water table was not encountered in the upper 10 ft of each soil boring. Soil samples were collected in six ounce high-density polyethylene (HDPE) containers and

immediately cooled with ice to less than 4 Degrees Celsius (°C).

5.5 Soil Boring Abandonment

Following the completion of drilling activities, each boring was backfilled with hydrated bentonite chips just below grade in order to seal the boring. Surface completions were patched with like materials (topsoil/seed) in accordance with RIBF specifications.

5.6 Temporary Monitoring Well Installation and Development

Six temporary monitoring wells were installed to investigate potential groundwater impacts at the five RIBF PRLs and at the Base boundaries. The primary purpose of installing the temporary monitoring wells was to assess groundwater quality downgradient of the PRLs and at the Base boundary. Although well elevation surveys were not part of this project scope, temporary 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 cuttings were monitored 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 with HSA 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 ground surface. No annular seals were installed.

The temporary monitoring wells, as well as two existing permanent monitoring wells (TMW-37 and MW-01-36), were developed prior to sampling using a submersible 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).

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 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

Eight groundwater samples were collected, six from temporary monitoring wells and two from existing permanent monitoring wells (TMW-37 and MW-01-36). Wells were purged with a peristaltic pump, and United States Environmental Protection Agency (USEPA) Low Stress sampling methodology was followed to collect groundwater samples. The initial water level was recorded using an electronic water level meter prior to purging and sampling activities. Low-density polyethylene tubing was inserted into the monitoring well to the depth recorded in the sampling logs above the bottom of the well to prevent disturbances and re-suspension of sediment present in the bottom of the well. In general, the pump intake was placed in the middle of the saturated interval. The tubing was connected to a multi-parameter water quality probe flow-through cell and then to the peristaltic pump. The pump rate during purging was maintained at a steady flow rate between 100 and 300 milliliters per minute, such that drawdown of the water level within the well did not exceed a maximum allowable drawdown of 0.3 ft. The following parameters were monitored and recorded during purging: temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen, turbidity, temperature, specific conductivity, and water level on approximately five-minute intervals.

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.

Upon stabilization, groundwater samples were collected in 125 milliliter HDPE containers and immediately cooled with ice to less than 4°C. 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**. Surface completions were patched with like materials (topsoil/seed) in accordance with RIBF specifications.

5.10 Surface Water Sampling

A total of three surface water samples were collected, one each from PRL 2, PRL 3, and PRL 5. Prior to sample collection, the following parameters were monitored as per the *Final Work Plan*: temperature, pH, ORP, dissolved oxygen, turbidity, and specific conductivity (Amec Foster Wheeler, 2017). Surface water samples were collected from mid-depth in the center of the water column. Surface water samples were collected using a decontaminated bottle sampler attached to a pole (e.g., stainless steel pole and dipper) or directly into the sample container itself. After retrieval from the sampling device, the surface water samples were inspected for visual evidence of impact. Surface water 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). Surface water sampling logs are included in **Appendix F**.

5.11 Sediment Sampling

In accordance with the SI work plan two sediment samples were collected, one each from PRL 1 and PRL 2. Samples were collected from the upper 0.5 foot of sediment utilizing a clean 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. Reusable 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, shovels, and other downhole equipment) was decontaminated prior to initial use, and between collection of 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 UCMR3 list. Concentrations were reviewed to ensure Amec Foster Wheeler's internal PFC-free criteria were met. The associated laboratory data report is included in **Appendix G**. Decontamination fluids were containerized in steel 55-gallon drums and managed in accordance with **Section 5.13**.

5.13 Investigation Derived Waste Management

Investigation Derived Waste (IDW) (including soil cuttings, purge water, development water, and decontamination fluids) was collected and contained in labeled, secured, steel 55-gallon drums. Soil drums were filled to no more than 2/3 of maximum capacity of the drum to ensure compliance with Department of Transportation weight restrictions. Drums were staged on-site in an area designated by the RIBF POC. After the completion of field activities, representative composite samples were collected for both solid and liquid IDW. Samples were placed in laboratory-supplied containers using clean disposable gloves 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. The soil and liquid IDW were characterized as non-hazardous. The disposal of drums was completed in a timely manner and in accordance with RIBF policy for IDW. A total of 13 IDW solids and three IDW liquids drums were generated as part of the SI activities. A&D Environmental Services, Inc. transported and disposed of the IDW drums at their facility in Greenville, South Carolina on 10 January 2018. IDW profiles, waste manifest forms, and laboratory data reports are included in **Appendix G**.

5.14 Laboratory

Soil, groundwater, sediment, and surface water samples were submitted to Vista, in El Dorado Hills, California for analysis of PFC compounds on the UCMR3 list by Modified USEPA Method 537.1. Vista is accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) and maintains a National ELAP certification via reciprocity in

Virginia.

Waste characterization samples were sent to TestAmerica Laboratories, Inc. (TestAmerica) in Arvada, Colorado for analysis of Toxicity Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act metals including mercury (Methods 6010C and 7471A), TCLP volatile organic compounds (Method 8260B), TCLP semi volatile organic compounds (Method 8260B), and total polychlorinated biphenyls (Method 8082A). TestAmerica is accredited under the DoD ELAP.

5.15 Field Quality Assurance/Quality Control Sample Results

Quality Assurance (QA) and Quality Control (QC) samples, including field duplicates, matrix spike/matrix spike duplicates, 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 3** through **Table 6**.

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: 44 soil samples, which included four field duplicates; three sediment samples, which included one field duplicate; and 16 aqueous samples, which included eight primary groundwater samples, three primary surface water samples, two field duplicates, two 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 DQOs specified in the QAPP found in the *Final Work Plan* (Amec Foster Wheeler, 2017). Amec Foster Wheeler performed USEPA Stage 4 validation on 10% 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 included 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 360 data records from field samples during the validation. Amec Foster Wheeler J qualified¹ 48 records (13%) as estimated values because of field duplicate imprecision, and/or analyte concentrations outside the instrument's calibration range; B qualified² 16 records (4.4%) because of detections in the associated field and/or laboratory blanks; and Q qualified³ 1 result (0.3%) because of detections in the associated laboratory and field blanks and field duplicate imprecision. The Data Validation Report, including qualified data, is included as **Appendix H**. Laboratory analytical reports and chains of custody forms are provided in **Appendix I**.

¹ The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

² The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than 10 times the concentration detected in the blank.

³ The analyte was B qualified because of a detection in an associated blank and J qualified because of an additional QC issue.

6.0 SITE INVESTIGATIONS

This SI field program was designed to collect data needed to evaluate the presence/absence of PFC compounds at each of the five PRLs. The scope of the SI was designed using recommendations presented in the PA prepared by BB&E (BB&E, 2016). 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

The following SI field activities were completed:

PRL Name	Location Type	Analyzed Parameters ¹	Soil Borings	Soil Samples	Groundwater Samples (Existing Wells)	Groundwater Samples (Temporary Wells)	Surface Water Samples	Sediment Samples
1. Bldg. 3649 (Former Main Hangar)	Hangar with AFFF FSS	PFCs	4	8	0	1	0	1
2. Bldg. 3645 (Former Fire Station)	Fire Station	PFCs	4	8	0	1	1	1
3. Bldg. 2851 (Former Fuel System Maint. Dock)	Hangar with AFFF FSS	PFCs	4	8	0	1	1	0
4. Bldg. 96 Former Hush House (Jet Engine Test Cell)	Hangar with AFFF FSS	PFCs	4	8	0	1	0	0
5. Concrete Apron/Ramp	Ramp Fuel Emergency	PFCs	4	8	8 1 0		1	0
Base Boundary Wells	Base Boundary	PFCs	0	0	1	2	0	0
TOTAL			20	40	2	6	3	2

Notes:

FSS = Fire Suppression System

¹Soil, groundwater, surface water, and sediment samples were collected and analyzed for the PFCs listed on the USEPA's Third Unregulated Contaminant Monitoring Rule (UCMR3) list.

Individual sampling locations are shown on Figures 4 through Figure 9. Field activity photographs, soil boring and monitoring well construction, well development, groundwater

sampling, and surface water and sediment sampling logs are included in **Appendices A**, **B**, **C**, **D**, and **F**, respectively.

6.2 General Work Plan Deviations

Deviations from the general work plan included the following conditions:

- The November 2017 USEPA residential soil Regional Screening Level (RSL) value for 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.

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

6.3 PRL 1: Building 3649 – Former Main Hangar

6.3.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. No surface water sample (01SW01) was collected due to the 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.

6.3.2 Soil Sampling

Four soil borings (SB) (01SB01, 01SB02, 01SB03, and 01SB04) were advanced at PRL 1 on 7 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. Due to the location of utilities, two borings (01SB03 and 01SB04) were pre-cleared using a hand auger. The borings were completed using DPT drilling techniques, and deep samples (8-10 ft bgs) were collected from the bottom two ft of each boring. A total of eight soil samples were collected at this PRL.

Soil boring locations are illustrated on Figure 4.

6.3.3 Groundwater Sampling

Temporary monitoring well TW-01 was drilled to a depth of 20 ft bgs on 6 November 2017, and a

well screen was installed from 10 -20 ft bgs. Groundwater was measured at a depth of 16.04 ft below top of casing (TOC) in TW-01 prior to purging and sampling. One groundwater sample was collected on 7 November 2017.

Temporary monitoring well locations are illustrated on Figure 4.

6.3.4 Sediment Sampling

One sediment sample (SD) (01SD01) was collected at PRL 1 on 8 November 2017. The sediment sample was collected using hand tools from the upper 0.5 ft of sediment near an area of stormwater drainage.

Sediment sample locations are illustrated on Figure 4.

6.4 PRL 2: Building 3645 – Former Fire Station

6.4.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.4.2 Soil Sampling

Four soil borings (02SB01, 02SB02, 02SB03, and 02SB04) were advanced at PRL 2 on 6 and 7 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using DPT drilling techniques, and deep samples (8-10 ft bgs) were collected from the bottom two ft of each boring. A total of eight soil samples were collected at this PRL.

Soil boring locations are illustrated on **Figure 5**.

6.4.3 Groundwater Sampling

Temporary monitoring well TW-02 was drilled to a depth of 20 ft bgs on 7 November 2017, and a well screen was installed from 10 -20 ft bgs. Groundwater was measured at a depth of 18.25 ft below TOC in TW-02 prior to purging and sampling. One groundwater sample was collected on 7 November 2017.

Temporary monitoring well locations are illustrated on Figure 5.

6.4.4 Sediment Sampling

One sediment sample (02SD01) was collected at PRL 2 on 8 November 2017. The sediment sample was collected using hand tools from the upper 0.5 ft of sediment near the White Oak

Swamp Creek downgradient from PRL 2.

Sediment sample locations are illustrated on Figure 5.

6.4.5 Surface Water Sampling

One surface water sample (02SW01) was collected at PRL 2 on 8 November 2017. The surface water sample was collected from White Oak Swamp Creek downgradient from PRL 2.

Surface water sample locations are illustrated on Figure 5.

6.5 PRL 3: Building 2851 – Former Fuel System Maintenance Dock

6.5.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.5.2 Soil Sampling

Four soil borings (03SB01, 03SB02, 03SB03, and 03SB04) were advanced at PRL 3 on 8 and 9 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using DPT drilling techniques, and deep samples (8-10 ft bgs) were collected from the bottom two ft of each boring. A total of eight soil samples were collected at this PRL.

Soil boring locations are illustrated on Figure 6.

6.5.3 Groundwater Sampling

Temporary monitoring well TW-03 was drilled to a depth of 20 ft bgs on 8 November 2017, and a well screen was installed from 10-20 ft bgs. Groundwater was measured at a depth of 12.58 ft below TOC in TW-03 prior to purging and sampling. One groundwater sample was collected on 9 November 2017.

Temporary monitoring well locations are illustrated on Figure 6.

6.5.4 Surface Water Sampling

One surface water sample (03SW01) was collected at PRL 3 on 9 November 2017. The surface water sample was collected from White Oak Swamp Creek near PRL 3.

Surface water sample locations are illustrated on Figure 6.

6.6 PRL 4: Building 96 – Former Hush House

6.6.1 Site Deviations

One deviation from the Work Plan occurred at this PRL. No surface water sample (04SW01) was collected due to the lack of surface water at the time of SI activities. No other deviations, apart from the general Work Plan deviations, occurred at this PRL.

6.6.2 Soil Sampling

Four soil borings (04SB01, 04SB02, 04SB03, and 04SB04) were advanced at PRL 4 on 7 and 8 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using DPT drilling techniques, and deep samples (8-10 ft bgs) were collected from the bottom two ft of each boring. A total of eight soil samples were collected at this PRL.

Soil boring locations are illustrated on Figure 7.

6.6.3 Groundwater Sampling

Temporary monitoring well TW-04 was drilled to a depth of 20 ft bgs on 6 November 2017, and a well screen was installed from 10- 20 ft bgs. Groundwater was measured at a depth of 15.05 ft below TOC in TW-04 prior to purging and sampling. One groundwater sample was collected on 8 November 2017.

Temporary monitoring well locations are illustrated on Figure 7.

6.7 PRL 5: Concrete Apron/Ramp

6.7.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.7.2 Soil Sampling

Four soil borings (05SB01, 05SB02, 05SB03, and 05SB04) were advanced at PRL 5 on 8 November 2017, and shallow soil samples (0-2 ft bgs) were collected from each boring. The borings were completed using DPT drilling techniques, and deep samples (8-10 ft bgs) were collected from the bottom two ft of each boring. A total of eight soil samples were collected at this PRL

Soil boring locations are illustrated on Figure 8.

6.7.3 Groundwater Sampling

One groundwater sample was collected on 8 November 2017 from existing permanent groundwater monitoring well TMW-37. Groundwater was measured at a depth of 17.90 ft below TOC prior to purging and sampling. Based on historical records, TMW-37 is screened from 12-27 ft bgs; the bottom of the well screen was measured at a depth of 27 ft (measured from TOC).

Temporary monitoring well locations are illustrated on Figure 8.

6.7.4 Surface Water Sampling

One surface water sample (05SW01) was collected at PRL 5 on 8 November 2017. The surface water sample was collected in the White Oak Swamp Creek downgradient from PRL 5.

Surface water sample locations are illustrated on **Figure 8**.

6.8 Base Boundary Wells

6.8.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.8.2 Groundwater Sampling

Temporary monitoring wells BW-01 and BW-02 were drilled to a depth of 20 ft bgs on 9 November 2017, and a well screen was installed from 10-20 ft bgs for each well. Groundwater was measured at a depth of 11.58 ft and 8.62 ft below TOC in BW-01 and BW-02, respectively, prior to purging and sampling. Two groundwater samples were collected from the base boundary temporary monitoring wells on 9 November 2017 (BW-02) and 10 November 2017 (BW-01).

In addition, one groundwater sample was collected on 10 November 2017 from existing permanent groundwater monitoring well MW-01-36. Groundwater was measured at a depth of 13.42 ft below TOC prior to purging and sampling. Based on historical records, MW-01-36 is screened from 14.15-29.15 ft bgs; the bottom of the well screen was measured at a depth of 29.15 ft (measured from TOC). A total of three groundwater samples were collected from the base boundary wells.

Base boundary monitoring well locations are illustrated on Figure 9.

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 these compounds.

In accordance with *Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations* (USAF, 2012) and USEPA lifetime drinking water Heath Advisories (HAs) for PFOS (USEPA, 2016a) and PFOA (USEPA, 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 values⁴).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

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).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

USEPA has also derived (RSL values for PFBS, for which there is a Tier 2 toxicity value (USEPA, 2017). The USAF will also consider a release to be confirmed if the following concentrations are

⁴ 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).

exceeded:

PFBS:

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

The HA, RSLs and USAF Guidance values are collectively referred to as screening criteria in this Report. **Table 7** 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 7**. Locations of detected analytes are shown on **Figure 4** through **Figure 9**.

8.1 PRL 1: Building 3649 – Former Main Hangar

8.1.1 PRL 1 Soil Analytical Results

Eight soil samples were collected and analyzed as described in **Section 6.3.3**: 01SB01 from 0-2 and 8-10 ft bgs; 01SB02 from 0-2 and 8-10 ft bgs; 01SB03 from 0-2 and 8-10 ft bgs; and 01SB04 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate that four of the six PFCs were detected above the laboratory reporting limit in at least one of the four soil samples collected; however, no compounds exceeded the screening criteria in any of the eight soil samples collected from PRL 1.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 4**.

8.1.2 PRL 1 Groundwater Analytical Results

One groundwater sample was collected from TW-01 and analyzed as described in **Section 6.3.4**. Analytical results from the groundwater sample indicates that five PFC compounds were detected at concentrations above the laboratory detection limit, with one compound exceeding the groundwater screening criterion. PFOS was detected in TW-01 above the 0.07 μ g/L USEPA Drinking Water HA (USEPA, 2016a), at a concentration of 0.181 μ g/L. The combined PFOS and PFOA concentration is 0.220 μ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 4**.

8.1.3 PRL 1 Sediment Analytical Results

One sediment sample was collected and analyzed as described in **Section 6.3.2**, 01SD01 from 0-0.5 ft bgs. Analytical results from the sediment sample indicate one PFC compound was detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in the sediment sample collected from PRL 1.

Comparisons of analytical results, including field duplicate results, to applicable criteria are presented on **Table 5**. The sediment sample location showing detected compounds are depicted on **Figure 4**.

8.2 PRL 2: Building 3645 – Former Fire Station

8.2.1 PRL 2 Soil Analytical Results

Eight soil samples were collected and analyzed as described in **Section 6.4.4**: 02SB01 from 0-2 and 8-10 ft bgs; 02SB02 from 0-2 and 8-10 ft bgs; 02SB03 from 0-2 and 8-10 ft bgs; and 02SB04 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate that each of the six PFCs were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in either of the eight samples collected from PRL 2.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 5**.

8.2.2 PRL 2 Groundwater Analytical Results

One groundwater sample was collected from TW-02 and analyzed as described in **Section 6.4.5**. Analytical results from the groundwater sample indicates 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-02 above the 0.07 μ g/L USEPA Drinking Water HA, at a concentration of 1.68 μ g/L and 0.588 μ g/L, respectively. The combined PFOS and PFOA concentration is 2.27 μ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 5**.

8.2.3 PRL 2 Sediment Analytical Results

One sediment sample was collected and analyzed as described in **Section 6.4.2**, 02SD01 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 criteria in the sediment sample collected from PRL 2.

Comparisons of analytical results, including field duplicate results, to applicable criteria are presented on **Table 5**. The sediment sample location showing detected compounds are depicted on **Figure 5**.

8.2.4 PRL 2 Surface Water Analytical Results

One surface water sample (02SW01) was collected and analyzed as described in **Section 6.4.3**. Analytical results from the surface water sample indicate six PFCs were detected above the laboratory reporting limit; with one compound exceeding the surface water screening criterion. PFOS was detected in 02SW01 above the 0.07 μ g/L USEPA Drinking Water HA, at a concentration of 0.0937 μ g/L. The combined PFOS and PFOA concentration is 0.14 μ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 6**. The surface water location showing detected compounds is illustrated on **Figure 5**.

8.3 PRL 3: Building 2851 – Former Fuel System Maintenance Dock

8.3.1 PRL 3 Soil Analytical Results

Eight soil samples were collected and analyzed as described in **Section 6.5.3**: 03SB01 from 0-2 and 8-10 ft bgs; 03SB02 from 0-2 and 8-10 ft bgs; 03SB03 from 0-2 and 8-10 ft bgs; and 03SB04 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate that three of the six PFCs were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in either of the eight samples collected from PRL 3.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 6**.

8.3.2 PRL 3 Groundwater Analytical Results

One groundwater sample was collected from TW-03 and analyzed as described in **Section 6.5.4**. Analytical results from the groundwater sample indicates that six PFCs were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07 μ g/L. PFOS and PFOA were detected in TW-03 at a concentration of 0.31 μ g/L and 0.303 μ g/L, respectively. The combined PFOS and PFOA concentration is 0.61 μ g/L at this location.

Comparisons of analytical results to applicable criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 6**.

8.3.3 PRL 3 Surface Water Analytical Results

One surface water sample (03SW01) was collected and analyzed as described in **Section 6.5.2**. 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. PFOS and PFOA were detected in 03SW01 above the 0.07 μ g/L USEPA Drinking Water HA, at a concentration of 0.453 μ g/L and 0.1 μ g/L, respectively. The combined PFOS and PFOA concentration is 0.553 μ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 6**. The surface water location showing detected compounds is illustrated on **Figure 6**.

8.4 PRL 4: Building 96 – Former Hush House

8.4.1 PRL 4 Soil Analytical Results

Eight soil samples were collected and analyzed as described in **Section 6.6.2**: 04SB01 from 0-2 and 8-10 ft bgs; 04SB02 from 0-2 and 8-10 ft bgs; 04SB03 from 0-2 and 8-10 ft bgs; and 04SB04 from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate four of the six PFCs were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in the eight samples collected from PRL 4.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 7**.

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 indicates that four PFCs were detected at concentrations above the laboratory detection limit, however, no compounds exceed the USEPA Drinking Water HA of 0.07 μ g/L.

Comparisons of analytical results to applicable criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 7**.

8.5 PRL 5: Concrete Apron/Ramp

8.5.1 PRL 5 Soil Analytical Results

Eight soil samples were collected and analyzed as described in **Section 6.7.3**: 05SB01 from 0-2 and 8-10 ft bgs; 05SB02 from 0-2 and 8-10 ft bgs: 05SB03 from 0-2 and 8-10 ft bgs; and 05SB04

from 0-2 and 8-10 ft bgs. Analytical results from soil samples indicate four of the six PFCs were detected above the laboratory reporting limit in at least one sample; however, no compounds exceeded the screening criteria in either of the eight samples collected from PRL 5.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 8**.

8.5.2 PRL 5 Groundwater Analytical Results

One groundwater sample was collected from TMW-37 and analyzed as described in **Section 6.7.4**. Analytical results from the groundwater sample indicates that six PFCs were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07 μ g/L. PFOS and PFOA were detected in TMW-37 at a concentration of 0.33 μ g/L and 0.162 μ g/L, respectively. The combined PFOS and PFOA concentration is 0.49 μ g/L at this location.

Comparisons of analytical results to applicable criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 8**.

8.5.3 PRL 5 Surface Water Analytical Results

One surface water sample (05SW01) was collected and analyzed as described in **Section 6.7.2**. Analytical results from the surface water sample indicate six PFCs were detected above the laboratory reporting limit; with one compound exceeding the surface water screening criterion. PFOS was detected in 05SW01 above the 0.07 μ g/L USEPA Drinking Water HA, at a concentration of 0.0809 μ g/L. The combined PFOS and PFOA concentration is 0.120 μ g/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 6**. The surface water location showing detected compounds is illustrated on **Figure 8**.

8.6 Base Boundary Wells

8.6.1 Groundwater Analytical Results

One groundwater sample was collected from BW-01 and analyzed as described in **Section 6.8.2**. Analytical results from the groundwater sample indicates that six PFCs were detected at concentrations above the laboratory detection limit, with one compound exceeding the USEPA Drinking Water HA of 0.07 μ g/L. PFOS was detected at a concentration of 0.21 μ g/L in BW-01. The combined PFOS and PFOA concentration is 0.23 μ g/L at this location.

One groundwater sample was collected from BW-02 and analyzed as described in **Section 6.8.2**. Analytical results from the groundwater sample indicates that five of the six PFCs were detected at concentrations above the laboratory detection limit, with two compounds exceeding the USEPA Drinking Water HA of 0.07 μ g/L. PFOS and PFOA were detected in BW-02 at a concentration of 0.423 μ g/L and 0.112 μ g/L, respectively. The combined PFOS and PFOA concentration is 0.535 μ g/L at this location.

Lastly, one groundwater sample was collected from MW-01-36 and analyzed as described in **Section 6.8.2**. Analytical results from the groundwater sample indicates that six PFCs were detected at concentrations above the laboratory detection limit, however, no compounds exceed the USEPA Drinking Water HA of 0.07 μ g/L.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 9**.

9.0 CONCLUSIONS/RECOMMENDATIONS

This section presents the SI conclusions and recommendations at each PRL. The recommendations are based on data collected by Amec Foster Wheeler during this SI, and an evaluation of results compared to applicable screening criteria.

A review of soil analytical data compared to soil screening criteria indicates there are no USEPA RSL exceedances for PFBS, and no USAF Guidance screening level exceedances for PFOS or PFOA at RBIF locations near the five PRLs. However, soil may be an ongoing source of contaminants to groundwater.

A review of groundwater data compared to screening criteria indicates exceedances of the USEPA Drinking Water HA existing at six of the eight temporary or existing monitoring wells sampled for PFOS and at four of the eight temporary or existing monitoring wells sampled for PFOA. A review of groundwater data compared to screening criteria indicates no exceedances of the USEPA Drinking Water HA for PFBS at any of the PRLs.

Groundwater results exceed the USEPA Drinking Water HA at temporary monitoring wells sampled at PRLs 1, 2, 3 and 5, and at the Base Boundary. Therefore, based on the local and regional groundwater flow directions at the RIBF there is a potential for PFC migration downgradient of each PRL toward the White Oak Swamp Creek and at the Base Boundary toward the southeast.

A review of surface water analytical data compared to screening criteria indicates there are no USEPA RSL exceedances for PFBS, however, there are exceedances of the USAF Guidance screening level for PFOS at PRL 2, PRL 3, and PRL 5, and for PFOA at PRL 3.

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 locations to evaluate the stormwater drainage basin. Although contamination was detected within the stormwater drainage basin, this is considered a migration pathway and is not likely to be an ongoing source of contamination.

Based on the SI results, additional investigation is recommended at each of the five PRLs and the Base boundary. The following DQOs are recommended:

• Additional soil investigations are recommended at each of the five PRLs to evaluate the extent of PFCs including within the saturated zone.

- Additional investigations are recommended to evaluate concentrations of PFCs in groundwater at each of the five PRLs. This should include a source evaluation and delineation to determine the nature and extent of the release.
- Additional investigations are recommended to further evaluate concentrations of PFCs in surface water at PRL 2, PRL 3, and PRL 5. 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 upand down-stream.
- Additional investigations are recommended both up and downgradient of the Base boundary to evaluate if there are PFCs migrating onto the Base and the extent of contamination migrating off Base.

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 Sites Summary

In summary, additional investigations are recommended for each of the five PRLs and the Base boundary.

These recommendations are summarized in **Table 8** below.

	Screening Criteria Exceedance				
PRL	Soil GW SW SD			SD	Recommendations
1		х			GW investigation to determine the nature and 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.
2		x	x		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.

Table 8: Screening Criteria Exceedances and Recommendations

	Screening Criteria Exceedance				
PRL	Soil GW SW SD			SD	Recommendations
3		х	x		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.
4					GW investigation to determine the nature and extent of the confirmed release. Soil investigation, including soils in the saturated zone, to determine if the soil may be a contributing source to GW.
5		х	×		GW investigation to determine the nature and 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. SW investigation to evaluate migration pathway of PFCs.
Base Boundary Wells		Х			GW investigation both up and downgradient of the base boundary to evaluate potential off base sources and to evaluate the nature and extent of the confirmed release.

Notes:

GW – Groundwater

PFC – Perfluorinated Compound

PRL – Potential Release Area

SD – Sediment

SW – Surface water X – Screening criteria exceedance THIS PAGE INTENTIONALLY LEFT BLANK.

10.0 REFERENCES

- AECOM, 2013. Focused Feasibility Study, Site 1 Basewide Groundwater Operable Unit, Former Virginia Air National Guard Base. March 2013.
- Amec Foster Wheeler (Amec Foster Wheeler), 2017. Final Work Plan, FY16 Phase I Regional Site Inspections for Perfluorinated Compounds, 192nd Fighter Wing, Virginia Air National Guard, Richmond Air National Guard Base, Sandston, Virginia. September 2017.
- Air National Guard (ANG), 2009. Air National Guard Investigation Guidance, Environmental Restoration Program. September 2009.
- BB&E, Inc. (BB&E), 2015. Trip Report: Surveillance and Oversight of Remedial Actions at Richmond International Airport (IRP Site 1 Basewide Groundwater Operable Unit), Former Virginia Air National Guard Base – Richmond, Virginia. 30 September.
- BB&E, 2016. Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, Virginia Air National Guard, Richmond Air National Guard Base, Sandston, Virginia. January 2016.
- CH2MHill, 2001. *Final Remedial Investigation/Feasibility Study for Site 1 and Site 3*. September 2001.
- DoD, 2017. DoD Department of Energy Consolidated Quality Systems Manual for Environmental Laboratories. Version 5.1, January 2017.
- Environmental Data Resources (EDR), 2015. *EDR Radius Map™ Report with Geocheck*®. Environmental Data Resources, Inc., Inquiry Number 4357667.2s. July 2015.
- Federal Aviation Administration (FAA), 2017. Final Determination Letter. 14 August.
- Henrico County Public Utilities (HCPU), 2017. Annual Water Quality Report: Water Testing Performed in 2016. 1 June.
- Innovative Technical Solutions, Inc. (ITSI), 2009. *Final Modified Comprehensive Site Evaluation Phase I Report*. July 2009.
- NRCS, 2017. Natural Resources Conservation Services Web Soil Survey [https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx]. October 2017.
- rssWeather, 2011. Climate for Richmond, Virginia. February 14, 2012. http://www.rssweather.com/climate/Virginia/Richmond/

- Science Applications International Corporation (SAIC), 2001. *Final Environmental Baseline Survey, 192nd Fighter Wing Virginia Air National Guard, Richmond International Airport, Sandston, Virginia*. April 2001.
- U.S. Air Force (USAF), 2012. Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations.
- United States Environmental Protection Agency (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 (UCMR3) 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-june-2017], June 2017.
- Virginia Department of Game and Inland Fisheries (VDGIF), 2017. Fish and Wildlife Information Service – Species Information. Accessed March 15, 2017. https://vafwis.dgif.virginia.gov/fwis/?Title=VaFWIS+Species+Information

TABLES

THIS PAGE INTENTIONALLY LEFT BLANK.

Table 1

Preliminary Assessment Recommendations

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds Former 192nd Fighter Wing, Richmond Air National Guard Richmond IAP Byrd Field, Sandston, Virginia

PRLUseRecommendation1. Building 3649 – Former Main HangarFormer Main Hangar with AFFF Fire Suppression System (FSS)Soil, sediment, surface water, and groundwater inspection2. Building 3645 – Former Fire StationFormer Fire StationSoil, sediment, surface water, and groundwater inspection3. Building 2851 – Former Fuel System Maintenance DockFormer Fuel System Maintenance Dock with AFFF FSSSoil, surface water, and groundwater inspection4. Building 96 – Former Hush House (Jet Engine Test Cell)Former Hush House (Jet Engine Test Cell)Soil, surface water, and groundwater inspection5. ConcreteConcreteSoil, surface water, and groundwater							
PRL	Use	Recommendation					
1. Building 3649 – Former Main Hangar	Former Main Hangar with AFFF Fire Suppression System (FSS)	Soil, sediment, surface water, and groundwater inspection					
2. Building 3645 – Former Fire Station	Former Fire Station	Soil, sediment, surface water, and groundwater inspection					
3. Building 2851 – Former Fuel System Maintenance Dock	Former Fuel System Maintenance Dock with AFFF FSS	Soil, surface water, and groundwater inspection					
4. Building 96 – Former Hush House (Jet Engine Test Cell)	Former Hush House (Jet Engine Test Cell)	Soil, surface water, and groundwater inspection					
5. Concrete Ramp/Apron	Aircraft ramp/runway	Soil, surface water, and groundwater inspection					

Notes:

Recommendations provided by BB&E, Inc. in the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report (BB&E, 2016)

Table 2

Summary of Site Inspection Activities

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

Former 192nd Fighter Wing, Richmond Air National Guard

Richmond IAP Byrd Field, Sandston, Virginia

PRL Name	Location Type	Analyzed Parameters ¹	Soil Borings	Soil Samples	Groundwater Samples (Existing Wells)	Groundwater Samples (Temporary Wells)	Surface Water Samples	Sediment Samples
1. Bldg. 3649 (Former Main Hangar)	Hangar with AFFF FSS	PFCs	4	8	0	1	0	1
2. Bldg. 3645 (Former Fire Station)	Fire Station	PFCs	4	8	0	1	1	1
3. Bldg. 2851 (Former Fuel System Maint. Dock)	Hangar with AFFF FSS	PFCs	4	8	0	1	1	0
4. Bldg. 96 Former Hush House (Jet Engine Test Cell)	Hangar with AFFF FSS	PFCs	4	8	0	1	0	0
5. Concrete Apron/Ramp	Ramp Fuel Emergency	PFCs	4	8	1	0	1	0
Base Boundary Wells	Base Boundary	PFCs	0	0	1	2	0	0
TOTAL			20	40	2	6	3	2

Notes:

¹ Soil, groundwater, surface water, and sediment samples were collected and analyzed for the PFCs listed on the USEPA's Third Unregulated Contaminant Monitoring Rule (UCMR3) list.

FSS = Fire Suppression System

Table 3 Summary of Soil Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Sandston, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
PRL	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	015001	RICHM-01-SB01-0-2	07-Nov-17	0.0-2.0	Ν	0.0142	0.000414 B	0.000984 U	0.000984 U	0.000431 J	0.000984 U
	013601	RICHM-01-SB01-8-10	07-Nov-17	8.0-10.0	Ν	0.000972 U	0.000972 U	0.000972 U	0.000972 U	0.000988 J	0.000972 U
	01SB02	RICHM-01-SB02-0-2	07-Nov-17	0.0-2.0	Ν	0.00646	0.000976 U	0.000976 U	0.000976 U	0.000976 U	0.000976 U
		RICHM-01-SB02-8-10	07-Nov-17	8.0-10.0	Ν	0.00101 U	0.00101 U	0.00101 U	0.00101 U	0.00111 J	0.00101 U
1		RICHM-01-SB03-0-2	07-Nov-17	0.0-2.0	Ν	0.00539 J	0.000746 B	0.000994 U	0.000994 U	0.000994 U	0.000526 J
	01SB03	RICHM-SO-DUP01-110717	07-Nov-17	0.0-2.0	FD	0.00331 J	0.000983 U	0.000983 U	0.000983 U	0.000983 U	0.000983 U
		RICHM-01-SB03-8-10	07-Nov-17	8.0-10.0	Ν	0.000984 U	0.000984 U	0.000984 U	0.000984 U	0.000984 U	0.000984 U
	015804	RICHM-01-SB04-0-2	07-Nov-17	0.0-2.0	Ν	0.000394 J	0.00045 B	0.000887 U	0.000887 U	0.000636 J	0.000887 U
	013004	RICHM-01-SB04-8-10	07-Nov-17	8.0-10.0	Ν	0.000978 U	0.000978 U	0.000978 U	0.000978 U	0.000978 U	0.000978 U
	025001	RICHM-02-SB01-0-2	06-Nov-17	0.0-2.0	Ν	0.0712	0.00206 B	0.000304 J	0.000456 J	0.00734	0.000939 U
_		RICHM-02-SB01-8-10	06-Nov-17	8.0-10.0	N	0.0013 J	0.000947 U	0.000947 U	0.000947 U	0.00104 J	0.000947 U
2		RICHM-02-SB02-0-2	07-Nov-17	0.0-2.0	N	0.103 J	0.00279 Q	0.00042 J	0.000621 J	0.0101	0.000522 J
	02SB02	RICHM-SO-DUP02-110717	07-Nov-17	0.0-2.0	FD	0.173 J	0.00485 J	0.00035 J	0.000887 J	0.0126	0.000621 J
		RICHM-02-SB02-8-10	07-Nov-17	8.0-10.0	Ν	0.00362	0.000493 B	0.000941 U	0.000941 U	0.003	0.000941 U

Table 3 Summary of Soil Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Sandston, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Screer	ning Level:	1.26 ¹	1.261	1300 ²	NA	NA	NA
	02SB03	RICHM-02-SB03-0-2	07-Nov-17	0.0-2.0	N	0.118	0.00669	0.000599 J	0.00109 J	0.0153	0.000401 J
2		RICHM-02-SB03-8-10	07-Nov-17	8.0-10.0	N	0.000989 U	0.00695	0.004	0.00136 J	0.0341	0.000309 J
2	025804	RICHM-02-SB04-0-2	07-Nov-17	0.0-2.0	N	0.0401	0.000552 B	0.000935 U	0.000935 U	0.00196	0.000935 U
		RICHM-02-SB04-8-10	07-Nov-17	8.0-10.0	N	0.000981 U	0.000981 U	0.000981 U	0.000981 U	0.000981 U	0.000981 U
	025001	RICHM-03-SB01-0-2	08-Nov-17	0.0-2.0	N	0.0123	0.000394 B	0.000996 U	0.000996 U	0.000996 U	0.000996 U
	035001	RICHM-03-SB01-8-10	08-Nov-17	8.0-10.0	N	0.000987 U	0.000987 U	0.000987 U	0.000987 U	0.000987 U	0.000987 U
	03SB02	RICHM-03-SB02-0-2	08-Nov-17	0.0-2.0	N	0.00095 U	0.00034 B	0.00095 U	0.000561 J	0.00095 U	0.00095 U
		RICHM-03-SB02-8-10	08-Nov-17	8.0-10.0	N	0.000948 U	0.000948 U	0.000948 U	0.000948 U	0.000948 U	0.000948 U
3	036003	RICHM-03-SB03-0-2	09-Nov-17	0.0-2.0	N	0.00457	0.000309 B	0.000946 U	0.000946 U	0.000946 U	0.000946 U
	055005	RICHM-03-SB03-8-10	09-Nov-17	8.0-10.0	N	0.000974 U	0.000974 U	0.000974 U	0.000974 U	0.000974 U	0.000974 U
	035004	RICHM-03-SB04-0-2	09-Nov-17	0.0-2.0	N	0.005	0.000611 B	0.000995 U	0.000995 U	0.00142 J	0.000995 U
	055804	RICHM-03-SB04-8-10	09-Nov-17	8.0-10.0	N	0.000998 U	0.000998 U	0.000998 U	0.00037 J	0.000998 U	0.000998 U
	04SB01	RICHM-04-SB01-0-2	07-Nov-17	0.0-2.0	N	0.0159	0.000866 B	0.000995 U	0.000758 J	0.00252	0.000995 U
		RICHM-04-SB01-8-10	07-Nov-17	8.0-10.0	N	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
		RICHM-04-SB02-0-2	07-Nov-17	0.0-2.0	Ν	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4	04SB02	RICHM-04-SB02-8-10	07-Nov-17	8.0-10.0	N	0.000965 U	0.000965 U	0.000965 U	0.000965 U	0.000965 U	0.000965 U
		RICHM-04-SB03-0-2	08-Nov-17	0.0-2.0	N	0.00486	0.000974 U	0.000974 U	0.000974 U	0.000974 U	0.000974 U
	04SB03	RICHM-04-SB03-8-10	08-Nov-17	8.0-10.0	N	0.000989 U	0.000989 U	0.000989 U	0.000989 U	0.000989 U	0.000989 U
		RICHM-SO-DUP03-110817	08-Nov-17	8.0-10.0	FD	0.000996 U	0.000996 U	0.000996 U	0.000996 U	0.000996 U	0.000996 U

Table 3 Summary of Soil Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Sandston, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Screen	ing Level:	1.261	1.261	1300 ²	NA	NA	NA
4	04SB04	RICHM-04-SB04-0-2	08-Nov-17	0.0-2.0	Ν	0.00222	0.000954 U	0.000954 U	0.000954 U	0.000381 J	0.000954 U
-		RICHM-04-SB04-8-10	08-Nov-17	8.0-10.0	Ν	0.000946 U	0.000946 U	0.000946 U	0.000946 U	0.000946 U	0.000946 U
	05SB01	RICHM-05-SB01-0-2	08-Nov-17	0.0-2.0	Ν	0.00501	0.000995 U	0.000995 U	0.000995 U	0.000995 U	0.000995 U
		RICHM-05-SB01-8-10	08-Nov-17	8.0-10.0	Ν	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
	05SB02	RICHM-05-SB02-0-2	08-Nov-17	0.0-2.0	Ν	0.0021	0.000984 U	0.000984 U	0.000984 U	0.000984 U	0.000984 U
		RICHM-05-SB02-8-10	08-Nov-17	8.0-10.0	Ν	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U	0.00096 U
5	055803	RICHM-05-SB03-0-2	08-Nov-17	0.0-2.0	Ν	0.00589	0.000973 U	0.000973 U	0.000973 U	0.000973 U	0.000973 U
-	033003	RICHM-05-SB03-8-10	08-Nov-17	8.0-10.0	Ν	0.000954 U	0.000734 B	0.000954 U	0.000954 U	0.00137 J	0.000954 U
		RICHM-05-SB04-0-2	08-Nov-17	0.0-2.0	Ν	0.0586 J	0.001 U	0.001 U	0.001 U	0.000739 J	0.000472 J
	05SB04	RICHM-SO-DUP04-110817	08-Nov-17	0.0-2.0	FD	0.0411 J	0.000963 U	0.000963 U	0.000963 U	0.000461 J	0.000321 J
		RICHM-05-SB04-8-10	08-Nov-17	8.0-10.0	Ν	0.000298 J	0.000993 U	0.000993 U	0.000993 U	0.000993 U	0.000993 U

Notes:

FD - Field Duplicate Sample

ft - feet

ID - Identification

J - The analyte was positively identified and the associated numerical value it the approximate concentration in the sample.

mg/kg - milligrams per kilogram

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.

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

¹ Screening levels calculated using the USEPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]

² USEPA Residential Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]

Table 4

Summary of Groundwater Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Richmond, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	PFOS+PFOA	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Health	Advisory:	0.07	0.07	0.07	NA	NA	NA	NA
PRL	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
1	T)A/ 01	RICHM-GW-TW01-110717	07-Nov-17	18.0-18.0	N	0.181	0.0392	0.220	0.00908	0.0137	0.166	0.00548 U
		RICHM-GW-DUP01-110717	07-Nov-17	18.0-18.0	FD	0.148	0.0341	0.182	0.0087	0.012	0.155	0.00534 U
2	TW-02	RICHM-GW-TW02-110717	07-Nov-17	18.0-18.0	N	1.68	0.588	2.27	0.307	0.125	4.03	0.00409 J
3	TW-03	RICHM-GW-TW03-110917	09-Nov-17	18.0-18.0	Ν	0.31	0.303	0.61	0.0105	0.735	0.0634	0.05
4	TW-04	RICHM-GW-TW04-110817	08-Nov-17	18.0-18.0	N	0.00553 U	0.0113 B	NA	0.0205	0.112	0.0953	0.00553 U
5	TMW-37	RICHM-GW-TMW37-110817	08-Nov-17	23.0-23.0	Ν	0.33	0.162	0.49	0.0738	0.0513	0.832	0.00262 J
	BW-01	RICHM-GW-BW01-111017	10-Nov-17	18.0-18.0	Ν	0.21	0.0201 B	0.23	0.0104	0.0168	0.154	0.0025 J
BBW	BW-02	RICHM-GW-BW02-110917	09-Nov-17	18.0-18.0	N	0.423	0.112	0.535	0.078	0.0446	0.916	0.00521 U
	MW-01-36	RICHM-GW-MW-01-36-111017	10-Nov-17	30.0-30.0	N	0.059	0.0588	0.12	0.0107	0.193	0.0606	0.00744 J

Table 4

Summary of Groundwater Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds 192nd Fighter Wing, Virginia Air National Guard Richmond IAP Byrd Field, Richmond, Virginia

Light Shaded Blue - Exceeds Health Advisory

FD - Field Duplicate Sample

ft - feet

ID - Identification

J - The analyte was positively identified and the associated numerical value it the approximate concentration 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.

 μ g/L - micrograms per liter

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 of 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" represent 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.

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.

¹ USEPA Residential Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]
Summary of Sediment Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Richmond, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Scree	ening Level:	1.26 ¹	1.26 ¹	NA	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
1	01SD01	RICHM-01-SD01-0-0.5	08-Nov-17	0.0-0.5	Ν	0.00429	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2	035001	RICHM-02-SD01-0-0.5	08-Nov-17	0.0-0.5	Ν	0.00633	0.00131 B	0.000994 U	0.000352 J	0.00329	0.00125 J
2	023001	RICHM-SD-DUP01-110817	08-Nov-17	0.0-0.5	FD	0.00558	0.00105 B	0.000957 U	0.000276 J	0.00225	0.000959 J

Notes:

FD - Field Duplicate Sample

ft - feet

ID - Identification

J - The analyte was positively identified and the associated numerical value it the approximate concentration in the sample.

mg/kg - milligrams per kilogram

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.

USEPA - U.S. Environmental Protection Agency

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

Summary of Surface Water Analytical Testing Results

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

192nd Fighter Wing, Virginia Air National Guard

Richmond IAP Byrd Field, Richmond, Virginia

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	PFOS+PFOA	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
				Health A	dvisory:	0.07	0.07	0.07	NA	NA	NA	NA
	r	1	1	EPA RSL Ta	pwater ¹ :	NA	NA	NA	400	NA	NA	NA
PRL Location Sample ID Sample Date				Sample Depth (ft.)	Sample Type	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
2	02SW01	RICHM-02-SW01-110817	08-Nov-17	0.0-0.5	Ν	0.0937	0.0463	0.14	0.0101	0.0331	0.0602	0.0165
3	03SW01	RICHM-03-SW01-110917	09-Nov-17	0.5-0.5	Ν	0.453	0.1	0.6	0.0671	0.0956	0.444	0.264
5	0553001	RICHM-05-SW01-110817	08-Nov-17	0.0-0.5	Ν	0.0809	0.0399	0.121	0.00662 J	0.0286	0.0497	0.0167
5	033001	RICHM-SW-DUP01-110817	08-Nov-17	0.0-0.5	FD	0.0722	0.0384	0.111	0.00886	0.0276	0.0501	0.0158

Notes:

Light Shaded Blue - Exceeds Health Advisory

FD - Field Duplicate Sample

ft - feet

ID - Identification

N - Normal Field Sample

NA - Not applicable

PRL - Potential Release Location

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.

¹ USEPA Residential Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]

USEPA and USAF SI Screening Criteria

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds Former 192nd Fighter Wing, Richmond Air National Guard Richmond IAP Byrd Field, Sandston, Virginia

Table ES-1: USEPA and USAF SI Screening Criteria

Parameter	Chemical Abstract Number	USEPA F Screening I (Novemb Residenti	Regional Level Table er 2017)ª Tap	USAF Guidance for Soils and Sediments ^b	USEPA Health Advisory Drinking Water (Surface Water	
	Rambol	al Soil (µg/kg)	Water (µg/L)	(µg/kg)	or Groundwater) (μg/L) ^c	
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1,300,000 ^d	400 ^f	NL	NL	
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	1,260	0.07°	
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	1,260		

Notes and Abbreviations:

NL – Not listed

USAF - U.S. Air Force

USEPA - U.S. Environmental Protection Agency

µg/L - micrograms per liter

µg/kg - micrograms per kilogram

^a USEPA Regional Screening Levels (USEPA, 2017).

^b 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).

- ^c USEPA, 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA) and USEPA, 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).
- ^d PFBS RSL for Residential Soil concentration presented in Work Plan 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.
- 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 for groundwater and surface water.
- ^f PFBS RSL for Tap Water presented in the SI Work Plan (Amec, 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.

Screening Criteria Exceedances and Recommendations

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

Former 192nd Fighter Wing, Richmond Air National Guard

Richmond IAP Byrd Field, Sandston, Virginia

	Screening Criteria Exceedance		eria e		
PRL	Soil	GW	SW	SD	Recommendations
1		х			GW investigation to determine the nature and extent of the confirmed PFC release. Soil investigation to determine if the soil may be a contributing source to GW.
2		х	х		GW investigation to determine the nature and extent of the confirmed PFC release. Soil investigation to determine if the soil may be a contributing source to GW. SW investigation to evaluate migration pathway of PFCs.
3		х	x		GW investigation to determine the nature and extent of the confirmed PFC release. Soil investigation to determine if the soil may be a contributing source to GW. SW investigation to evaluate migration pathway of PFCs.
4					NFA
5		х	x		GW investigation to determine the nature and extent of the confirmed PFC release. Soil investigation to determine if the soil may be a contributing source to GW. SW investigation to evaluate migration pathway of PFCs.

Notes:

GW - Groundwater

PFC - Perfluorinated Compound

PRL - Potential Release Location

SD - Sediment

SW - Surface water

X - Screening criteria exceedance

FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK.



P:\Government\Federal\DOD\ANG PFC\Richmond IAP Byrd Field\7_Cadd and GIS\Work Plan Figures\Fig1_Sitelocation.mxd December 12, 2017 DWN: david.young2 CHKD: AKN



Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond/7_Cadd and GIS\MXDs\Fig2_Sitefeatures.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond/Figures\Figure 2 - Site & Area Features.pdf 10/17/2018 7:54 AM brian.peters



SITE & AREA FEATURES

Former Richmond Air National Guard Base Sandston, Virginia

Legend

- Domestic Water Well (SAIC, 2001) (approximate) 3 Municipal Water Well (SAIC, 2001) 8 (approximate)
- Well (EDR, 2015) (approximate) 8
- Streams and Rivers
- > Approximate Regional Groundwater Flow
- Installation Area (approximate)

Location of Site

Notes & Sources

Sources: Installation Area data layer obtained from Figure 2 (Site Features and Potential AOCs) of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016. Groundwater flow direction based on information from the AECOM 2017 Groundwater Monitoring Report Site 1 Basewide Groundwater Operable Unit (OU1), Former Virginia Air National Guard Base, Sandston, Virginia. Lakes and ponds and rivers and stream data layer sourced from VADEQ, Virginia Environmental GIS





Document: P:/Projects/ANG Phase I-291330006/7.0_Sites/Richmond/7_Cadd and GIS/MXDs/Fig3_PRLSampleLocations.mxd PDF: P:/Projects/ANG Phase I-291330006/7.0_Sites/Richmond/Figures/Figure 3 - PRL Locations.pdf 10/17/2018 7:53 AM brian.peters

PRL LOCATIONS

Richmond Air National Guard Base Sandston, Virginia

Legend

- Temporary Monitoring Well
- + Existing Monitoring Well
- Soil Sample
- Surface Water/Sediment Sample
- Approximate Regional Groundwater Flow
- Streams and Rivers
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:

AFFF - aqueous film forming foam PRL - potential release location PFC - perfluorinated compounds



1000			//		1			-	E A	2	1	/	P	E.		
100		6		1100	E	1000		1	100	Marine Con			SEDIMENT			1
54.52				1 81		GRO	OUNDWATE	R		100 - 100	Location	Analyte	Depth (f	:) Result	(µg/kg)	537
1			1 2		Location	Analyte	Depth (ft)	Result (µg/L)				PFOS	0.5	4	.29	19
1			1999			PFOS	18	0.181				PFOA	0.5	1.0	00 U	7
	1	-		-		PFOA	18	0.0392				PFBS	0.5	1.0	00 U	1
16	1					PFBS	18	0.00908			01SD01	PFHpA	0.5	1.	00 U	Charles I
and a	11				TW-01	PFHpA	18	0.0137				PFHxS	0.5	1.0	00 U	1000
1		SOIL				PFHxS	18	0.166	The second s			PFNA	0.5	1.	00 U	1 R
Loc	cation	Analyte Depth (ft) Result (µg/kg)			PFNA	18	0.00548 U	Contraction of the second		100		10000	10	1000	
		PFOS 2	14.2		1	NY NE	14 2	har it.		and the second		A Star	1253	6	SURF	ACE WA
1		PFOA 2	0.414 B	-	1.1	18	E P	Art. ski		(dallar	2.28			Locat	ion Ana	yte F
1		PFBS 2	0.984 U		C (23)	X	TW-01	State P			- (1)	10		100	PF	S
		PFHpA 2	0.984 U		/	1992	N	100 100		6	1	Sec. 2		635	PF	ЭА
2.5		PFHxS 2	0.431 J			100	1000	the are	3		3 📼	2610		0151	PF	BS co
		PFNA 2	0.984 U			1993		The state			-	1800		01300	PFH	ipA la
01	SB01	PFOS 8 - 10	0.972 U		2/			1111			1	- Yes			PFF	IxS
23		PFOA 8 - 10	0.972 U	20								100			PF	NA
24		PFBS 8 - 10	0.972 U	11						T. T.		- 7	/	M		
1		PFHpA 8 - 10	0.972 U	and the second	1					T	1	- 69	1/	Voisw	01/01SD	J 1
		PFHxS 8 - 10	0.988 J	112 12	0-/						10	9	01	ISB04		5
1		PFNA 8-10	0.972 U	a al								100	•	100	1	
En a ser	1.00	Maria 19	741									12000	1000	1	in the	
2.32		- n (2	1.11.1	-		11000							8		SOIL	
62.0	1 chas		2 11 12										Locatio	n Analyt	e Depth	(ft) F
0	. 9		01SB01										2	PFOS	2	
The s	-	C. Store Gl	•	- 1100-000			1. Bu	ilding 3649	(Former Main Hangar)					PFOA	2	
2.2	200			100										PFBS	2	
10.00				TA.										PFHpA	2	
10				100										PFHxS	2	
		66.000											01SB04	PFNA	2	
1.05													01000	PFOS	8 - 1	.0
2.9.43													-	PFOA	8 - 1	.0
												and I	F	PFBS	8 - 1	.0
	-									1	11		8	PFHpA	8 - 1	.0
									-			10	1	PFHxS	8 - 1	.0
										á my	the second	E.	8	PFNA	8 - 1	.0
									A 13	and the	01SB0	3	1000	1 .	-	01
		SOIL				the state			10.01	2 miles				5	OIL	
Loc	ation	Analyte Depth (ft)	Result (µg/kg)			18			100	1	1990		ocation A	nalyte De	epth (ft)	Result
		PFOS 2	6.46	1.17						States and States				PFOS	2	5.
		PFOA 2	0.972 U				123311		1	5.0 m		32	F	PFOA	2	0.7
		PFBS 2	0.972 U	- 100 V					A CONTRACTOR OF THE OWNER	Ser and a series of the series		12		PFBS	2	0.9
		PFHpA 2	0.972 U	1000			1.		and the second second			983	Р	FHpA	2	0.9
		PFHxS 2	0.972 U				01SB02		100000				Р	FHxS	2	0.9
		PFNA 2	0.972 U		1	1	-	1	and the second second			0	1SB03	PFNA	2	0.5
019	SR05	PFOS 8 - 10	1.01 U	1998		1.20	1.000				/			PFOS	8 - 10	0.9
		PFOA 8 - 10	1.01 U	1000		17-20	2		and the second s		100	1	F	PFOA	8 - 10	0.9
		PFBS 8 - 10	1.01 U	1	1032							255		PFBS	8 - 10	0.9
		PFHpA 8 - 10	1.01 U	1				al fair				-	Р	FHpA	8 - 10	0.9
		PFHxS 8 - 10	1.11 J	1. 155			1/	And A seal				1000	Р	FHxS	8 - 10	0.9
		PFNA 8 - 10	1.01 U	1999				11/10/10	Source: Esri, DigitalGlobe, GeoEye,	Earthstar Geogra	aphics, CN	IES/Ai		PFNA	8 - 10	0.9
			and the second	1 Contractor		1.1			User Community		a state					

Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig4_PRL1_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\Figures\Figure 4 - PRL 1 Sample Results.pdf 10/17/2018 7:25 AM brian.peters

and the second	
	100
	100
	0.0
	12
1	522
March .	1. 5
1	1.00
Restan	1
1 -	100
TER	1
Result (µg/L)
	3
No sample	2
llected due	to
ck of surfac	e
water	3
	1
	Y.C.
11	1
	100
	-
	3)
0.394 J	
0.887 U	
0.887 U	1
0.636 J	0
0.887 U	30
0.978 U	1
0.978 U	3
0.978 U	1
0.978 U	
0.978 U	
0.978 U	2
1	
	120
: (µg/kg)	Gin
39 J	1
'46 B	
94 U	12.0
94 U	1
94 U	1 m
526 J	1.5-76
84 U	346
84 U	202
84 U	
84 11	-
84 11	
	0

PRL 1 SAMPLE RESULTS Richmond

Air National Guard Base Sandston, Virginia

Legend

- Temporary Monitoring Well
- Soil Sample
 - Surface Water/Sediment Sample



Approximate Regional Groundwater Flow Potential AFFF PFC PRL

(approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft - feet
- µg/kg micrograms per kilogram
- µg/L micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid
- PFBS Perfluorobutanesulfonic acid
- PFHpA Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid
- PFNA Perfluorononanoic acid

B - The analyte was found in an associated blank, as well as in the sample.

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

Q - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection. YELLOW highlighted cells indicate 0.07 µg/L

Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



Prophs.		9	EDIMENT												164				
	Location	Analyte	Depth (ft)	Result (ug/kg)															
2.800		PEOS	0.5	6.33			Rec 1								100				
A 128	-	PFOA	0.5	1.31 B											1000				
Ter IL	-	PEBS	0.5	0.994 U															
an and	02SD01	PFHnA	0.5	0.352 J	Star 20							dit -						ALL THE	
	F	PFHxS	0.5	3,29	and the	-	122 m	02SW01	1/02SD01					100	5				y
	-	ΡΕΝΔ	0.5	1 25 1		5 500	>					COLUMN AND	Salar .	1	2	1º			
23.27	The last in		0.5	1.25 7		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							and a second	1	20	C			1E
	SURFACE	WATER	2		Contraction of									1	1-1				11
Locatio	n Analyte	Result	(µg/L)			creek						10-10-1		A.C.	1 S	and and			
1 mar	PFOS	0.09	937		amp	U.								- 0	1				
(P)	PFOA	0.04	463	10 10 100	oak SWa									GR	OUNDW	ATER			
025340	PFBS	0.01	101	white	00						RECE		Location	Analyte	Denth	(ft) Re	sult (ug/L)		
023000	PFHpA	0.03	331	W										PEOS	18		1.68	2.000	
and the	PFHxS	0.06	502									and and	a state	PFOA	18		0.588		
22	PFNA	0.0	165						24.925	- 34		1 K	S. Inter	PERS	18		0 307	,)	//
A COM	Lis V	2.325							2010			A later	TW-02	PEHnA	18		0.125	11	13
									20m				1. 1 1		10		/ 02	1 ;	15
								100				Til I	the second		10			1	
1. 1. 1. 1.		1					1000					CONTRACT OF		PENA	10		5.00409 5	1 al	5
D. TO		14					R.					A MARCE	/ /				SOIL		
Tahi					11.5	21	11		18	0000			11	Lo	ocation	Analyte	Depth (ft)	Result (µ	g/kg)
					and the second se	1 2 1 1	5011	-	10000	02SB	01 TW-02	Park and				PFOS	2	71.2	
				and and a	Location	Analista	SUIL) Bocul	+ (ug/kg)	6356	•			1923		PFOA	2	2.06	в
- land		6.2			Location		2	.) Nesul	02 I	1200			1 1			PFBS	2	0.304	l
				548		PFOA	2	2	79.0	354.20		1 4		10		PFHpA	2	0.456	l
			12 /	Carl V		DEBS	2		420 I	Nº 1				1965		PFHxS	2	7.34	l
			11			DEHnA	2	0.	420 J 621 I	XX	5/1-			1		PFNA	2	0.938	U
			Ser.			ренус	2	0.	0213	13	02SB02	19972	-	0	25801	PFOS	8 - 10	1.30	J
			-				2	0	5221	AY	-0					PFOA	8 - 10	0.947	U
1/2010					02SB02		× 10	0.	522 5	Sec. 1		303 1		-		PFBS	8 - 10	0.947	U
20:	370					PFOA	8 - 10		493 B	Cr Ser	1					PFHpA	8 - 10	0.947	U
	1					DEBS	8 - 10	0.0		1	Carlo -		1.7			PFHxS	8 - 10	1.04	l
33.4						DEHnA	8 - 10	0.0		1	2. Building 3	8645 (Forme	r Fire Station	-		PFNA	8 - 10	0.947	U
						ренус	8 - 10	0.3	2 00	and and	Li Dunung u			1	180	X	191	191.1	and a
4			1				8 10	0.0	04111	1993			1			XB	10	05.4	12 mil
E.			X			FFINA	8 - 10	0.5	9410	Bezel.	Carlo and		la	1.	1	25	R		C.A.
							1		T	SOIL	1			025B0	14		-1	SOIL	
		10				1		Location	Analyte	Depth (ft)	Result (µg/kg)	02SB03		Q		Location	Analyte	Depth (ft)	Resu
					1		1		PFOS	2	118			1	<		PFOS	2	
		9				-	100		PFOA	2	6.69 B	181	a)	0			PFOA	2	0
				11			1.1		PFBS	2	0.599 J	19 61	150	1	1.40		PFBS	2	0.
				6			100		PFHpA	2	1.09 J	1301-20	11	-	1		PFHpA	2	0.
			2	Com					PFHxS	2	15.3	and the second	1/	1 the			PFHxS	2	
				12				025002	PFNA	2	0.401 J	and the	North St.	•		025004	PFNA	2	0.
								023003	PFOS	8 - 10	0.981 U	Ser It	F.			023604	PFOS	8 - 10	0.
		-	1						PFOA	8 - 10	6.95 B	12011	1.1.				PFOA	8 - 10	0.
									PFBS	8 - 10	4.00	1.02	AV				PFBS	8 - 10	0.
									PFHpA	8 - 10	1.36 J	Service Service	AF CUULUU				PFHpA	8 - 10	0.
									PFHxS	8 - 10	34.1	4 APRIL M	- 11-1116-				PFHxS	8 - 10	0.
									PFNA	8 - 10	0.390 J	all and the	and the second				PFNA	8 - 10	0.
/									1	107 233	Source: Esri I	DigitalGlobe Geol	Eve. Earthstar Geog	raphics C	NES/Air	thus DS	JSDA USG	S. AeroGRI	ID. IGN
Contraction of the second												g.a.a.a.a.a.a.				200 00, 0		e,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	

Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig5_PRL2_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\Figures\Figure 5 - PRL 2 Sample Results.pdf 10/17/2018 7:33 AM brian.peters



PRL 2 SAMPLE RESULTS Richmond

Air National Guard Base Sandston, Virginia

Legend

- Temporary Monitoring Well
- Soil Sample
- ▲ Surface Water/Sediment Sample
- Approximate Regional Groundwater Flow
- Streams and Rivers

Potential AFFF PFC PRL (approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft feet
- µg/kg micrograms per kilogram
- µg/L micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds
- PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid PFBS - Perfluorobutanesulfonic acid
- PFBS Perfluorobutanesultonic ac PFHpA - Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid
- PFNA Perfluorononanoic acid

B - The analyte was found in an associated blank, as well as in the sample.

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

 ${\bf Q}$ - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection. YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



All Markey	
03SW01	

White Cak Swimp Creek

SURFACE WATER									
Location	Analyte	Result (µg/L)							
	PFOS	0.453	8						
	PFOA	0.1	G						
0201/04	PFBS	0.0671							
032001	PFHpA	0.0956	1						
	PFHxS	0.444	2						
	PFNA	0.264	8						

1000	and the second	1219 1220			
		SOIL			
ocation	Analyte	Depth (ft)	Result (µg/kg)		
	PFOS	2	5.00		
	PFOA	2	0.611 B		
	PFBS	2	0.995 U		
	PFHpA	2	0.995 U		
	PFHxS	2	0.00142 J		
2004	PFNA	2	0.995 U		
J35B04	PFOS	8 - 10	0.998 U		
	PFOA	8 - 10	0.998 U		
	PFBS	8 - 10	0.998 U		
	PFHpA	8 - 10	0.370 J		
	PFHxS	8 - 10	0.998 U		
	PFNA	8 - 10	0.998 U		

		SOIL	
Location	Analyte	Depth (ft)	Result (µg/kg)
	PFOS	2	4.57
	PFOA	2	0.309 B
	PFBS	2	0.996 U
	PFHpA	2	0.996 U
	PFHxS	2	0.996 U
026002	PFNA	2	0.996 U
032803	PFOS	8 - 10	0.974 U
	PFOA	8 - 10	0.974 U
	PFBS	8 - 10	0.974 U
	PFHpA	8 - 10	0.974 U
	PFHxS	8 - 10	0.974 U
	PFNA	8 - 10	0.974 U

03SB03	

3. Building 2851 (Former Fuel

03SB02

User Community

and the second	R. Car	A CONTRACTOR	South States
		SOIL	
Location	Analyte	Depth (ft)	Result (µg/kg)
	PFOS	2	0.950 U
	PFOA	2	0.340 B
	PFBS	2	0.950 U
	PFHpA	2	0.000561 J
	PFHxS	2	0.950 U
036003	PFNA	2	0.950 U
032802	PFOS	8 - 10	0.974 U
	PFOA	8 - 10	0.974 U
	PFBS	8 - 10	0.974 U
	PFHpA	8 - 10	0.974 U
	PFHxS	8 - 10	0.974 U
	PFNA	8 - 10	0.974 U

System	Maintenance Dock)	
		1

03SB01

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, C

TW-03

03SB04

SOIL												
Location	Analyte	Depth (ft)	Result (µĮ									
	PFOS	2	12.3									
	PFOA	2	0.394									
	PFBS	2	0.935									
	PFHpA	2	0.935									
	PFHxS	2	0.935									
026004	PFNA	2	0.935									
032801	PFOS	8 - 10	0.981									
	PFOA	8 - 10	0.981									
	PFBS	8 - 10	0.981									
	PFHpA	8 - 10	0.981									
	PFHxS	8 - 10	0.981									
	PFNA	0.981										
	Construction of the local distribution of th	100	2 CC 3855 B									

			and the second s	and a second second
		GR	OUNDWATE	R
25	Location	Analyte	Depth (ft)	Result (
		PFOS	18	0.3 1
23		PFOA	18	0.30
25	TM 02	PFBS	18	0.010
1	100-03	PFHpA	18	0.73
		PFHxS	18	0.063
12		PFNA	18	0.05
NES/	Airbus DS.	USDA, U	SGS, AeroG	RID, IGN,
	Strange State	1000		

Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig6_PRL3_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\Figures\Figure 6 - PRL 3 Sample Results.pdf 10/17/2018 7:37 AM brian.peters



PRL 3 SAMPLE RESULTS Richmond Air National Guard Base

Sandston, Virginia

Legend

- Temporary Monitoring Well
- Soil Sample
- Surface Water/Sediment Sample
- Approximate Regional Groundwater Flow
- Streams and Rivers
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft - feet
- µg/kg micrograms per kilogram
- µg/L micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds
- PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid
- PFBS Perfluorobutanesulfonic acid
- PFHpA Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid
- PFNA Perfluorononanoic acid

B - The analyte was found in an associated blank, as well as in the sample.

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

Q - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection. YELLOW highlighted cells indicate 0.07 µg/L

Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



									~		
								1		4	-/
	SOIL									L	1
Location	Analyte Depth (ft) Result (µg/kg)	-					122	100	1	100
	PFOS 2	15.9								SOIL	
	PFOA 2	0.866 J	-					Location	Analyte	Depth (ft)	Result (µg/
	PFBS 2	0.995 0							PFOS	2	2.22
Contraction of the second second		0.738 J		6	A NO				PFOA	2	0.954 U
		0.005.11						10	PFBS	2	0.954 U
04SB01	PFINA Z	1.00.11		N.		KON .			PFHpA	2	0.954 U
	PF03 8-10	1.00 U	- /		XIXXX	- 0			PFHxS	2	0.381 J
		1.00 U	1		102	10		04SB04	PFNA	2	0.954 U
2 Martin Carlos	PFB3 8-10	1.00 U	141		A		The Martin		PFOS	8 - 10	0.946 U
and the second	PTTIPA 8-10	1.00 U	12	1.51	NO.		ALC: NO	2	PFOA	8 - 10	0.946 U
	PENA 8 - 10	1.00 U	÷ ,	14	New Y		04SB04	24	PFBS	8 - 10	0.946 U
	FINA 8-10	1.00 0	1	/			•		PFHpA	8 - 10	0.946 U
		0458	01			KAK I	4 1		PFHxS	8 - 10	0.946 U
		6430				NO CO	1		PFNA	8 - 10	0.946 U
GROUNDWATER Location Analyte Depth (ft) Result (μg/L) PFOS 18 0.00553 U PFOA 18 0.0113 PFBS 18 0.0205 PFHpA 18 0.112 PFHxS 18 0.0953						1	0	4SB03			504
PFNA 18 0.00553 U				1.5243.5	04SB02	04	4SW01		Locati	ion Analyte	Denth (ft)
a state of the second second second					1 0-		1.1.1		Locati	PEOS	2
S. C. M. S. M. S.				1			17			PFOA	2
Martin and I and a second second		1	1 13	/		1.1	18 - 22			PFBS	2
		11	100	/					2	PFHpA	2
and a constant on a sub-		X	1900	/			SURFACE WA	ATER	3	PFHxS	2
	A ABORTON A RECORDER	CO!!	A 11 11			Location	Analyte	Result (µg/L)		PFNA	2
	Location Analyte	SUIL Donth (ft) Bosi	ult (ug/kg)			131	PFOS		04SB0	D3 PFOS	8 - 10
				ACT STANK		and the second	PFOA	No sample		PFOA	8 - 10
	PEOA	2	1.00.0	K ALLER	11/1000	0.4514/01	PFBS co	llected due to		PFBS	8 - 10
1 1 1 1 2 2 - A BANKER	PEBS	2	1.00.0	1	1/ 1/1	045W01	PFHpA la	ick of surface		PFHpA	8 - 10
	PEHnA	2	1.00 U	1.1.	and the second	1.20	PFHxS	water		PFHxS	8 - 10
and the second sec	PEHXS	2	1.00 U	1.1		all and the second s	PFNA			PFNA	8 - 10
	04SB02 PFNA PFOS PFOA PFBS PFHpA PFHxS DENA	2 3 8 - 10 0 8 - 10 0 8 - 10 0 8 - 10 0 8 - 10 0 8 - 10 0 8 - 10 0	1.00 U .965 U .965 U .965 U .965 U .965 U .965 U		Sources East Disticulate		Conversiti	- ONEC//Ail			
and the provide	PENA	0 01-8	.905 U	the settle of	Source: Esri, DigitalGlobe,	GeoEye, Earthsta	r Geographic	s, CNES/Airbu	s DS, USI	JA, USGS, A	AeroGRID, I

Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig7_PRL4_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\Figures\Figure 7 - PRL 4 Sample Results.pdf 10/17/2018 7:41 AM brian.peters



PRL 4 SAMPLE RESULTS Richmond

Air National Guard Base Sandston, Virginia

Legend

- Temporary Monitoring Well
- Soil Sample
- ▲ Surface Water/Sediment Sample
- Approximate Regional Groundwater
 - Potential AFFF PFC PRL
- (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft feet
- µg/kg micrograms per kilogram
- µg/L micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds
- PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid
- PFBS Perfluorobutanesulfonic acid
- PFHpA Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid PFNA - Perfluorononanoic acid

B - The analyte was found in an associated blank, as well as in the sample.

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

 ${\bf Q}$ - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection. YELLOW highlighted cells indicate 0.07 μg/L

Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



					- 200			1.1	and a			J.	X			
		SURFAC	E WATER					GR	OUNDWATE	R	1 A MARK	25 K	1115			
1 12/1	Loca	tion Analyt	e Result	t (µg/L)		05SW01	Location	Analyte	Denth (ft)	Result (ug/L)	and the second second	101		VF 1		
		PFOS	0.0	809	and the second		Location	PEOS	23	0.33	ALL IN		1th	The second secon	211	
1. 1. 1.	1 1 1 1	PFOA	. 0.0	399	h and h	and the state of the	10	PEOA	23	0.55	State Contraction				and the second	
	055	V01 PFBS	0.00	662 J		The state of the s	1 second		23	0.162				4		
J	000	PFHp/	٥.0	286		A REAL	TMW-37	PFBS	23	0.0738	Con front		2			
à	15	PFHxS	6 0.0	497		TMW-37		РЕНрА	23	0.0513			The second	1 All	PAG	
1		PFNA	0.0	0167			2	PFHxS	23	0.832			1			
						11/ 16		PFNA	23	0.00262 J	1. Building 3649				11 12	
Notice State			1		Ref 1				A starting		(Former Main Hangar)				·	E
			1													
		1			6								1	SOIL		
				05SB01							1	Location	Analyte	Depth (ft)	Result (µg/k	(g)
	A CONTRACT		i	2							100		PFOS	2	58.6 J	
			1	1									PFOA	2	1.00 U	
1. 1 22			()										PFBS	2	1.00 U	
11000			Y	119						A UK esta			PFHpA	2	1.00 U	
12.36			/\	de la						- 6 S	10		PFHxS	2	0.739 J	
1962 1212			/	1.30						0.			PFNA	2	0.472 J	
			1	12								05SB04	PFOS	8 - 10	0.298 J	
and the second			/	A.								7	PFOA	8 - 10	0.993 U	
	SO	IL		I.									PFBS	8 - 10	0.993 U	
Location	n Analyte Dept	th (ft) Resi	ult (µg/kg)								05SB04		PFHpA	8 - 10	0.993 U	
1	PFOS	2	5.01		1 10000						•		PEHxS	8 - 10	0 993 U	
	PFOA	2 0	.995 U	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1								ΡΕΝΔ	8 - 10	0.993 U	
	PFBS	2 0	.995 U		1. 6. 11							1000		0 10	0.555 0	13/8
	PFHpA	2 0	.995 U	1 Marsha	1		5. Concre	ete Ran	np/Apro	n		*		1		
	PFHxS	2 0	.995 U	1 Ball											on 1/	
	PFNA	2 0	.995 U			2 1							1.	1 Provinsi		
05SB01	PFOS 8 -	- 10	1.00 U	18 al tan			1									
	PFOA 8-	- 10	1.00 U			05SB02						an		8° . 1	2	
	PFBS 8 -	- 10	1.00 U	And the		2						A PARTIE		17		
	PFHpA 8 -	- 10	1.00 U	N. Carlor	1							1 here		1 .	1	
	PFHxS 8 -	- 10	1.00 U			X										
	PENA 8-	- 10	1.00 U								1		RA	C. C.	18 242	1
TELES INTE		20			/					1 . 7	a ler		ALL T	All	P. C.	
				SOIL									the	5 2 3	X	
1 1111		Location	Analyte	Depth (ft)	Result (µg/kg)							-	14		5011	
		11	PFOS	2	2.10									tion Analy	SUIL Donth (ft)	<u>т</u>
111117			PFOA	2	0.984 U	1						05SB	03			╢
det to be			PFRS	2	0.984 11	i							14	PFO		╋
			DEHnA	2	0.984.11	1	(BBA)					Sec. 22	/	PFO	4 <u>2</u>	+
		1		2	0.984 U	- · · · · · · · · · · · · · · · · · · ·						1 le		PFBS	5 2	╇
Section 1				2	0.984 U		S III				1 1 1	17.0	1	PFHp	A 2	_
al se li celle		05SB02		2 0 10	0.564 0		in	1			A A A	All a	El	PFHx	S 2	+
			PFUS	ð - 10	0.960 0					A	en al la la		055	B03 PFN/	A 2	╇
100 100			PFUA	δ - 10 0 - 10	0.960 0					The A	Sector Contraction			PFO	8 - 10	\bot
			PEBS	8 - 10	0.960 U				1	1 1		Ph	-	PFO	A 8 - 10	\bot
			РЕНрА	8 - 10	0.960 U				E.		K	1.	Sec.	PFBS	8 - 10	
			PFHxS	8 - 10	0.960 U			1	5	4. Building 96				PFHp	A 8-10	
			PFNA	8 - 10	0.960 U			1/2	(Fo	ormer Hush House	14			PFHx	S 8 - 10	
12			1 1.			and the former			MARCE .					PFN	8 - 10	
								Sou	irce: Esri Di	igitalGlobe, GeoEv	ve. Earthstar Geographics	CNES/Airb	us DS_US	DA. USGS	AeroGRID IG	άN
and the second										Gine Cool, COOL)				,,	, (0	

Document: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig8_PRL5_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006\7.0_Sites\Richmond\Figures 8- PRL5 Sample Results.pdf 10/17/2018 7:47 AM brian.peters



0.960 U

PRL 5 SAMPLE RESULTS Richmond

Air National Guard Base Sandston, Virginia

Legend

- Existing Monitoring Well
- Soil Sample
- ▲ Surface Water/Sediment Sample
 - Approximate Regional Groundwater Flow
- Streams and Rivers
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft feet
- µg/kg micrograms per kilogram
- µg/L micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds
- PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid
- PFBS Perfluorobutanesulfonic acid
- PFHpA Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid PFNA - Perfluorononanoic acid

B - The analyte was found in an associated blank, as well as in the sample.

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

 ${\bf Q}$ - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection. **YELLOW** highlighted cells indicate 0.07 µg/L Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



	toly.				1	Arris 1			15	CDC		
MW-01-36				and the second			-	Con La	1	GRU		n Desuite (u
					and a surger		14		Location	Analyte		Result (µ
				0			1			PFUS	18	0.21
		GRO	UNDWATE	R	and a star			No. 19			18	0.020
	Location	Analyte	Depth (ft)	Result (µg/L)	a state &			100	BW-01		18	0.010
AT A REAL AND A REAL		PFOS	25	0.059						ргимс	18	0.016
		PFOA	25	0.0588	THE REPORT			11			18	0.154
3. Building 2851	MW-01-	PFBS	25	0.0107	1 7%	- Salar	7. 200		Star and	PFNA	18	0.0025
(Former Fuel System TW-03	36	PFHpA	25	0.193	000	. 3	L. C.S				GR	OUNDWATE
Maintenance Dock)		PFHxS	25	0.0606	Colona, and		-	1	MAT OF	Location	Analyte	Depth (ft)
		PFNA	25	0.00744 J	and the state		A				PEOS	18
	1. 3×1 2	Ware B	1.392	1 Call	and the second	1 10 10		11			PFOA	18
			and the second	A State		1					PERS	18
		1 de	-					BW-01		BW-02	PFHnA	18
GROUNDWATER		A. F. Con	See 1	A Call		A all		•	a start		PEHYS	18
		100 - 1	A P		all all a					1	ΡΕΝΔ	18
PFOS 18 0.31	1 Ala	Contra						1 L.	and an	the M		10
PF0A 18 0.303	and and									to plate	3 -10	1621
TW-03 PFBS 18 0.0105		Part ?										
PFHpA 18 0.735	the state of the					CONT -						
PFHX5 18 0.0634	360					1305	1. A.S.					
PFNA 18 0.05						(Sale	10 2 3					B. Ca
					D at		121 1 12					Allow I
						11000	Care a					
				1300		GROU	JNDWATER		400			
					Locatio	on Analyte [Denth (ft)	Result (ug/l)	1000			
GROUNDWATER				0 Dellation 0		PFOS	18	0.181				$\langle i$
Location Analyte Depth (ft) Result (µg/L)			TW/-02	Z. Building 30	o45 ation)	PFOA	18	0.0392	14			
PFOS 18 1.68			100-02	(ronner rice ou	ution)	PERS	18	0.00908	199			
PFOA 18 0.588		d he	1	TW-01	TW-0	1 PEHnA	18	0.0137	19.3/2			
PFBS 18 0.307	TMW-	37			30	PEHyS	18	0.166	Let "		2.0	
TW-02 PFHpA 18 0.125	A				2 63		18	0.005/18 11	6100	and the second		
PFHxS 18 4.03		- 4			1 100		10	0.003400		-	Starting 1	
PFNA 18 0.00409 J				and the	A statement		0	1				<. 11
				1 200 6	and the second	103		and the second s				
GROUNDWATER				1. Build	ling 3649	I The	1					and the
Location Analyte Depth (ft) Result (µg/L)				(Former Ma	ain Hangar)	- A	1					REEK S
PFOS 23 0.33					1		1					1991 1
PFOA 23 0.162			10	1 12-15	Cin the	LEL	and the second s					100
TRAIN 27 PFBS 23 0.0738	5. Con	crete Ramp	/Apron		the second second	AV1						Ter 2
PFHpA 23 0.0513	N.A.			· · · /		.1						
PFHxS 23 0.832	10/23			- 1								- lakara
PFNA 23 0.00262 J						1 and a state of the state of t						A Land
				115								11 the
GROUNDWATER					1.			SA.				
Location Analyte Depth (ft) Result (µg/L)	-			1	and the second s	1		10 Ala				
PFOS 18 0.00553 U			1			1	The	Coff .				
PFOA 18 0.0113	/	TM	/-04			10/1	A					
TW-04 PFBS 18 0.0205	1		1.7	A P.1	ilding 96	11/2		11 22			573	1
PFHpA 18 0.112	100	1 h	100	(Former H	lush House)		Stal 1	11 3			-	1
PFHxS 18 0.0953		- 1	1.	Course	Pot Esri-DigitalClat	De GeolEve F	arthetar Coor	raphice CNI	=S/Airbuc			
PFNA 18 0.00553 U			V	Sourc		Je, George, Ea	annistar Geogl	apriles, CNI		03, USDA	, 0303, A6	FIGRID, IG

Document: P:\Projects\ANG Phase I-291330006/7.0_Sites\Richmond\7_Cadd and GIS\MXDs\Fig9_GW_SampleResults.mxd PDF: P:\Projects\ANG Phase I-291330006/7.0_Sites\Richmond\Figure 9 - GW Sample Results.pdf 10/17/2018 7:49 AM brian.peters



GROUNDWATER SAMPLE RESULTS Richmond

Air National Guard Base Sandston, Virginia

Legend

- Temporary Monitoring Well
- + Existing Monitoring Well
- Approximate Regional
- Groundwater Flow
- Streams and Rivers
- Potential AFFF PFC PRL
- (approximate)

Installation Area (approximate)

Notes & Sources

Notes:

- AFFF aqueous film forming foam ft feet
- μ g/kg micrograms per kilogram
- $\mu g/L$ micrograms per liter
- PRL potential release location
- PFC perfluorinated compounds
- PFOS Perfluorooctanesulfonic acid
- PFOA Perfluorooctanoic acid
- PFBS Perfluorobutanesulfonic acid
- PFHpA Perfluoroheptanoic acid
- PFHxS Perfluorohexanesulfonic acid PFNA - Perfluorononanoic acid

 B - The analyte was found in an associated blank, as well as in the sample.

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

 ${\bf Q}$ - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

BOLD text indicates a detection.

YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance in water or 1,260 µg/kg Air Force Calculated Screening Level Exceedance in soil. Groundwater depths presented in the tables represent the approximate pump intake depth.



APPENDIX A

FIELD ACTIVITY PHOTOGRAPHIC LOG

THIS PAGE INTENTIONALLY LEFT BLANK.

PHOTO 1:

Photo of TW-01 being installed at PRL 1 using hollow stem augers.

PHOTO 2:

Photo of TW-02 being installed at PRL 2 using hollow stem augers.



PHOTO 3:

Photo of TW-03 being installed at PRL 3 using hollow stem augers.

PHOTO 4:

Photo of TW-04 being installed at PRL 4 using hollow stem augers.



8

FY16 Site Inspections Photographs Taken: November 6 through 10, 2017

PHOTO 5:

Photo of BW-01 being installed at the Base boundary using hollow stem augers.

PHOTO 6:

Photo of BW-02 being installed at the Base boundary using hollow stem augers.



PHOTO 7:

An example of twoinch diameter, schedule 40 PVC riser and screen being installed for temporary well location.

PHOTO 8:

An example of a temporary well after installation.



PHOTO 9:

Photo of abandoned and backfilled temporary well location after sampling was completed.



PHOTO 10:

Photo showing hand clearing method completed at necessary locations using post-hole digger and hand auger.



PHOTO 11:

Photo of boring location 02SB04 preparing to use direct push method.



PHOTO 12:

Photo of sediment sample location 01SD01. Photo shows area of drainage, but lack of surface water.



Photo of sediment sample location 02SD01 near White Oak Swamp Creek drainage area.

PHOTO 14:

Photo of White Oak Swamp Creek near samples 02SW01 and 05SW01.





PHOTO 15:

Photo showing decontamination of hollow stem augers between locations.



PHOTO 16:

Photo showing staging of drums containing IDW before appropriate disposal.

APPENDIX B

SOIL BORING AND MONITORING WELL CONSTRUCTION LOGS

THIS PAGE INTENTIONALLY LEFT BLANK.

ſ	D						MONT					
	E P T	AND REMARKS	EG		BLOW CT		Т		R E C O	CONSTR	UCTION DETAILS	D E P
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	(ft)	PER 6 IN	SAMPLE ID	P E	PID (ppm)	V E R Y (feet)	AINL	J REMARKS	T H
	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,			-	RICHM-01SB01-0-2	<u>}</u>					0
					1		555				-	
ľ					1			0.0	4.5		-	
							555					
	- 5										-	_ 5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					655					_
											-	_
				-		RICHM-01SB01-8-10	\$\$\$ }}	0.0	4.5		-	_
					-						-	_
	- 10				-		555			Bottom of	-	_ 10
					-					feet. Not refusal.	-	-
											-	-
·											-	-
					1						-	-
	- 15				1						-	_ 15
·											-	-
											-	-
												_
/2/18	- 20											_ 20
E.GDT 2											-	-
MPLATE											-	_
PFC TE				- ·							-	
GS.GPJ				- ·	-						-	
RING LC	- 25			L _								25
OND BO.		DATE: 11/7/2017 GROUND ELEVATION: ft.			20		3	/ M4				חא
RICHM		R: TWS, Cascade NORTHING: 371104' MENT: Geoprobe 7822DT EASTING: 1182776 DD: Direct Push HORIZONTAL DATUM NAD 83	.969 ft. 0.87 ft.		Pro	ject: Rich	<u>יי</u> חוד 22			IG FY16 S	Site Inspection for F	PFC
NG LOG	HOLE E SITE: LOGGF	DIA.: 2 1/4" ID RICHM ED BY: David Young			Ch	ecked By: BL		000	0.0		01SB	01
RICHMOND A	THIS REC EXPLORA MAY DIFFE MAY BE G	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 THE AT OTHER TWEEN ST	TIMES IRATA	ar	nec foster	W	hee	eler	*	271 Mill Road Chelmsford, MA 0182	4
- •											Page 1 of 1	

ſ	D					MONT						
	E P T	AND REMARKS	БСБ		BLOW CT PEP		Ţ	DIC	RECOV		UCTION DETAILS D REMARKS	D E P
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Ē	(ppm)	E R Y (feet)			H U
	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				RICHM-01SB02-0-2						
				_			555	0.0	4.5		-	_
				_							-	
	- 5						<u>}</u>				-	5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					}}				-	-
ł				_				0.0	4.5		-	-
				-		RICHM-01SB02-8-10					-	-
ŀ				-			555				-	10
	- 10									Bottom of boring at 10 feet. Not refusal)	
										. oradan	-	_
											-	
-					-						-	_
╞	- 15										-	_ 15
											-	-
ł											-	
											-	
/2/18	- 20										-	_ 20
E.GDT 2											-	-
EMPLAT											-	-
J PFC T					-						-	
.0GS.GF					-						-	-
30RING L	- 25	<u> </u>		L	J	<u> </u>		I		<u> </u>		⊥ 25
HMOND E		DATE: 11/7/2017 GROUND ELEVATION: ft. ATE: 11/7/2017 VERTICAL DATUM: 371000' R' TWS. Cascade NORTHING: 371000'	976 ft		S		G	/ M	ON	ITORING	G WELL RECOR	RD
NG LOG RICI	EQUIPM METHO HOLE D SITE:	MENT: Geoprobe 7822DT EASTING: 1182785 DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4 ID RICHM David Young	5.9 ft.		Pro Pro Ch	nject: Ricl nject No: 291 ecked By: BL	חד 33	ionc 000	1 AN 6.0	IG FY16 S 7	Site Inspection for F Boring N 01SB	′⊦C lo. 02
RICHMOND A	THIS REC EXPLORA MAY DIFFE MAY BF G	CD 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 THE AT OTHER TWEEN ST	TIMES IRATA	ar	nec foster	w	hee	eler	*	271 Mill Road Chelmsford, MA 01824	4
- L											Page 1 of 1	

ſ	D			E		SAMPLE	S				
	E P	AND REMARKS	Ē						RE	CONSTRUCTION DETAILS	DE
	Т Н		E		CT PER 6	SAMPLE	Ϋ́	PID	0 V F	AND REMARKS	P
	(ft)	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	IN	ID	Ė	(ppm)	R Y (feet)		Ĥ
ŀ	- 0 -	· · · · ·			-	RICHM-01SB03-0-2	222				- 0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				and RICHM-SO- DUP01	833			-	
							\sum	1			
					-		655				-
							\sum	0.0	4.5		
	_						655				
					-		\gtrsim			-	-
	-						655				5
ľ	- 5	Paddiah brown fat CLAV, aithy atiff highly plaatia, no adar			1		RSS				
		moist (CH)			-		§\$\$	1		-	-
							833				
					1		888	0.0	45		-
					-	RICHM-01SB03-8-10	655	0.0			_
							\sum				
					1		655			-	-
	- 10						$\geq \geq$			Pottom of	10
	-									boring at 10 feet Not	
					1					refusal.	-
				L .							_
ŀ					-						-
	- 15				-						_ 15
				[.						-	
					-						-
				- ·	1						-
				- ·	-						_
18											
2/2/	- 20				1						- 20
.GDT				Ļ .	-						_
LATE											
EMP				F .	1						1
FC 1				Ļ .							_
FJ F											
GS.G				F .	1					-	-
GLO	- 25			L_							25
ORIN	-										
ND B(START	DATE: 11/7/2017 GROUND ELEVATION: ft.			_		_				
OMH	END DA	ATE: 11/7/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3710956	6.139 ft.	ł	S	JIL BORING	<u>ا ز</u>	M		I I ORING WELL RECO	
RIC	EQUIPM	MENT: Geoprobe 7822DT EASTING: 1182803 DD Direct Push HORIZONITAL DATLIM NAD 83	39.64 ft.		Pro	iject: Rich	nm מי		AN A	IG FY16 Site Inspection for F	-≻C I∩
LOG	HOLE	DIA.: 2 1/4" ID RICHM Note: Lond super to 5 ft has	-		Ch	ecked Rv [,] RI	33	000	0.0		03
ANG	LOGGE	ED BY: David Young		ŀ		CONCU DY. DL			-		
QNO	THIS REC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS	AT THE		21	ner fostor	14/	her		271 Mill Road	1
CHM	EXPLORA	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE	AT OTHER TWEEN ST	TIMES TRATA	al	net justel	VV	nee	ier		4
Ŕ	MAY BE G	RADUAL.									

ſ	D		1	F		SAMPLF	S				
	E P T	AND REMARKS	E G		BLOW		Т		RECO		DE
	Ĥ	SEE KEY SYMBOL SHEET FOR EXPLANATION	E N	V	PER 6 IN	SAMPLE ID	Y P E	PID (ppm)	U V E R Y	AND REMARKS	Р Т Н
╞	(tt) - 0	OF SYMBOLS AND ABBREVIATIONS USED BELOW.		(tt) 		RICHM-01SB04-0-2	777		(feet)		0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)								-	_
								0.0	4.5		_
							}}			-	-
					-		}}			-	-
	- 5 -				-		}}} }???			-	_ 5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					}}			-	-
							}}				
							\$\$\$	0.0	4.5		
						RICHM-01SB04-8-10	$\langle \rangle \langle$				
							$\langle \rangle \langle$			-	
	- 10			1 -			(((Bottom of boring at 10	10
					-					feet. Not refusal.	-
										-	-
										-	-
	45										15
	- 15									-	
										-	
					-					-	
					-					-	
					-					-	
/2/18	- 20									-	_ 20
GDT 2											_
PLATE.											
C TEMF					1						1
PJ PF(-	
JGS.GI					-					-	-
ING LC	- 25			L _							25
D BOR	START			T							
NOMH:	END DA	R: TWS, Cascade NORTHING: 371107	9.021 ft.	ŀ	S(DIL BORING	<u>G /</u>	<u>M</u>		ITORING WELL RECOR	
G RIC	EQUIPM METHO	VIENT: Geoprobe 7822DT EASTING: 1182808 DD: Direct Push HORIZONTAL DATUM: NAD 8 DA 2 1/4/" ID	38.64 ft. 3		Pro	ject No: 291	33	000	6.0	7 Boring N	lo.
NNG LC	SITE:	RICHM Note: Hand auger to 5 ft bgs			Ch	ecked By: BL				01ŠB	04
dNOI	THIS REC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS	AT THE	TIMES	ar	ner foster	M	hee		271 Mill Road Chelmsford MA 0182	1
RICHM	EXPLORA [®] MAY DIFFE <u>MAY BE G</u> I	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE RADUAL.	TWEEN ST	TIMES RATA	u	nee joster		nee			
					_		_		_		

DE	SOIL CLASSIFICATION	L	E		SAMPLE	S			
P	AND REMARKS	E G	LE	BLOW		т		RHCO	
Ĥ	SEE KEY SYMBOL SHEET FOR EXPLANATION	E N	V	PER 6 IN	SAMPLE ID	Ý	PID (ppm)	0 V E B	AND REMARKS
(ft)	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)			E		Y (feet)	
	Reddish brown silty CLAY, soft, slightly plastic, no odor, moist (CLM)			-	RICHM-SO-02SB01- 0-2		0.0	4	Bentonite
- 5	Dark gray fat CLAY, medium stlff, moderately plastic, no odor, moist (CH) Reddish brown fat CLAY, stiff, highly plastic, no odor, moist (CH)			-			0.0	1	FilPro 1S Filter sand 3-20 ft bgs
 - 10 				-	RICHM-SO-02SB01- 8-10		0.0	15	2-inch 0.010 Slotted screen 10-20 ft bgs
- 15 - 15 				-	RICHM-GW-TW02- 110717				Harder at 15 feet. Water level
				-					- 18.25 ft bgs before groundwater sampling Bottom of boring at 20 feet. Not refusal.
25- 25- START END D DRILLE EQUIPI METHON	DATE: 11/7/2017 GROUND ELEVATION: ft. ATE: 11/7/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3711236 MENT: Geoprobe 7822DT EASTING: 1182769 DD: Hollow Stem Auger HORIZONTAL DATUM: NAD 83	6.135 ft. 3.91 ft.	 	S(Prc Prc	DIL BORING ject: Rich ject No: 291	G / nm 33	M	ON 1 AN	ITORING WELL RECORD NG FY16 Site Inspection for PFC 7 Well No.
HOLE I SITE: LOGGE THIS REC EXPLORA MAY DIFF MAY BE G	DIA.: 8-INCH RICHM Note: Temporary well abandoned ED BY: David Young 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.	AT THE AT OTHER T TWEEN STI	TIMES RATA	Che	ecked By: BL	W	hee	eler	271 Mill Road Chelmsford, MA 01824

	2		1			SAMPLF	S				
		AND REMARKS	E G		BLOW		-		R E C	CONSTRUCTION DETAILS	D E
H	1	SEE KEY SYMBOL SHEET FOR EVELANATION	EN	V	PER 6	SAMPLE	[Y P	PID (ppm)	0 VED	AND REMARKS	P T
(1	ft)	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)		10	E	(FF)	Y (feet)		H 0
Γ	0 -	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor.			1 -	RICHM-02SB02-0-2 and RICHM-SO-	}}				Ţ
F	-	moist (CH)			-	DUP02					-
-	_						\sum				_
							\$\$\$	0.0	4.5		
Ē	_				1		}}				
F	_				-						-
	5						<u>}</u>				5
	-	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					\$\$\$				
F	-	moist (CH)			1		}}			· · · · · · · · · · · · · · · · · · ·	-
-	-				-						-
	_						\$\$\$	0.0	4.5		
						RICHM-02SB02-8-10	\$\$\$				
-	-				1		}}				-
-	10				-		<u>}}</u>			Bottom of	10
				L .						boring at 10 feet. Not	
ſ				[
-	-										-
-	_										_
	_				1						
\vdash	15				1						15
-	-										_
-	-				1						
-	-				-						-
	_			L .	1						_
18											00
T 2/2/	20				1						- 20
E.GD	_				+						-
PLAT	_			L .							
CTEN											
- PF	-				1					 	-
SS.GP	-				-						-
BLOG	25-										25
ORIN	20-										
	ART	DATE: 11/7/2017 GROUND ELEVATION: ft.			<u> </u>			/			
UN EN DR		ALE: 11/1/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3711187.	.938 ft.	ł	<u> </u>	DIL BUKING	<i>ן ב </i> חור			I OKING WELL KECO	YD PFC
		VIENT: GEOPTODE (822DT EASTING: 11827692 DD: Direct Push HORIZONTAL DATUM: NAD 83 NA 2 214/8 ID	1.83 ft.		Pro	ject No: 291	33	000	6.0	7 Boring N	lo .
	E:	NA. 2 1/4 IU RICHM ID DV. David Voung			Ch	ecked By: BL				02SB	02
	GGE	DE 18 A DEASONADI E INTERPRETATION OF 81 001 05405 001015000 1	ттис							271 Mill Road	
	LORA	UND IS A REASONABLE IN LERFREIATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT EN.INTERFACES BETWEEN STRATA ARE APPROXIMATE TRANSITIONS APD	I THE FOTHER WEEN ST		ar	nec foster	W	hee	eler	Chelmsford, MA 0182	4
MAY	BE GI	RADUAL.									

Г	D		1	F		SAMPLE	S			MON		
	E P	AND REMARKS	Ē		BLOW!		Ĺ		REC	CONSTR	RUCTION DETAILS	D E
	T H		E		CT PER 6	SAMPLE	Ϋ́	PID	CO VE	AN	DREMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D N	(ft)	Ň	ID	Ē	(ppm)	Ř Y (feet)			ΉΗ
-	0 —	· · ·			-	RICHM-02SB03-0-2	222		. ,			- 0
_	_	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					633					_
							\gtrsim					
-	-						655					-
	_						\mathbb{R}	0.0	4.5		-	
							555					
F	-				1		833				-	-
	5						\sum					5
	-	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					655					
-	_	moist (CH)					ß				-	-
	_						555					
							833	0.0	4.5			
-	-					RICHM-02SB03-8-10	<u>}</u>				-	-
	_						655					_
							ß					
-	10—		////		1		ĸ	1		Bottom of	-	_ 10
-	-									feet. Not refusal.		_
-	-											-
	-			L .	-							_
-	-										-	-
-	15—				-							15
-	-			-							-	-
-	-			- ·	-						-	-
	-											
-	-			-	-							-
2/18	20											20
T 2/2	20											_ 20
E.GD	-				-						-	-
PLAT	_			L								
TEM												
- PFC	-				1						-	-
S.GP.	_											_
LOG												_
SING	25—	1		L	J		I	I		1		⊥ 25
	TADT											
NOW		ATE: 11/7/2017 VERTICAL DATUM: D: TWS Coppode NODTUNO: 071111	E EEO #		S	DIL BORING	G	/ M (ON	ITORIN	G WELL RECOR	RD
RICH		ALE TWS, Cascade NORTHING: 371111 MENT: Geoprobe 7822DT EASTING: 118272		Pro	ject: Rich	nm	ond	AN	IG FY16	Site Inspection for F	PFC	
U00 H		DIA: 21/4" ID DIQUM		Pro	Ject NO: 291	33	000	6.0	(DUTING N 0298	10. 17	
SNG L	OGGE	David Young	UII	EUNEU DY. BL	0230							
Q TH	IS REC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS	ner foster	14/	her			271 Mill Road	4			
MHOI EX	PLORA	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE DADUAL	AT OTHER TWEEN ST	TIMES RATA	al	nec justel	vv	ilet	.101			+
	AT BE G	KADUAL.							Page 1 of 1			

Г	D		ı	E		SAMPLF	S				
	E	AND REMARKS	E		BLOW	<i></i>	-		REC	CONSTRUCTION DETAILS	DE
	Т Н		E	V	CT PER 6	SAMPLE	T Y P	PID	CO VE	AND REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	IN	ID	Ė	(ppm)	R Y (feet)		Ĥ
┢	0 -				1 -	RICHM-02SB04-0-2	255				+ 0
-	-	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)			-		555			-	-
							$\$				
-	-				1		555	0.0	45	-	1
-	-				-		}}	0.0	4.5	-	_
							} }				
-	-				1		555			-	-
-	- 5		///		4		\mathbb{R}			-	5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					555				
-	-	moist (CH)			1		555			-	-
-	_				-		\gtrsim				-
							555	0.0	4.5		
-	-				1	RICHM-02SB04-8-10	}}			-	-
-	_				-		555			-	_
							555				10
-	- 10				1					Bottom of boring at 10	- 10
-	-				-					feet. Not refusal.	-
_	-				1					-	-
-	-				-					-	-
	-				1					-	
-	15-				-					-	15
	-			[]					-	
-	-				-					-	-
	_										
-	-				+					-	-
2/18	20-										20
T 2/2	20]						T
E.GD	-				-					-	-
PLA	_			L.							
TEM	_										
- PFC	-				1					-	-
S.GPJ	-			Ļ.	1					-	
LOG											
SING	25-	1		L	J			L			⊥ 25
BOF	<u></u>										
MONE	START END DA	DATE: 11///2017 GROUND ELEVATION: ft. ATE: 11/7/2017 VERTICAL DATUM:			<u>S</u> (DIL BORING	<u>G /</u>	<u>M</u>	ON	ITORING WELL RECOR	RD
RICH	URILLE EQUIPN	R: I WS, Cascade NORTHING: 3711120. MENT: Geoprobe 7822DT EASTING: 11827805	933 ft. 5.12 ft.	Γ	Pro	ject: Rich	۱m	onc	IAN	IG FY16 Site Inspection for F	FC
90	METHC HOLE D	DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4" ID			Pro	ject No: 291	33	000	6.0	7 Boring N	10.
ANG L	SITE: LOGGE	RICHM D BY: David Young		ļ	Ch	ecked By: BL				02SB	04
1 ONC	HIS REC	- ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A	T THE			ne Carta-		h-	1-	271 Mill Road	
HMC	XPLORA 1AY DIFFI	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET	OTHER WEEN ST	TIMES RATA	ar	nec toster	W	nee	eler	Chelmsford, MA 01824	4
N N N	IAY BE G	RADUAL.									

ſ	D		1	F		SAMPLE	ΞS					
	E P T	AND REMARKS	EG	L E	BLOW CT		Т		R E C O		TION DETAILS	D E P
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	(ft)	PËR 6 IN	SAMPLE ID	Ý P E	PID (ppm)	V E R Y (feet)	AND F		T H
-	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)		-		RICHM-03SB01-0-2		0.0	4.5			- 0
-		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,			-						-	- 5
					-	RICHM-03SB01-8-10		0.0	4.5		-	-
	- 10									Bottom of	-	_ 10
-				_	-					feet. Not refusal.	-	-
					-						-	_ 15
-					_						-	-
2/2/18	 - 20				-						-	20
C TEMPLATE.GDT					-						-	-
DRING LOGS.GPJ PF				_							-	25
DND BC	START	DATE: 11/8/2017 GROUND ELEVATION: ft.			9		2	/ N /				חא
ANG LOG RICHMC	DRILLE EQUIPM METHO HOLE D SITE: LOGGE	IR: TWS, Cascade NORTHING: 3712358 MENT: Geoprobe 7822DT EASTING: 1182697 DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4" ID RICHM ED BY: David Young	Soil BORING / WONITORING WELL RECProject:Richmond ANG FY16 Site Inspection for Project No: 291330006.07Checked By: BL039							vFC Io. 01		
RICHMOND /	THIS RECO EXPLORA MAY DIFFE MAY BE GI	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.	TIMES 'RATA	amec foster wheeler is 271 Mill Road Chelmsford, MA 018							4	
											Page 1 of 1	
	D		1	F		SAMPLF	S			MON		
------------	------------	--	----------------------	---------------	----------------	--------------------------	----------	--------------	------------------	--------------------------	-----------------------	-----------
	E P	AND REMARKS	Ē		BI OW		Ĺ		REC	CONSTR	RUCTION DETAILS	D E
	T H		E		CT PER 6	SAMPLE	Ϋ́	PID		AN	D REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	Ň	ID	Ë	(ppm)	R Y (feet)			H
-	0 —	· · ·	////			RICHM-03SB02-0-2	222		()			0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					RR					
ſ	_]		655	1				
-	-				-		ß				-	-
							555	0.0	4.5			
-	_				1		ß				-	
	_				4		555	1			-	_
							833					
-	5 —				1		\sum				-	5
	_	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)			_		655				-	
							\sum	1				
F	-				-		655				-	-
							\sum	0.0	4.5			
	_				1	RICHM-03SB02-8-10	655				-	
-	-				-		\sum	1			-	-
							655					10
-	10—			t -	1			1		Bottom of boring at 1	-	10
-	-			- ·	-					feet. Not refusal.	-	_
F	-				1						-	-
-	-			- ·	-						-	-
-	-				1						-	-
_	15—				4						-	15
F	-				-						-	-
	_			L .							-	
F	-				-						-	-
	_			L .							-	
ω												
2/2/1	20—				-						-	20
SDT												
ATE.0	_				1						-	
- MPL	-			-	-						-	-
FC TE				L								
	_				1						-	
3S.GI	-			-	-						-	-
3LOC	2 ⊑											25
DRING	20											- 20
	ART	DATE: 11/8/2017 GROUND ELEVATION: ft.										
	ND DA	ATE: 11/8/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 371232	3.919 ft.		S	DIL BORINO	G	/ M (<u>ON</u>	ITORIN	G WELL RECOP	<u>RD</u>
EC M		MENT: Geoprobe 7822DT EASTING: 1182688	94.6 ft.		Pro	vject: Rich	າm ວວ	ionc		IG FY16	Site Inspection for F	7-C
		DIA.: 2 1/4" ID RICHM	•		Ch	ecked Rv [,] RI	აპ	000	0.0	I	03SR	02
BNG FC	GGE	ED BY: David Young			011							
	SREC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS	AT THE	TIN (55	ar	ner foster	M	her			271 Mill Road	4
MAY MAY		TION LOGATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE PADIAL	AT OTHER TWEEN ST	TIMES RATA	a	nee justel	vv	ilee	lici			7
ſ™A`	I BE G	RADUAL.									Page 1 of 1	

Г	D		1	E		SAMPLF	S				
	E	AND REMARKS	Ē		BLOW	<i></i>			REC	CONSTRUCTION DETAILS	DE
	Т Н		E		CT PER 6	SAMPLE	T Y P	PID	O V E	AND REMARKS	P T
	(ft)	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	IN	ID	Ė	(ppm)	R Y (feet)		Ĥ
F	0 -				1 -	RICHM-03SB03-0-2	<u>}</u>				+ 0
-	-	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)			-		555			-	-
							$\langle \rangle \rangle$				
-	-				1		\$\$\$	0.0	45		-
-	-				-		}}	0.0	4.5		_
							\sum				
-	-				1		\$\$\$			-	-
	- 5		///		4		$\langle \rangle \rangle$				5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					\$\$\$	1			
F	-	moist (CH)			1		}}			-	-
-	_				-		$\langle \rangle$				-
							555	0.0	4.5		
-	-				1	RICHM-03SB03-8-10	}}				-
-	_				-		\$\$\$	1		-	_
							555				10
	- 10				1					Bottom of boring at 10	- 10
-	-				-					feet. Not refusal.	-
-	-				1						-
-	-				-						-
-	-				1					-	
-	15-				-						15
	-]						
-	-				-						-
	_										
-	-				+					-	-
2/18	20-										20
Т 2/2	20]						T
E.GD	-				-					-	-
PLA1	_			L.							
: TEM	_										
PFC	-				1						-
S.GPJ	-			Ļ .	1						
LOG											
SING	25-	1		L	J					l	⊥ 25
BOF	<u></u>										
MONE	START END DA	DATE: 11/9/2017 GROUND ELEVATION: ft. ATE: 11/9/2017 VERTICAL DATUM:			<u>S</u> (DIL BORING	G	<u> M</u>	ON	ITORING WELL RECOR	RD
RICHI	URILLE EQUIPN	R: I WS, Cascade NORTHING: 3712435 MENT: Geoprobe 7822DT EASTING: 11826845	.372 ft. 9.04 ft.	Γ	Pro	ject: Rich	۱m	iond	AN	IG FY16 Site Inspection for F	FC
90	METHC HOLE D	DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4" ID			Pro	ject No: 291	33	000	6.0	7 Boring N	10.
NGL	SITE: LOGGF	RICHM D BY: David Young		ļ	Ch	ecked By: BL				03SB	03
₹ QNC			TTHE			and factor		-	1-	271 Mill Road	
NHMC E N	XPLORA	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET	T OTHER WEEN ST	TIMES RATA	ar	nec toster	W	nee	ler	Chelmsford, MA 0182	4
N N	IAY BE G	RADUAL.									

Г	D		1			SAMPLE	S				
	E P	AND REMARKS	Ē		BI OW	LL	Ĺ		REC	CONSTRUCTION DETAILS	D E
	T H		E	V	CT PER 6	SAMPLE	T Y P	PID	CO VE	AND REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	IŇ	ID	Ė	(ppm)	R Y (feet)		Ĥ
┟	- 0				-	RICHM-03SB04-0-2	<u>k</u> ??				+ 0
	_	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					655				_
							\gtrsim				
ŀ	_						655		4.5		-
	_			L .			ß	0.0	4.5		_
							888				
	-				1		655			-	-
	- 5						\mathbb{N}				5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					655				
ŀ	-	moist (CH)			1		ß			-	-
	_						888				
							655	0.0	4.5		
	-				1	RICHM-03SB04-8-10	<u>}</u>			-	-
	_			L .			655				_
							ß				
ŀ	- 10		////		1		K ((1		Bottom of	10
	-			Ļ .						feet. Not refusal.	_
	-				1					-	-
	_										
	-				1					-	-
	- 15			L _							15
ŀ	-				1					-	-
				L .							_
ŀ	-				1					-	-
	_			L .							
80											
2/2/1	- 20				1						_ 20
GDT	_			L .							_
ATE											
EMPL	_				1						-
FCT	_			L .							
Ъ											
GS.G	-				1					-	-
GLO	- 25			L _]						25
NINC	_0										
ND B(START	DATE: 11/9/2017 GROUND ELEVATION: ft.					_				
OMH	END DA	ATE: 11/9/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3712464.	.989 ft.	ŀ	<u>S(</u>	JIL BORINO	<u>ا ز</u>			I ORING WELL RECO	<u> </u>
RIC	EQUIPM	MENT: Geoprobe 7822DT EASTING: 11826945 DD: Direct Push HORIZONTAL DATUM: NAD 83	5.58 ft.		Pro	vjeci. KICI vject No: 201	עט ווו		1 AIN	Roring No Site Inspection for F	
9 L O G	HOLE D	DIA.: 2 1/4" ID RICHM			Ch	ecked Bv RI	55		0.0	03SB	04
ANG	LOGGE	D BY: David Young		ł	5.10						
dNO ¹		ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A			ar	nec foster	W	hee	ler	271 Mill Road Chelmsford MA 0182	4
ICHN		TON LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET PADIAL	WEEN ST	RATA	u	nee jobter		ince			
ш	NAT DE G								-		

ſ	D		1	F		SAMPLE	S					
	E P T	AND REMARKS	EGF		BLOW CT PER		Ţ	חוק	R ECOV	CONSTR	DRING WELL RUCTION DETAILS D REMARKS	D E P
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Ē	(ppm)	E R Y (feet)			H H
	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				RICHM-04SB01-0-2						
				_							-	_
				-			\$\$\$	0.0	4.5		-	-
				_							-	_
ŀ	- 5						<u>}</u> }					_ 5
		moist (CH)		-							-	-
				_				0.0	4.5		-	-
						RICHM-04SB01-8-10					-	
	- 10									Bottom of		_ 10
										boring at 1 feet. Not refusal.	0 -	-
-												-
											-	-
	· -										-	-
	- 15											_ 15
				_								_
											-	-
-				_							-	_
л 2/2/18	- 20											_ 20
LATE.GD				_							-	-
FC TEMP											-	
S.GPJ P				_							-	_
ING LOG	- 25											25
ND BOR	START	DATE: 11/7/2017 GROUND ELEVATION: ft.			<u> </u>		_					
RICHMC		ALE. 17772017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3710163 MENT: Geoprobe 7822DT EASTING: 1182768 DD: Direct Push HORIZONTAL DATUM: NAD 93	9.285 ft. 3.64 ft.		Pro	ject: Ricl	<u>ו כ</u> חוו			IG FY16 S	Site Inspection for F	YFC
NG LOG	HOLE E SITE: LOGGF	DIA: 2 1/4" ID RICHM ED BY: David Young			Ch	ecked By: BL	33	000	0.0	1	04SB	01
RICHMOND A	THIS REC EXPLORA MAY DIFFE MAY BE G	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 THE AT OTHER TWEEN ST	TIMES IRATA	ar	nec foster	w	hee	eler	*	271 Mill Road Chelmsford, MA 0182	4
											Page 1 of 1	

ſ	D		1	F		SAMPLE	S					
	E P T	AND REMARKS	EGF		BLOW CT PER		Ţ	חוק	R ECOV	CONSTR	DRING WELL RUCTION DETAILS D REMARKS	D E P
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	6 IN	SAMPLE ID	Ē	(ppm)	E R Y (feet)			H H
	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				RICHM-04SB02-0-2	}}					
											-	_
				-			555	0.0	4.5		-	-
											-	_
ŀ	- 5						<u>}</u>				-	5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					\$\$\$ }}				-	-
-								0.0	4.5		-	-
						RICHM-04SB02-8-10					-	-
	- 10						\$\$\$ }}			Dellana	-	10
										boring at 1 feet. Not refusal.	0	_
-												_
											-	-
											-	-
	- 15										-	_ 15
											-	_
											-	
-											-	_
2/2/18	- 20										-	_ 20
TE.GDT											-	_
TEMPLA											-	_
PJ PFC					-							-
LOGS.G				L .							-	
BORING	- 25		1	<u> </u>	J				L	1		± 25
UNOMH	START END DA DRILLE	DATE: 11/7/2017 GROUND ELEVATION: ft. ATE: 11/7/2017 VERTICAL DATUM: VERTICAL DATUM: R: TWS, Cascade NORTHING: 3710084	1.061 ft.		S(<u>G /</u>	<u>/ M</u>			G WELL RECOR	
ING LOG RIC	EQUIPM METHO HOLE D SITE: LOGGE	/IENT: Geoprobe 7822DT EASTING: 1182776 DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4" ID RICHM ED BY: David Young	4.5 ft.		Pro	ject No: 291 ecked By: BL	33	000	6.0	7	Boring N 04SB	lo. 02
RICHMOND A	THIS REC EXPLORA MAY DIFFE MAY BE G	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 THE AT OTHER TWEEN ST	TIMES TRATA	ar	nec foster	w	hee	eler	*	271 Mill Road Chelmsford, MA 01824	4
				1							Page 1 of 1	

ſ	D			E		SAMPLE	S				
	E P	AND REMARKS	Ē		BLOW				RE	CONSTRUCTION DETAILS	DE
	Т Н		E		CT PER 6	SAMPLE	Ϋ́	PID	0 V F	AND REMARKS	P
	(ft)	OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	IN	ID	Ë	(ppm)	R Y (feet)		Ĥ
ł	- 0 -	· · · ·			-	RICHM-04SB03-0-2	222				- 0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					ß				
							555				
					-		833			-	-
							\sum	0.0	4.5		
]		655				
⊦					-		\gtrsim			-	-
	_						655				5
ľ	- 5	Daddiah braum fat CLAV, silty stiff highly plastic, as adar			1		RSS				- 5
		moist (CH)			-		655			-	-
							833				
ľ					1		888	0.0	45		-
						RICHM-04SB03-8-10	633	0.0	4.0		-
						and RICHM-SO- DUP03	\sum				
ł					1		655			-	-
	- 10						$\geq \geq$			Bottom of	10
										boring at 10 feet Not	
ŀ					1					refusal.	-
				L .						-	_
					1					-	-
ł	- 15				-					-	15
]						
ŀ					-						-
				[.	1					-	
⊦					-					-	-
18											00
2/2	- 20				1					-	- 20
GD.					-						_
LATE											
TEMP				F .	1					-	1
- DHC				ļ .	-						-
I Lde											
GS.C	· _			F .	1					-	1
IG LC	- 25			L _	L_						25
ORIN											
ND B	START	DATE: 11/8/2017 GROUND ELEVATION: ft.			_		~				
OMH	END DA	ATE: 11/8/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 371011 ⁻	1.558 ft.	-	<u>5</u>		<u>ا ک</u>			I OKING WELL RECO	
RIC	EQUIPN METHC	MENT: Geoprobe 7822DT EASTING: 1182786 DD: Direct Push HORIZONTAL DATUM: NAD 83	65.5 ft. 3		Pro	vjeci. KICI Nact Na: 201	33 III		1 AIN	Roring Ne inspection for F	
DOG:		DIA.: 2 1/4" ID RICHM Note: Hand auger to 5 ft has			Ch	ecked Rv RI	55		0.0	, 04SB	03
ANG	LOGGE	D BY: David Young		ŀ	0.11						
IOND	THIS REC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS	AT THE	TIMES	ar	nec foster	W	hee	ler	271 Mill Road Chelmsford MA 0182	4
CHM	EXPLORA	TION LOGATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND / ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BE DADIAL	AT OTHER TWEEN ST	TIMES	u	nee jostel	vv	ince	.iei		T
Ŕ	WAY BE G	KADUAL.									

ſ	D		1	F		SAMPLE	S					
	E P T	AND REMARKS	БСБ		BLOW CT PEP		Ţ	DIC	RECOV	CONSTR	UCTION DETAILS	D E P
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	v (ft)	6 IN	SAMPLE ID	P E	(ppm)	V E R Y (feet)	7		H U
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				RICHM-04SB04-0-2						
											-	
							555	0.0	4.5		-	_
					-						-	_
	- 5						<u>}</u>				-	5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)		-	-		555				-	-
·								0.0	4.5			_
·						RICHM-04SB04-8-10					-	
							555				-	10
	- 10									Bottom of boring at 10 feet. Not refusal		
											-	_
											-	
					-						-	
	- 15										-	_ 15
											-	
											-	_
·											-	
2/18											-	20
.GDT 2/											-	_
MPLATE												_
I PFC TE					-						-	
JGS.GP.											-	-
DRING LC	- 25			L _								25
MOND BC	START END DA	DATE: 11/8/2017 GROUND ELEVATION: ft. ATE: 11/8/2017 VERTICAL DATUM:			S	DIL BORIN	G	<u>/ M</u>	ON	ITORING	S WELL RECOP	RD
G RICHN		R: TWS, Cascade NORTHING: 371018 MENT: Geoprobe 7822DT EASTING: 1182784 DD: Direct Push HORIZONTAL DATUM: NAD 83	5.283 ft. 8.16 ft. 8		Pro Pro	ject: Ricl ject No: 291	חד 33		I AN 6.0	IG FY16 S 7	ite Inspection for F Boring N	PFC
ANG LO	HOLE D SITE: LOGGE	RICHM BICHM D BY: David Young			Ch	ecked By: BL					04ŠB	04
ICHMOND	THIS REC 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 PADILAL	AT THE AT OTHER TWEEN ST	TIMES TRATA	ar	nec foster	W	hee	eler	-	271 Mill Road Chelmsford, MA 01824	4
ш	MAIDE G								_		Page 1 of 1	

Г	D		ı	-		SAMPLF	S				
	E P	SUIL CLASSIFICATION AND REMARKS	E		BI OW		Ĺ		REC	CONSTRUCTION DETAILS	D E
	Т Н		E		CT PER 6	SAMPLE	T Y P	PID	0 V E	AND REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	N D	(ft)	IŇ	ID	Ė	(ppm)	R Y (feet)		Ĥ
ŀ	- 0				-	RICHM-05SB01-0-2	<u>k</u> ??				+ 0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					655			-	-
							ß				
					1		555	0.0	45		-
							833	0.0	4.5		_
							\sum				
ŀ					1		655			-	-
	- 5		///		-		<u>}}</u>				5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					888				
		moist (CH)			1		633			-	-
					-		\gtrsim				-
							655	0.0	4.5		
					1	RICHM-05SB01-8-10	ß				-
							888			-	_
							833				10
ľ	- 10			+ -	1			1		Bottom of boring at 10	- 10
-					-					feet. Not refusal.	-
					1						
					-						-
					1					-	
	- 15				-						15
					1						
					-						-
					1						
					-						-
/18											20
2/2	- 20				1					-	- 20
EGD.					-					-	-
LATE											
TEMF					1						
PFC					-						-
GPJ											
.S9C				F .	1					-	1
NGL	- 25			L _							25
BOR											
DND		DATE: 11/8/2017 GROUND ELEVATION: ft.			S		3	/ M			חא
CHM		R: TWS, Cascade NORTHING: 3710943.	27 ft.	ŀ	Pro	ject: Rich	<u>יי</u> חוו	ionc	I AN	IG FY16 Site Inspection for F	PFC
DG R	METHO	DD: Direct Push HORIZONTAL DATUM: NAD 83	<u>.</u> 11.		Pro	ject No: 291	33	000	6.0	7 Boring N	lo.
IG LC	SITE:	RICHM			Ch	ecked By: BL			_	05ŠB	01
NA D	LOGGE	D BA: David torna		Ī					-	271 Mill Road	
MON	THIS REC	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS A TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT	T THE	TIMES	ar	nec foster	W	hee	eler	Chelmsford, MA 0182	4
RICH	MAY DIFFI MAY BE G	ER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BET RADUAL.	WEEN ST	RATA							

ſ	D				E		SAMPLE	S				
	E P T	AND REMA	ARKS	E G	L E	BLOW	0, 22	т		RECO	CONSTRUCTION DETAILS	DE
	H	SEE KEY SYMBOL SHEET F		E N	(ff)	PER 6 IN	SAMPLE ID	Ý P E	PID (ppm)	0 V E R Y	AND REMARKS	T H
╞	- 0	OF STIVIDOLS AND ADDREVIA	TIONS USED BELOW.				RICHM-05SB02-0-2	277		(feet)		0
╞		Reddish brown fat CLAY, silty, stil moist (CH)	ff, highly plastic, no odor,			-		\sum				_
								\$\$\$				_
									0.0	4.5		_
ľ	- 5	Reddish brown fat CLAY, silty, sti	ff, highly plastic, no odor,			1		}}				- 5
ŀ		moist (CH)						}}				-
									0.0	4.5		-
╞					- ·	-	RICHM-05SB02-8-10					-
-						-						-
╞	- 10					-		$\geq \geq >$			Bottom of	- 10
											feet. Not refusal.	_
												_
												_
	_											
	45											15
Ī	- 15					1						
ŀ						1						-
						1						_
╞												-
-						-						-
2/2/18	- 20					-						_ 20
E.GDT	. –					-						-
MPLAT												_
PFC TE					L .							
GPJ F					L .							
SDOL E	_ 25											25
BORINC	25				_							
MOND E	START END DA	DATE: 11/8/2017 GROU ATE: 11/8/2017 VERT	JND ELEVATION: ft. ICAL DATUM:			S	DIL BORING	G /	/ M (ON	ITORING WELL RECO	DRD
RICHI		H: IWS, Cascade NORT MENT: Geoprobe 7822DT EAST DD: Direct Push HORD	HING: 3710562 ING: 1182741 ZONTAL DATUM: NAD 8:	2.153 ft. 12.46 ft. 3		Pro	ject: Rich	าm วว	iond		IG FY16 Site Inspection for	PFC
IG LOG	HOLE C	DIA.: 2 1/4" ID RICHM Note: 1	Hand auger to 5 ft bgs			Ch	ecked By: BL	55		0.0	, 05S	B02
ND AN	LOGGE	D BY: David Young	OF SUBSURFACE CONDITIONS	AT THE	Ī	-	noc fostar		ha	Jan	271 Mill Road	
RICHMC	EXPLORA MAY DIFFE	TION LOCATION. SUBSURFACE CONDITION ER. INTERFACES BETWEEN STRATA ARE AF RADUAI	IS AT OTHER LOCATIONS AND A PPROXIMATE. TRANSITIONS BE	AT OTHER TWEEN ST	TIMES RATA	ar	nec toster	W	nee	eler	Chelmsford, MA 01	324
щ												

ſ	D		1	F		SAMPLE	S			MONUT		
	E P T	AND REMARKS	EG		BLOW		Ţ		R E C O		UCTION DETAILS	D E P
	H (ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	E N D	V (ft)	PER 6 IN	SAMPLE ID	P E	PID (ppm)	V E R Y (feet)	AINL	J REMARKS	T H
ľ	- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,			1 -	RICHM-05SB03-0-2	<u>}</u>					_ 0
							\$\$\$				-	
								0.0	4.5		_	_
							\$\$\$				-	_
	- 5										-	_ 5
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)					\$\$\$ }}				-	_
											-	-
					-	RICHM-05SB03-8-10		0.0	4.5		-	_
					-		555				-	_
	- 10				-		<u>}}</u>			Bottom of boring at 10	-	_ 10
										feet. Not refusal.	-	-
·											-	-
											-	-
·	15			-							-	15
	- 13-										-	
											-	_
											-	-
					-						-	-
2/2/18	- 20				-						-	_ 20
VTE.GDT					-						-	-
TEMPL/					-						-	-
PJ PFC					-						-	-
LOGS.G				-	1						-	0.5
BORING	- 25	·	·	<u> </u>	J							± 25
DNOMH	START END DA DRILLE	DATE: 11/8/2017 GROUND ELEVATION: ft. ATE: 11/8/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 371037	.114 ft.		S		G	/ M (ON		G WELL RECOR	RD
OG RICI	EQUIPN METHO HOLE D	MENT: Geoprobe 7822DT EASTING: 1182801 DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA.: 2 1/4" ID	3.85 ft.		Pro	ject: Ricl	٦m 33	000	6.0	IG F Y 16 S 7	Boring N	/FC lo.
D ANG L	SITE: LOGGE	RICHM D BY: David Young			Ch	ecked By: BL					271 Mill Pood	03
RICHMON	THIS RECO EXPLORA MAY DIFFE MAY BE GI	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 THE AT OTHER TWEEN ST	TIMES TRATA	ar	nec foster	W	hee	eler		Chelmsford, MA 01824	4
- •											Page 1 of 1	

ſ	D			E		SAMPLE	S				
	E P	AND REMARKS	Ē						RE	CONSTRUCTION DETAILS	DE
	Т Н		E		CT PER 6	SAMPLE	Ϋ́	PID	0 V F	AND REMARKS	P T
	(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	ĪŇ	ID	Ē	(ppm)	R Y (feet)		Ĥ
ł	- 0 -	· · · · ·			-	RICHM-05SB04-0-2	222				- 0
		Reddish brown fat CLAY, silty, stiff, highly plastic, no odor, moist (CH)				and RICHM-SO- DUP04	833			-	
							888	1			
					-		655				-
							\sum	0.0	4.5		
							655				
					-		\mathbb{R}				-
	5						555	1			5
	- 5	Reddish brown fat CLAY silty stiff highly plastic no odor					833				Ţ
ŀ		moist (CH)		-	-		\sum	1			-
							655				
					1		\gtrsim	0.0	4.5		
					-	RICHM-05SB04-8-10	655				-
							ß				
ľ					1		555				-
ŀ	- 10				-		<u> </u>			Bottom of	- 10
										boring at 10 feet. Not	
				F .	1					refusal.	
					-						-
				- ·	1					-	
				- ·	-						_
											45
ľ	- 15				1					-	- 15
				- ·	-						_
ł					1						-
				Ļ .							_
ł				- ·	1					-	-
/2/18	- 20			L -	4						_ 20
DT 2											
TE.G					1					-	-
IPLA				L .							_
CTEN											
Р Р				F .	1					-	-
S.GP.				Ļ .							_
LOG											
SING	- 25	1		<u> </u>				L			⊥ 25
BOF				,							
JUND	START	DATE: 11/8/2017 GROUND ELEVATION: ft. ATE: 11/8/2017 VERTICAL DATUM: VERTICAL DATUM:			S	OIL BORING	G	/ M(ON	ITORING WELL RECOP	RD
RICHN	DRILLE	R: TWS, Cascade NORTHING: 371073 MENT: Geoprobe 7822DT EASTING: 1182785	8.409 ft. 50.1 ft.	Ì	Pro	ject: Rich	٦m	iond	AN	IG FY16 Site Inspection for F	PFC
ЧЭС		DD: Direct Push HORIZONTAL DATUM: NAD 83 DIA : 2 1/4" ID	3		Pro	ject No: 291	33	000	6.0	7 Boring N	lo.
NG LC	SITE:	RICHM Note: Hand auger to 5 ft bgs			Ch	ecked By: BL				05SB	04
ND AI			AT TUE			and and				271 Mill Road	
IOMH	THIS REC	UND IS A REASONABLE IN LERPRE LATION OF SUBSURFACE CONDITIONS. TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A	AT THE AT OTHER		ar	nec foster	W	hee	eler	Chelmsford, MA 0182	4
RIC	MAY BE G	EN INTENTALS DE INVELITOTRATA ARE AFRUXIMATE. TRANSITIUNS BE RADUAL.	I VVEEIN SI								

D			1	F		SAMPLE	S			ΜΟΝΙΤ		
P T H	AND REMARKS		E G E	L E V	BLOW CT PER	SAMPI E	T Y	PID	RECOV	CONSTRU	JCTION DETAILS REMARKS	D E P
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELO	W.	N D	(ft)	6 IN	ID	P E	(ppm)	E R Y (feet)			H H
	Brown sandy SILT, trace gravel, soft, non-plastic, no c moist (ML)	odor,			-			0.0	5	Bentonite chip seal 0-3 ft bgs		_
- 5 	Gray sandy SILT, soft, slightly plastic, no odor, wet (M	L)			-					FilPro 1S Filter sand 3-20 ft bgs		- - 5 -
 - 10 					-			0.0	15	2-inch 0.010 Slotted screen 10-20 ft bgs Water level ~ 11.58 ft bgs before groundwater samoling		- - - 10
- 15					-					jg		_ _ 15 _
20 					-	RICHM-GW-BW01- 111017				Bottom of boring at 20 feet. Not refusal.		_ _ 20 _
25-					_							25
START END DA DRILLE EQUIPM METHC HOLE D SITE: LOGGE	DATE: 11/9/2017 GROUND ELEVATION: f ATE: 11/9/2017 VERTICAL DATUM: R: TWS, Cascade NORTHING: 3 IENT: Geoprobe 7822DT EASTING: 1 D: Hollow Stem Auger HORIZONTAL DATUM: 1 DIA.: 8-inch RICHM D BY: David Young	n. 1712030.35 1828845.9 NAD 83	53 ft. 99 ft.	-	S(Pro Pro Che	DIL BORING ject: Rich ject No: 291 ecked By: BL	G / nm 330	M(ond 000	<mark>DN</mark> AN 6.0 ⁻	ITORING IG FY16 S 7	B WELL RECO ite Inspection for I Boring I BW	RD PFC No. -01
THIS RECO EXPLORA MAY DIFFE MAY BE G	ORD IS A REASONABLE INTERPRETATION OF SUBSURFACE COND TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATION R. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITI RADUAL.	ITIONS AT T IS AND AT C ONS BETWE	THE DTHER 1 EEN STR	TIMES RATA	ar	nec foster	w	nee	ler	*	271 Mill Road Chelmsford, MA 0182	24

D		1	F		SAMPL F	S				
E P	AND REMARKS	Ē		BL OW		\square		REC	CONSTRUCTION DETAILS	D E
T H		E		CT PER 6	SAMPLE	Y	PID	0 VE	AND REMARKS	Р т
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	ĨŇ	ID	Ē	(ppm)	R Y (feet)		Ĥ
- 0	· · · · · · · · · · · · · · · · · · ·		 -	1 -						_ 0
	Brown sandy SILT, soft, non-plastic, no odor, moist (ML)			_						
									chip seal 0-3 ft bas	
			-	1					-	
				_						
							0.0	7		
				1						
- 5			L -	-					FilPro 1S	- 5
									Filter sand 3-20 ft bas	
			-	1						
			 	-						
	Gray sandy SILT, soft, slightly plastic, no odor, wet (ML)									
-				1						
				-					Water level -	
									before groundwater	10
- 10				1						_ 10
			-	-					2-inch 0.010	
									Slotted	
				1					10-20 ft bgs	
				-						
							0.0	13		
F -				1						
- 15				-						_ 15
-			-	1						
			- -	-						
			·							
				1	RICHM-GW-BW02- 110917					
			-	-						
										20
- 20				1					Bottom of boring at 20	- 20
			-	-					refusal. –	
]					_	
				-					-	
- 25-			L _							_ 25
START END DA	DATE: 11/9/2017 GROUND ELEVATION: ft. ATE: 11/9/2017 VERTICAL DATUM:			S		G/	М	ON	ITORING WELL RECOR	RD
DRILLE	R: TWS, Cascade NORTHING: 371 IENT: Geoprobe 7822DT EASTING: 1182	1445.723 ft. 9615.88 ft.	İ	Pro	oject: Ric	hme	ond	AN	IG FY16 Site Inspection for P	FC
	D: Hollow Stem Auger HORIZONTAL DATUM: NAI	D 83		Pro	ject No: 291	330	000	6.0	7 Boring N	0.
SITE:	RICHM D BY David Young			Ch	ecked By: BL				BW-0	J2
									271 Mill Road	
I HIS REC	JRU IS A REASONABLE IN FERPRETATION OF SUBSURFACE CONDITION TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS A DE INTEREACES DETWIEN STRATA ADD ADD ADD ADD ADD ADD ADD ADD ADD	ND AT OTHER		ar	nec foster	w	nee	ler	Chelmsford, MA 01824	
MAY DIFFE	ER, INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITION RADUAL.	DEIWEEN SI	RAIA			~				



D			F		SAMPLE	S			ΜΟΝΙΤ		
P	AND REMARKS	Ē	Ĺ	BI OW				REC	CONSTRU	CTION DETAILS	DE
н		E	V	CT PER 6	SAMPLE	Y	PID	Ö V E	AND	REMARKS	P T
(ft)	SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	D	(ft)	IN	ID	Ë	(ppm)	R Y (feet)			Ĥ
- 0	Reddish brown fat CLAY, silty, stiff, highly plastic, no odor,					335					- 0
	moist (CH)					\mathbb{R}			Bentonite	→	-
						555			0-3 ft bgs		
						83					
				-		\sum					-
						655					_
						88					
- 5 -									FilPro 1S		_ 5
						855			3-20 ft bgs		_
						88					
						} }					-
						855	0.0	16			_
						\mathbb{R}					
						\$ \$\$					-
- 10				-		}}					_ 10
						\sum					
						555			2-inch 0.010 Slotted		-
				$\left \right $		83			screen 10-20 ft bgs		-
						}			Water level		
						555			 12.56 It bgs before groundwater 		
				-		88			sampling		-
15-						} }					15
10						835					
						<u>}</u> }					-
	Yellowish brown sandy SILT, very soft, non-plastic, no odor, wet (ML)					833					_
						\sum					
				-	RICHM-GW-TW03- 110917	555	0.0	4			-
						83					_
						\sum					
- 20									Bottom of boring at 20	1.2.3 1.2.5 X	- 20
									feet. Not refusal.		_
											-
				-							_
- 25-								1			⊥ 25
START END DA	DATE: 11/8/2017 GROUND ELEVATION: ft. TE: 11/8/2017 VERTICAL DATUM:			SC		G/	M	ON	ITORING	WELL RECO	RD
DRILLE	R: TWS, Cascade NORTHING: 3712280 IENT: Geoprobe 7822DT EASTING: 1182701	.422 ft. 8.34 ft.	Ī	Pro	ject: Ric	hm	ond	I AN	IG FY16 Sit	e Inspection for F	PFC
METHO HOLE D	D: Direct Push HORIZONTAL DATUM: NAD 83 IIA.: 8-inch			Pro	ject No: 291	33	000	6.0	7	Well	NO.
SITE:	RICHM Note: Temporary well abandoned D BY: David Young		ļ	Che	ecked By: BL					TW	-03
		TTHE					-	1	2	271 Mill Road	
EXPLORA MAY DIFF	TION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND A RINTERFACES BETWEEN STRATA ARE APPROXIMATE TRANSITIONS AND A	T OTHER T		an	nec foster	W	nee	eler	· 🔨 (Chelmsford, MA 0182	4
MAY BE G	RADUAL.		2					-	-		



APPENDIX C

THIS PAGE INTENTIONALLY LEFT BLANK.



WIEciel													
Project Name: Contract:	Phase Compo	1 Regional unds at Mul	Site Inspect tiple Air Nat	ions for Per- ional Guard	Fluorinated Installations	Project N	umber:			291330006.07			
Contract:			۷	V9133L-14-I	D-0002		Task Ord	er:			0006		
Installation:				RICHM	1		Date Star	ted/Date Co	mpleted:		11/09/17/11/09/17		
Well ID:				BW-01			Initial Dep	oth to Wate	r (ft):		11.55		
Measuring Point	:			Top of Ca	sing		Total Dep	th of Well (ft):		20.0		
Development Me	ethod:			PUMPE	D		Depth to	Water After	Purging (ft):		16.95		
Total Volume Pu	irged (gal):			10			1 Casing	Volume (ga	l):		1.4		
Technician(s):			1	Sarah Lev	/ine		3 Casing	Volumes (g	al):	r	4.2		
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.)		
11/09/17 16:14			1.5			()					Pumping Started		
11/09/17 16:19	19.5	16.35	1.5	18.91	5.28	0.112	2.29	38.6	Over	4	Brown, turbid		
11/09/17 16:24	19.5	16.70	1.5	18.60	5.39	0.096	1.47	2.9	Over	8	Brown, turbid		
				-									
						<u> </u>							
			†		†		1						
			1		1	1	1						
						-							
				-									
	-					-							
				-									
	-					-							
	-					-							
						1							
Instruments (N	lanufacturer	, Model,	and Seria	il No.):			0.11 - 0.00				No.		
Equipment Calibrate	ed (Y/N):		٢	res -		Calibrated Within	Criteria (Y/N):			Yes		
				I	urbidity Mete	Hanna 98703 08. YSI 556 MPS H0	leter, Water L J101227, 0006328	evel Meter					
Calculations:											Signature:		
				-1/64/0									
Saturated well C V = Volume (gal/ft) $\Pi = 3.14$ R = well radius (ft) = H = height of water	= (well diameter (column (ft)	$V = \Pi(R^{2})H^{*}7.48 \text{ gal/ft}^{3}$ er (in)/12 (in/ft))/2) * 8.45 * 7.48 gal/ft^3 = 1.4 gal.								Salti			
Notes:											Name (print):		
	None								Sarah Levine				
QA/QC'd by:	drv							0	A/QC Date:		1/2/2018		



wneeler											
Project Name: Contract:		Phase Compo	1 Regional ounds at Mul	Site Inspect tiple Air Nat	ions for Per- ional Guard	Fluorinated Installations	Project N	umber:		291330006.07	
Contract:			۷	V9133L-14-I	D-0002		Task Ord	er:			0006
Installation:				RICHM	1		Date Star	ted/Date Co	mpleted:		11/09/17/11/09/17
Well ID:				BW-02			Initial Dep	pth to Wate	r (ft):		7.7
Measuring Point				Top of Ca	sing		Total Dep	oth of Well (ft):		20.0
Development Me	ethod:			PUMPE	D		Depth to	Water After	Purging (ft):		10.48
Total Volume Pu	irgeu (gai).			Sarah Lev	/ine		3 Casing	Volumes (ga	ı). al):		6.1
reenneidin(3).						Specific	o ousing	Volunics (g			
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.)
11/09/17 12:55			1.5								Pumping Started
11/09/17 13:00	19.5	8.95	1.5	16.45	4.68	0.151	7.95	45.1	Over	4	Light brown, turbid
11/09/17 13:05	19.5	9.36	1.5	16.26	5.12	0.161	6.58	25.2	226	8	Light brown, cloudy
							-				
							-				
							-				
							-				
			<u> </u>						<u> </u>		<u> </u>
Instruments (N	lanufacturer	, Model,	and Seria	al No.):				N.			Vec
Equipment Calibrate	ed (Y/N):		٢	res _		Calibrated Within	n Criteria (Y/N	1):			Yes
				1	urbidity Mete	er, Water Quality N Hanna 98703 08.	leter, Water L J101227.	_evel Meter			
						YSI 556 MPS HO	0006328				
Calculations:											Signature:
Seturated well a			0\LI*7 49 av	ol/#42							
Saturated well c	asing volume:	v= 11(R^.	2)⊟″7.48 ga	al/Itro							\sim
V = Volume (gal/ft)							V= П(R^2	2)H*7.48 gal/ft	^3		$C' \wedge I$
Π = 3.14						=∏ * (2.0) (in)/12 (in/ft) –))/2)^2 * 12.30 2.0 gal	* 7.48 gal/ft^3		$\searrow // //$
R = well radius (ft) = H = height of water	= (well diameter (column (ft)	in)/12 (in/ft)))/2)				-	2.0 yai.			XIII
											man m
Notes:											Name (print):
			Purg	ed with subr	nersible Wat	erspout 1 complete	e.				Sarah Levine
QA/QC'd bv:	ary							(A/QU Date:		1/2/2018



Project Name		Phase	1 Regional	Site Inspect	ions for Per-	Fluorinated	Project N	umber:			291330006.07	
r reject Runie.		Compo	ounds at Mul	tiple Air Nat	ional Guard	Installations	110,000110					
Contract:			V	V9133L-14-I	D-0002		Task Orde	er:			0006	
Installation:				RICHM	1		Date Star	ted/Date Co	mpleted:		11/06/17/11/06/17	
Well ID: Mossuring Point				Top of Ca	sina		Initial Dep	oth to Wate	r (ft): #\\.		20.0	
Development Ma	athod:			PUMPE	D	<u> </u>	Denth to V	Wator Aftor	Puraina (ft):		Dry	
Total Volume Pu	irged (gal):			4.5	-		1 Casing	Volume (ga	l):		0.6	
Technician(s):	5 (5)			Sarah Lev	/ine		3 Casing	Volumes (g	, al):		1.9	
		Wator				Specific				Cum	Commonts/Obsonvations	
Date/Time	Intake Depth (feet)	Level (feet)	Rate (Gpm)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Volume (gal.)	During Purging (color, sediment, etc.)	
11/06/17 15:53			1.5								Pumping Started	
11/06/17 15:56	19.5	Na	1.5	Na	Na	Na	Na	Na	Na	1.5	Brown, very turbid	
11/06/17 16:00	19.5	16.55	Na	Na	Na	Na	Na	Na	Na	1.5	Brown, turbid	
11/06/17 16:01	19.5	Na	1.5 No	20.10	3.88 No	0.046	5.89	84.9	Over	3	Brown, turbid	
11/06/17 16:09	19.5	10.4 No	Na	Na	Na	Na	Na	Na	Na	45	Light brown, turbid	
11/00/17 10.11	10.0	Na		TNCI			TNG	i va	ING			
				1								
						-						
				-		-						
						-						
Instruments (N	lanufacturer	, Model,	and Seria	l No.):								
Equipment Calibrat	ed (Y/N):		Y	'es		Calibrated Within	Criteria (Y/N):			Yes	
				I	urbidity Mete	Hanna 98703 H0	1eter, Water L 1006328,	Level Meter				
Calculations:						131 330 MP3 000	J101227				Signaturo	
Concentrations:			0) *7 40 ~	-1/64/2							orgnature.	
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) : H = height of water	= (well diameter (column (ft)	v – 11(R [.] 2	2)n 7.40 ga))/2)	ant's		=∏ * (2.	V= Π(R^2 0 (in)/12 (in/ft =	!)H*7.48 gal/ft))/2)^2 * 3.95 0.6 gal.	^3 * 7.48 gal/ft^3		Sahr	
Notes:										Name (print):		
	Pump well dry and allowed to recharge in 1-2 minute i										Sarah Levine	
QA/QC'd by:	drv							(A/QC Date:		1/2/2018	



meeter												
Project Name: Contract:		Phase Compo	1 Regional unds at Mult	Site Inspect tiple Air Nati	ions for Per- ional Guard I	Fluorinated	Project N	umber:			291330006.07	
Contract:	-		V	V9133L-14-[D-0002		Task Orde	er:			0006	
Installation:	-			RICHN	1		Date Star	ted/Date Co	mpleted:		11/07/17/11/07/17	
Well ID:				TW-02			Initial Dep	oth to Water	· (ft):	17.65		
Measuring Point	:			Top of Cas	sing		Total Dep	th of Well (f	ft):		20.0	
Development Me	ethod:			PUMPE	D		Depth to V	Water After	Purging (ft):		19.78	
Total Volume Pu	irged (gal):			4			1 Casing	Volume (ga	l):		0.4	
Technician(s):				Sarah Lev	vine		3 Casing	Volumes (g	al):		1.2	
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.)	
11/07/17 13:02			1.5								Pumping Started	
11/07/17 13:02	19.5	17.65	1.5	17.67	5.16	0.084	10.07	128.0	165	1	Light brown tint	
11/07/17 13:03	19.5	Na	Na	Na	Na	Na	Na	Na	Na	1	Dry	
11/07/17 13:09	19.5	18.82	1.5	17.42	4.94	0.065	6.83	66.2	158	1.5	Light brown	
11/07/17 13:11	19.5	Na	Na	Na	Na	Na	Na	Na	Na	1.5	Dry	
11/07/17 13:19	19.5	18.64	1.5	17.48	4.96	0.064	6.20	46.2	1.8	3	Light brown tint	
11/07/17 13:21	19.5	Na	Na	Na	Na	Na	Na	Na	Na	3	Dry	
									-			
	├											
	├		<u> </u>		<u> </u>							
	┼───┤							<u> </u>				
									-			
Instruments (N Equipment Calibrate	lanufacturer, ed (Y/N):	, Model, a	and Seria Y	i l No.): ′es		Calibrated Within	Criteria (Y/N):			Yes	
				Т	urbidity Mete	r, Water Quality M Hanna 98703 08	leter, Water L J101227, 0006328	evel Meter				
Colouistionou											Cimpotuno	
Saturated well c	asing volume:	V= П(R^2	2)H*7.48 qa	al/ft^3							orginature.	
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) = H = height of water	= (well diameter (column (ft)	in)/12 (in/ft))/2)			=∏ * (2.	V= П(R^2 0 (in)/12 (in/ft =)H*7.48 gal/ft))/2)^2 * 2.35 0.4 gal.	^3 * 7.48 gal/ft^3		Salti	
Notes:			Pu	mped dry int	ermittantly a	t approx 1.5 gpm.					Name (print): Sarah Levine	
QA/QC'd bv:	dry								A/QC Date:		1/2/2018	



Wheeler												
Project Name:	Phase Compo	1 Regional ounds at Mul	Site Inspect tiple Air Nat	ions for Per- ional Guard I	Fluorinated nstallations	Project N	umber:		291330006.07			
Contract:	-		V	V9133L-14-I	D-0002		Task Ord	er:			0006	
Installation:	-			RICHN	1		Date Star	ted/Date Co	mpleted:		11/09/17/11/09/17	
Well ID:				TW-03	1		Initial Dep	oth to Water	r (ft):	12.4		
Measuring Point	::			Top of Ca	sing	<u> </u>	Total Dep	th of Well (1	ft):		20.0	
Development Me	ethod:			PUMPE	D		Depth to	Water After	Purging (ft):		19.04	
Total Volume Pu	irged (gal):			8		<u> </u>	1 Casing	Volume (ga	l):		1.2	
Technician(s):			1	Sarah Lev	/ine		3 Casing	Volumes (g	al):		3.7	
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.)	
11/09/17 10:57			1.5								Pumping Started	
11/09/17 10:59	19.5	17.55	1.5	Na	Na	Na	Na	Na	Over	3.5	Light brown, turbid	
11/09/17 11:01	19.5	Na	1.5	17.83	5.64	0.047	3.22	47.1	Over	5	Dry. Stop	
11/09/17 11:06	19.5	15.25	1.5	Na	Na	Na	Na	Na	Over	6	Start. Light brown, turbid	
11/09/17 11:07	19.5	Na	1.5	16.90	5.52	0.048	4.42	49.3	Over	6	Dry	
11/09/17 11:11	19.5	16.08	1.5	Na	Na	Na	Na	Na	Over	8	lurbid	
	1											
	1 1				, ,,							
			1		1		1		1			
	-											
	1											
	┼───┤											
	+											
	1 1		ł		t		1		1	-		
Instruments (N Equipment Calibrat	Manufacturer, ed (Y/N):	, Model, a	and Seria	l No.): ′es		Calibrated Within	Criteria (Y/N):			Yes	
				Т	urbidity Mete	r, Water Quality M Hanna 98703 08. YSI 556 MPS H0	leter, Water L I101227, 0006328	evel Meter				
Calculations:											Signature:	
Saturated well o	asing volume:	V= П(R^2	2)H*7.48 ga	al/ft^3							Signature.	
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) H = height of water	= (well diameter (column (ft)	in)/12 (in/ft))/2)			=∏ * (2.1	V= П(R^2 0 (in)/12 (in/ft =	2)H*7.48 gal/ft))/2)^2 * 7.60 1.2 gal.	^3 * 7.48 gal/ft^3		Salti	
Notes:			Purez	ed with sub-	nersible Wat	erspout 1 Complete	9				Name (print):	
	dry		ruge				. .				1/2/2018	
unvucu by:	ary							6	and we bald.		112/2010	



miccler												
Project Name:		Phase Compo	1 Regional unds at Mulf	Site Inspect tiple Air Nati	ions for Per- ional Guard I	Fluorinated Installations	Project N	umber:			291330006.07	
Contract:	-		W	/9133L-14-[0-0002		Task Orde	er:			0006	
Installation:	-			RICHM	1		Date Star	ted/Date Co	mpleted:		11/06/17/11/06/17	
Well ID:	-			TW-04			Initial Der	oth to Water	(ft):	15.25		
Measuring Point	-			Top of Cas	sing		Total Dep	th of Well (f	ft):		20.0	
Development Me	thod:			PUMPE	D		Depth to \	Water After	, Purging (ft):		19.24	
Total Volume Pu	rged (gal):			3.5			1 Casing	Volume (ga	l):		0.8	
Technician(s):	· · · · ·			Sarah Lev	vine		3 Casing	Volumes (a	al):		2.3	
						Specific			T T			
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.)	
11/06/17 12:29			1.5 gpm								Pumping Started	
11/06/17 12:34	19.5	Na	Na	Na	Na	Na	Na	Na	Over	1.5	Pump stop. Brown, turbid	
11/06/17 12:38	19.5	18.35	1.5	20.81	3.98	.074	4.76	249.6	Over	2.5	Brown, turnid	
11/06/17 12:39	19.5	18.96	Na	Na	Na	Na	Na	Na	Ns	Na	Stop	
11/06/17 12:48	19.5	19.31	1.5	21.19	3.52	0.043	5.10	160.0	Over	3.5	Light brown, turbid	
11/06/17 12:50											Stop	
			l	1	İ		1					
			l	1	İ		1					
	† †					1	1		ł			
	 				l	1			ł			
	ł ł						-					
	ł ł						-					
							-					
							_					
							_					
			l	1	İ		1					
			1	1	1		1					
			1	1	1		1					
Instruments (M	lanufacturer,	Model,	and Seria	I No.):		1						
Equipment Calibrat	ed (Y/N):		Y	es		Calibrated Within	n Criteria (Y/N):			Yes	
	-			Т	urbidity Mete	r, Water Quality M Hanna 98703 08	leter, Water L J101227,	evel Meter				
						151 556 MPS HU	1006328					
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	= (well diameter (i column (ft)	n)/12 (in/ft))/2)			=∏ * (2.	V= Π(R^2 0 (in)/12 (in/ft =)H*7.48 gal/ft⁄))/2)^2 * 4.75 ⁻ 0.8 gal.	^3 * 7.48 gal/ft^3		Sahi	
Notes:											Name (print):	
Intermittant flow	during developm	ent. Well ra	in dry in app 1.5gpm us	rox 2 minute	es. Waited 5 ersible Water	min for recharge a spout 1 Complete	and restarted pump.	pump. Purged	I dry repeatedly	at approx	Sarah Levine	
QA/QC'd bv:	dry							G	A/QC Date:		1/2/2018	



miccici												
Project Name:		Phase Compo	1 Regional unds at Mult	Site Inspect tiple Air Nati	ions for Per- ional Guard I	Fluorinated Installations	Project N	umber:			291330006.07	
Contract:	-		V	/9133L-14-[D-0002		Task Ord	er:			0006	
Installation:	-			RICHM	1		Date Star	ted/Date Co	mpleted:		11/06/17/11/06/17	
Well ID:	-			TMW-3	7		Initial Dep	oth to Water	r (ft):	17.8		
Measuring Point	::			Top of Cas	sing		Total Dep	th of Well (1	ft):	27.0		
Development Me	ethod:			PUMPE	D		Depth to	Water After	Purging (ft):		24.35	
Total Volume Pu	irged (gal):			6			1 Casing	Volume (ga	I):		1.5	
Technician(s):	1		1	Sarah Lev	vine		3 Casing	Volumes (g	al):	-	4.5	
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.)	
11/06/17 13:22			1.5								Pumping Started	
11/06/17 13:24	26.5	17.75	Na	Na	Na	Na	Na	Na	Na	3	Brown, turbid	
11/06/17 13:26	26.5	24.78	1.5	21.41	3.78	0.036	4.57	87.3	203	3	Light brown, turbid	
11/06/17 13:29	26.5	18.60	Na	Na	Na	Na	Na	Na	Na	6	Brown, turbid	
11/06/17 13:31	26.5	24.10	1.5	21.14	3.20	0.030	3.07	125.1	Over	6	Brown, turbid	
			1		1							
			-									
			1		1							
			-									
									+			
			<u> </u>									
Instruments (N Equipment Calibrat	lanufacturer, ed (Y/N):	, Model, a	and Seria Y	l No.): ^{'es}		Calibrated Within	ı Criteria (Y/N):			Yes	
				Т	urbidity Mete	r, Water Quality M Hanna 98703 H0 XSI 556 MPS 08.	leter, Water L 006328, 1101227	evel Meter				
Calculations											Signatura	
Saturated well c	asing volume:	V= П(R^2	2)H*7.48 ga	al/ft^3							Signature.	
V = Volume (gal/ft) Π = 3.14 R = well radius (ft) H = height of water	= (well diameter (column (ft)	in)/12 (in/ft))/2)			=∏ * (2.	V= Π(R^2 0 (in)/12 (in/ft =	2)H*7.48 gal/ft))/2)^2 * 9.20 1.5 gal.	^3 * 7.48 gal/ft^3		Sahi	
Notes:											Name (print):	
	W	ell purged	using subme	ersible Wate	rspout 1 Cor	nplete at approx 1.	.5gpm. High r	echarge			Sarah Levine	
QA/QC'd by:	drv							C	A/QC Date:		1/2/2018	



Project Name:		Phase	1 Regional	Site Inspect	ions for Per-	Fluorinated	Project N	umber:			201330006.07
rioject Name.		Compo	ounds at Mul	tiple Air Nat	ional Guard I	nstallations	riojectini	umber.			231330000.07
Contract:			V	V9133L-14-I	D-0002		Task Ord	er:			0006
Installation:				RICHN	1		Date Star	ted/Date Co	mpleted:		11/09/17/11/09/17
Well ID: Mossuring Point				Top of Ca	30 sina		Initial Dep	oth to Water	r (ft): #\\.		13.3
Development Me	thod:			PUMPE	D		Depth to	Water After	Puraina (ft):		17.18
Total Volume Pu	irged (gal):			12.5			1 Casing	Volume (ga	l):		3.6
Technician(s):	5 (5)			Sarah Lev	/ine		3 Casing	Volumes (g	, al):		10.9
		Water				Specific				Cum	Comments/Observations
Date/Time	Intake Depth (feet)	Level (feet)	Rate (Gpm)	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 11:31			1.5								Pumping Started
11/09/17 11:33	29	16.95	1.5	15.25	4.05	0.032	2.19	113.0	Over	4	Brown, turbid
11/09/17 11:38	29	17.03	1.5	15.40	4.35	0.031	2.67	87.7	206	8	Cloudy
11/09/17 11.43	29	17.14	1.5	15.30	4.40	0.032	2.93	11.4	95.9	12	Cloudy
				ļ							
				-							
	-										
				ļ							
Instrumonts (N	lanufacturor	Model	and Soria								
Equipment Calibrate	ed (Y/N).	, would,		es		Calibrated Within	Criteria (Y/N).			Yes
				Т	urbidity Mete	r, Water Quality M Hanna 98703 08J	leter, Water L I101227,	Level Meter			
						ר איז אנג איז אנג אנא אנג אנא אנג אנג אנג אנג אנג אנג	ιυυσόΖδ				.
Calculations:											Signature:
Saturated well c	asing volume:	V= П(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	= (well diameter (column (ft)	$V = \Pi (\mathbb{R}^{2}) \mathbb{H}^{*7.48} \text{ gal/ft}^{3}$ = $\Pi * (2.0 (in)/12 (in/ft))/2/2 * 22.20 * 7.48 \text{ gal/ft}^{3}$ = 3.6 gal.							Sahi		
Notes:										Name (print):	
			Purge	ed with subn	nersible Wate	erspout 1 Complete	e.				Sarah Levine
QA/QC'd by:	drv							C	A/QC Date:		1/2/2018

APPENDIX D

GROUNDWATER SAMPLING LOGS

THIS PAGE INTENTIONALLY LEFT BLANK.



		Dhave 4 Day	viewel Otte In		Den Electionet					
Project Name:		Phase 1 Reg	gional Site In at Multiple A	spections for ir National Gu	Per-Fluorinat	ed Compounds	Project Nu	umber:		291330006.07
Contract:			V	V9133L-14-D-	0002	<u> </u>	Task Orde	er:		0006
Installation:				RICHIM			l ecnnicia Deter	n(s):		Sarah Levine
well ID:	101-4 (6 4)-			BW-01			Date:	- 1 () - () -		11/10/17
Initial Depth to	o Water (ft):			11.58			Well Diam	eter (in):	- N -	2.0
Total Depth of	r weii (π):	-		20.0				volume (ga	ai): 	1.4
Method of Pur	ging:			Pen-pump) of Coning		3 Casing V	volumes (g	gal):	4.1
Measuring Po	Int (toc, tor, et	:c.):		Тор	or Casing	Creatific	Pump Inta	ke Depth ((Teet):	18
Time	Water Level (feet)	Flow Rate (Gpm)	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	
08:02		0.034								Pumping/Purging Started
08:06	11.68	0.034	.136	16.89	6.23	0.124	1.54	63.7	-	Clear
08:10	11.68	0.034	.272	16.82	5.90	0.107	1.36	66.7	-	Clear
08:14	11.65	0.034	.408	16.76	5.67	0.099	1.14	69.6	-	Clear
08:18	11.65	0.034	.544	16.65	5.49	0.096	1.06	73.1	-	Clear
08:22	11.65	0.034	.680	16.92	5.36	0.093	1.00	72.4	-	Clear
08:26	11.65	0.034	.816	17.13	5.41	0.093	1.01	62.3	-	Clear
08:30	11.65	0.034	.952	17.23	5.43	0.091	0.92	52.5	-	Clear
08:34	11.65	0.034	1.088	17.22	5.38	0.091	0.86	44.4	-	Clear
08:38	11.65	0.034	1.224	17.51	5.30	0.090	0.82	31.0	-	Clear
08:42	11.65	0.034	1.36	17.52	5.26	0.089	0.80	28.7	-	Clear
08:46	11.65	0.034	1.496	17.49	5.23	0.088	0.79	25.8	4.87	Clear
	-	-				-			-	
		-								
	-					-			-	
	-					-			-	
		1								
		1								
Stability Reac	hed (Y/N):			Yes		If No. Provide E	xplanation			NA
	. ,	Final	Values	47.40	E 02	0.088	0.79 25.8 4.87			
		Final	values:	17.49	5.23	0.000	0.79	25.8	4.87	
Sample ID:			RICH	IM-GW-BW01	1-111017		Method of	Sampling	:	Low flow, Peri-pump
QA/QC Sample	es (Yes/No):			INO NIA			Sample Da	ate:		11/10/17
Duplicate ID:	· <u>-</u> / ·			INA 405 millips			Sample Co	Dilection I	ime:	08.50
Sample Conta	iner Type(s):			125 ml HDF	νE		Total Volu	me Purge	d (gal):	1.5
Preservative(s	5): !/- \-)		Sample De	eptn (π):	0	10
Analysis/Meth	od(s):	an Madal	and Caria	UCIVIRS LI	SI		Depth to v	vater Atter	Sampling (ft):	11.05
Equipment Calibr	ated (Y/N):	er, Model,	and Seria Y	i NO.): es		Calibrated Within	Criteria (Y/N):			Yes
				Turbidity	Meter, Wate	r Quality Meter, Wa	ater Level Met	er, Peristalti	c Pump	
					Hanna 987	03 H0006328, YSI	556 MPS 08J	101227		
Calculations	:									Signature:
Saturated well	l casing volum	ne: V= П(R^2	2)H*7.48 ga	al/ft^3						ĺ
)\LI*7 49 act	1842	
V=Volume (gal/ft)					= 🗆 * (2	2.0 (in)/12 (in/f	t))/2)^2 * 8.4	2 * 7.48 gal/ft^3	
$\mathbf{R} = \text{well radius (f)}$	t) = (well diamete	er (in)/12 (in/ft))	/2)				=	1.4 gal.		
H = height of wat	er column (ft)	, = (invit);	-,							KININ
Notes:										Name (print):
10103.										itanio (pinic).
	Initial problem	n with turbidime	eter reading l	ow turbidities.	Fixed by sar	nple collection. Tur	bidity reading a	at sample co	ellection: 4.87	Sarah Levine
QA/QC'd by:	dry								QA/QC Date:	1/2/2018
w wy	· •									



meeter										
Project Name:	:	Phase 1 Reg	gional Site In at Multiple A	spections for ir National Gu	Per-Fluorinal ard Installation	ted Compounds	Project Nu	umber:		291330006.07
Contract:			V	V9133L-14-D-	0002		Task Orde	er:	•	0006
Installation.				RICHM	0002		Technicia	n(s) [.]	•	Sarah Levine
				BW-02			Date:	11(3).		11/09/17
weir iD. Initial Danth to				0.62			Mall Diam			2.0
Initial Depth to				0.02			weii Diam	eter (in):	· N ·	2.0
Total Depth of	r well (π):			20.0			1 Casing V	volume (ga	ai):	1.9
Method of Pur	rging:			Peri-pump)		3 Casing V	Volumes (g	jal):	5.6
Measuring Po	int (toc, tor, et	c.):		Тор	of Casing		Pump Inta	ke Depth	feet):	18
Time	Water Level	Flow Rate	Cum. Volume	Temp.	pH	Specific Electrical	DO (mg/l)	ORP		Comments/Observations
	(feet)	(Gpm)	(gal.)	(*C)	(50)	(mS/cm)	(mg/L)	(mv)	(NTO)	During Purging (color, sediment, odor, etc.)
		Stabilization	n Criteria	±0.5°C	±0.1	±3%	±10%	±10%	NTU	
13:29		0.044								Pumping/Purging Started
13:33	7.65	0.044	0.178	16.47	4.99	0.162	2.58	28.9	431	Cloudy, light brown tint
13:37	7.68	0.044	.355	16.56	4.93	0.158	2.56	21.2	169	Cloudy
13:41	7 67	0.044	.533	16 59	4.86	0.156	2 48	21.5	99.7	Cloudy
13:45	7.65	0.044	711	16.62	4.81	0.156	2.10	25.7	58.5	Clear
13:40	7.65	0.044	880	16.60	4.76	0.154	2.72	27.1	52.0	Clear
10.49	7.00	0.044	1.00	10.09	4.74	0.154	2.32	21.1	32.8	Clear
13:55	C0.1	0.044	1.00	10.72	4.70	0.101	2.22	20.3	40.0	Clear
13:57	7.65	0.044	1.24	16.71	4.70	0.110	2.24	29.7	29.3	Clear
14:01	7.65	0.044	1.42	16.71	4.64	0.146	2.22	31.8	18.8	Clear
14:05	7.65	0.044	1.60	16.68	4.61	0.144	2.19	33.1	15.1	Clear
14:09	7.65	0.044	1.78	16.68	4.59	0.143	2.16	32.9	12.4	Clear
14:13	7.65	0.044	1.95	16.67	4.57	0.142	2.14	32.3	9.58	Clear
						-	-			
	_					-	-			
							_			
							_			
Stability Reac	hed (Y/N):			Yes		If No. Provide E	Explanation			NA
					r	-,		1		
		Final	Values:	16.67	4.57	0.142	2.14	32.3	9.58	
Sample ID:			RICH	IM-GW-BW02	2-110917		Method of	Sampling	:	Low flow, Peri-pump
QA/QC Sampl	es (Yes/No):			No			Sample Da	ate:		11/09/17
Duplicate ID:	. ,			NA			Sample Co	ollection T	ime:	14:15
Sample Conta	iner Type(s):			125 ml HDF	Έ		Total Volu	ıme Purae	d (gal):	2
Preservative/s	s).			Ice (4 °C)			Sample De	enth (ft)		18
Analysis/Moth	od(e):			LICMR3 Li	st		Denth to V	Nator Aftor	Sampling (ft)	7.65
Analysis/weth	(Manufactur	or Model	and Soria		51		Deptil to v	Valei Ailei	Samping (it).	1.05
Fauinment Calib		er, wouer,		ii NO.j.		Colibrated Within				Xee
Equipment Calibi	rated (Y/N):		Ť	es		_Calibrated within	Criteria (Y/N):			fes
				Turbidity						
					Hanna 98	703 H0006328, YSI	556 MPS 08J	J101227		
Calculations	5:									Signature:
Saturated well		ο· V= Π/R^	2)H*7 48 as	al/ft^3						Ī
Saturated wer	reasing volun		_)ii 7.40 ga							
V=Volume (gal/ft	.)						V= Π(R^2	2)H*7.48 gal	'ft^3	
Π = 3.14	.)					= Π * (2	.0 (in)/12 (in/ft))/2)^2 * 11.3	38 * 7.48 gal/ft^3	
R = well radius (f	ft) = (well diamete	er (in)/12 (in/ft))	/2)				=	1.9 gal.		$\times // - // - //$
H = height of wat	ter column (ft)	. //								Mike
Notes:										Name (print):
					None					Sarah Levine
OA/OC'd by	dry									1/2/2018
u	ary								and at Date.	1.2.2010



		Phase 1 Rec	nional Site In	spections for	Per-Eluorinat	ed Compounds					
Project Name:			at Multiple A	ir National Gu	ard Installatio	ons	Project Nu	imber:		291330006.07	
Contract:			V	/9133L-14-D-	-0002		Task Orde	er:		0006	
Installation:				RICHM			Technicia	n(s):		Sarah Levine	
Well ID:				TW-01			Date:			11/07/17	
Initial Depth to	Water (ft):			16.04			Well Diam	eter (in):		2.0	
Total Depth of	Well (ft):			20.0		<u> </u>	1 Casing \	/olume (ga	al):	0.6	
Method of Pure	ging:			Peri-pump)		3 Casing \	/olumes (g	jal):	1.9	
Measuring Poi	nt (toc, tor, et	c.):		Тор	of Casing		Pump Inta	ke Depth (feet):	18	
Time	Water Level (feet)	Flow Rate (Gpm)	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	(,,,	
11:15		0.04						1		Pumping/Purging Started	
11:20	16.34	0.04	.16	17.26	5.67	0.067	5.07	146.2	59.8	Fairly clear	
11:24	16.36	0.04	.32	17.66	5.34	0.065	4.90	139.4	24.9	Clear	
11:28	16.37	0.04	.48	17.68	5.22	0.064	4.76	101.0	18.8	Clear	
11:32	16.37	0.04	.64	17.64	5.09	0.062	4.70	75.4	10.8	Clear	
11:36	16.73	0.04	.80	17.68	4.98	0.060	4.65	61.2	6.78	Clear	
11:40	16.37	0.04	.96	17.78	4.94	0.055	4.39	48.7	4.01	Clear	
11:44	16.37	0.04	1.12	17.75	4.80	0.054	4.41	45.5	2.42	Clear	
11:40	16.37	0.04	1.44	17.73	4 74	0.052	4.34	40.4	1.99	Clear	
11.02	10.01	0.04				0.002	20	100.1			
								İ			
										L	
										<u> </u>	
-											
-						1					
Stability Reach	ned (Y/N):			Yes		If No, Provide E	xplanation			NA	
		Final	Values:	17.71	4.74	0.052	4.28	498.1	1.70		
Sample ID:			RICH	IM-GW-TW0	1-110717		Method of	Sampling		Low flow, Peri-pump	
QA/QC Sample	es (Yes/No):		Y	es DUP, MS	/MSD		Sample Da	ate:		11/07/17	
Duplicate ID:			RICH	M-GW-DUP0	1-110717		Sample Co	ollection T	ime:	12:00	
Sample Contai	iner Type(s):			125ml HDP	Έ		Total Volu	me Purge	d (gal):	1.5	
Preservative(s):			Ice (4 °C))		Sample De	epth (ft):		18	
Analysis/Metho	od(s):			UCMR3 Li	st		Depth to V	Vater After	Sampling (ft):	16.25	
Instruments	(Manufactur	er, Model,	and Seria	l No.):		Colibrated Within	Critoria (V/NI):			Vac	
Equipment Calibra	aleu (1/11).			63			Chiena (1/N).			165	
				Turbidity	Meter, Wate Hanna 987	r Quality Meter, Wa 703 H0006328, YSI	ater Level Mete 556 MPS 08J	er, Peristaltio	Pump		
O al avel eff	-										
Calculations										Signature:	
Saturated well	casing volum	ne: V= П(R^2	2)H*7.48 ga	al/ft^3						-	
							V= П(R^2	2)H*7.48 gal/	ft^3	\bigcap \bigwedge	
$\Pi = 3.14$						= 🗆 * (2	2.0 (in)/12 (in/fl	t))/2)^2 * 3.9	6 * 7.48 gal/ft^3		
R = well radius (ft	:) = (well diamete	er (in)/12 (in/ft))	/2)				=	0.6 gal.			
H = height of wate	er column (ft)									Juli	
Notos											
NOLES:										name (print):	
					None					Sarah Levine	
QA/QC'd by:	dry								QA/QC Date:	1/2/2018	



Project Name:	:	Phase 1 Rec	gional Site In at Multiple A	spections for ir National Gu	291330006.07					
Contract			M	/01331_1/	.0002		Task Orda			0006
Installation			v	RICHM	0002		Technicia	n(e).		Sarah Levine
				T\W_02		<u> </u>	Date:	ii(s).		11/07/17
Initial Donth to	Wator (ft)			18.25			Woll Diam	otor (in):		20
Total Depth of	f Woll (ft).			20.0			1 Casing \	/olume (a:	al).	0.3
Method of Pur				Peri-Pumr			3 Casing \	/olumoe (g	ai). aal):	0.9
Meanuring Pol	int (toc tor at	c):		Ton	of Casing		Bump Inta	ko Donth (jai). (foot):	18.5
Weasuring PO		c.j.		төр	or casing	Specific	Fumpinta	ke Deptil (leet).	10.5
Time	Water Level (feet)	Flow Rate (Gpm)	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	
13:57		0.06								Pumping/Purging Started
14:02	18.29	0.06	.24	19.10	4.90	0.061	5.29	37.3	16.6	Clear
14:06	18.35	0.06	.48	19.36	4.87	0.062	5.15	38.2	12.9	Clear
14:10	18.39	0.06	.72	19.46	4.76	0.062	5.08	37.2	10.7	Clear
14:14	18.41	0.06	.96	19.48	4.64	0.062	5.29	39.5	9.24	Clear
14:18	18.44	0.06	1.2	19.55	4.59	0.062	5.22	40.0	7.02	Clear
14:22	18.46	0.06	1.44	19.55	4.57	0.062	5.19	38.6	5.83	Clear
	1									
-										
-										
-										
-										
-										
					I					
Stability Reac	hed (Y/N):			Yes	1	If No, Provide E	xplanation	-	1	NA
		Final	Values:	19.55	4.57	0.062	5.19	38.6	5.83	
Sample ID:			RICH	IM-GW-TW02	2-110717		Method of	Sampling	:	Low flow, Peri-pump
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/07/17
Duplicate ID:				NA			Sample Co	ollection T	ime:	14:30
Sample Conta	iner Type(s):			125 ml HDF	ΡE		Total Volu	me Purge	d (gal):	1.5
Preservative(s	s):			Ice (4 °C))		Sample De	epth (ft):		18.5
Analysis/Meth	od(s):			UCMR3 Li	st		Depth to V	Vater After	Sampling (ft):	18.38
Instruments	(Manufactur	er, Model,	and Seria	l No.):		Calibrated Within	Criteria (V/N):			Ves
Equipment Galibi				Turk idite						100
				Iurbidity	Meter, Wate Hanna 987	er Quality Meter, Wa 703 H0006328, YSI	ater Level Mete 556 MPS 08J	er, Peristaltio	c Pump	
Calculations	•									Signature
Saturated well	Leasing volum	α: \/= Π/ΡΛ'	2)H*7 /8 as	u/ft^3						orginataro.
Saturated well	sasing voluli		-, r . o ya	awit U					10.00	\frown
V=Volume (gal/ft)					* *	V= Π(R^2 2.0 (in)/12 (in/#	2)H*7.48 gal	TT^3 5 * 7 48 col/#^2	
Π = 3.14		(in) (40 (in (ft))	(0)			= 11 " (2	2.0 (11)/12 (11/11 =	0.3 gal	5 7.46 gai/it/5	
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2) H = height of water column (ft)							-	5.6 yai.		the film
Notes:										Name (print):
										······
					None					Sarah Levine
QA/QC'd by:	dry								QA/QC Date:	1/2/2018



Project Name:		Phase 1 Reg	gional Site In at Multiple A	spections for ir National Gu	Per-Fluorinat	ed Compounds	Project Nu	imber:		291330006.07
Contract:			V	V9133L-14-D-	0002		Task Orde	er:		0006
							Techniciai Data:	n(s):		
Initial Donth to	Wator (ft):			12 58			Wall Diam	otor (in):		2.0
Total Depth of	Well (ft)			20.0			1 Casing \	/olume (a:	al).	1.2
Method of Pur	aina:			Peri-pump)		3 Casing V	/olumes (g	nal):	3.7
Measuring Poi	int (toc. tor. et	tc.): Top of Casing						ke Depth (feet):	18
					Ū	Specific				
Time	Water Level (feet)	Flow Rate (Gpm)	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	
15:05		0.029								Pumping/Purging Started
15:07	12.55	0.029	.057	18.21	4.97	0.039	4.06	54.8	10.5	Clear
15:11	12.55	0.029	.171	18.55	5.09	0.037	2.89	24.3	61.3	Clear
15:15	12.55	0.029	.285	18.68	4.94	0.036	2.00	10.0	26.0	Clear
15:19	12.55	0.029	.399	18.59	4.81	0.037	1.89	17.8	15.0	Clear
15:23	12.55	0.029	.513	18.58	4.68	0.037	1.81	19.6	10.3	Clear
15:27	12.55	0.029	.627	18.57	4.62	0.037	1.71	17.7	5.49	Clear
15:31	12.55	0.029	.741	18.57	4.55	0.035	1.70	15.9	4.51	Clear
15:35	12.55	0.029	.855	18.61	4.52	0.035	1.68	16.3	3.28	Clear
15:39	12.55	0.029	.969	18.62	4.54	0.035	1.66	14.8	3.08	Clear
		ļ						ļ		
	_									
	_									
	-	-				-	+			
	-						-			
	-						-	-		
	-						-	-		
		1								
Stability Deco	had (V/N):			Vee	I	If No. Drovido E	valenation			NA
Stability React	neu (m).			165	1	II NO, FIOVIDE L				
		Final	Values:	18.62	4.54	0.035	1.66	14.8	3.08	
Sample ID:			RICH	M-GW-TW03	3-110917		Method of	Sampling	:	Low flow, Peri-pump
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/09/17
Duplicate ID:				NA			Sample Co	ollection T	ime:	15:45
Sample Conta	iner Type(s):	-		125 ml HDF	РЕ		Total Volu	me Purge	d (gal):	1.0
Preservative(s	s):			Ice (4 °C))		Sample De	epth (ft):		18
Analysis/Meth	od(s):			UCMR3 Li	st		Depth to V	Vater After	Sampling (ft):	12.55
Instruments Equipment Calibr	(Manufactur rated (Y/N):	er, Model,	and Seria Y	l No.): es		Calibrated Within	Criteria (Y/N):			Yes
				Turbidity	Meter, Wate Hanna 98	er Quality Meter, Wa 703 H0006328, YSI	ater Level Mete I 556 MPS 08J	er, Peristaltio	c Pump	
0-1-1-1										
Calculations	:									Signature:
Saturated well V=Volume (gal/ft) П = 3.14 R = well radius (ft	l casing volun) t) = (well diamete	ne: V= ∏(R^2	2)H*7.48 ga /2)	al/ft^3		= П * (;	V= Π(R^2 2.0 (in)/12 (in/fl =	2)H*7.48 gal/ t))/2)^2 * 7.4 1.2 gal.	ft^3 2 * 7.48 gal/ft^3	Sala
H = height of wat	er column (ft)									
Notes:										Name (print):
					None					Sarah Levine
QA/QC'd by:	dry								QA/QC Date:	1/2/2018



Project Name:		Phase 1 Reg	gional Site In	spections for ir National Gu	Per-Fluorinat	ed Compounds	Project Nu	umber:		291330006.07
			at wulliple A	ii National Gu		JIS				
Contract:			V	V9133L-14-D-	0002	<u> </u>	Task Orde	er:		0006
Installation:				RICHM			Technicia	n(s):		Sarah Levine
Well ID:				TW-04			Date:			11/08/17
Initial Depth to	Water (ft):			15.05		<u> </u>	Well Diam	eter (in):	- 0 -	2.0
Total Depth of	well (π):			20.0				volume (ga	ai):	0.8
Method of Purg	ging: nt/too_tor_of			Ton	of Casing		3 Casing V	volumes (g	yaı): (feet):	2.4
Measuring Pol	nt (toc, tor, et	:c.):	1	тор	UI Casiliy	Specific	Pump Inta	ke Depth ((reet):	10
Time	Water Level (feet)	Flow Rate (Gpm)	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	
09:21		0.05								Pumping/Purging Started
09:22	15.29	0.05	0	16.05	5.15	0.048	10.44	45.5	7.10	Clear
09:26	15.57	0.05	.2	16.99	5.16	0.047	8.11	38.4	2.64	Clear
09:30	15.69	0.05	.4	17.18	5.15	0.047	7.53	37.0	2.57	Clear
09:34	15.84	0.05	.6	17.48	5.10	0.048	6.99	37.3	2.22	Clear
09:38	15.93	0.05	.8	17.29	4.94	0.047	6.82	45.6	1.86	Clear
09:42	16.09	0.05	1.0	17.34	4.83	0.047	6.78	49.3	1.15	Clear
09:46	16.21	0.05	1.2	17.29	4.80	0.047	6.66	47.8	0.93	Clear
09:50	16.30	0.05	1.4	7.18	4.79	0.048	6.58	47.1	0.87	Clear
		-				-	+			
			-			-	-			
		1								
Stability Boach	and (X/N):			Ves		If No. Provide F	volganation			NA
Otability React				100	1			-	1	
-		Final	Values:	7.18	4.79	0.048	6.58	47.1	0.87	
Sample ID:		-	RICH	M-GW-TW04	1-110817		Method of	Sampling	:	Low flow, Peri-pump
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/08/17
Duplicate ID:				NA	_		Sample Co	ollection T	ime:	10:00
Sample Contai	iner Type(s):			125 ml HDF	'E	<u> </u>	Total Volu	ime Purge	d (gal):	1.5
Preservative(s):			Ice (4 °C)		Sample De	epth (ft):		18
Analysis/Metho	od(s):			UCMR3 LI	st		Depth to V	Vater After	r Sampling (ft):	15.87
Equipment Calibra	(Manufactur ated (Y/N):	er, Model,	and Seria	ll NO.): ′es		Calibrated Within	Criteria (Y/N):			Yes
				Turbidity	Meter, Wate	r Quality Meter, Wa	ater Level Mete	er, Peristaltio	c Pump	
					1 1011110 301	55 10000320, 131	000 IVIF 0 00J	101221		
Calculations										Signature:
Saturated well	casing volum	ne: V= П(R^2	2)H*7.48 ga	al/ft^3						
V=Volume (gal/ft)							V= Π(R^2	2)H*7.48 gal	/ft^3	C / L
Π = 3.14						= 🗆 * (2	2.0 (in)/12 (in/fl	t))/2)^2 * 4.9	5 * 7.48 gal/ft^3	
R = well radius (ft) = (well diamete	er (in)/12 (in/ft)))/2)				=	0.8 gal.		1-1-1
H = height of wate	er column (ft)									M
Netco										
NOTES:										Name (print):
					None					Sorah Lavina
					NOTIE					Saran Levine
	dnu									4/0/2049
	ury								WHINGO Date:	1/2/2010



Project Name:		Phase 1 Reg	jional Site In at Multiple A	spections for ir National Gu	Per-Fluorinat ard Installation	ed Compounds ons	Project Nu	imber:		291330006.07	
Contract:			V	/9133L-14-D-	0002		Task Orde	r:		0006	
Installation:				RICHM	0002		Technicia	n(s):		Sarah Levine	
Well ID:				TMW-37			Date:			11/08/17	
Initial Donth to	Wator (ft)			17.9			Woll Diam	otor (in):		2.0	
Total Depth of	Well (ft)			27.0			1 Casing \	/olume (as	al).	15	
Mothod of Pur	aina:			Peri-numn			3 Casing \	/olumoe (ge	n).	4.5	
Mechouring Doi	ging. Int (too tor of	- \·		Ton	of Casing		Dump Into	ko Donth (fant).		
weasuring Pol	ni (ioc, ior, ei			TOP	UI Casiliy	Specific	Pumpinta	ke Depth (leet):	23	
Time	Water Level (feet)	Flow Rate (Gpm)	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	(,,,,	
11:14		0.625								Pumping/Purging Started	
11:18	18.13	0.625	.25	18.92	4.74	0.034	1.53	46.0	65.0	Cloudy	
11:22	18.11	0.625	.5	19.45	4.67	0.034	1.46	26.1	66.2	Cloudy	
11:26	18.09	0.625	.75	19.57	4.58	0.034	1.38	25.3	68.4	Cloudy	
11:30	18.05	0.625	1	19.65	4.52	0.035	1.38	22.9	68.9	Cloudy	
11:34	18.05	0.625	1.25	19.71	4.44	0.035	1.39	24.0	66.3	Cloudy	
11:38	18.06	0.625	1.5	19.80	4.36	0.035	1.39	26.4	58.1	Cloudy	
11:42	18.07	0.625	1.75	19.86	4.32	0.035	1.40	26.3	48.3	Cloudy	
11:46	18.08	0.625	2	19.83	4.33	0.035	1.38	24.3	36.7	Clear	
11:50	18.09	0.625	2.25	19.85	4.25	0.035	1.27	27.4	29.7	Clear	
11:54	18.10	0.625	2.5	19.99	4.26	0.035	1.31	23.7	23.0	Clear	
11:58	18.11	0.625	2.75	19.96	4.29	0.034	1.22	18.8	17.2	Clear	
12:02	18.12	0,625	3	19.96	4.25	0.035	1.21	20.4	14.6	Clear	
12:06	18 13	0.625	3.25	19.98	4.23	0.035	1 19	19.1	11.8	Clear	
12:10	18 14	0.625	3.5	19.97	4.22	0.035	1 17	18.3	9 47	Clear	
12.10		0.020		10.01				10.0	0.11		
Otabilita Daari				N/s s		If No. Descriptor E	Surface affects				
Stability React	nea (1/N):	Final		res	4.00	II NO, PIOVIDE E	xpianation			NA	
		Final	values:	19.97	4.22	0.035	1.17	18.3	9.47		
Sample ID:			RICH	N-GW-TMW3	7-110817		Method of	Sampling	:	Low flow, Peri-pump	
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/08/17	
Duplicate ID:				NA			Sample Co	ollection T	ime:	12:15	
Sample Conta	iner Type(s):			125 ml HDP	Έ		Total Volu	me Purge	d (gal):	3.5	
Preservative(s):			Ice (4 °C)			Sample De	epth (ft):		23	
Analysis/Meth	od(s):			UCMR3 Lis	st		Depth to V	Vater After	Sampling (ft):	18.03	
Instruments Equipment Calibr	(Manufactur ated (Y/N):	er, Model,	and Seria Y	l No.): es		Calibrated Within	Criteria (Y/N):			Yes	
4. F	,			Turbidity	Meter Wate	- r Quality Meter, Wa	ater Level Met	er Peristaltio	Pump		
				,	Hanna 987	03 H0006328, YSI	556 MPS 08J	101227			
Calculations	:									Signature:	
Saturated well	casing volum	ne: V= П(R^2	2)H*7.48 ga	al/ft^3						İ	
V=Volume (aal/ft)	1						V= П(R^2	!)H*7.48 gal/	ft^3		
Π = 3.14						= 🗆 * (2	2.0 (in)/12 (in/fl	())/2)^2 * 9.1	0 * 7.48 gal/ft^3	\leq / / \leq	
R = well radius (ff H = height of wat	:) = (well diamete er column (ft)	er (in)/12 (in/ft))	/2)				=	1.5 gal.		ma	
Notos:	.,										
110165.										name (print).	
					None					Sarah Levine	
QA/QC'd by:	dry								QA/QC Date:	1/2/2018	



Project Name:	:	Phase 1 Reg	gional Site In at Multiple A	spections for ir National Gu	Per-Fluorinat ard Installatio	ed Compounds	Project Nu	ımber:		291330006.07	
Contract:			۷	/9133L-14-D-	0002		Task Orde	er:		0006	
Installation:				RICHM			Technicia	n(s):		Sarah Levine	
Well ID:				MW-01-36	6		Date:			11/10/17	
Initial Depth to	o Water (ft):			13.42			Well Diam	eter (in):		2.0	
Total Depth of	f Well (ft):			29.15			1 Casing \	/olume (ga	al):	3.6	
Method of Pur	ging:			Peri-pump)		3 Casing \	/olumes (g	gal):	10.9	
Measuring Po	int (toc, tor, et	tc.):		Тор	of Casing		Pump Inta	ke Depth	(feet):	25	
Time	Time Water Level (feet)		Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP L) (mV)	RP V) Turbidity (NTU) 20% ±10% and <10 NTU	Comments/Observations During Purging	
		Stabilizatio	Stabilization Criteria		±0.1	±3%	±10%	±10%		(color, sediment, odor, etc.)	
09:32		0.045								Pumping/Purging Started	
09:36	13.45	0.045	0.181	16.12	4.09	0.035	3.75	92.9	15.9	Clear	
09:40	13.43	0.045	0.362	16.12	3.80	0.035	2.56	102.8	9.92	Clear	
09:44	13.42	0.045	0.543	16.13	3.77	0.034	2.13	101.2	7.94	Clear	
09:48	13.43	0.045	0.724	16.05	3.79	0.033	1.60	97.9	5.94	Clear	
09:52	13.43	0.045	0.905	16.02	3.68	0.033	1.34	99.8	5.63	Clear	
09:56	13.44	0.045	1.086	15.98	3.63	0.033	1.29	100.2	5.49	Clear	
10:00	13.45	0.045	1.267	16.09	3.74	0.033	1.26	84.7	5.80	Clear	
10:04	13.47	0.045	1.448	16.17	3.87	0.033	1.19	82.6	6.47	Clear	
10:08	13.48	0.045	1.629	16.25	3.83	0.033	1.20	87.1	6.18	Clear	
10:12	13.48	0.045	1.810	16.27	3.85	0.033	1.20	90.1	7.04	Clear	
-											
Stability Reac	hed (Y/N):			Yes		If No. Provide E	xplanation			NA	
	, γ	Final	Values		0.05	0.000					
		Final	values:	16.27	3.85	0.033	1.20	90.1	7.04		
Sample ID:			RICH	IM-MW-01-36	5-111017		Method of	Sampling	:	Low flow, Peri-pump	
QA/QC Sample	es (Yes/No):			No			Sample Da	ate:		11/10/17	
Duplicate ID:				NA			Sample Co	ollection T	ime:	10:20	
Sample Conta	iner Type(s):			125 ml HDP	ΡE		Total Volu	ime Purge	d (gal):	2	
Preservative(s	s):			Ice (4 °C)			Sample De	epth (ft):		25	
Analysis/Meth	od(s):			UCMR3 Lis	st		Depth to V	Vater After	· Sampling (ft):	13.48	
Instruments Equipment Calibr	(Manufactur rated (Y/N):	er, Model,	and Seria Y	l No.): es		Calibrated Within	Criteria (Y/N):			Yes	
				Turbidity	Meter, Wate	r Quality Meter, Wa	ater Level Met	er, Peristalti	c Pump		
Calculations	•									Signature	
Saturated well	I casing volum	ne: V= П(R^:	2)H*7.48 ga	al/ft^3						orginataro	
V=Volume (gal/ft Π = 3.14 R = well radius (f H = height of wat) t) = (well diamete ter column (ft)	er (in)/12 (in/ft))/2)			= Π * (2	V= Π(R^2 .0 (in)/12 (in/ft) =	2)H*7.48 gal))/2)^2 * 22.(3.6 gal.	/ft^3 08 * 7.48 gal/ft^3	Suppe	
Notes:					None					Name (print):	
					None				04/00 5 4		
QA/QC'd by:	dry								QA/QC Date:	1/2/2018	
APPENDIX E



Project Name:		Phase 1 Regior	nal Site Insp	ections for Per-F	Fluorinated Compounds at nstallations	Multiple Air N	lational Guard	Project	t Number:		291330006.07			
Contract:		W9	133L-14-D-	0002	Task Order:	0006		Date:		-	11	1/06/17		
Installation:					RICHM			Calibra	ation Start T	ime:	(09:47		
Sample Techni	ician(s):			S	arah Levine			Calibra	ation End Ti	me:		11:23		
					Readings	alibration								
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm) D.O. (%) Salinity (%)		ORP/Eh (mV)	Baron Pres	netric sure	Cor	mments			
11/06/17	11/06/17 09:47 Na 3.70 0 11/06/17 09:47 Na 7.46 15 100 9.86 750			(ms/cm) - 1.309	86.7	Na	212.8	(mm 76	Hg) 30	None				
			Reading	Is After Ca	libration									
	1				Specific Electrical				Baron	netric				
Date	Date Time (24hr) Temperature (°C) pH (SU) Turbidity (NTUs)				Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	ORP/Eh (mV) Pressure (mm Hg)		Comments			
11/06/17 09:47 Na 4.00 0 11/06/17 09:47 Na 15 100 100 100 100			1.413	100	Na	240	76	60		None				
Calibration M	aterials Reco	rd:		•					•					
	рН	Calibration Standa	ards		Specific Electrical Condu Reduction	ictance, Salin n Potential (O	ity, Dissolved O RP) Calibration	xygen (DO) and Standards	l Oxidation		Turbidity Sta	andards		
Standard	<u>Cal. Sta</u>	ndard Lot #	<u>Expi</u>	ration Date	Standard	Cal. Star	ndard Lot #	Expiration Date		Standard	Cal. Standard Lot #	Expiration Date		
pH (4)	70	GF303	(06/01/19	Spec. Conductance	7Gł	11079	08/01/	18	10	2444	04/01/18		
pH (7)	70	GF779	0	06/01/19	Salinity	I	Na	11/06/	17	20	2455	10/01/17		
pH (10)	70	GF743	(06/01/19	D.O.	I	Na	11/06/	17	100	2456	10/01/17		
ORP 1720 06/0					06/01/2	22	800	2457	10/01/17					
Instruments (Manufacturer	, Model, and Seri Manufacture	ial No.): er/Model	Serial No	Notes:					Signature	e:	11		
Water Quality M Turbidity Meter Calibrated Withi	Meter: r: in Acceptance C	YSI 556 I Hanna 98 riteria (Y/N):	MPS 3703	08J101227 H0006328 Yes	- None						Ju	the		
If No, Provide Explanation: NA										Name (pr	int):	Sarah Levine		
OA/OC'd by:	dry								QA	QC Date:	1	/2/2018		



Project Name:	ame: Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations 291330006.07						30006.07						
Contract:		W9	133L-14-D-	0002	Task Order:	0006		Date:		-	11	/07/17	
Installation:					RICHM			Calibra	tion Start T	ime:		10:23	
Sample Technie	cian(s):			S	Sarah Levine			- Calibra	tion End Ti	me:		10:51	
					Reading	alibration							
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	Salinity (%)	ORP/Eh (mV) Barometric Pressure (mm Hg)			Cor	nments		
11/07/17 10:32		4.09 0 Na 6.65 100 9.91 750		1.210	109.6	Na	261.0	760		None			
				I	Reading	gs After Ca	libration	1				_	
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity ORP/Eh Pressure Comments (%) (mV) (mm Hg)				nments		
11/07/17 10:32		Na	4.00 7.00 10.00	<0.1 15 100 750	1.413	100	Na	240	70	60		None	
Calibration Ma	aterials Reco	rd:		100									
	pH	Calibration Standa	ards		Specific Electrical Condu Reductio	uctance, Salin n Potential (O	ity, Dissolved C RP) Calibration	Dxygen (DO) and Standards	l Oxidation		Turbidity Sta	ndards	
Standard	<u>Cal. Sta</u>	ndard Lot #	<u>Expi</u>	ration Date	Standard	Cal. Star	ndard Lot #	Expiration Date		Standard	Cal. Standard Lot #	Expiration Date	
pH (4)	70	GF303	(06/01/19	Spec. Conductance	7Gł	H1079	08/01/	18	10	2444	04/01/18	
pH (7)	70	GF779	(06/01/19	Salinity		Na	11/07/	17	20	2455	10/01/17	
pH (10)	70	GF743	(06/01/19	D.O.		Na	11/07/	17	100	100 2456 10/01/17		
					ORP	1	720	06/01/	22	800	2457	10/01/17	
Instruments (I	Manufacturer	, Model, and Seri Manufacture	al No.): er/Model	Serial No	Notes:					Signature		11.	
water Quality N Turbidity Meter	neter: ::	VSI 556 I LaMotte :	MPS 2020	08J101227 H0006328	-				Ju	the			
Calibrated Withir	n Acceptance C xplanation:	riteria (Y/N):	NA	Yes	-					Name (pr	int):	Sarah Levine	
	dn/								04	1/0/C Date: 1/2/2049			



Project Name:		Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations 291330006.07						30006.07				
Contract:		W9	133L-14-D-	0002	Task Order:	0006		Date:		-	11	1/08/17
Installation:					RICHM			Calibra	tion Start T	ime:	(08:06
Sample Technie	cian(s):			S	Sarah Levine			Calibra	tion End Ti	me:	(08:32
					Reading	alibration						
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm) D.O. Salinity (%)			ORP/Eh (mV) Barometric Pressure (mm Hg)			Comments	
11/08/17	11/08/17 08:15 Na		3.90 0 6.82 100 10.21 750		1.318	113.5	Na	258	76	50	None	
			10.21	750								
	L	1			Reading	gs After Ca	libration		Baran	notrio		
Date	Time (24hr)	Time (24hr)Temperature (°C)pH (SU)Turbidity (NTUs)Opcome Licentical Conductance (mS/cm)D.O. (%)Salinity (%)ORP/Eh (mV)Database Pressure (mW)					sure Hg)	Comments				
11/08/17	11/08/17 08:15 Na 7.00		<0.1 15 100 750	1.413	100	Na	240	76	60	None		
Calibration Ma	aterials Reco	.q.		100								
	pH	Calibration Standa	ırds		Specific Electrical Condu Reductio	uctance, Salin n Potential (O	ity, Dissolved O RP) Calibration	xygen (DO) and Standards	Oxidation		Turbidity Sta	indards
Standard	<u>Cal. Sta</u>	ndard Lot #	<u>Expi</u>	ration Date	Standard	Cal. Star	ndard Lot #	Expiration	Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	70	GF303	C	06/01/19	Spec. Conductance	7Gł	H1079	08/01/1	8	10	2444	04/01/18
pH (7)	70	GF779	C	06/01/19	Salinity		Na	11/08/1	7	20	2455	10/01/17
pH (10)	7GF743 06/01/19 D.O. Na 11/08/17					7	100	2456	10/01/17			
					ORP	1	720	06/01/2	22	800	2457	10/01/17
Instruments (I	Manufacturer,	Model, and Seri Manufacture	al No.): er/Model	Serial No	Notes:					Signature		11
Water Quality N	leter:	YSI 556 I	MPS	08J101227	4							1///
Turbidity Meter Calibrated Withir	: n Acceptance C	LaMotte 2 riteria (Y/N):	2020	H0006328 Yes	None						SU	mn
If No, Provide Explanation: NA					1					Name (pr	int):	Sarah Levine
QA/QC'd by:	drv				<u> </u>				QA/	QC Date:	1	/2/2018



Project Name:	Name: Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations 291330006.07						30006.07								
Contract:		Wg	133I -14-D-	0002	Task Order:	0006		Date:		-	11/09/17				
Installation:					RICHM			Calibra	tion Start T	ime:		07.49			
Sample Techni	cian(s):			S	arah Levine			Calibra	tion End Ti	me:		08:13			
-															
					Reading:	s Before C	alibration		Baron	notric					
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Pres (mm	sure Hg)	Comments				
			4.07	0											
11/09/17	07:49	Na	6.74	15	1.293	114.7	Na	259.5	76	60		None			
			9.91	750											
					Reading	gs After Ca	libration								
Date	DateTime (24hr)Temperature (°C)pH (SU)Turbidity (NTUs)Specific Electrical Conductance (mS/cm)D.O. (%)					Salinity (%)	ORP/Eh (mV)	ORP/Eh Barometric (mV) Pressure (mm Hg)		Comments					
			4.00 <0.1												
11/09/17	11/09/17 07:49		7.00	100	1.413	100	Na	240.0	760		None				
			10.00	750											
Calibration Ma	aterials Reco	rd:													
	pH	Calibration Standa	ards		Specific Electrical Condu Reductio	uctance, Salin n Potential (O	ity, Dissolved C RP) Calibration	xygen (DO) and Standards	Oxidation		Turbidity Sta	andards			
Standard	<u>Cal. Sta</u>	ndard Lot #	<u>Expi</u>	ration Date	Standard	Cal. Star	ndard Lot #	Expiration Date		Standard	Cal. Standard Lot #	Expiration Date			
pH (4)	70	GF303	C	06/01/19	Spec. Conductance	7Gł	H1079	08/01/*	18	10	2444	04/01/18			
pH (7)	70	GF779	C	06/01/19	Salinity		Na	11/09/1	17	20	2455	10/01/17			
pH (10)	70	GF743	C	06/01/19	D.O.		Na	11/09/1	17	100	2456	10/01/17			
					ORP	1	720	06/01/2	22	800	2457	10/01/17			
Instruments (I	Manufacturer	, Model, and Seri Manufacture	ial No.): er/Model	Serial No	Notes:					Signature	»:	1 1			
Water Quality N	Neter:	YSI 556 I	MPS	08J101227							\sim				
Turbidity Meter Calibrated Within	: n Acceptance C	LaMotte : riteria (Y/N):	2020	H0006328 Yes		- None					St	th'h			
If No, Provide Explanation: NA					-					Name (pr	int):	Sarah Levine			
QA/QC'd by:	drv				1				QA	A/QC Date: 1/2/2018					



Project Name:		Phase 1 Regior	nal Site Insp	ections for Per-I	Fluorinated Compounds at nstallations	Multiple Air N	National Guard	Project	t Number:		291330006.07			
Contract:		W9	133L-14-D-	0002	Task Order:	0006		Date:		•	11/10/17			
Installation:					RICHM			Calibra	tion Start T	ime:	(07:28		
Sample Technie	cian(s):			S	arah Levine			Calibra	tion End Ti	me:	(07:48		
					Reading	alibration								
Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV) Barometric Pressure (mm Hg)			Comments			
11/10/17 07:46 Na		Na	3.90 Na 6.86 9.90		1.395	115.3	Na	258.4	258.4 760		None			
	•	· · · · · · · · · · · · · · · · · · ·	Reading	as After Ca	libration									
Date	Time (24hr)	Temperature (°C)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Baron Pres (mm	netric sure Hg)	Comments				
11/10/17	11/10/17 07:46 Na 4.00 10.00		4.00 7.00 10.00	<0.1 20 100 750	1.413	100	Na	240	76	50	None			
Calibration Ma	aterials Reco	rd:		1					1					
	рН	Calibration Standa	ards		Specific Electrical Condu Reductio	uctance, Salin on Potential (O	ity, Dissolved C RP) Calibration	Oxygen (DO) and Standards	Oxidation		Turbidity Sta	Indards		
Standard	Cal. Sta	ndard Lot #	<u>Expi</u>	ration Date	Standard	Cal. Star	ndard Lot #	Expiration	<u>Date</u>	Standard	Cal. Standard Lot #	Expiration Date		
pH (4)	70	GF303	(06/01/19	Spec. Conductance	7GI	H1079	08/01/	18	10	2444	04/01/18		
pH (7)	70	GF779	(06/01/19	Salinity		Na	11/10/	17	20	2455	10/01/17		
pH (10)	70	GF743	(06/01/19	D.O.		Na	11/10/	17	100	2456	10/01/17		
					ORP	1	720	06/01/2	22	800	2457	10/01/17		
Instruments (I	Manufacturer	, Model, and Seri Manufacture	ial No.): er/Model	Serial No	Notes:					Signature		11		
Water Quality N	leter:	YSI 556 I	MPS	08J101227	4							1////		
Turbidity Meter Calibrated Withir	:: n Acceptance C	LaMotte : riteria (Y/N):	2020	H0006328 Yes	- None						80	mn		
If No, Provide Explanation: NA]					Name (pr	int):	Sarah Levine		
QA/QC'd by:	drv								QA	QC Date:	1	/2/2018		

APPENDIX F

SEDIMENT AND SURFACE WATER SAMPLING LOGS



			(
Project Name:	Compounds a	t Multiple Air Nati	ons for Per-F onal Guard I	nstallations	Project Nu	umber:		291330006.07				
Contract:		W9133L-14-E	-0002		Task Orde	er:	-	0006				
Installation:		RICHM			Date:		_	11/08/17				
Location ID:		01SD01			Northing/Easting: 4153856/295834							
Technician(s):		Sarah Lev	ine									
				SEDIMEN	SAMPLE							
	NAME	(USCS Symbol)	· color moist	Descr ure % by wt play	iption sticity dilatan	ry toughnes	s dry strenat	h consistency				
			. color, mois	urc, 70 by wt, pla	sticity, dilatario	y, touginica	is, dry strongt					
	CL, sil	ty clay with fine	gravel, rec	ldish brown, mc	ist, no odor	low plasti	city, soft, low	v dry strength				
Sample Depth (ft):		0 - 0.5			Sample ID	:		RICHM-01-SD01-0-0.5				
MS/MSD Collected:		Yes			Sample D	ate:	-	11/08/17				
Duplicate ID:		NA			Sample C	ollection T	ime:	14:15				
Sample Container Ty	pe(s):	602	HDPE		Sample C	ollection M	lethods:	Hand auger				
Preservative(s):		lce (4 °C)		Analysis/	/lethod(s):	UCMR3 List					
				SURFACE S	OIL SAMP	LE						
				Descr	iption							
	NAME	(USCS Symbol)	: color, moist	ure, % by wt, plas	sticity, dilatano	cy, toughnes	s, dry strengt	h,consistency				
				Ν	A							
Sample Depth (ft):		NA			Sample ID	:	-	NA				
MS/MSD Collected:		NA			Sample D	ate:		NA				
Duplicate ID:		NA	NIA		Sample C	ollection I	ime:	NA				
Sample Container Ty	npie Container Type(s): NA					Intection N	lethous:	NA				
Fleservalive(s).												
				Specific			1 1					
Time	Intake Depth (in)	Temp. (°C)	pH (units)	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 D	ate:	-	NA				
Sample ID:		NA			Sample C	ollection T	ime:	NA				
MS/MSD Collected:		NA			Sample C	ollection M	lethods:	NA				
Duplicate ID:		NA			Surface W	ater Dept	h (ft):	NA				
Sample Container Ty	pe(s):		NA		Water Boo	ly and Wa	ter Quality	Characteristics:				
Preservative(s):		NA						NA				
Analysis/Method(s):		NA					6					
Location Sketch:					Instrume	nts (Man	utacturer,	Model, and Serial No.):				
T					Equipment (Calibrated (Y	⁷ /N):	NA				
N					Calibrated v	Vitnin Criteria	a (Y/N):	NA				
	\land	\mathcal{I}_{\star})				Μ	lanual Hand Tools				
	ς γ χ	<u>\</u>	1		Notes:			Signaturo				
R		\$/	,				None	Name (print): Sarah Levine				
QA/QC'd by:			dry		I	QA	QC Date:	1/2/2018				



Project Name:	Phase 1 Reg Compounds a	ional Site Inspect at Multiple Air Nati	ions for Per-I onal Guard I	Fluorinated	Project Nu	ımber:		291330006.07			
Contract:		W01331 1/ F	0-0002		Taek Orde		-	0006			
Installation:		RICHM	0002		Date:	.	-	11/08/17			
Location ID:		02SD01 and 0	2SW01		Northing/I	Easting:	-	4153944/295700			
Technician(s):		Sarah Lev	ine				-				
				SEDIMEN [®]	T SAMPLE						
				Descr	iption						
	NAME	E (USCS Symbol)	: color, mois	ture, % by wt, pla	sticity, dilatano	y, toughnes	s, dry strengt	n,consistency			
	М	L, silt with sand	l, brown, m	oist, no plasticit	y, low tough	ness, low c	dry strength,	very soft			
Sample Depth (ft):		0 - 0.5			Sample ID	:		RICHM-02-SD01-0-0.5			
MS/MSD Collected:		No			Sample D	ate:	-	11/08/17			
Duplicate ID:	-	RICHM-SD-DUP	01-110817		Sample C	ollection T	ime:	15:20			
Sample Container Ty	pe(s):	6oz	HDPE		Sample C	ollection M	lethods:	Hand auger			
Preservative(s):		lce (4 °C	C)		Analysis/Method(s): UCMR3 List						
				SURFACE S	OIL SAMP	LE					
				Descr	iption						
	NAME	E (USCS Symbol)	: color, mois	ture, % by wt, pla	sticity, dilatano	y, toughnes	s, dry strengt	n,consistency			
Sample Depth (ft):		NA			Sample ID	:	-	NA			
MS/MSD Collected:		NA			Sample D	ate:		NA			
Duplicate ID:		NA	NIA		Sample C		ime:	NA			
Sample Container Ty	pe(s):	NIA	NA		Sample C		lethoas:	NA			
Preservative(s):	reservative(s): NA							NA			
	1				IER SAW	PLE	<u> </u>				
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.)			
16:01	6	11.54	6.17	0.111	9.11	93.9	13.1	Clear			
Sample Depth (ft):		0.5 - 0.5	5		Sample D	ate:		11/08/17			
Sample ID:		RICHM-02-SW0	1-110817		Sample C	ollection T	ime:	16:15			
MS/MSD Collected:		Yes			Sample C	ollection M	lethods:	Sample container			
Duplicate ID:		NA			Surface W	ater Dept	h (ft):	0.5			
Sample Container Ty	pe(s):	125r	nl HDPE		Water Boo	Characteristics:					
Preservative(s):		Ice (4 °C	C)				Stre	eam, Flowing, Clear			
Analysis/Method(s):		UCMR3 I	List		. .		<u> </u>				
Location Image:			an an Al Al Al		Instrume	nts (Man	ufacturer,	Model, and Serial No.):			
		A second			Equipment (Calibrated (Y	/N):	Yes			
		Contraction and	X St		Calibrated V	/ithin Criteria	a (Y/N):	Yes			
						Turbidi	ty Meter, Wat Hanr YSI 5	er Quality Meter, Manual Hand Tools na 98703 H0006328, 556 MPS 08J101227			
		N. 94.	A ST AND		Notes:			Signaturo			
and the		Star Star			Notes.		None	Signature.			
								Name (print):			
Caption:		SW-SD location			1			Sarah Levine			
			drv								



Project Name:	Phase 1 Regi Compounds a	ional Site Inspecti It Multiple Air Nati	ions for Per-F ional Guard I	Fluorinated	Project N	umber:		291330006.07				
Contract:		W9133L-14-E	0-0002		Task Orde	er:	-	0006				
Installation:		RICHM			Date:		-	11/09/17				
Location ID:		03SW0	1		Northing/	Easting:	_	See figure/See figure				
Technician(s):		Sarah Lev	ine									
				SEDIMEN	T SAMPLE							
				Desc	ription							
	NAME	E (USCS Symbol)	: color, moist	ure, % by wt, pla	sticity, dilatan	cy, toughnes	s, dry strength	n,consistency				
				Ν	IA							
Sample Depth (ft):		NA			Sample ID):		NA				
MS/MSD Collected:		NA			Sample D	ate:	-	NA				
Duplicate ID:		NA			Sample C	ollection 1	ime:	NA				
Sample Container Ty	/pe(s):		NA		Sample C	ollection M	NA					
Preservative(s):		NA			Analysis/Method(s): NA							
				SURFACE S	OIL SAMP	LE						
				Desc	ription							
	NAME	E (USCS Symbol)	: color, moist	ure, % by wt, pla	sticity, dilatan	cy, toughnes	s, dry strength	n,consistency				
				Ν	IA							
Sample Depth (ft):		NA			Sample ID):	_	NA				
MS/MSD Collected:	/MSD Collected: NA Sample Date:							NA				
Duplicate ID:		NA			Sample C	ollection 1	ime:	NA				
Sample Container Ty	NA		Sample C	ollection M	lethods:	NA						
Preservative(s):		NA			Analysis/	Nethod(s):		NA				
	-	1	8	URFACE WA	ATER SAM	PLE	1 1					
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.)				
10:09	6	13.20	6.19	0.158	8.09	229.8	14.2	None				
Sample Depth (ft):		0.5 - 0.8	5		Sample D	ate:	_	11/09/17				
Sample ID:		RICHM-03-SW0	1-110917		Sample C	ollection 1	ime:	10:15				
MS/MSD Collected:		No			Sample C	ollection M	lethods:	Sample containers				
Duplicate ID:		NA			Surface W	later Dept	h (ft):	0.5				
Sample Container Ty	/pe(s):	125N	IL HDPE		Water Boo	dy and Wa	ter Quality (Characteristics:				
Preservative(s):	-	Ice (4 °C) · ·				Stre	eam, Flowing, Clear				
Analysis/Method(s):		UCMR31	list		1							
Location Image:				1	Instrume	nts (Man	ufacturer,	Model, and Serial No.):				
		Alter A	A the first		Equipment (Calibrated (Y	′/N):	Yes				
		Contraction of the Party			Calibrated V	Vithin Criteri	a (Y/N):	Yes				
							Meter, Water Hanr YSI 5	Quality Meter, Other(s): Sample bottles na 98703 H0006328, 556 MPS 08J101227				
					Notes:		None	Signature:				
Caption:		SW sample						Sarah Levine				
QA/QC'd by:			dry			QA	QC Date:	1/2/2018				



Project Name:	Phase 1 Regi Compounds a	onal Site Inspect t Multiple Air Nati	ions for Per-F ional Guard Iı	Iuorinated	Project Nu	ımber:		291330006.07				
Contract:		W9133L-14-E	0-0002		Task Orde	r:		0006 11/08/17				
Installation:		RICHM			Date:			11/08/17				
Location ID:		05SW0	1		Northing/I	Easting:		See figure/See figure				
Technician(s):		Sarah Lev	vine									
				SEDIMEN	T SAMPLE							
				Desci	ription							
	NAME	(USCS Symbol)	: color, moist	ure, % by wt, pla	sticity, dilatano	y, toughnes	ss, dry strength,	consistency				
				Ν	IA							
Sample Depth (ft):		NA			Sample ID	:		NA				
MS/MSD Collected:		NA			Sample D	ate:		NA				
Duplicate ID:		NA			Sample C	ollection 1	Time:	NA				
Sample Container Ty	/pe(s):		NA		Sample C	ollection M	NA					
Preservative(s):		NA			Analysis/Method(s): NA							
				SURFACE S	OIL SAMP	LE						
				Desci	ription							
	NAME	(USCS Symbol)	s, dry strength,	consistency								
				N	IA							
Sample Depth (ft);		NA			Somalo ID			NA				
MS/MSD Collected	SD Collected: NA Sample ID: SD Collected: NA Sample Date: Cate ID: NA Sample Collection Time:							NA				
Dunlicate ID:								NA				
Sample Container Ty	ner Type(s): NA Sample Collection Methods:						Methods:	NA				
Preservative(s):			Analysis/	lethod(s):		NA						
110001144110(0).			S	URFACE WA	TER SAM	PI F	•					
				Snaoifia								
Time	Intake Depth (in)	Temp. (°C)	pH (units)	Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)				
16:27	2	11.23	6.46	0.108	9.67	66.9	11.8	Clear				
Sample Depth (ft):		0.2 - 0.2	2		Sample D	ate:		11/08/17				
Sample ID:		RICHM-05-SW0	1-110817		Sample C	ollection 1	Time:	16:30				
MS/MSD Collected:		No			Sample C	ollection M	lethods:	Sample container				
Duplicate ID:	F	RICHM-SW-DUP	01-110817		Surface W	ater Dept	h (ft):	0.2				
Sample Container Ty	/pe(s):	125N	IL HDPE		Water Boo	ly and Wa	haracteristics:					
Preservative(s):		Ice (4 °C	C)				Strea	am Flowing Clear				
Analysis/Method(s):		UCMR3 I	_ist				0100	an, Honnig, Gloai				
Location Image:					Instrume	nts (Man	ufacturer, N	lodel, and Serial No.):				
- S	5	and the second	and the second		Equipment (Calibrated (Y	(/N):	Yes				
George Contraction	and the second second		an and the second		Calibrated V	/ithin Criteri	a (Y/N):	Yes				
7-14 S	the said with		A. S. S. M. M.									
		No.	1			Turbidi	ity Motor - Water	r Quality Meter, Manual Hand Tools				
		her a start				T UI DIUI	Hanna	a 98703 H0006328,				
The second	And the second second second						YSI 55	56 MPS 08J101227				
1. 1. A.	MAN AN AN		ALS IN									
2												
1.00	G. M. LA	mare and	1.62		Notes:			Signature:				
1.1	· · · · · · · · · · · · · · · · · · ·	MAR OF	Antes The				None					
1 1-3	i shale i sha	and the second						Ć				
								Julti				
	Carlos y		a sala					Name (print):				
Caption:	SW	/ Sample location	dav			04						
			ury			QA		1/2/2010				

APPENDIX G

INVESTIGATION DERIVED WASTE PROFILES AND WASTE MANIFEST FORMS

APPENDIX H

DATA VALIDATION REPORTS

APPENDIX I LABORATORY ANALYTICAL REPORTS